# INTERNATIONAL STANDARD

# ISO 10303-227

First edition
2001-03-01

## Industrial automation systems and integration — Product data representation and exchange —

## Part 227: Application protocol: Plant spatial configuration

*Systèmes d'automatisation industrielle et intégration — Représentation et échange de données de produits —*

*Partie 227: Protocole d'application: Configuration spatiale d'usine*



Reference number
ISO 10303-227:2001(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

## Contents

Page





 

**Figures**





 

**Tables**

# Foreword

ISO (International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

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

International Standard ISO 10303-227 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

This International Standard is organized as a series of parts, each published separately. The structure of this international standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

— Parts 11 to 14 specify the description methods;
— Parts 21 to 29 specify the implementation methods;
— Parts 31 to 35 specify the conformance testing methodology and framework;
— Parts 41 to 50 specify the integrated generic resources;
— Parts 101 to 107 specify the integrated application resources;
— Parts 201 to 237 specify the application protocols;
— Parts 301 to 337 specify the abstract test suites;
— Parts 501 to 520 specify the application interpreted constructs.

A complete list of parts of ISO 10303 is available from the Internet:

http://www.nist.gov/sc4/editing/step/titles/

Should further parts of ISO 10303 be published, they will follow the same numbering pattern.

Annexes A, B, C, D, and E form a normative part of this part of ISO 10303. Annexes F, G, H, J, K, L, M, and N are for information only.

# Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.

This part of ISO 10303 is a member of the application protocol series. This part of ISO 10303 specifies an application protocol (AP) for the exchange of the spatial configuration information of process plants. This information includes the shape and spatial arrangement characteristics of piping system components as well as the shape and spatial arrangement characteristics of other related plant systems (i.e., electrical, instrumentation and controls, heating, ventilation and air-conditioning, and structural systems) that impact the design and layout of piping systems. In the design and fabrication of a piping system, the piping layout must be evaluated with respect to the spatial characteristics and arrangement of these related plant systems, and the requirements for clearances between systems. The complete specification of these other systems is not needed, but enough spatial information is needed to support the layout of the piping system. Users of this standard should understand the basic principles and concepts of pant and piping system design.

This AP specifies additional requirements for the exchange of information required for the design and installation of a piping system. This includes information on the piping material, process stream fluid, and the piping system functional characteristics. A process and system design specifies process requirements for a piping system that includes pipe size, design temperatures and pressures, and insulation class. The physical design uses these process requirements for the design of the piping system.

This AP also identifies and provides a functional specification of the components of the plant piping system. The design information for a piping system may specify a pump capable of maintaining a pressure and flow rate. The design will also specify the shape limitations or requirements and the location of the pump in the system, but not sufficient information for the fabrication of the pump.

The principle focus of the AP is on piping systems and the shape and spatial arrangement of systems including plant items required to ensure the physical integrity of piping systems. Figure 1 contains a data planning model that provides a high level description of the requirements for this application protocol, as well as the relationships between the basic data components. The data planning model illustrates that a plant consists of plant items and that plant items may be connected to one another using connectors on the plant item. The data planning model also illustrates significant concepts found on piping and instrumentation diagrams (P&IDs): the functional view of the piping system (piping system functional characterization) and one kind of plant item: piping components. The shape and spatial arrangement of plant items are represented by the item shape. The shape representation may use constructive solid geometry (CSG), solid boundary representation (B-rep) geometry, wireframe geometry, or combinations of these. The plant item shape may be represented at various levels of abstraction, from an encompassing envelope to a detailed design description. The data planning model further illustrates that the concept of change is a requirement for this application protocol. Change is applicable to each individual plant item, the relationships between plant items, and to groupings of plant items. It applies to all the concepts noted on the data planning model.



 

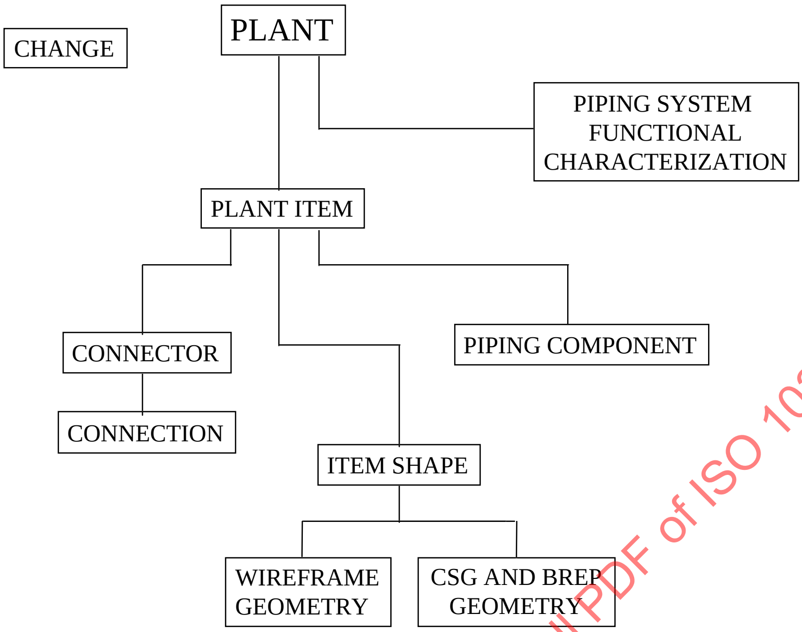


**Figure 1 - Data planning model**

NOTE This part of ISO 10303 may be used in conjunction with ISO 13584 [13] to identify catalogue items and classifications.

This application protocol defines the context, scope, and information requirements for the exchange of design and layout information for a plant piping system between different agents over the life cycle of a plant and specifies the integrated resources necessary to satisfy these requirements. The reasons for exchanging this information include:

— exchange of requirements from a plant owner to an engineering firm;

— exchange of piping and equipment designs from a design engineer to a plant system engineer;

— exchange of piping and equipment designs from a design engineer to a piping or equipment fabricator;

— exchange of changes to piping and equipment designs from a design engineer to a plant system engineer or a fabricator;

— exchange of piping fabrication and installation information between engineering and construction firms;

— integration of designs created by different engineers;

— detection of physical interferences of plant piping system components with components of other plant systems;

— exchange of construction specifications between engineering and construction firms;

— exchange of as-built plant and system configurations among plant owners, engineering firms and construction firms.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model, is given in annex G. A tiled "wallpaper" version of the application reference model (ARM) is given in annex M.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.

# Industrial automation systems and integration — Product data representation and exchange —

# Part 227:
# Application protocol: Plant spatial configuration

## 1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the exchange of spatial configuration information of process plants. The spatial configuration information focuses on the shape and spatial arrangement of the components of the plant piping systems. Components of the plant piping system include pipes, fittings, pipe supports, valves, in-line equipment, and in-line instruments. However, shape and spatial configuration information for equipment and non-piping plant systems are also included in this part of ISO 10303. The spatial configuration information principally supports the plant engineering design life-cycle phases, but may be useful in the downstream life-cycle phases of construction and maintenance. This part accommodates the disciplines of plant design and piping design.

NOTE 1 The application activity model in annex F provides a graphical representation of the processes and information flows that are the basis for the definition of the scope of this part of ISO 10303.

NOTE 2 Figure 2 illustrates the basic life-cycle stages of a process plant. Plant design life-cycle phases are enclosed in a box labeled AP 227 - Plant Design (solid line). Downstream life-cycle phases for which AP 227 may be useful are enclosed in a box labeled AP 227 (dashed line).

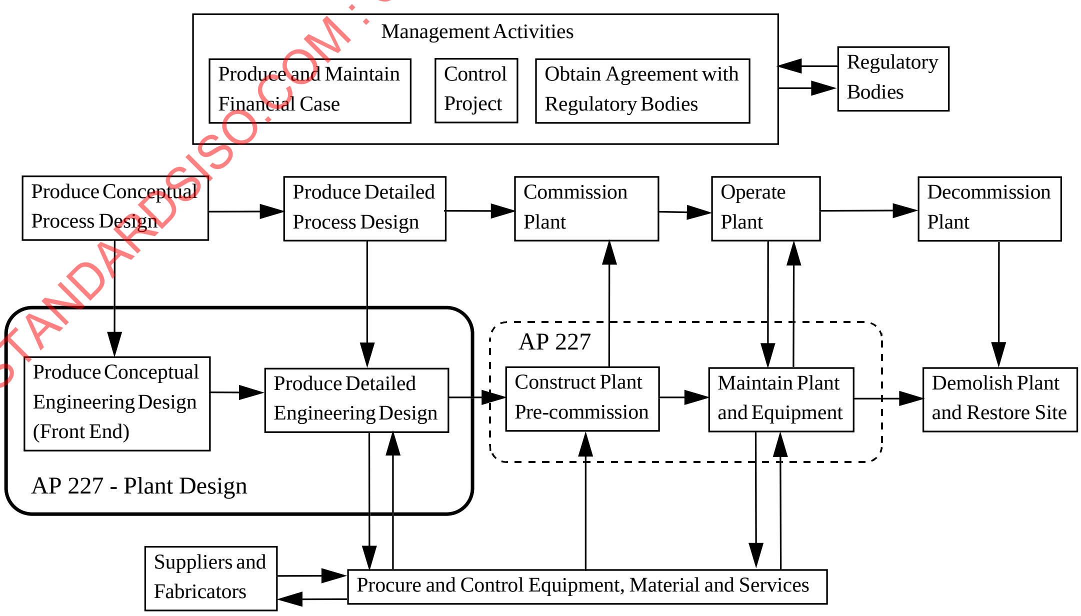


**Figure 2 - Process plant life cycle activity coverage**

NOTE 3 Design of piping systems includes the determination of the requirements of piping components, such as block valves, bypass valves, vents and drains, in-line instrumentation, and instrument taps, and their topological sequences. These piping component requirements and sequences are the starting point of the activities covered by this part of ISO 10303.

The following are within the scope of this part of ISO 10303:

— the shape and spatial arrangement of plant items in plant systems within the process plant;

— explicit representation of the 3D shape of plant piping systems;

— explicit representation of the 3D external shape of plant piping system components and equipment. The representation may include envelope, outline and detailed representations as well as a parametric representation of the external shape.

— the functional configuration of the plant piping system and the relationship of the functional configuration to the planned physical piping system design;

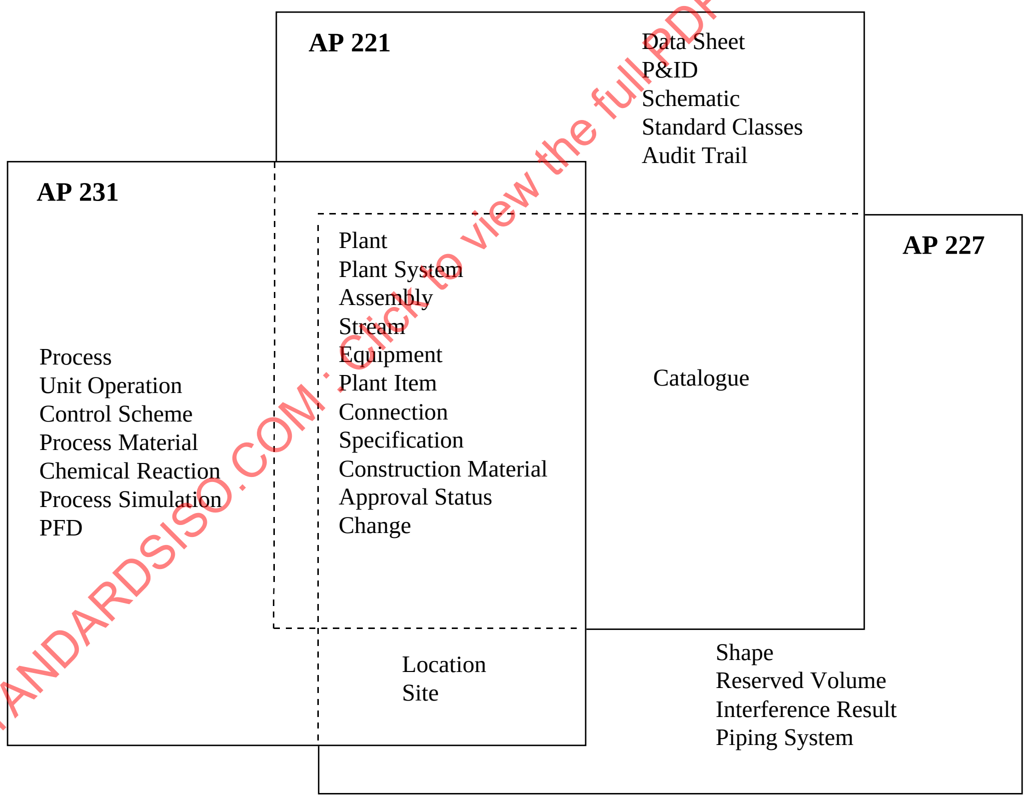


**Figure 3 - Process plant AP coverage and overlaps**

NOTE 4 The functional configuration overlaps the requirements specified in ISO 10303-221. Figure 3 illustrates areas of overlap between this part of ISO 10303 and ISO 10303-221 and ISO 10303-231.



 

NOTE 5 The functional configuration entails connectivity, sequencing, pipe size, pipe schedule, and flange class, and may include other information, such as equipment tag numbers and requirements to perform consistency checks between the functional and physical representations of the design.

— basic engineering data as needed for spatial layout and configuration of the plant piping system;

— references to functional requirements of the plant piping system, such as stream data and operational characteristics;

— references to or designation of functional characteristics of piping components and connected equipment as required for piping design;

— the identification, shape, location, and orientation of reserved areas, volumes, and space-occupying elements of a plant;

NOTE The connectivity and enumeration of non-piping systems (e.g., HVAC, electrical and structural), while provided for by the structure of this part of ISO 10303, is not the primary focus of this part.

— references to specifications, standards, guidelines, or regulations for the plant piping systems, components, or connected equipment that may specify physical characteristics of the system or component;

EXAMPLE 1 Physical characteristics include material and welding requirements.

EXAMPLE 2 References to standards include ISO 10303-221 [3] and ISO 13584 [13].

— the identification of catalogue information associated with a piping component;

— the identification of catalogues that contain piping component definitions;

— status of piping components and connected equipment and of their spatial arrangement;

NOTE Status labels are used by project management to monitor and control the execution of the project. Labels such as "preliminary", "in-work", and "released for design" are used to designate the degree of completeness or suitability for further action of the design or layout that the label is applied to.

— connections and connection requirements for piping components and equipment;

— definition of piping components in sufficient detail to support the acquisition of the components;

— change request approval, notification, and verification, tracking of differences between versions of piping system information, and tracking of changes to plant items and attributes of plant items;

NOTE Only the specific change information described in this part of ISO 10303 is in scope. The change process itself is not in scope.

— specification of the chemical composition of the streams carried by the plant piping systems in sufficient detail to evaluate the suitability of piping components for the desired process;

— data exchange;

— external reference to classes;

— external reference to standard parts;

— external reference to representations of standard parts.

The following are outside the scope of this part of ISO 10303:

— schematic representations;

EXAMPLE Schematic representations include P&IDs and process flow diagrams (PFDs).

— the contents of specifications, standards, guidelines, or regulations;

— preparation of piping specifications;

— logistics and materials management;

— detailed information required for the assembly and erection of piping systems except for shape, location, orientation, and connectivity of the components of the system;

— information required for the assembly and erection of non-piping plant systems;

— specification of the chemical composition of the streams carried by the plant piping system in sufficient detail for process flow design;

— process design and conceptual engineering;

EXAMPLE Process design includes activities such as process material and heat balances, process flow diagram development, and determination of equipment sizes.

— fabrication and installation information beyond the shape and spatial arrangements of piping components and the definition of piping spools;

— testing, commissioning, handover, maintenance, and disposal of a plant;

— plant operating procedures;

— commercial aspects of procurement and contracting;



 

EXAMPLE Commercial aspects include pricing, terms and conditions, and payment schedules.

— information necessary to manage the evolution and growth of data sets through the life-cycle of a product or project other than indications of changes and approvals;

— history data;

— internal design and maintenance of equipment.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 8824-1:1998, *Information technology — Abstract Syntax Notation One (ASN.I): Specification of basic notation.*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 10303-11:1994/Cor. 1:1999, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*.

ISO 10303-21:1994/Cor. 1:1996, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*.

ISO 10303-31:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 31: Conformance testing methodology and framework: General concepts.*

ISO 10303-41:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resource: Fundamentals of product description and support.*

ISO 10303-42:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resource: Geometric and topological representation*.

ISO 10303-43:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures*.

ISO 10303-44:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resource: Product structure configuration*.

ISO 10303-45:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resource: Materials*.

ISO 10303-46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation*.

ISO 10303-47:1997, *Industrial automation systems and integration — Product data representation and exchange — Part 47: Integrated generic resource: Shape variation tolerances*.

ISO 13584-24:—[1)], *Industrial automation systems and integration — Parts library — Part 24: Logical resource: Logical model of supplier library*.

ISO 13584-42:1998, *Industrial automation systems and integration — Parts library — Part 42: Description methodology: Methodology for structuring part families*.

# 3 Terms, definitions, and abbreviations

## 3.1 Terms defined in ISO 10303-1

This part of ISO 10303 makes use of the following terms defined in ISO 10303-1:

— abstract test suite (ATS);

— application;

— application activity model (AAM);

— application interpreted model (AIM);

— application protocol (AP);

— application reference model (ARM);

— conformance class;

— implementation method;

— integrated resource;

[1)] To be published.



 

— product;

— product data;

— protocol information and conformance statement (PICS);

— unit of functionality (UoF).

## 3.2 Terms defined in ISO 10303-31

This part of ISO 10303 makes use of the following terms defined in ISO 10303-31:

— conformance testing;

— implementation under test (IUT).

## 3.3 Other definitions

For the purposes of this part of ISO 10303, the following definitions apply:

**3.3.1**
**actual**
descriptive adjective that, when applied to an item, indicates that the item exists at some time in the real world. An actual plant item (see 3.3.32) has properties that can be measured or observed

NOTE 1 The terms actual, planned (see 3.3.31), and required (see 3.3.41) loosely reflect life-cycle stages of an item.

NOTE 2 Within the scope of this part of ISO 10303, being actual can be specified for an item that is:

— a plant item;

— an association between plant items such as a connection;

— an activity or an association between a plant item and an activity;

— a possession of a property by a plant item or activity.

NOTE 3 An item cannot be both actual and planned. An actual item can be the realization of an planned item.

**3.3.2**
**assembly**
a set of items that have a relationship to each other apart from being members of the same set



 

NOTE Within the scope of this part of ISO 10303, an assembly can be items that are plant items (see 3.3.32).

**3.3.3**
**basic engineering data**
parameters and descriptions that specify design (see 3.3.11) characteristics and boundaries for the plant item (see 3.3.32) that are required to support piping system (see 3.3.30) design

EXAMPLE Piping system design parameters and descriptions include design temperature, design pressure, design codes, and weights.

**3.3.4**
**branch**
a portion of a piping system (see 3.3.30) that diverges or divides from the main flow path

NOTE A branch may have a different identifier from that of the main flow path.

**3.3.5**
**catalogue**
a collection (see 3.3.6) of items or an electronic or paper document that contains information about a collection of items

NOTE Within the scope of this part of ISO 10303, a catalogue can be a collection of typical or reference plant items (see 3.3.32), that the definition of a specific occurrence of a plant item in the design (see 3.3.11) of a process plant (see 3.3.37) can be selected from.

**3.3.6**
**collection**
a set of things that do not have any relationship to each other apart from being members of the same set

NOTE Within the scope of this part of ISO 10303, a collection can be items that are plant items (see 3.3.32).

**3.3.7**
**component**
an item that may be part of another item

NOTE 1 Within the scope of this part of ISO 10303, an item that is a component can be part of a functional (see 3.3.13) or physical (see 3.3.24) plant item (see 3.3.32) or part of a process material (see 3.3.36) that is a mixture.

NOTE 2 A component can itself have components.



 

**3.3.8**
**connection**
an association between two items that enables the flow of process material (see 3.3.36), energy, mechanical loads, or signals between them or constrains their relative positions

NOTE 1 Within the scope of this part of ISO 10303, a connection can be between either functional (see 3.3.13) or physical (see 3.3.24) plant items (see 3.3.32).

NOTE 2 A connection can be the result of a physical joining.

NOTE 3 A functional connection can exist between two plant items without a physical joining of the plant items.



**3.3.9**
**connector**
a physical (see 3.3.24) or functional (see 3.3.13) property of a plant item (see 3.3.32) that links it to another plant item, or to a compatible connector on another plant item. This linkage enables the flow of energy, mechanical loads, process material (see 3.3.36), or signals through the connected plant items

**3.3.10**
**construction material**
the substance or substances that a physical (see 3.3.24) plant item (see 3.3.32) is made from

**3.3.11**
**design**
a representation (see 3.3.40) of a process plant (see 3.3.37), portion of a process plant, or plant item (see 3.3.32), that is created for a specific purpose and uses a consistent syntax and symbology

NOTE A PFD is a design that represents the flow and reaction of process materials (see 3.3.36). A P&ID is a design that represents the logical functionality of a piping system (see 3.3.30). A three-dimensional geometric model is a design that represents the physical (see 3.3.24) shape and arrangement of the components (see 3.3.7) of a process plant or plant system (see 3.3.33).

**3.3.12**
**equipment**
a plant item (see 3.3.32) that carries out an operation and that is treated as a single item for the purpose of design (see 3.3.11), acquisition, or operation

NOTE An equipment has both physical (see 3.3.24) and functional (see 3.3.13) aspects.

**3.3.13**
**functional**
descriptive adjective that, when applied to an item, refers to the actions, activities, or capabilities, that the item provides or may provide to fulfill a purpose

NOTE In the process plant industry, a plant item (see 3.3.32) that provides functional capability in a process plant (see 3.3.37) is typically denoted by a tag number.

**3.3.14**
**functional characteristics**
nomenclature, codes, and named values that describe or specify the performance or behaviour of a plant item (see 3.3.32)

EXAMPLE Functional characteristics include flow rates, operating pressure, and maximum temperature.

**3.3.15**
**functional requirements**
nomenclature, codes, and named values that describe or specify the performance or behaviour to be met by a plant item (see 3.3.32)

**3.3.16**
**instrument**
an individually identifiable plant item (see 3.3.32) or combination of plant items, that is part of a system that monitors or controls a process plant (see 3.3.37)

EXAMPLE Instruments include items such as control valves, sensors, and gauges.

**3.3.17**
**insulation**
a quantity of matter or space that provides resistance to the flow of heat, electricity, sound, or mechanical vibration

**3.3.18**
**line**
a logical component (see 3.3.7) of a piping system (see 3.3.30) that is composed of a collection (see 3.3.6) of line segments (see 3.3.19)

NOTE Further explanation of lines and line segments is provided in K.7.

**3.3.19**
**line segment**
an element of a line (see 3.3.18)

**3.3.20**
**line segment termination**
one of two logical end-points of a line segment (see 3.3.19)

NOTE Lines (see 3.3.18) are composed of line segments. Line segments are connected through line segment terminations.



 

**3.3.21**
**line segment termination connection**
a logical linkage between two line segments (see 3.3.19) or between a line segment and a plant item (see 3.3.32)

**3.3.22**
**material**
a quantity of matter

**3.3.23**
**material stream**
a flow of process material (see 3.3.36) past a defined point along a path

**3.3.24**
**physical**
descriptive adjective that, when applied to an item, refers to a set of characteristics, properties, or traits of the item

EXAMPLE Characteristics include weight, size, and location and orientation of the item.

NOTE In the process plant industry, a physical object that is, or may be, installed as a plant item (see 3.3.32), can be identified by a serial number.

**3.3.25**
**pipe**
a plant item (see 3.3.32) that is hollow and approximately cylindrical, that may have a constant cross-section along its extent, and that conveys fluid, vapour, or particulate material (see 3.3.22)

NOTE Heating, ventilation, and air conditioning (HVAC) duct that has a rectangular cross section is not a pipe.

**3.3.26**
**pipe fitting**
a plant item (see 3.3.32) that is used, or is intended to be used, to join or terminate pipes (see 3.3.25) or other items in a piping system (see 3.3.30) or equipment (see 3.3.12) connectors (see 3.3.9), or to provide changes of pipe direction or branching within a piping system

**3.3.27**
**piping and instrumentation diagram**
a piping and instrumentation diagram schematic representation (see 3.3.40) that consists, as a minimum, of the functional (see 3.3.13) connection (see 3.3.8) and assembly (see 3.3.2) of plant items (see 3.3.32), and the identification of principal plant items

NOTE The piping and instrumentation diagram can also present the functional and physical (see 3.3.24) aspects of plant items.

**3.3.28**
**piping class**
a functional (see 3.3.13) performance envelope defined by a set or range of common physical (see 3.3.24) properties, and an identification of the pipes (see 3.3.25), pipe fittings (see 3.3.26), and valves that have these properties

EXAMPLE 1 Piping classes include stainless steel, cast iron, and carbon steel.

EXAMPLE 2 Physical properties of a piping class include diameter, pressure, and temperature.



**3.3.29**
**piping specification**
a definition of various aspects of a piping system (see 3.3.30). It is also used to refer to a document or electronic file that contains such a definition

NOTE Piping system aspects that may be included in a piping specification include design pressures and temperatures, piping construction materials (see 3.3.10), pipe wall thicknesses or schedules, types of fittings to be used, types of valves and flanges, valve and flange pressure rating requirements, and fabrication, examination, testing, inspection, cleaning, and installation requirements, including the requirements for seismic installations, where applicable.

**3.3.30**
**piping system**
a plant system (see 3.3.33) that performs a transport function, and that is composed primarily of pipes (see 3.3.25), pipe fittings (see 3.3.26), and valves subject to the same set or sets of design (see 3.3.11) conditions

**3.3.31**
**planned**
descriptive adjective that, when applied to an item, indicates that an item that has been designed or predicted

NOTE 1 The terms actual (see 3.3.1), planned, and required (see 3.3.41) loosely reflect life-cycle stages of an item.

NOTE 2 Within the scope of this part of ISO 10303, being planned can be specified for an item that is:

— a plant item (see 3.3.32);

— an association between plant items such as a connection (see 3.3.8);

— an activity or an association between a plant item and an activity;

— a possession of a property by a plant item or activity.

 

NOTE 3 An item cannot be both actual and planned. An actual item can be the realization of a planned item.

**3.3.32**

**plant item**

a physical (see 3.3.24) object or volume of space that is, or is intended to be, a part of a process plant (see 3.3.37). A plant item can be an assembly (see 3.3.2) of other plant items. A plant item has both physical and functional (see 3.3.13) aspects

NOTE If a plant item is a volume of space, it may or may not contain other plant items.

**3.3.33**

**plant system**

a part of a process plant (see 3.3.37) that provides or performs, or is intended to provide or perform, a service or function contributing to, or enabling the operation of, a process plant. A plant system consists of an assembly (see 3.3.2) of one or more plant items (see 3.3.32). A plant system has both physical (see 3.3.24) and functional (see 3.3.13) aspects

**3.3.34**

**process activity**

an activity that transforms or transports process material (see 3.3.36) between its input to a process plant (see 3.3.37) as feed stock and its output from a process plant as a product or waste

NOTE The transformation can be a change of physical (see 3.3.24) state, a physical separation or mixing, or a biological or chemical process

**3.3.35**

**process flow diagram**

a schematic representation (see 3.3.40) that consists, as a minimum, of the connection of process activities (see 3.3.34) by material streams (see 3.3.23) and the identification of plant items (see 3.3.32) that perform the process activities

NOTE 1 The process activities shown on a process flow diagram can also be called unit operations.

NOTE 2 The process flow diagram can also present:

— properties of process activities and material streams for particular cases;

— measurements that are made upon process activities and material streams;

— the flow of signals between sensors, controllers, and actuators;

— the control logic that is implemented by a controller.



 

**3.3.36**
**process material**
the material (see 3.3.22) that is transformed or transported by a process activity (see 3.3.34)

**3.3.37**
**process plant**
an assembly (see 3.3.2) of one or more plant systems (see 3.3.33) and plant items (see 3.3.32) that can, or is intended to perform, a chemical, physical (see 3.3.24) or transport process. A process plant is identified as a single unit for the purposes of management and ownership. A process plant has both physical and functional (see 3.3.13) aspects

**3.3.38**
**range of values**
a specification of a value range for a given dimension, parameter, or nominal size, for the purpose of defining a family of plant items (see 3.3.32)

NOTE This is done by specifying two dimensional values for a given parameter. One dimension has a name with a value of minimum_<parameter name>, such as minimum_flange_inside_diameter. The other dimension has a name with a value of maximum_<parameter name>, such as maximum_flange_inside_-diameter.

**3.3.39**
**range value**
an indication of variation of a dimension, parameter, or nominal size on an actual physical (see 3.3.24) plant item (see 3.3.32). A range value is not a toleranced dimension. A range value, like the range of values (see 3.3.38), has a minimum and maximum value. It does not, however, indicate a family of plant items

NOTE The attributes that use range values in 4.2 are differentiated from the attributes those that use range of values by a explanatory note that follows the attribute definition.

EXAMPLE Insulation (see 3.3.17) may be described as 6 inches thick, but in reality it may be 5-7 inches thick. Range values permit this to be specified.

**3.3.40**
**representation**
a description, drawing, or depiction of something

**3.3.41**
**required**
descriptive adjective that, when applied to an item, indicates that an item is essential or necessary, i.e., it has to be provided to satisfy a functional (see 3.3.13) need

NOTE 1 The terms actual (see 3.3.1), planned (see 3.3.31), and required loosely reflect life-cycle stages of an item.



 

NOTE 2 Within the scope of this part of ISO 10303, being required can be specified for an item that is:

— a plant item (see 3.3.32);

— an association between plant items such as a connection (see 3.3.8);

— an activity or an association between a plant item and an activity;

— a possession of a property by a plant item or activity.

**3.3.42**
**site**
an area of land or water that one or more process plants (see 3.3.37) is or may be situated on

**3.3.43**
**spatial configuration**
the location, orientation, and relative position of the components (see 3.3.7) of a plant system (see 3.3.33)

## 3.4 Abbreviations

For the purposes of this part of ISO 10303, the following abbreviations apply:

| | |
|---|---|
| AAM | application activity model |
| AE | architectural engineering |
| AEC | architecture, engineering, and construction |
| AIC | application interpreted construct |
| AIM | application interpreted model |
| AISC | American Institute of Steel Construction |
| ANSI | American National Standards Institute |
| AP | application protocol |
| ARM | application reference model |
| ASTM | American Society for Testing and Materials |
| ATS | abstract test suite |



 

B-rep boundary representation

BOP bottom of pipe

CAD computer-aided design

COP centre of pipe

CSG constructive solid geometry

ECN engineering change notice

EPA Environmental Protection Agency

FDA Food and Drug Administration

GIS geographic information system

HVAC heating, ventilation, and air conditioning

id identifier

ICOM input, control, output, or mechanism

OSHA Occupational Safety and Health Administration

PFD process flow diagram

P&ID piping and instrumentation diagram

PICS protocol information and conformance statement

PIEBASE Process Industry Executive for achieving Business Advantage using Standards for data Exchange

PSI pounds per square inch

UoF unit of functionality

UTM universal transverse mercator



 

# 4 Information requirements

This clause specifies the information required for the exchange of plant spatial configuration information between application systems.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTE 1 A graphical representation of the information requirements is given in annex G.

NOTE 2 The information requirements correspond to those of the activities identified as being in the scope of this application protocol in annex F.

NOTE 3 The mapping table specified in 5.1 shows how the integrated resources are used to meet the information requirements of this application protocol. The use of the integrated resources introduces additional requirements that are common to application protocols.

## 4.1 Units of functionality

This subclause specifies the UoFs for the plant spatial configuration application protocol. This part of ISO 10303 specifies the following units of functionality:

— change_information UoF;

— connection UoF;

— connector UoF;

— hybrid_shape UoF;

— piping_component_characterization UoF;

— piping_system_functional_characterization UoF;

— plant_characterization UoF;

— plant_csg_shape UoF;

— plant_item_characterization UoF;

— shape UoF;

— site_characterization UoF.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in 4.2.

### 4.1.1 change_information UoF

The change_information UoF describes information such as the design change requests and approvals for modifications to Plant objects, Plant_item objects, Plant_system objects, and other components associated with the Plant.

The following application objects are used by the change_information UoF:

— Change;

— Change_approval;

— Change_item;

— Change_life_cycle_stage;

— Change_life_cycle_stage_sequence;

— Change_life_cycle_stage_usage;

— Changed_line_assignment;

— Changed_line_branch_connection;

— Changed_line_plant_item_branch_connection;

— Changed_line_plant_item_connection;

— Changed_line_to_line_connection;

— Changed_piping_specification;

— Changed_piping_system_line;

— Changed_piping_system_line_segment;

— Changed_piping_system_line_segment_termination;



 

— Changed_planned_physical_plant;

— Changed_plant;

— Changed_plant_item;

— Changed_plant_item_collection;

— Changed_plant_item_connection;

— Changed_plant_item_connector;

— Changed_plant_item_location;

— Changed_plant_item_shape;

— Changed_plant_process_capability;

— Changed_plant_system;

— Changed_reference_geometry;

— Changed_required_material_description;

— Changed_site;

— Changed_site_feature;

— Changed_sited_plant;

— Changed_sub_plant_relationship.

### 4.1.2 connection UoF

The connection UoF describes the physical linkage or connectivity between Plant_item objects. Plant_-item objects have connectors. Two connectors of a compatible type are attached to form a connection. The sequence of connections establishes the physical connectivity of items within Plant_system objects.

The following application objects are used by the connection UoF:

— Connection_definition;

— Electricity_transference;

— Flexible_connection;

— Fluid_transference;

— Functional_connection_definition_satisfaction;

— Functional_connection_occurrence_satisfaction;

— Load_transference;

— Locked_orientation_connection;

— Plant_item_connection;

— Plant_item_connection_occurrence.

### 4.1.3 connector UoF

The connector UoF is the information about the part of a Plant_item that is intended to interconnect with another Plant_item. This UoF describes the physical features of Plant_item objects that are designed to connect or mate with a similar physical feature on another Plant_item object.

The following application objects are used by the connector UoF:

— Branch_hole;

— Buttweld;

— Catalogue_connector;

— Connector_definition;

— Electrical_connector;

— Female_end;

— Flanged;

— Flanged_end;

— Functional_connector;

— Functional_connector_definition_satisfaction;

— Functional_connector_occurrence_satisfaction;

— Male_end;



 

— Physical_connector;

— Piping_connector;

— Piping_connector_service_characteristic;

— Plant_item_connector;

— Plant_item_connector_occurrence;

— Pressure_fit;

— Service_operating_case;

— Socket;

— Structural_load_connector;

— Threaded.

### 4.1.4 hybrid_shape UoF

The hybrid_shape UoF specifies the representation of Plant_item shapes using B-rep geometry and topology.

The following application objects are used by the hybrid_shape UoF:

— B_rep_element;

— Conic;

— Curve;

— Free_form_curve;

— Line;

— Point;

— Polygon;

— Surface;

— Vector;

— Wire_and_surface_element.

### 4.1.5 piping_component_characterization UoF

The piping_component_characterization UoF describes the individual elements of the Piping_system within a Plant. Piping_component objects include pipes, fittings, valves, in-line equipment, and other elements that regulate, control, or convey Piping_system fluids.

The following application objects are used by the piping_component_characterization UoF:

— Blank;

— Blind_flange;

— Bushing;

— Coupling;

— Cross;

— Eccentric_reducer;

— Eccentric_swage;

— Elbow;

— Expander_flange;

— Family_definition;

— Fitting;

— Flange;

— Gasket;

— Inline_equipment;

— Inline_instrument;

— Insert;



 

— Inside_and_thickness;

— Lap_joint_flange;

— Lap_joint_stub_end;

— Lateral;

— Mitre_bend_pipe;

— Nipple;

— Olet;

— Orifice_flange;

— Orifice_plate;

— Outside_and_thickness;

— Paddle_blank;

— Paddle_spacer;

— Pipe;

— Pipe_bend;

— Pipe_closure;

— Piping_component;

— Piping_size_description;

— Pressure_class;

— Reducer;

— Reducing_flange;

— Ring_spacer;

— Schedule;

— Slip_on_flange;

— Socket_weld_flange;

— Spacer;

— Specialty_item;

— Spectacle_blind;

— Straight_pipe;

— Swage;

— Swept_bend_pipe;

— Tee;

— Threaded_flange;

— Union;

— Valve;

— Weld_neck_flange;

— Y_type_lateral.

### 4.1.6 piping_system_functional_characterization UoF

The piping_system_functional_characterization UoF describes the functional connectivity of a Piping_-system and the functional connectivity among Plant_item objects in that system. This UoF provides the information that describes the functional links and properties of a flow stream in a Piping_system. It includes information about the segments in the line and the specifications for these segments, such as design criteria, service conditions, and line identifier.

The following application objects are used by the piping_system_functional_characterization UoF:

— Line_branch_connection;

— Line_branch_termination;

— Line_piping_system_component_assignment;

— Line_plant_item_branch_connection;

— Line_plant_item_branch_connector;



 

— Line_plant_item_connection;

— Line_plant_item_connector;

— Line_plant_item_termination;

— Line_to_line_connection;

— Line_to_line_termination;

— Piping_specification;

— Piping_system_line;

— Piping_system_line_segment;

— Piping_system_line_segment_termination;

— Piping_system_line_termination;

— Segment_insulation;

— Stream_design_case;

— Stream_phase.

### 4.1.7 plant_characterization UoF

The plant_characterization UoF describes identifiable collections of Plant_item objects that perform specific functions within a plant. The Plant_item objects are functionally dependent on one another for the performance of the system and are interrelated through physical connections. The collection of Plant_system objects as a whole enables the Plant to operate.

The following application objects are used by the plant_characterization UoF:

— Ducting_system;

— Electrical_system;

— External_classification;

— Functional_plant;

— Functional_plant_satisfaction;



 

— Hvac_system;

— Instrumentation_and_control_system;

— Line_less_piping_system;

— Location_in_plant;

— Manufacturing_line;

— Piping_system;

— Planned_physical_plant;

— Plant;

— Plant_process_capability;

— Plant_system;

— Plant_system_assembly;

— Structural_system;

— Sub_plant_relationship;

— Train;

— Unit.

### 4.1.8 plant_csg_shape UoF

The plant_csg_shape UoF specifies the representation of Plant_item shapes using CSG primitives.

The following application objects are used by the plant_csg_shape UoF:

— Block;

— Circular_ellipsoid;

— Cone;

— Csg_element;

— Cylinder;



 

— Eccentric_cone;

— Eccentric_cylinder;

— Eccentric_pyramid;

— Extrusion;

— Faceted_brep;

— Hemisphere;

— Pyramid;

— Reducing_torus;

— Solid_of_revolution;

— Sphere;

— Square_to_round;

— Torus;

— Trimmed_block;

— Trimmed_cone;

— Trimmed_cylinder;

— Trimmed_pyramid;

— Trimmed_sphere;

— Trimmed_torus.



### 4.1.9 plant_item_characterization UoF

The plant_item_characterization UoF describes major elements that Plant objects and Plant_system objects are comprised of. These are items within a Plant that occupy space and possess physical, measurable characteristics. This UoF specifies spatial and physical information about Piping_system_-component objects and Equipment, but only spatial characteristics of components of other Plant_system objects, such as HVAC and instrumentation.

 

This UoF describes the information and options associated with the specification of the substance or substances that a Plant_item is composed of. It also describes specification and catalogue information concerning piping components.

This UoF describes the spatial shape and position of volumes of space in a Plant.

NOTE 1 Physical plant_items are things that can be touched.

NOTE 2 As used in this part of ISO 10303, material does not refer to the products that flow within plant systems.

The following application objects are used by the plant_item_characterization UoF:

— Cable_support;

— Catalogue_definition;

— Catalogue_item;

— Catalogue_item_substitute;

— Connected_collection;

— Design_project;

— Ducting_component;

— Electrical_component;

— Equipment;

— Equipment_breaching;

— Equipment_trim_piping;

— Externally_defined_user_defined_attribute_value;

— Functional_design_view;

— Functional_plant_item_satisfaction;

— Hierarchically_organized_collection;

— Hvac_component;



 

— Hvac_ducting;

— Installed_physical_design_view;

— Instrument;

— Instrumentation_and_control_component;

— Insulation;

— Jacketed_piping;

— Material_specification_selection;

— Material_specification_subset_reference;

— Offline_instrument;

— Physical_design_view;

— Piping_spool;

— Piping_spool_assignment;

— Piping_system_component;

— Planned_physical_plant_item;

— Plant_item;

— Plant_item_collection;

— Plant_item_definition;

— Plant_item_design_view;

— Plant_item_instance;

— Plant_item_location;

— Plant_item_weight;

— Plant_volume;

— Process_ducting;

— Project_design_assignment;

— Relative_item_location;

— Required_material_description;

— Reserved_space;

— Route;

— Spare_plant_item_usage;

— Structural_component;

— Supplied_equipment;

— Supplier;

— Support_component;

— Support_constraints;

— Support_usage;

— Support_usage_connection;

— System_space;

— User_defined_attribute_value.

### 4.1.10 shape UoF

The shape UoF specifies the external shapes of components, assemblies of components, and volumes of a Plant. The external shape of a component can be specified as an envelope of the space occupied by a component, as an outline of the component, or as a detailed definition of the shape of a component.

The following application objects are used by the shape UoF:

— Detail_shape;

— Envelope_shape;

— Hybrid_shape_representation;

— Interfering_shape_element;



 

— Outline_shape;

— Plant_csg_shape_representation;

— Plant_item_centreline;

— Plant_item_interference;

— Plant_item_interference_status;

— Plant_item_shape;

— Reference_geometry;

— Shape_interference_zone_usage;

— Shape_parameter;

— Shape_representation;

— Shape_representation_element;

— Shape_representation_element_usage.

### 4.1.11 site_characterization UoF

The site_characterization UoF describes the significant features of the Site where the Plant is located. It includes information about the site location, infrastructure like roads and sewers, buildings, and other structures located on the Site, and the shape of the terrain where a Building or Site_feature is located.

The following application objects are used by the site_characterization UoF:

— Breakline;

— Building;

— Facet_trigon;

— Faceted_surface_representation;

— Gis_position;

— Location_in_building;

— Location_in_site;



 

— Point_and_line_representation;

— Site;

— Site_feature;

— Site_shape_representation;

— Sited_plant;

— Survey_point.

## 4.2 Application objects

This subclause specifies the application objects for the plant spatial configuration application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

Each application object attribute need not be present unless the attribute is specifically identified as required for an application object.

### 4.2.1 B_rep_element

A B_rep_element is a type of Shape_representation_element (see 4.2.216) that is composed of geometric and topological elements.

NOTE A B_rep_element need not represent a solid shape.

### 4.2.2 Blank

A Blank is a type of Fitting (see 4.2.83) that is placed between two Flange (see 4.2.84) objects to block the flow of material between the pipelines on either side of the Blank. Each Blank may be one of the following: a Paddle_blank (see 4.2.150) or a Spectacle_blind (see 4.2.229).

The data associated with a Blank are the following:

— outside_diameter;

— thickness.



 

#### 4.2.2.1 outside_diameter

The outside_diameter specifies the external diameter of the Blank. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.2.2 thickness

The thickness specifies the distance between the two faces of the Blank. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.3 Blind_flange

A Blind_flange is a type of Flange (see 4.2.84) that is used to block material flow at a flanged connection.

### 4.2.4 Block

A Block is a type of Csg_element (see 4.2.54) that is a 3D right rectangular solid.

NOTE The size and shape of a Block is described by three real values representing the dimensions of the Block.

### 4.2.5 Branch_hole

A Branch_hole is a type of Piping_connector (see 4.2.158) end type that is a hole cut in a pipe for a branch connection.

NOTE A Branch_hole is not typically a design feature of the pipe, but rather is added after the fact to create a branch from the pipe. The hole may be used for stub-in connections, olets, or nipples can be welded or screwed to it.

The data associated with a branch_hole are the following:

— diameter.

The diameter specifies the diameter value of the branch_hole. It may be specified as a single value or as a range of values.

NOTE 2 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.6 Breakline

A Breakline is a contiguous set of straight line segments that designate a path across a Site_shape_-representation (see 4.2.220).

NOTE The path is a constraint on the mathematical interpolation of the surface of the terrain.

### 4.2.7 Building

A Building is a partially or totally enclosed structure located on a Site (see 3.3.42, 4.2.218) that contains Plant_system (see 4.2.190) objects or provides supporting infrastructure within its boundaries. The z-axis of the local coordinate system of the Building shall be considered the elevation of the coordinate space.

The data associated with a Building are the following:

— building_id;

— location_and_orientation;

— name;

— shape.

#### 4.2.7.1 building_id

The building_id specifies a unique number used to identify the building. Building_id is required for each Building.

#### 4.2.7.2 location_and_orientation

The location_and_orientation specifies the position of the Building relative to the site coordinate system and the orientation of the Building relative to a specified direction.

EXAMPLE E5704.35', N5912.87' are coordinates. They can be used to locate a known point in the Building (e.g., centrelines of column row 1A).

#### 4.2.7.3 name

The name specifies a textual label given to the Building.



 

#### 4.2.7.4 shape

The shape specifies the outline or characteristic surface configuration or contour of the building.

### 4.2.8 Bushing

A Bushing is a type of Fitting (see 4.2.83) with one external and one smaller internal end.

NOTE Figure 4 depicts a typical threaded hexagon Bushing. It is typically used to connect a smaller Pipe (see 3.3.25, 4.2.154) to a larger Fitting or nozzle.

The data associated with a Bushing are the following:

— end_1_connector;

— end_2_connector;

— end_to_end_length.

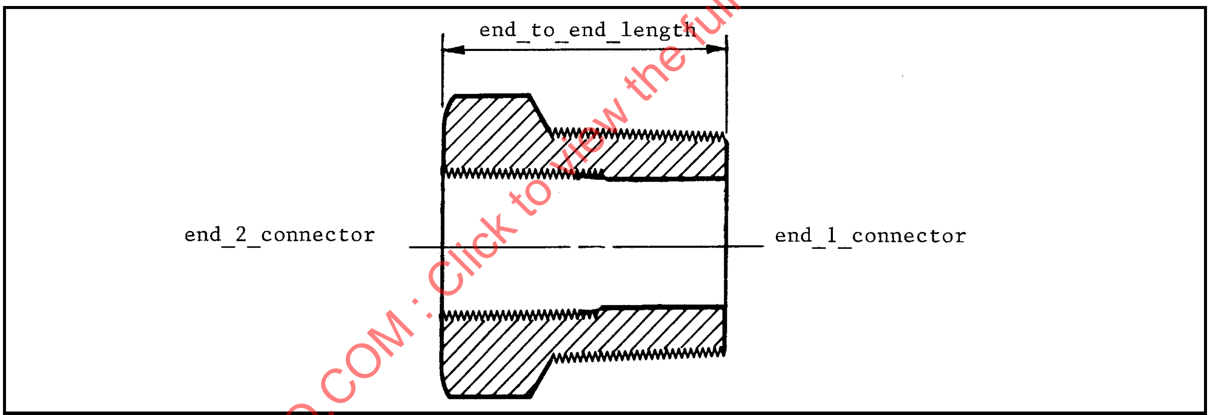


**Figure 4 - Bushing**



#### 4.2.8.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) Male_end (see 4.2.138).

#### 4.2.8.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) Female_end (see 4.2.82).

 

#### 4.2.8.3 end_to_end_length

The end_to_end_length specifies the external length of the Bushing from the end-one face to the end-two face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.9 Buttweld

A Buttweld is a type of Piping_connector (see 4.2.158) that consists of the welding of two Piping_-component (see 4.2.157) objects where they are aligned edge to edge.

The data associated with a Buttweld are the following:

— end_preparation.

The end_preparation specifies a description of the end of the connector that is necessary to prepare it for welding.

### 4.2.10 Cable_support

A Cable_support is a type of Support_component (see 4.2.241) that provides support to Electrical_-component (see 4.2.67) objects.

The data associated with a Cable_support are the following:

— cable_support_type.

The cable_support_type specifies a description of the category of Cable_support.

### 4.2.11 Catalogue_connector

A Catalogue_connector is the definition or the reference of a Connector_definition (see 4.2.51). A Connector_definition may appear in a catalogue, or the properties of a Connector_definition may be drawn from a catalogue.

NOTE A Catalogue_connector is analogous to a Catalogue_item (see 4.2.13) in that both have standardized characteristics.

### 4.2.12 Catalogue_definition

A Catalogue_definition is the identification of a document that lists Catalogue_item (see 4.2.13) objects.

NOTE 1 Catalogue_definition may reference either an electronic or printed catalogue.

 

NOTE 2 A Catalogue_definition may be defined by ISO 13584 [13]. ISO 13584 will be considered a normative reference when it has reached the DIS level.

The data associated with a Catalogue_definition are the following:

— catalogue_id;

— catalogue_name;

— catalogue_version.

#### 4.2.12.1 catalogue_id

The catalogue_id specifies a unique identifier given to a catalogue. Catalogue_id is required for each Catalogue_definition.

#### 4.2.12.2 catalogue_name

The catalogue_name specifies a textual label given to the catalogue.

#### 4.2.12.3 catalogue_version

The catalogue_version specifies a particular release of a catalogue within a sequence of catalogue releases.

### 4.2.13 Catalogue_item

A Catalogue_item is an item whose characteristics are standardized and have been categorized in a library or catalogue. A Catalogue_item that is defined by a plant_item_definition (see 4.2.181) must be defined by a plant_item_definition in which the plant_item (see 4.2.174) is defined as a Physical_design_view (see 4.2.153).

The data associated with a Catalogue_item are the following:

— item_name;

— item_version;

— model_number.

#### 4.2.13.1 item_name

The item_name specifies a textual label that is used by the supplier to refer to the Catalogue_item.

#### 4.2.13.2 item_version

The item_version specifies a particular release of a Catalogue_item within a sequence of Catalogue_item releases.

NOTE This attribute accommodates the possibility of revision pages to a supplier catalogue.

#### 4.2.13.3 model_number

The model_number is the identifier assigned by the supplier to one or more Catalogue_item objects.

### 4.2.14 Catalogue_item_substitute

A Catalogue_item_substitute is an alternate Catalogue_item (see 4.2.13) that can be used instead of the specified Catalogue_item.

### 4.2.15 Change

A Change is the modification or requested modification of a Plant_item (see 4.2.174).

NOTE A Change may be a request to make a change or an approved change.

The data associated with a Change are the following:

— business_unit;

— change_id;

— change_reason;

— change_summary;

— date;

— project_number;

— revision;

— title.

#### 4.2.15.1 business_unit

The business_unit specifies the organization(s), company(s), or functional group(s) responsible for the Change.



 

#### 4.2.15.2 change_id

The change_id specifies a unique identifier for the Change.

#### 4.2.15.3 change_reason

The change_reason specifies the rationale for the Change.

#### 4.2.15.4 change_summary

The change_summary specifies a general description of the Change.

#### 4.2.15.5 date

The date specifies the calendar day-month-year and time that the Change was initiated on.

NOTE A specific ordering of the day, month, and year within the date is not required.

#### 4.2.15.6 project_number

The project_number specifies a designation assigned to identify projects within an organization. More than one project (and therefore more than one project_number) may be associated with a Change.

EXAMPLE Identification of a project_number is used to allow tracking of items such as costs and job hours associated with a Change.

NOTE A project_number may or may not be the same as the designation of a Design_project (see 4.2.57).

#### 4.2.15.7 revision

The revision specifies the particular amendment of the Change within a sequence of amendments.

#### 4.2.15.8 title

The title specifies a descriptive label for the Change.

### 4.2.16 Change_approval

A Change_approval is the endorsement by an authority of the change in status of a specific Change.

The data associated with a Change_approval are the following:

— approval_date;

— approver;

— approver_role.

#### 4.2.16.1 approval_date

The approval_date specifies the specific calendar day-month-year and time when the approval authority signed the Change (see 4.2.15) as approved.

NOTE A specific ordering of the day, month, and year within the date is not required.

#### 4.2.16.2 approver

The approver specifies the name of the individual who endorsed the Change (see 4.2.15).

#### 4.2.16.3 approver_role

The approver_role specifies the purpose or function of the approver that approves a change.

### 4.2.17 Change_item

A Change_item is an item that may be modified, for which there is a request to modify, or is the result of a modification to a Change_item. Each Change_item is either: a Changed_line_assignment (see 4.2.21), a Changed_line_branch_connection (see 4.2.22), a Changed_line_plant_item_branch_connection (see 4.2.23), a Changed_line_plant_item_connection (see 4.2.24), a Changed_line_to_line_connection (see 4.2.25), a Changed_piping_system_line (see 4.2.27), a Changed_piping_system_line_segment (see 4.2.28), a Changed_piping_system_line_segment_termination (see 4.2.29), a Changed_planned_-physical_plant (see 4.2.30), a Changed_plant (see 4.2.31), a Changed_plant_item (see 4.2.32), a Changed_plant_item_collection (see 4.2.33), a Changed_plant_item_connection (see 4.2.34), a Changed_plant_item_connector (see 4.2.35), a Changed_plant_item_shape (see 4.2.37), a Changed_-plant_process_capability (see 4.2.38), a Changed_plant_system (see 4.2.39), a Changed_reference_-geometry (see 4.2.40), a Changed_required_material_description (see 4.2.41), a Changed_sited_plant (see 4.2.44), or a Changed_sub_plant_relationship (see 4.2.45).

The data associated with a Change_item are the following:

— change_item_id;

— creation_date;

— description;



 

— from_or_to;

— item_owner;

— supersedence_status.

#### 4.2.17.1 change_item_id

The change_item_id specifies a unique identifier for a Change_item.

#### 4.2.17.2 creation_date

The creation_date specifies the calendar day-month-year and time that the Change_item is created on.

NOTE A specific ordering of the day, month, and year within the date is not required.

#### 4.2.17.3 description

The description specifies a textual explanation or summary of the item being changed.

#### 4.2.17.4 from_or_to

The from_or_to specifies whether the Change_item is the item for which the change is being identified or the item which is the result of the change.

#### 4.2.17.5 item_owner

The item_owner specifies the name of the person or organization that owns the item being changed and is responsible for implementing or approving the change.

#### 4.2.17.6 supersedence_status

The status specifies the textual description of the existence condition of a Change_item.

EXAMPLE Examples of Change_item status include Current, Superseded, and Deleted.

### 4.2.18 Change_life_cycle_stage

A Change_life_cycle_stage is a state in the life cycle of the change that indicates or classifies the status or disposition of the change.

The data associated with a Change_life_cycle_stage are the following:

— name.

The name specifies a textual label given to the stage.

EXAMPLE Examples of names include requested, pending, and implemented.

### 4.2.19 Change_life_cycle_stage_sequence

A Change_life_cycle_stage_sequence is the mechanism that specifies the sequence of life-cycle stages.

### 4.2.20 Change_life_cycle_stage_usage

A Change_life_cycle_stage_usage is the assignment of a Change (see 4.2.15) to a particular Change_-life_cycle_stage (see 4.2.18).

The data associated with a Change_life_cycle_stage_usage are the following:

— date_of_activation;

— date_of_completion;

— description.

#### 4.2.20.1 date_of_activation

The date_of_activation specifies the calendar day-month-year and time when the Change was assigned to the Change_life_cycle_stage. A specific ordering of the day, month, and year within the date is not required.

#### 4.2.20.2 date_of_completion

The date_of_completion specifies the calendar day-month-year and time when the Change was released from, or completed, the assigned life_cycle stage.

#### 4.2.20.3 description

The description specifies a textual explanation or summary of the assignment of the Change to a particular stage.

### 4.2.21 Changed_line_assignment

A Changed_line_assignment is a type of Change_item (see 4.2.17) that identifies a Line_piping_system_-component_assignment (see 4.2.125) that is being changed or is the result of a Change (see 4.2.15).



 

### 4.2.22 Changed_line_branch_connection

A Changed_line_branch_connection is a type of Change_item (see 4.2.17) that identifies a Line_branch_-connection (see 4.2.122) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.23 Changed_line_plant_item_branch_connection

A Changed_line_plant_item_branch_connection is a type of Change_item (see 4.2.17) that identifies a Line_plant_item_branch_connection (see 4.2.126) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.24 Changed_line_plant_item_connection

A Changed_line_plant_item_connection is a type of Change_item (see 4.2.17) that identifies a Line_-plant_item_connection (see 4.2.128) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.25 Changed_line_to_line_connection

A Changed_line_to_line_connection is a type of Change_item (see 4.2.17) that identifies a Line_to_-line_connection (see 4.2.131) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.26 Changed_piping_specification

A Changed_piping_specification is a type of Change_item (see 4.2.17) that identifies a Piping_-specification (see 4.2.161) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.27 Changed_piping_system_line

A Changed_piping_system_line is a type of Change_item (see 4.2.17) that identifies a Piping_system_-line (see 4.2.166) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.28 Changed_piping_system_line_segment

A Changed_piping_system_line_segment is a type of Change_item (see 4.2.17) that identifies a Piping_-system_line_segment (see 4.2.167) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.29 Changed_piping_system_line_segment_termination

A Changed_piping_system_line_segment_termination is a type of Change_item (see 4.2.17) that identifies a Piping_system_line_segment_termination (see 4.2.168) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.30 Changed_planned_physical_plant

A Changed_planned_physical_plant is a type of Change_item (see 4.2.17) that identifies a Planned_-physical_plant (see 4.2.170) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.31 Changed_plant

A Changed_plant is a type of Change_item (see 4.2.17) that identifies a Plant (see 4.2.172) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.32 Changed_plant_item

A Changed_plant_item is a type of Change_item (see 4.2.17) that identifies a Plant_item (see 4.2.174) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.33 Changed_plant_item_collection

A Changed_plant_item_collection is a type of Change_item (see 4.2.17) that identifies a Plant_item_-collection (see 4.2.176) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.34 Changed_plant_item_connection

A Changed_plant_item_connection is a type of Change_item (see 4.2.17) that identifies a Plant_item_-connection (see 4.2.177) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.35 Changed_plant_item_connector

A Changed_plant_item_connector is a type of Change_item (see 4.2.17) that identifies a Plant_item_-connector (see 4.2.179) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.36 Changed_plant_item_location

A Changed_plant_item_location is a type of Change_item (see 4.2.17) that identifies a Plant_item_-location (see 4.2.186) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.37 Changed_plant_item_shape

A Changed_plant_item_shape is a type of Change_item (see 4.2.17) that identifies a Plant_item_shape (see 4.2.187) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.38 Changed_plant_process_capability

A Changed_plant_process_capability is a type of Change_item (see 4.2.17) that identifies a Plant_-process_capability (see 4.2.189) that is being changed or is the result of a Change (see 4.2.15).



 

### 4.2.39 Changed_plant_system

A Changed_plant_system is a type of Change_item (see 4.2.17) that identifies a Plant_system (see 4.2.190) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.40 Changed_reference_geometry

A Changed_reference_geometry is a type of Change_item (see 4.2.17) that identifies a Reference_-geometry (see 4.2.204) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.41 Changed_required_material_description

A Changed_required_material_description is a type of Change_item (see 4.2.17) that identifies a Required_material_description (see 4.2.206) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.42 Changed_site

A Changed_site is a type of Change_item (see 4.2.17) that identifies a Site (see 3.3.42, 4.2.218) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.43 Changed_site_feature

A Changed_site_feature is a type of Change_item (see 4.2.17) that identifies a Site_feature (see 4.2.219) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.44 Changed_sited_plant

A Changed_sited_plant is a type of Change_item (see 4.2.17) that identifies a Sited_plant (see 4.2.221) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.45 Changed_sub_plant_relationship

A Changed_sub_plant_relationship is a type of Change_item (see 4.2.17) that identifies a Sub_plant_-relationship (see 4.2.238) that is being changed or is the result of a Change (see 4.2.15).

### 4.2.46 Circular_ellipsoid

A Circular_ellipsoid is a type of Csg_element (see 4.2.54) that has the following geometric characteristics: it is axial symmetric; cross sections taken in a plane normal to the axis result are circular; cross sections taken in plane containing the axis are elliptical; it is trimmed with a plane that is normal to an axis.

NOTE The shape of a Circular_ellipsoid may be described as a hemisphere that has been compressed along the circular axis.

### 4.2.47 Cone

A Cone is a type of Csg_element (see 4.2.54) that is a 3D volume with parallel, coaxial, circular cross-sections of radii that varies uniformly from a circular base to an axis normal to and positioned at the centre point of the base.

### 4.2.48 Conic

A Conic is a type of Curve (see 4.2.55) composed of points located at a uniform distance from a point, a pair of points, or a point and a line.

EXAMPLE Kinds of Conics include circles, ellipses, parabolas, and hyperbolas.

### 4.2.49 Connected_collection

A Connected_collection is a type of Plant_item_collection (see 4.2.176) where elements of the whole collection must be connected.

NOTE These connections may be identified explicitly by Plant_item_connection (see 4.2.177) objects.

EXAMPLE A set of Plant_item objects can be collected for the purpose of defining the items that comprise an assembly. Examples of this assembly include packaged unit and module in a plant.

### 4.2.50 Connection_definition

A Connection_definition is a type of Plant_item_connection (see 4.2.177) that specifies connection comprised of two or more connectors that is part of a Plant_item_definition (see 4.2.181).

NOTE A Connection_definition that is part of a Plant_item_definition implies that the Plant_item_-definition is a Connected_collection (see 4.2.49).

### 4.2.51 Connector_definition

A Connector_definition is a type of Plant_item_connector (see 4.2.179) that identifies the connector where a non-instantiated Plant_item (see 4.2.174) can connect to one or more other Plant_item_connector (see 4.2.179) objects.

### 4.2.52 Coupling

A Coupling is a type of Fitting (see 4.2.83) that is used to make a linear connection between two pipes.

NOTE Figure 5 depicts a typical socket-weld Coupling.



 

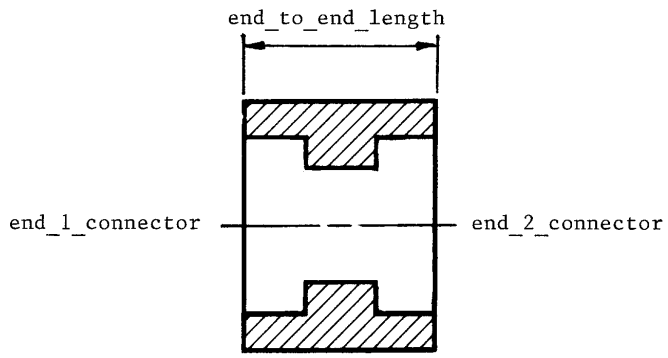


**Figure 5 - Coupling**

The data associated with a Coupling are the following:

— end_1_connector;

— end_2_connector;

— end_to_end_length.

#### 4.2.52.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) designated as end one.

#### 4.2.52.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) designated as end two.

#### 4.2.52.3 end_to_end_length

The end_to_end_length specifies the external distance between the end-one and end-two faces. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.53 Cross

A Cross is a type of Fitting (see 4.2.83) that is a branched outlet consisting of four perpendicular legs to provide straight through and 90 degree flow.

NOTE Figure 6 depicts a typical butt-weld Cross.

The data associated with a Cross are the following:

— centre_to_end_1_length;

— centre_to_end_2_length;

— centre_to_end_3_length;

— centre_to_end_4_length;

— end_1_connector;

— end_2_connector;

— end_3_connector;

— end_4_connector.

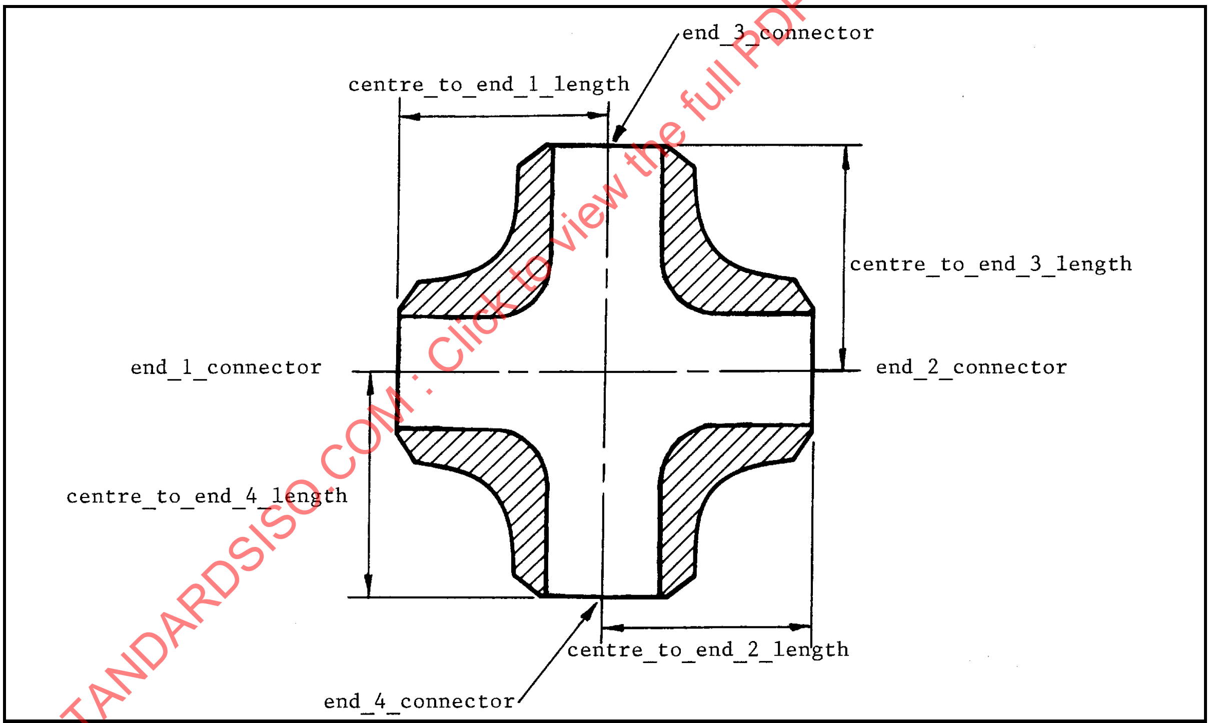



**Figure 6 - Cross**

### 4.2.53.1 centre_to_end_1_length

The centre_to_end_1_length specifies the distance from the intersection of the cross straight-run centreline and branch-run centreline to the end-one (straight-run) face. It may be specified as a single value or as a range of values.

 

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.53.2 centre_to_end_2_length

The centre_to_end_2_length specifies the distance from the intersection of the cross straight-run centreline and branch-run centreline to the end-two (straight-run) face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.53.3 centre_to_end_3_length

The centre_to_end_3_length specifies the distance from the intersection of the cross straight-run centreline and branch-run centreline to the end-three (branch-run) face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.53.4 centre_to_end_4_length

The centre_to_end_4_length specifies the distance from the intersection of the cross straight-run centreline and branch-run centreline to the end-four (branch-run) face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.53.5 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) designated as end one.

#### 4.2.53.6 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) designated as end two.

#### 4.2.53.7 end_3_connector

The end_3_connector specifies the Piping_connector (see 4.2.158) designated as end three.

#### 4.2.53.8 end_4_connector

The end_4_connector specifies the Piping_connector (see 4.2.158) designated as end four.

### 4.2.54 Csg_element

A Csg_element is a type of Shape_representation_element (see 4.2.216) that is a regular, 3D geometric shape that is combined with other regular shapes through boolean operations to create a complex, 3D, solid model. Each Csg_element is either: a Block (see 4.2.4), a Circular_ellipsoid (see 4.2.46), a Cone (see 4.2.47), a Cylinder (see 4.2.56),an Eccentric_cone (see 4.2.61), an Eccentric_cylinder (see 4.2.62), an Eccentric_pyramid (see 4.2.63), an Extrusion (see 4.2.77), a Faceted_brep (see 4.2.79), a Hemisphere (see 4.2.101), a Pyramid (see 4.2.200), a Reducing_torus (see 4.2.203), a Solid_of_revolution (see 4.2.225), a Sphere (see 4.2.230), a Square_to_round (see 4.2.231), a Torus (see 4.2.253), a Trimmed_-block (see 4.2.255), a Trimmed_cone (see 4.2.256), a Trimmed_cylinder (see 4.2.257), a Trimmed_-pyramid (see 4.2.258), a Trimmed_sphere (see 4.2.259), a Trimmed_torus (see 4.2.260).

### 4.2.55 Curve

A Curve is a type of Wire_and_surface_element (see 4.2.267) that is a one-dimensional manifold in a space of dimension two or three. A Curve may be a Conic (see 4.2.48), a Free_form_curve (see 4.2.89), a Line (see 3.3.18, 4.2.121), a Polygon (see 4.2.195), or a Vector (see 4.2.265).

NOTE Informally, a Curve can be envisioned as the path of a point moving in its coordinate space.

### 4.2.56 Cylinder

A Cylinder is a type of Csg_element (see 4.2.54) that is a 3D cylindrical solid primitive with end surfaces that are planar and are perpendicular to the axis. The size and shape of a Cylinder is completely described by two real values that represent the radius and length of the cylinder.

### 4.2.57 Design_project

A Design_project is a task with a specifically defined purpose and scope that is used for the administration and management of plant designs.

The data associated with a Design_project are the following:

— description;

— design_project_id;

— name;

— owner.

#### 4.2.57.1 description

The description specifies a textual explanation or summary of the Design_project.



 

#### 4.2.57.2 design_project_id

The design_project_id specifies a unique identifier for the Design_project. Design_project_id is required for each design_project.

#### 4.2.57.3 name

The name specifies a textual label given to the Design_project.

#### 4.2.57.4 owner

The owner specifies the name of the organization that is responsible for the Design_project.

### 4.2.58 Detail_shape

A Detail_shape is a type of Shape_representation (see 4.2.215 4.2.212) that is the actual or intended external shape of a Plant_item (see 4.2.174). A Detail_shape does not include the description of voids or other internal details of the shape of the Plant_item.

NOTE Contrast Detail_shape with Outline_shape (see 4.2.148) and Envelope_shape (see 4.2.71). A Detail_shape more closely approximates the actual shape of the plant_item than either Envelope_shape or Outline_shape and is, therefore, likely to be more complex than either Envelope_shape or Outline_-shape.

### 4.2.59 Ducting_component

A Ducting_component is a type of Plant_item (see 4.2.174) that conveys gaseous matter or airborne, particulate matter. Each Ducting_component may be one of the following: an Equipment_breaching (see 4.2.73), an Hvac_ducting (see 4.2.104), or a Process_ducting (see 4.2.198).

EXAMPLE A Ducting_component that does not fall within one of the subtype categories may be cable trays, raceways, and other ducting used for routing and support of cables.

### 4.2.60 Ducting_system

A Ducting_system is a type of Plant_system (see 4.2.190) that controls the temperature, humidity, cleanliness, and circulation of environmental or exhaust air as required in a Plant (see 4.2.172). A Ducting_system may be an Hvac_system (see 4.2.105).

The data associated with a Ducting_system are the following:

— type.

The type specifies a designation that classifies a Ducting_system based on the kind of service that it provides.

### 4.2.61 Eccentric_cone

An Eccentric_cone is a type of Csg_element (see 4.2.54) that consists of a Cone (see 4.2.47) with an axis that is not normal to the base.

### 4.2.62 Eccentric_cylinder

An Eccentric_cylinder is a type of Csg_element (see 4.2.54) that consists of a Cylinder (see 4.2.56) with an axis that is not normal to the base.

### 4.2.63 Eccentric_pyramid

An Eccentric_pyramid is a type of Csg_element (see 4.2.54) that consists of a Pyramid (see 4.2.200) with an axis that is not normal to the base.

### 4.2.64 Eccentric_reducer

An Eccentric_reducer is a type of Reducer (see 4.2.201) where the small end is off-centre from the large end.

NOTE Figure 7 depicts a typical butt-weld Eccentric_reducer. The end_<number>_connectors correspond to the end_<number>_connector attributes defined in Reducer (see 4.2.201).

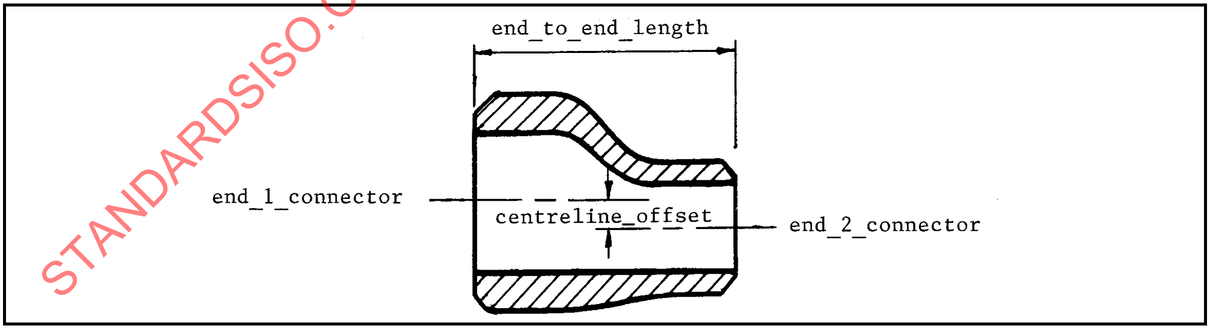


**Figure 7 - Eccentric reducer**



 

The data associated with an Eccentric_reducer are the following:

— centreline_offset;

— flat_side_orientation.

#### 4.2.64.1 centreline_offset

The centreline_offset specifies the perpendicular distance between the centreline of the large end of the Reducer (see 4.2.201) and the centreline of the smaller end of the Reducer.

#### 4.2.64.2 flat_side_orientation

The flat_side_orientation specifies the direction of the straight side of the Eccentric_reducer.

NOTE 1 The direction of the straight side is typically specified as up or down.

NOTE 2 The straight side of the Eccentric_reducer corresponds to the side where the ends of the Eccentric_reducer have a common tangent point parallel to the centreline axes of the Eccentric_reducer.

### 4.2.65 Eccentric_swage

An Eccentric_swage is a type of Swage (see 4.2.247) where the small end is off-centre from the large end.

NOTE Figure 8 depicts a typical butt-weld Eccentric_swage. The end_<number>_connectors correspond to the end_<number>_connector attributes defined in Swage (see 4.2.247).

The data associated with a Eccentric_swage are the following:

— centreline_offset;

— flat_side_orientation.

#### 4.2.65.1 centreline_offset

The centreline_offset specifies the perpendicular distance between the centreline of the large end of the Swage (see 4.2.247) and the centreline of the smaller end of the Swage.

#### 4.2.65.2 flat_side_orientation

A flat_side_orientation specifies the direction of the straight side of the Eccentric_swage.

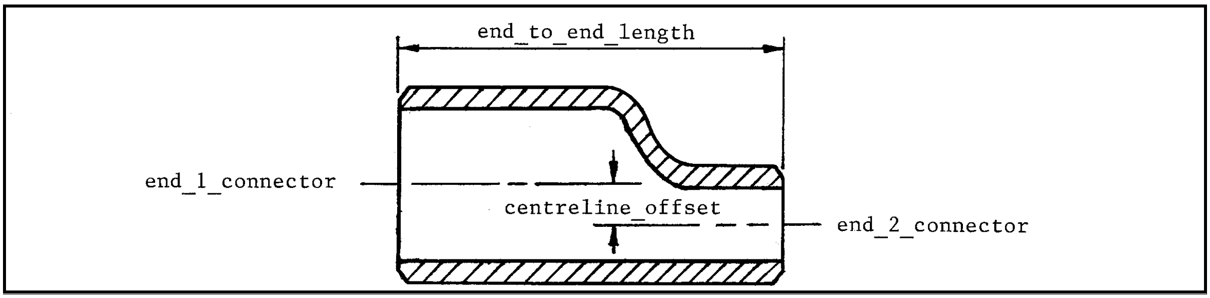


**Figure 8 - Eccentric swage**

NOTE 1 The direction of the straight side is typically specified as up or down.

NOTE 2 The straight side of the Eccentric_swage corresponds to the side where the ends of the Eccentric_swage have a common tangent point parallel to the centreline axes of the Eccentric_swage.

### 4.2.66 Elbow

An Elbow is a type of Fitting (see 4.2.83) that is used to change the direction of piping.

NOTE Figure 9 depicts a typical socket-weld Elbow.

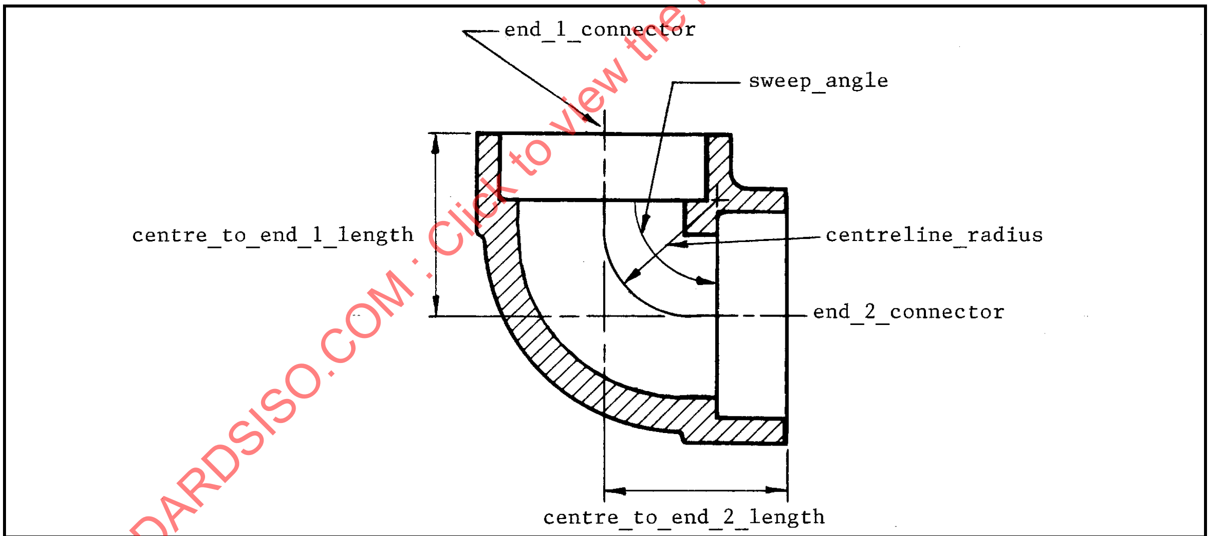


**Figure 9 - Elbow**

The data associated with an Elbow are the following:

— centre_to_end_1_length;

— centre_to_end_2_length;

— centreline_radius;

 

— end_1_connector;

— end_2_connector;

— sweep_angle;

— type.

#### 4.2.66.1 centre_to_end_1_length

The centre_to_end_1_length specifies the distance from the centre of the Elbow (i.e., where the centrelines for the two ends intersect) to the end-one face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.66.2 centre_to_end_2_length

The centre_to_end_2_length specifies the distance from the centre of the Elbow (i.e., where the centrelines for the two ends intersect) to the end-two face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.66.3 centreline_radius

The centreline_radius specifies the distance from the centreline of the Elbow to the intersection of the perpendicular projection of the centreline taken at the point where the Elbow centreline ends or where the inlet and outlet ends of the Elbow centreline become straight lines. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.66.4 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) designated as end one.

#### 4.2.66.5 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) designated as end two.

#### 4.2.66.6 sweep_angle

The sweep_angle specifies the included angle formed between two lines that are parallel to the end-one and end-two faces of the Elbow, measured at their point of intersection (the centre of radius of the Elbow). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.66.7 type

The type specifies a designation that classifies the Elbow.

EXAMPLE Examples of elbow designations include long radius, short radius, reducing, and street.

### 4.2.67 Electrical_component

An Electrical_component is a type of Plant_item (see 4.2.174) that is an individually identifiable and functional part of an Electrical_system (see 4.2.69).

EXAMPLE Examples of Electrical_components include cable tray, wireway, conduit, ductbank, cables, switches, relays, motor control centres, and junction boxes.

### 4.2.68 Electrical_connector

An Electrical_connector is a type of Plant_item_connector (see 4.2.179) that is intended to establish an electrical connection (signal or power) between two Plant_item (see 4.2.174) objects.

The data associated with an Electrical_connector are the following:

— type.

The type specifies the designation that describes the functional behaviour of the Electrical_connector.

### 4.2.69 Electrical_system

An Electrical_system is a type of Plant_system (see 4.2.190) that is a system of wiring, switches, relays, and other equipment associated with receiving and distributing electrical power.

The data associated with an Electrical_system are the following:

— system_voltage_designation;

— type.



 

#### 4.2.69.1 system_voltage_designation

The system_voltage_designation is the rated voltage of the system.

#### 4.2.69.2 type

The type specifies a designation that classifies the Electrical_system based on the kind of service that it provides.

### 4.2.70 Electricity_transference

An Electricity_transference is a type of Plant_item_connection (see 4.2.177) that identifies the purpose or role of the connection as being the transfer of electrical current or signal.

### 4.2.71 Envelope_shape

An Envelope_shape is a type of shape_representation (see 4.2.215) that is a 3D spatial volume that completely encloses or bounds a Plant_item (see 4.2.174). An Envelope_shape is a very simple geometric shape, such as a box, that encloses the plant item. An Envelope_shape may, but need not, include clearance or access spaces associated with the plant item.

NOTE Contrast Envelope_shape with Detail_shape (see 4.2.58) and Outline_shape (see 4.2.148).

### 4.2.72 Equipment

An Equipment is a type of Plant_item (see 4.2.174) that is treated as a single and self-contained unit that provides a function. Each Equipment may be an Inline_equipment (see 4.2.107).

The data associated with an Equipment are the following:

— equipment_characteristics;

— equipment_type;

— heat_tracing_type;

— insulation_specification;

#### 4.2.72.1 equipment_characteristics

The equipment_characteristics specifies functional attributes of the Equipment.

EXAMPLE Equipment characteristics of a pump may be that it operates at 80% efficiency while pumping 1250 gallons per minute.

#### 4.2.72.2 equipment_type

The equipment_type specifies a classification of an Equipment based on its performance characteristics.

EXAMPLE Examples of equipment_type classifications include compressor, engine, furnace, gear box, heat exchanger, pressure vessel, pump, silo, tank, and turbine.

#### 4.2.72.3 heat_tracing_type

The heat_tracing_type specifies the means utilized to impart a temperature increase to the Equipment by an external wrapping or coiling.

EXAMPLE Examples of heat_tracing_types include, but are not limited to, electrical or steam.

#### 4.2.72.4 insulation_specification

The insulation_specification specifies the document that defines the insulation requirements for the Equipment.

### 4.2.73 Equipment_breaching

An Equipment_breaching is a type of Ducting_component (see 4.2.59) consisting of a type of ductwork connected to a piece of Equipment (see 3.3.12, 4.2.72) for the purpose of exhausting gases.

### 4.2.74 Equipment_trim_piping

An Equipment_trim_piping is piping connected to a piece of Equipment (see 3.3.12, 4.2.72) that performs a function integral to the Equipment.

NOTE The piping is normally designed and possibly provided or installed by the Equipment manufacturer. Piping of this nature is normally of nominal size two inches and below.

### 4.2.75 Expander_flange

An Expander_flange is a type of Flange (see 4.2.84) that provides a transition from a smaller to a larger diameter Pipe (see 3.3.25, 4.2.154) at a flanged connection.

NOTE Figure 10 depicts a typical Expander_flange.



 

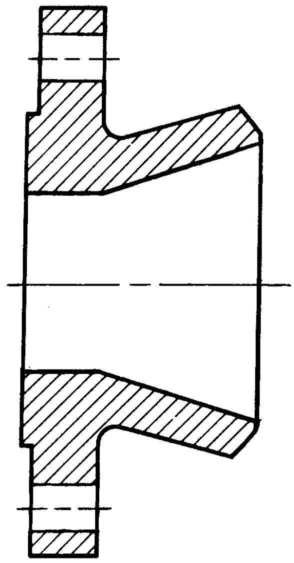

**Figure 10 - Expander flange**



#### 4.2.75.1 External_classification

An External_classification is a designation and description that classifies a Plant_item (see 4.2.174), Plant (see 4.2.172), Plant_system (see 4.2.190), or Plant_item_connector (see 4.2.179) based on predefined tables or sources defined externally to this part. The designation is a reference to the predefined table or source.

EXAMPLE The table defined in ISO 10303-221, annex M [3], may be used as an external classification in this part. The value of source would be "ISO 10303-221"; the value of name and description will correspond to the name and the description of the table row that classifies the plant item.

The data associated with an External_classification are the following:

— description;

— name;

— source.

#### 4.2.75.2 description

The description specifies a textual explanation or summary of the External_classification.

 

#### 4.2.75.3 name

The name specifies a textual label given to the External_classification.

#### 4.2.75.4 source

The source specifies a designation that identifies a table or document that contains a list of candidate classifications that the name and description are drawn from.

### 4.2.76 Externally_defined_user_defined_attribute_value

An Externally_defined_user_defined_attribute_value is a type of user_defined_attribute_value (see 4.2.263).

The data associated with an Externally_defined_user_defined_attribute_value are the following:

— source;

#### 4.2.76.1 source

The source specifies a textual identification of the reference resource in which the User_defined_attribute_value is described.

### 4.2.77 Extrusion

An Extrusion is a type of Csg_element (see 4.2.54) that is a closed, 2D profile swept through a linear distance in space.

### 4.2.78 Facet_trigon

A Facet_trigon is a planar, polygonal surface with three sides.

NOTE In 3D computer models, curved surfaces are sometimes represented by a collection of Facets that approximate the curved surface.

### 4.2.79 Faceted_brep

A Facet_brep is a type of csg_element.

### 4.2.80 Faceted_surface_representation

A Faceted_surface_representation is a type of Site_shape_representation (see 4.2.220) that consists of a collection of Facet_trigon (see 4.2.78) objects that represent the topography of a Site (see 3.3.42, 4.2.218).



 

### 4.2.81 Family_definition

A Family_definition is a Plant_item_definition (see 4.2.181) that characterizes a set of Piping_-component (see 4.2.157) objects based on common physical characteristics. Physical characteristics may be specified as a specific value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

EXAMPLE A Piping_specification (see 4.2.161) describes a Family_definition, such as a class of elbows made of stainless steel that are long radius elbows between six inches and twenty four inches in diameter.

The data associated with a Family_definition are the following:

— family_classification_description.

The family_classification_description specifies a textual explanation of the principle characteristics that vary within the family.

### 4.2.82 Female_end

A Female_end is a type of Piping_connector (see 4.2.158) end type that forms a hub of material at the connector to support the insertion of a compatible male connector.

NOTE Figure 11 depicts a typical Female_end.

The data associated with a Female_end are the following:

— depth;

— hub_inside_diameter;

— hub_length;

— hub_outside_diameter.



 

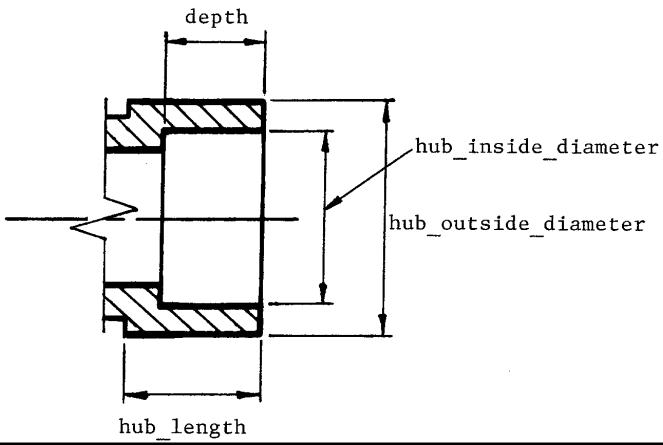


Figure 11 - Female end

### 4.2.82.1 depth

The depth specifies the distance from the face of the Piping_connector to the depth of relief. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.82.2 hub_inside_diameter

The hub_inside_diameter specifies the diameter of the opening at the hub. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.82.3 hub_length

The hub_length specifies the distance from the face of the Plant_item_connector (see 4.2.179) to the point where the hub size transitions to the body size of the Plant_item (see 4.2.174). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.82.4 hub_outside_diameter

The hub_outside_diameter specifies the external diameter of the hub. It may be specified as a single value or as a range of values.



 

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.83 Fitting

A Fitting is a type of Piping_component (see 4.2.157) used to join or terminate sections of Pipe (see 3.3.25, 4.2.154) or provide changes of direction or branching in a Piping_system (see 4.2.164). Each Fitting may be one of the following: a Blank (see 4.2.2), a Bushing (see 4.2.8), a Coupling (see 4.2.52), a Cross (see 4.2.53), an Elbow (see 4.2.66), a Flange (see 4.2.84), an Insert (see 4.2.109), a Lap_joint_-stub_end (see 4.2.119), a Lateral (see 4.2.120), an Olet (see 4.2.145), an Orifice_plate (see 4.2.147), a Pipe_closure (see 4.2.156), a Reducer (see 4.2.201), a Spacer (see 4.2.226), a Swage (see 4.2.247), a Tee (see 4.2.250), a Union (see 4.2.261), or a Y_type_lateral (see 4.2.268).

### 4.2.84 Flange

A Flange is a type of Fitting (see 4.2.83) that is an annular collar that permits a bolted connection to a similar collar. Each Flange contains two end connectors, one of which shall be a Piping_connector of type Flanged_end. Each Flange may be one of the following: a Blind_flange (see 4.2.3), an Expander_-flange (see 4.2.75), an Orifice_flange (see 4.2.146), or a Reducing_flange (see 4.2.202). Each Flange may be one of the following: a Lap_joint_flange (see 4.2.118), a Slip_on_flange (see 4.2.222), a Socket_-weld_flange (see 4.2.224), a Threaded_flange (see 4.2.252), or a Weld_neck_flange (see 4.2.266).

NOTE Figure 12 depicts a typical weld-neck Flange.

The data associated with a Flange are the following:

— end_1_connector;

— end_2_connector;

— hub_through_length;

— hub_weld_point_diameter.

#### 4.2.84.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) at the flange face.

#### 4.2.84.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) at the hub face.



 

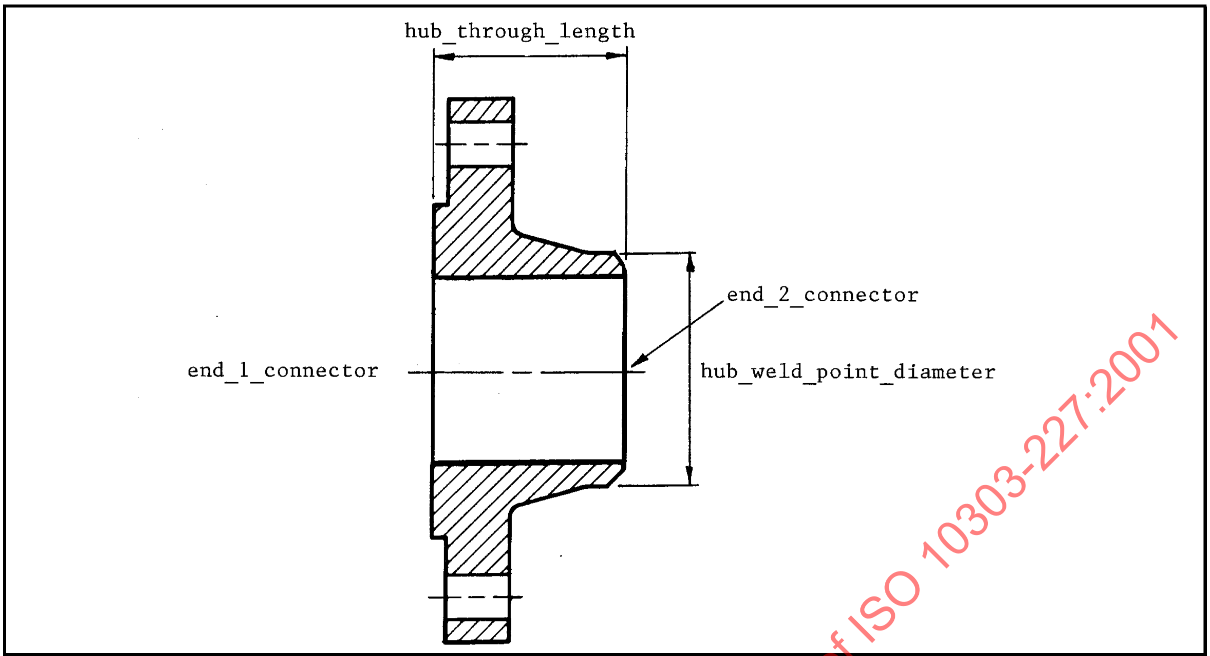


**Figure 12 - Flange**



### 4.2.84.3 hub_through_length

The hub_through_length specifies the distance between the flange face and the hub face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.84.4 hub_weld_point_diameter

The hub_weld_point_diameter specifies the outside diameter of the hub at the point of connection between the flange and the pipe. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

## 4.2.85 Flanged

A Flanged is a type of Piping_connector (see 4.2.158) end engagement type consisting of a circular disk of material with holes around the circumference and a facing style.

NOTE The holes are used to bolt together two connected flanges. The facing is the mating surface that in conjunction with a gasket forms a tight connection by the pressure of the two connected flanged connectors. A flanged connection can be disassembled.

 

### 4.2.86 Flanged_end

A Flanged_end is a type of Piping_connector (see 4.2.158) end type that is a circular disk of material that supports the insertion of bolts to mate with a compatible Flanged_end.

NOTE Figure 13 depicts a typical Flanged_end.

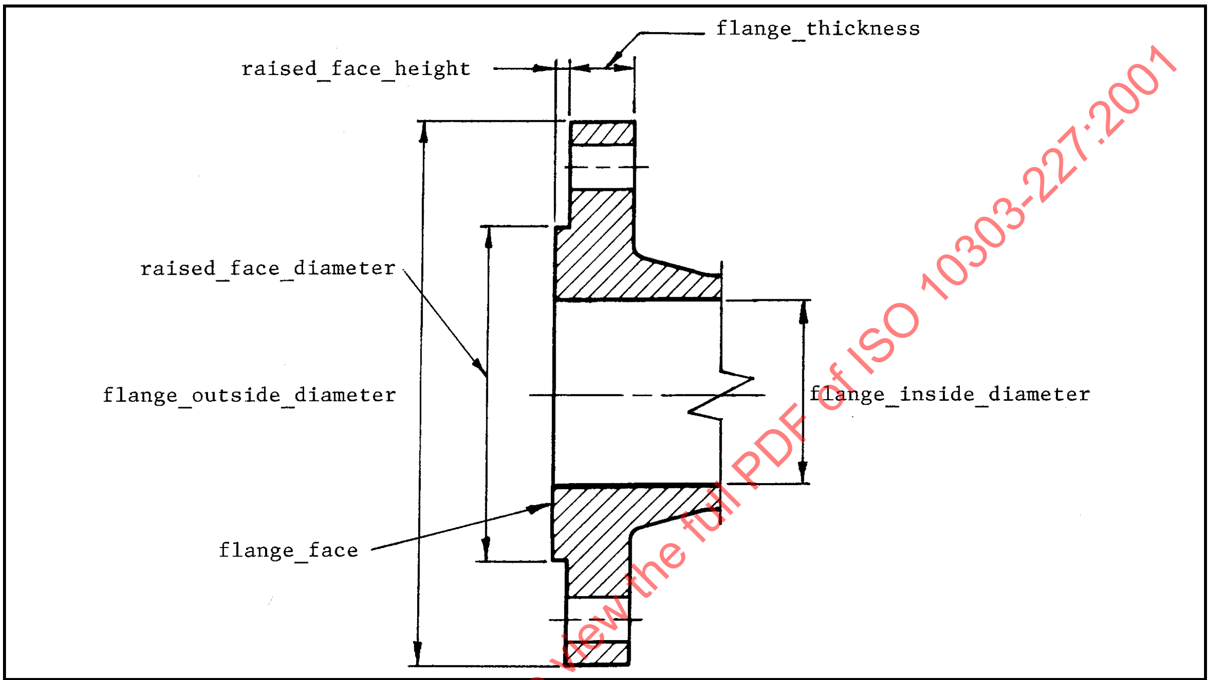


**Figure 13- Flanged end**

The data associated with a Flanged_end are the following:

— face_finish;

— flange_inside_diameter;

— flange_outside_diameter;

— flange_thickness;

— raised_face_diameter;

— raised_face_height;



 

— ring_bottom_radius;

— ring_diameter;

— ring_width.

#### 4.2.86.1 face_finish

The face_finish specifies a description of the Flange (see 4.2.84) face surface roughness and groove pattern.

#### 4.2.86.2 flange_inside_diameter

The flange_inside_diameter specifies the interior diameter of the Flange (see 4.2.84) at the working point. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.86.3 flange_outside_diameter

The flange_outside_diameter specifies the external diameter of the Flange (see 4.2.84). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.86.4 flange_thickness

The flange_thickness specifies the distance between the inside and outside Flange (see 4.2.84) disk surfaces, measured at the disk perimeter. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.86.5 raised_face_diameter

The raised_face_diameter specifies the diameter measured across the elevated portion of the mating surface of a Flange (see 4.2.84). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.



 

#### 4.2.86.6 raised_face_height

The raised_face_height specifies the perpendicular distance measured from the elevated portion of the Flange (see 4.2.84) mating surface to the lower Flange surface. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.86.7 ring_bottom_radius

The ring_bottom_radius specifies the radial measure of the bottom corners of a ring in raised face. The ring_bottom_radius may not be specified for a particular Flanged_end (see 4.2.86), but when specified must be accompanied by raised_face_diameter, raised_face_height, ring_diameter, and ring_width.

#### 4.2.86.8 ring_diameter

The ring_diameter specifies the diameter of a ring in the raised-face portion of a Flanged_end. The ring_-diameter may not be specified for a particular Flanged_end, but when specified must be accompanied by raised_face_diameter, raised_face_height, ring_bottom_radius, and ring_width.

#### 4.2.86.9 ring_width

The ring_width specifies the width of the groove formed by a ring in the raised-face portion of a Flanged_end. The ring_width may not be specified for a particular Flanged_end, but when specified must be accompanied by raised_face_diameter, raised_face_height, ring_bottom_radius, and ring_diameter.

### 4.2.87 Flexible_connection

A Flexible_connection is a type of Plant_item_connection (see 4.2.177) in which two Plant_item_-connector (see 4.2.179) objects are in physical contact, though there is no implication concerning the freedom of motion of the connected Plant_item (see 4.2.174) objects.

EXAMPLE The pump driver may be connected to an electrical cable at its terminal using a Flexible_-connection; the cable need not rotate when the pump is rotated, but contact must be preserved.

### 4.2.88 Fluid_transference

A Fluid_transference is a type of Plant_item_connection (see 4.2.177) that identifies the purpose or role of the connection as being the transfer of gas, vapour, liquid or solid material.

### 4.2.89 Free_form_curve

A Free_form_curve is a type of Curve (see 4.2.55). It is a one-dimensional, contiguous set of points.

## 4.2.90 Functional_connection_definition_satisfaction

A Functional_connection_definition_satisfaction is the assignment of an actual Connection_definition (see 4.2.50) to a functional Connection_definition for the purpose of satisfying the functional requirements with a physical object.

## 4.2.91 Functional_connection_occurrence_satisfaction

A Functional_connection_occurrence_satisfaction is the assignment of an actual Plant_item_-connection_occurrence (see 4.2.178) to a functional Plant_item_connection_occurrence for the purpose of satisfying the functional requirements with a physical object.

## 4.2.92 Functional_connector

A Functional_connector is a type of Plant_item_connector_occurrence (see 4.2.180) that represents the functional or logical aspect of the plant_item_connector_occurrence. Each Functional_connector is either: a Line_plant_item_branch_connector (see 4.2.127) or a Line_plant_item_connector (see 4.2.129).

## 4.2.93 Functional_connector_definition_satisfaction

A Functional_connector_definition_satisfaction is the assignment of an actual Connector_definition (see 4.2.51) to a functional Connector_definition for the purpose of satisfying the functional requirements with a physical object.

## 4.2.94 Functional_connector_occurrence_satisfaction

A Functional_connector_occurrence_satisfaction is the assignment of an actual Physical_connector (see 4.2.152) to a Functional_connector (see 4.2.92) for the purpose of satisfying the functional requirements with a physical object.

## 4.2.95 Functional_design_view

A Functional_design_view is a type of Plant_item_design_view (see 4.2.182) that indicates that data associated with the Plant_item (see 4.2.174) are the logical characteristics of a Plant_item rather than the physical.

The data associated with a Functional_design_view are the following:

— tag_number.

The tag_number specifies an optional identifier assigned to the Plant_item (see 4.2.174) for purposes of functional identification and eventual physical tracking.



 

### 4.2.96 Functional_plant

A Functional_plant is a Plant (see 4.2.172) that is the identification of a view of the Plant that aggregates the functional characteristics of the Plant.

### 4.2.97 Functional_plant_satisfaction

A Functional_plant_satisfaction is the assignment of an actual Planned_physical_plant (see 4.2.170) to a Functional_plant (see 4.2.96) for the purpose of satisfying the functional requirements with a physical object.

### 4.2.98 Functional_plant_item_satisfaction

A Functional_plant_item_satisfaction is the assignment of a Physical_design_view (see 4.2.153) to a Functional_design_view (see 4.2.95, 4.2.95) for the purpose of satisfying the functional requirements with a physical object.

### 4.2.99 Gasket

A Gasket is a type of Piping_component (see 4.2.157) that seals a connection between two connectors.

NOTE Gaskets are primarily used with Flanged (see 4.2.85) Plant_item_connector (see 4.2.179).

The data associated with a Gasket are the following:

— compressed_thickness;

— uncompressed_thickness.

#### 4.2.99.1 compressed_thickness

The compressed_thickness specifies the distance between the two parallel surfaces of the Gasket in its compressed state in a connection. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.99.2 uncompressed_thickness

The uncompressed_thickness specifies the as-procured distance between the two parallel surfaces of the Gasket. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.100 Gis_position

A Gis_position is the positioning and orientation information necessary for transforming coordinate values between a local coordinate space and the global coordinate system of earth. Transformation procedures depend upon the geographic information system (GIS) [14] coordinate system. Each Gis_-position object designates the global position and orientation of a Site_shape_representation (see 4.2.220).

The data associated with a Gis_position are the following:

— height;

— scale;

— system;

— x_axis_delta_x;

— x_axis_delta_y;

— x_coordinate;

— y_coordinate;

— zone.

#### 4.2.100.1 height

The height specifies the distance above sea level or reference level in the GIS coordinate system.

#### 4.2.100.2 scale

The scale specifies a transformation factor applied to the conversion of point coordinates between a local coordinate system and a GIS coordinate system. The precise application of the transformation will depend on the GIS system.

#### 4.2.100.3 system

The system specifies the identifier of the GIS system being used.

EXAMPLE Gauss-Krueger, Universal Transverse Mercator (UTM), and State Plane are examples of GIS systems used for global positioning.



 

### 4.2.100.4 x_axis_delta_x

The x_axis_delta_x specifies the abscissa value of the end point of a vector indicating the positive x axis of GIS coordinate space in the local coordinate system.

### 4.2.100.5 x_axis_delta_y

The x_axis_delta_y specifies the ordinate value of the end point of a vector indicating the orientation or the positive x axis of GIS coordinate space in the local coordinate system.

EXAMPLE The GIS coordinate system XY00 has an origin at the intersection of the equator and the Greenwich meridian. The x_axis of the coordinate system runs East (positive) and West (negative). The y axis runs North (positive) and South (negative). The positive z axis is up (above sea level or the reference level in the GIS coordinate system). The negative z axis is down (below sea level or the reference level in the GIS coordinate system). An x_axis_delta_x of 1.0 and x_axis_delta_y of 1.0 indicates x axis of the GIS coordinate space makes a +45° angle with respect to the x axis of the local coordinate; if the local coordinate space were superimposed on the GIS coordinate space, the positive x axis of the local coordinate system would point in a South-East direction (-45°).

### 4.2.100.6 x_coordinate

The x_coordinate specifies the distance from the y axis of the coordinate space defined by the GIS system and zone.

### 4.2.100.7 y_coordinate

The y_coordinate specifies the distance from the x axis of the coordinate space defined by the GIS system and zone.

### 4.2.100.8 zone

The zone specifies a subdivision of the earth's surface based on the GIS system.

EXAMPLE The Gauss-Krueger GIS system subdivides the earth into 120 zones that are 3° in longitudinal width. Each zone is identified as 3°, 6°, 9°, etc., from the Greenwich meridian.

## 4.2.101 Hemisphere

A Hemisphere is a type of Csg_element (see 4.2.54) that is formed by cutting a Sphere (see 4.2.230) with a plane that passes through the centre point of the Sphere and removing one section.



 

### 4.2.102 Hierarchically_organized_collection

A Hierarchically_organized_collection is a type of Plant_item_collection (see 4.2.176) that indicates whether a Plant_item (see 4.2.174) that is a member of an aggregate Plant_item is related to other Plant_items that are also members of the aggregate Plant_item. The members of the aggregate may, but need not, be connected.

### 4.2.103 Hvac_component

An Hvac_component is a type of Plant_item (see 4.2.174) that is an individually identifiable item or combination of items that is part of an HVAC system.

EXAMPLE The description attribute inherited from Plant_item is used to describe the Hvac_component. Examples to descriptions include "air handling unit", "chiller", or "space heater".

### 4.2.104 Hvac_ducting

An Hvac_ducting is a type of Ducting_component (see 4.2.59) and a type of Hvac_component (see 4.2.103) that is an individually identifiable piece or section of ducting that is part of an HVAC system.

### 4.2.105 Hvac_system

An Hvac_system is a type of Ducting_system (see 4.2.60) that controls the temperature, humidity, cleanliness, and circulation of environmental air as required in a Building (see 4.2.7).

### 4.2.106 Hybrid_shape_representation

A hybrid_shape_representation is a type of shape_representation. (see 4.2.215)

### 4.2.107 Inline_equipment

An Inline_equipment is a type of Equipment (see 3.3.12, 4.2.72) and Piping_system_component (see 4.2.165) that is inserted into the flow of a process stream to perform a function. Each Inline_equipment may be a Jacketed_piping (see 4.2.117).

### 4.2.108 Inline_instrument

An Inline_instrument is a type of Instrument (see 3.3.16, 4.2.112) and Piping_system_component (see 4.2.165) that is inserted into the flow of a process stream to measure some characteristic of the stream.

EXAMPLE Thermowells, pressure gauges, and flowmeters are examples of Inline_instruments.



 

### 4.2.109 Insert

An Insert is a type of Fitting (see 4.2.83) with one external and one smaller internal end.

NOTE Figure 14 depicts a typical Insert.

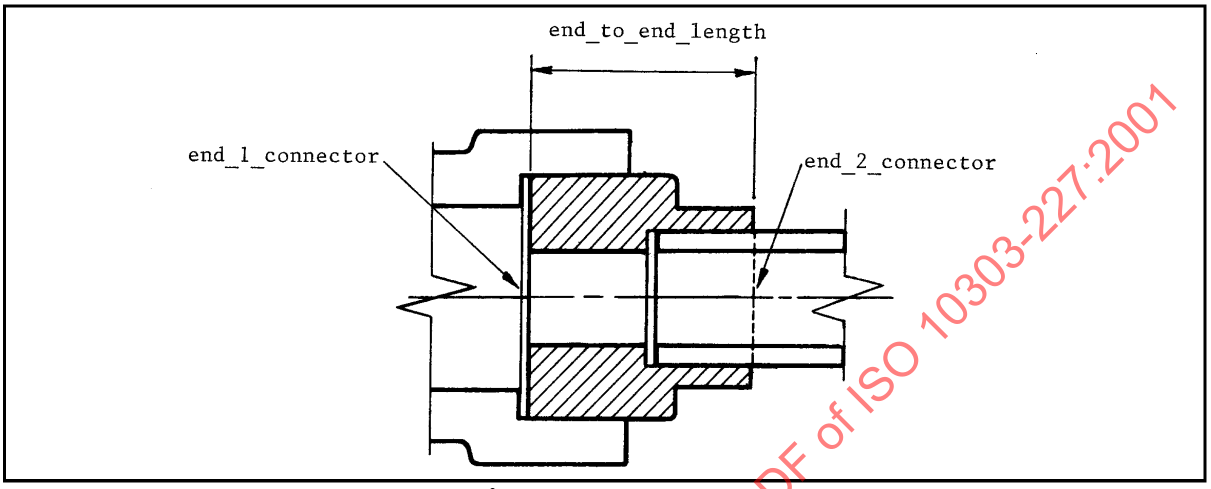


**Figure 14 - Insert**

The data associated with an Insert are the following:

— end_1_connector;

— end_2_connector;

— end_to_end_length.

#### 4.2.109.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) Male_end (see 4.2.138).

#### 4.2.109.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) designated as Female_end (see 4.2.82).

#### 4.2.109.3 end_to_end_length

The end_to_end_length specifies the external length of the Insert from the end-one face to the end-two face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.110 Inside_and_thickness

An Inside_and_thickness is a type of Piping_size_description (see 4.2.160) that describes the size of a Piping_system_component (see 4.2.165) or a Piping_connector (see 4.2.158) using an actual (intended) inside diameter and wall thickness.

The data associated with an Inside_and_thickness are the following:

— inside_diameter;

— thickness.

#### 4.2.110.1 inside_diameter

The inside_diameter specifies the actual (intended, not nominal) inside diameter of the Piping_system_-component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.110.2 thickness

The thickness specifies the minimum distance between the inside and outside piping wall surfaces required for the Piping_system_component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.111 Installed_physical_design_view

An Installed_physical_design_view is an indication that the Plant_item (see 4.2.174) described by a Physical_design_view (see 4.2.153) is physically installed within the Plant (see 4.2.172).

NOTE Within a usage of this part of ISO 10303, all Plant_items are considered as planned physical design views unless they are related to Installed_physical_design_view. This relationship indicates that the Plant_item is an actual item that currently exists or is installed in the Plant.

The data associated with an Installed_physical_design_view are the following:

— serial_number.



 

The serial_number specifies a designation that uniquely identifies a particular physical Plant_item that is installed in a Plant.

NOTE The designation is typically assigned and affixed by the manufacturer of the Plant_item.

### 4.2.112 Instrument

An Instrument is a type of Instrumentation_and_control_component (see 4.2.113) that monitors one or more performance characteristics of a system. Each Instrument may be one of the following: an Inline_-instrument (see 4.2.108) or an Offline_instrument (see 4.2.144).

The data associated with an Instrument are the following:

— control_loop_id;

— instrument_type;

— sensor_type;

— signal_type;

— stream_interaction_type.

#### 4.2.112.1 control_loop_id

The control_loop_id specifies a unique identifier for the Instrument loop. Control_loop_id is required for each Instrument.

#### 4.2.112.2 instrument_type

The instrument_type specifies a classification of an Instrument based on its performance characteristics.

EXAMPLE Examples of instrument_type classifications include flow control, level control, pressure, or temperature.

#### 4.2.112.3 sensor_type

The sensor_type specifies a classification of an Instrument actuator based on its operational characteristics.

#### 4.2.112.4 signal_type

The signal_type specifies a classification of an Instrument signal based on its physical characteristics.

EXAMPLE Examples of instrument signal_type classifications include electric and pneumatic.

#### 4.2.112.5 stream_interaction_type

The stream_interaction_type specifies a classification of an Instrument based on how the sensor is positioned to sense the stream.

EXAMPLE Examples of stream_interaction_types include outside, inserted, and immersed.

### 4.2.113 Instrumentation_and_control_component

An Instrumentation_and_control_component is a type of Plant_item (see 4.2.174) that is an individually identifiable item or combination of items that is part of the Instrumentation_and_control_system (see 4.2.114). Each Instrumentation_and_control_component may be an Instrument (see 3.3.16, 4.2.112).

EXAMPLE Examples of Instrumentation_and_control_component objects include wiring, switches, control valves, and gauges.

### 4.2.114 Instrumentation_and_control_system

An Instrumentation_and_control_system is a type of Plant_system (see 4.2.190) that is a system of wiring, switches, controls, and other equipment associated with monitoring and controlling the performance characteristics of Plant_system objects.

The data associated with an Instrumentation_and_control_system are the following:

— type.

The type specifies a designation that classifies the Instrumentation_and_control_system based on the kind of service that it provides.

### 4.2.115 Insulation

An Insulation is a type of Plant_item (see 4.2.174) that is a material or assembly of materials used to provide resistance to heat flow.

### 4.2.116 Interfering_shape_element

An Interfering_shape_element is the portion of the Plant_item_shape (see 4.2.187) that is interfered with by a shape element of another Plant_item (see 4.2.174).

NOTE This application object is intended to support design integration, specifically the need to identify the elements of the designs that physically interfere with one another.



 

The data associated with an Interfering_shape_element are the following:

— interference_colour.

The interference_colour specifies the colour that displays the element.

### 4.2.117 Jacketed_piping

A Jacketed_piping is a type of Inline_equipment (see 4.2.107) that is a Pipe (see 3.3.25, 4.2.154) surrounded or enclosed by another Pipe.

### 4.2.118 Lap_joint_flange

A Lap_joint_flange is a type of Flange (see 4.2.84) that has a rounded contour at the intersection of the bore and the Flange face in order to mate to a Lap_joint_stub_end (see 4.2.119).

NOTE This Flange can be swiveled around a Lap_joint_stub_end in order to align bolt holes.

### 4.2.119 Lap_joint_stub_end

A Lap_joint_stub_end is a type of Fitting (see 4.2.83) used with a Lap_joint_flange (see 4.2.118), consisting of a cylinder or barrel with an integral flat ring or lap around one end with a rounded contour at the external intersection of the barrel and the lap.

NOTE 1 Figure 15 depicts a typical Lap_joint_stub_end.

NOTE 2 End two is beveled for butt welding to pipe. The lap face normally has a spiral serrated finish. This surface serves as the raised-face gasket surface of the Flange (see 4.2.84) in Lap_joint_flange connections.

The data associated with a Lap_joint_stub_end are the following:

— end_1_connector;

— end_2_connector;

— length;

— stub_diameter;

— stub_thickness.



 

### 4.2.119.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) at the stub end face that connects to another Flange (see 4.2.84) or nozzle.

### 4.2.119.2 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) at the stub end face that connects to another Flange (see 4.2.84) or nozzle.

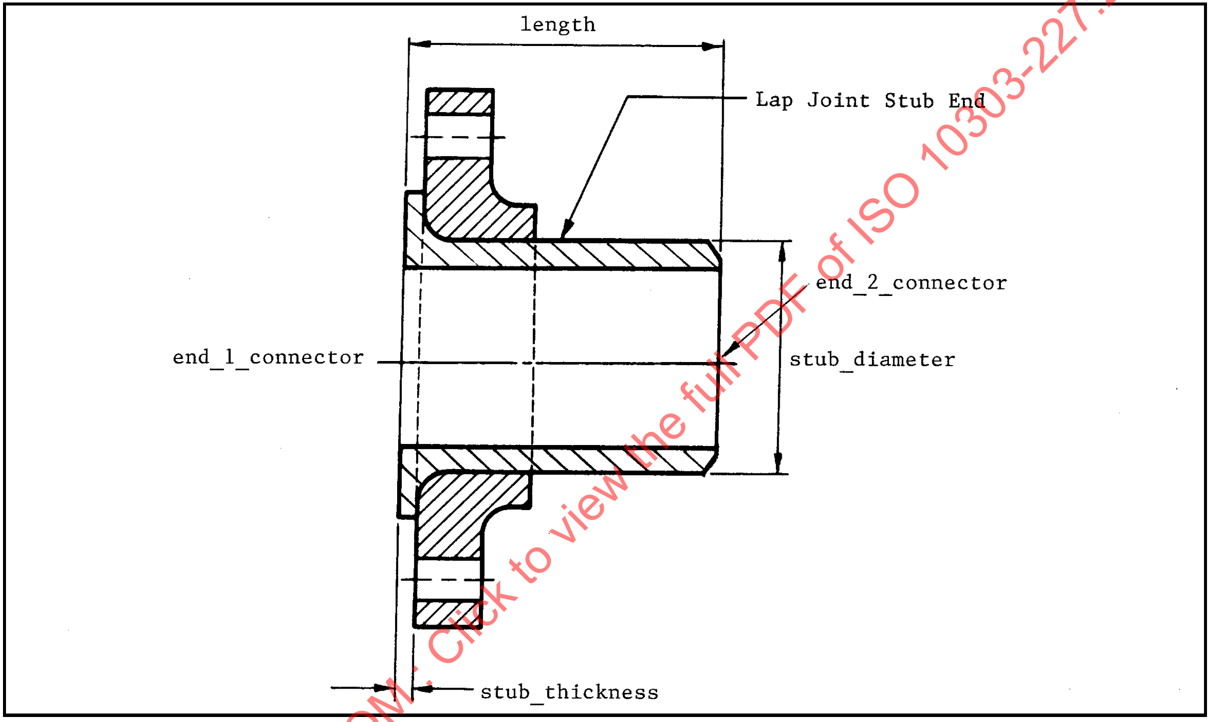


**Figure 15 - Lap joint flange and stub end**

### 4.2.119.3 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) at the stub end face that connects to another Flange (see 4.2.84) or nozzle.

### 4.2.119.4 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) at the stub end face that connects to a non-flange Piping_component (see 4.2.157).



 

#### 4.2.119.5 length

The length specifies the external distance between the lap face and the other stub end face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.119.6 stub_diameter

The stub_diameter specifies the nominal diameter of the Lap_joint_stub_end. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.119.7 stub_thickness

The stub_thickness specifies the distance between the inner and outer surfaces of the flared portion of the stub end. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.120 Lateral

A Lateral is a type of Fitting (see 4.2.83) that is a three-way fitting having two ends opposite each other in a straight run and a branch outlet projecting from the run at an angle.

NOTE Figure 16 depicts a typical butt-weld Lateral.

The data associated with a Lateral are the following:

— branch_angle;

— centre_to_end_1_length;

— centre_to_end_2_length;

— centre_to_end_3_length;



 

— end_1_connector;

— end_2_connector;

— end_3_connector.

## 4.2.120.1 branch_angle

The branch_angle specifies the angle that the branch projects from the straight run. It may be specified as a single value or as a range of values.

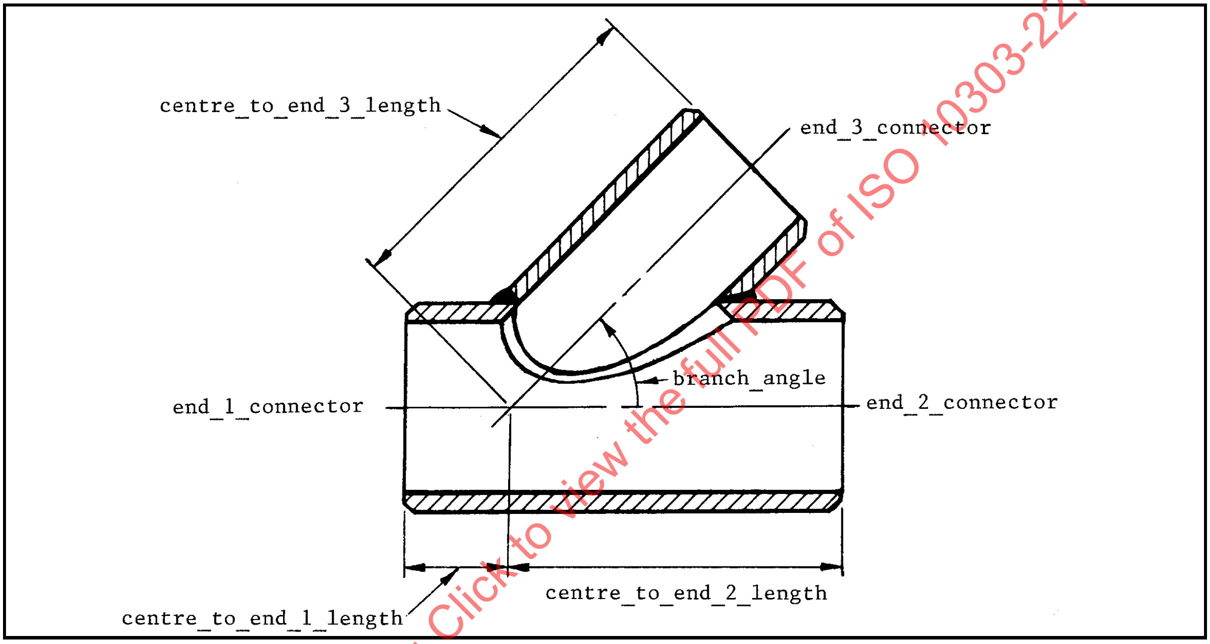


**Figure 16 - Lateral**

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

## 4.2.120.2 centre_to_end_1_length

The centre_to_end_1_length specifies the distance between the point where the branch and straight run centrelines intersect and the straight-run face that is closest to the intersection. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.



 

#### 4.2.120.3 centre_to_end_2_length

The centre_to_end_2_length specifies the distance between the point where the branch and straight run centrelines intersect and the straight-run face that is furthest from the intersection. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.120.4 centre_to_end_3_length

The centre_to_end_3_length specifies the distance between the point where the branch and straight run centrelines intersect and the branch face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.120.5 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) on the straight run that is closest to the intersection between the centrelines of the branch run and straight run.

#### 4.2.120.6 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) on the straight run that is furthest from the intersection between the centrelines of the branch run and straight run.

#### 4.2.120.7 end_3_connector

The end_3_connector specifies the Piping_connector (see 4.2.158) that connects to the branch line.

### 4.2.121 Line

A Line is a type of Curve (see 4.2.55) that is a one-dimensional, contiguous set of points that are positioned at a constant distance from a vector or that constitute the shortest distance between two points.

### 4.2.122 Line_branch_connection

A Line_branch_connection is a connection between the logical termination of one Piping_system_line_-segment (see 4.2.167) and a point on another Piping_system_line_segment other than a termination. The former Piping_system_line_segment branches from the latter Piping_system_line_segment.

The data associated with a Line_branch_connection are the following:

— branch_sequence_id.

The branch_sequence_id specifies an alphanumeric identifier that indicates the order that lines branch off of the main line segment.

NOTE All branch_sequence_ids are unique with respect to the branches of a given Piping_system_-line_segment.

### 4.2.123 Line_branch_termination

A Line_branch_termination is a type of Piping_system_line_segment_termination (see 4.2.168) that connects to a piping_system_line_segment at a point other than a termination.

### 4.2.124 Line_less_piping_system

A Line_less_piping_system is a type of Piping_system (see 4.2.164) that does not have a line designation as defined in Piping_system_line (see 4.2.166).

### 4.2.125 Line_piping_system_component_assignment

A Line_piping_system_component_assignment is the relationship between a Piping_system_line (see 4.2.166) and a Piping_system_component (see 4.2.165) that is part of, or satisfies the need specified by, the Piping_system_line.

### 4.2.126 Line_plant_item_branch_connection

A Line_plant_item_branch_connection is a connection between a Line_plant_item_branch_connector (see 4.2.127) and a point on a Piping_system_line_segment other than a termination. The Line_plant_-item_branch_connector branches from the Piping_system_line_segment.

The data associated with a Line_plant_item_branch_connection are the following:

— branch_sequence_id.

The branch_sequence_id specifies an alphanumeric identifier that indicates the order that lines branch off of the main line segment.

NOTE All branch_sequence_ids are unique with respect to the branches of a given Piping_system_-line_segment (see 4.2.167) and are ordered from termination_1 and termination_2.

### 4.2.127 Line_plant_item_branch_connector

A Line_plant_item_branch_connector is a type of Functional_connector (see 4.2.92) that participates in a Line_plant_item_branch_connection (see 4.2.126).



 

### 4.2.128 Line_plant_item_connection

A Line_plant_item_connection is a connection between the logical termination of a Piping_system_line_-segment (see 4.2.167) and a Line_plant_item_connector (see 4.2.129).

### 4.2.129 Line_plant_item_connector

A Line_plant_item_connector is a type of Functional_connector (see 4.2.92) that participates in a Line_-plant_item_connection (see 4.2.128).

### 4.2.130 Line_plant_item_termination

A Line_plant_item_termination is a type of Piping_system_line_segment_termination (see 4.2.168) that connects to Plant_item_connector_occurrence (see 4.2.180).

### 4.2.131 Line_to_line_connection

A Line_to_line_connection is a connection between the logical terminations of two or more Piping_-system_line_segment (see 4.2.167) objects.

The data associated with a Line_to_line_connection are the following:

— line_to_line_connection_id.

The line_to_line_connection_id specifies a unique identifier for the Line_to_line_connection.

### 4.2.132 Line_to_line_termination

A Line_to_line_termination is a type of Piping_system_line_segment_termination (see 4.2.168) that connects to other Line_to_line_termination objects.

### 4.2.133 Load_transference

A Load_transference is a type of Plant_item_connection (see 4.2.177) that identifies the purpose or role of the connection as being the transfer of load or force.

### 4.2.134 Location_in_building

A Location_in_building is a type of Plant_item_location (see 4.2.186) that is the position of the Plant_-item (see 4.2.174) relative to the Building (see 4.2.7).

### 4.2.135 Location_in_plant

A Location_in_plant is a type of Plant_item_location (see 4.2.186) that is the position of the Plant_item (see 4.2.174) relative to the Plant (see 4.2.172).



 

### 4.2.136 Location_in_site

A Location_in_site is a type of Plant_item_location (see 4.2.186) that is the position of the Plant_item (see 4.2.174) relative to the Site (see 3.3.42, 4.2.218).

### 4.2.137 Locked_orientation_connection

A Locked_orientation_connection is a type of Plant_item_connection (see 4.2.177) in which two Plant_-item_connector (see 4.2.179) objects are in physical contact and there is no relative motion of the connected Plant_item (see 4.2.174) objects with respect to each other.

NOTE A pump housing (containing the impeller and shaft) can be connected to the driver (motor) using a Locked_orientation_connection; this would mean that they move in unison.

### 4.2.138 Male_end

A Male_end is a type of Piping_connector (see 4.2.158) end type that forms a compatible connection with a Female_end (see 4.2.82).

### 4.2.139 Manufacturing_line

A Manufacturing_line is a type of Plant (see 4.2.172) that is defined by the type of product(s) it produces.

### 4.2.140 Material_specification_selection

A Material_specification_selection is the candidate material specifications for piping system design. Each Material_specification_selection may be a Material_specification_subset_reference (see 4.2.141).

The data associated with a Material_specification_selection are the following:

— description;

— material_specification_id;

— required_or_optional;

— selection_id;

— type.

EXAMPLE The material_specification_selection for a piping component would have a of type of "Stainless Steel", a material_specification_id of "ASTM (American Society for Testing and Materials) A403", a selection_id of "SS A316S", a description of "standard material callout", and be required.



 

#### 4.2.140.1 description

The description specifies a textual explanation or summary of the selected material specification.

#### 4.2.140.2 material_specification_id

The material_specification_id specifies a unique identifier for the material specification selected. Material_specification_id is required for each Material_specification_selection.

#### 4.2.140.3 required_or_optional

The required_or_optional specifies whether the material specification is required or whether its use is optional.

#### 4.2.140.4 selection_id

The selection_id specifies a unique identifier for the candidate material specification. Selection_id is required for each Material_specification_selection.

#### 4.2.140.5 type

The type specifies a designation that classifies a Material_specification_selection based on selection criteria.

### 4.2.141 Material_specification_subset_reference

A Material_specification_subset_reference is a type of Material_specification_selection (see 4.2.140) that is the reference parameters required to identify the applicable subset of a Required_material_-description (see 4.2.206).

The data associated with a Material_specification_subset_reference are the following:

— subset_id.

The subset_id specifies a unique identifier for the specified subset portion of a Required_material_-description. Subset_id is required for each Material_specification_subset_reference.

NOTE The subset reference is used when further subdivisions of the material specification selection are provided to allow for a more precise specification of the material.

### 4.2.142 Mitre_bend_pipe

A Mitre_bend_pipe is a type of Pipe (see 3.3.25, 4.2.154) that is a change in Pipe direction accomplished through the use of two or more straight sections of Pipe that are beveled and joined on a line bisecting the angle of junction.

NOTE Figure 17 depicts a typical Mitre_bend_pipe.

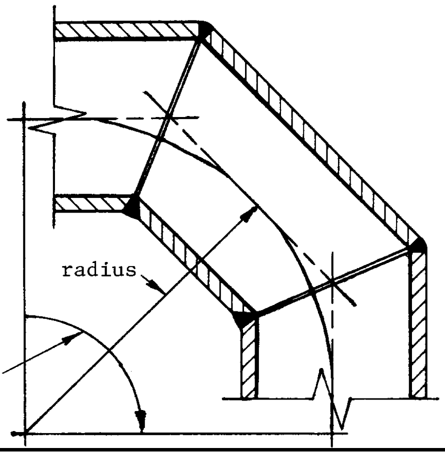


**Figure 17 - Mitre bend pipe**

The data associated with a Mitre_bend_pipe are the following:

— number_of_segments;

— radius;

— sweep_angle.

### 4.2.142.1 number_of_segments

The number_of_segments specifies the number of distinct straight sections of pipe that constitute the mitre_bend_pipe. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.142.2 radius

The radius specifies the measure of the radius of curvature for a mitre_bend_pipe. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.142.3 sweep_angle

The sweep_angle specifies the angular measure at the center of curvature from one end of the mitre_bend_pipe to other. It may be specified as a single value or as a range of values.



 

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.143 Nipple

A Nipple is a type of Pipe (see 3.3.25, 4.2.154) that is commonly acquired in prefabricated lengths and end preparations. Nipples are generally small in size in comparison to other pipes in a piping system.

### 4.2.144 Offline_instrument

An Offline_instrument is a type of Instrument (see 3.3.16, 4.2.112) that monitors the conditions of a system but is not an integral element of the system.

EXAMPLE Local panels, analyzer houses, junction box are examples of Offline_instruments.

### 4.2.145 Olet

An Olet is a type of Fitting (see 4.2.83) welded onto a hole in the side of a Pipe (see 3.3.25, 4.2.154) or other Fitting.

NOTE 1 The primary use of an Olet is for making small branch connections or connecting Instrument (see 3.3.16, 4.2.112) lines to Piping_component (see 4.2.157) objects.

NOTE 2 Figure 18 depicts a typical butt-welded latrolet, a kind of Olet.

EXAMPLE Other kinds of Olets include weldolets, sweepolets, elbowlets, and sockolets.

The data associated with an Olet are the following:

— base_outside_diameter;

— branch_angle;

— end_1_connector;

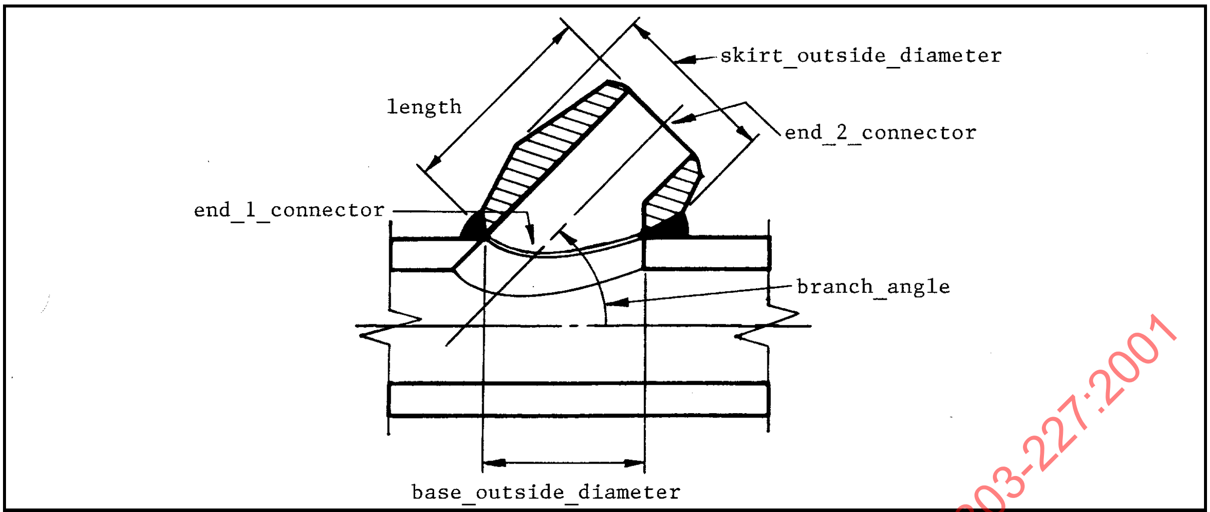


**Figure 18 - Olet**



— end_2_connector;

— length;

— skirt_outside_diameter.

### 4.2.145.1 base_outside_diameter

The base_outside_diameter specifies the external diameter of the olet at the surface that mates with the straight-run pipe. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.145.2 branch_angle

The branch_angle specifies the angle that the branch projects from the straight run. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.145.3 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) that connects to the main Pipe (see 3.3.25, 4.2.154) or Fitting (see 4.2.83).

 

#### 4.2.145.4 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) that connects to the branch line.

#### 4.2.145.5 length

The length specifies the distance between the end-one face and the end-two face at the centreline of the Olet. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.145.6 skirt_outside_diameter

The skirt_outside_diameter specifies the maximum external diameter of the Olet (measured perpendicular to the Olet centreline). It may be specified as a single value or as a range of values.

NOTE 1 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

NOTE 2 The sides of an Olet are tapered (not vertical).

### 4.2.146 Orifice_flange

An Orifice_flange is a type of Flange (see 4.2.84) used to assemble an Inline_instrument (see 4.2.108) to meter the flow of liquids or gases in a Pipe (see 3.3.25, 4.2.154).

NOTE 1 Orifice_flange objects are used in pairs in conjunction with an Orifice_plate (see 4.2.147).

NOTE 2 Figure 19 depicts a typical Orifice_flange and Orifice_plate (see 4.2.147) configuration.

The data associated with an Orifice_flange are the following:

— jacking_screw_orientation;

— tap.

#### 4.2.146.1 jacking_screw_orientation

The jacking_screw_orientation specifies the angular position of the threaded bolt holes in an Orifice_-flange.

NOTE Jacking screws are used to separate the Orifice_flange objects sufficiently to remove or insert the Orifice_plate (see 4.2.147).

#### 4.2.146.2 tap

The tap specifies the Piping_connector (see 4.2.158) designated as the tap.

### 4.2.147 Orifice_plate

An Orifice_plate is a type of Fitting (see 4.2.83) that is a disk with a calibrated hole that is placed in a Pipe (see 3.3.25, 4.2.154) to measure flow.

NOTE Figure 19 depicts a typical Orifice_flange (see 4.2.146) and Orifice_plate configuration.

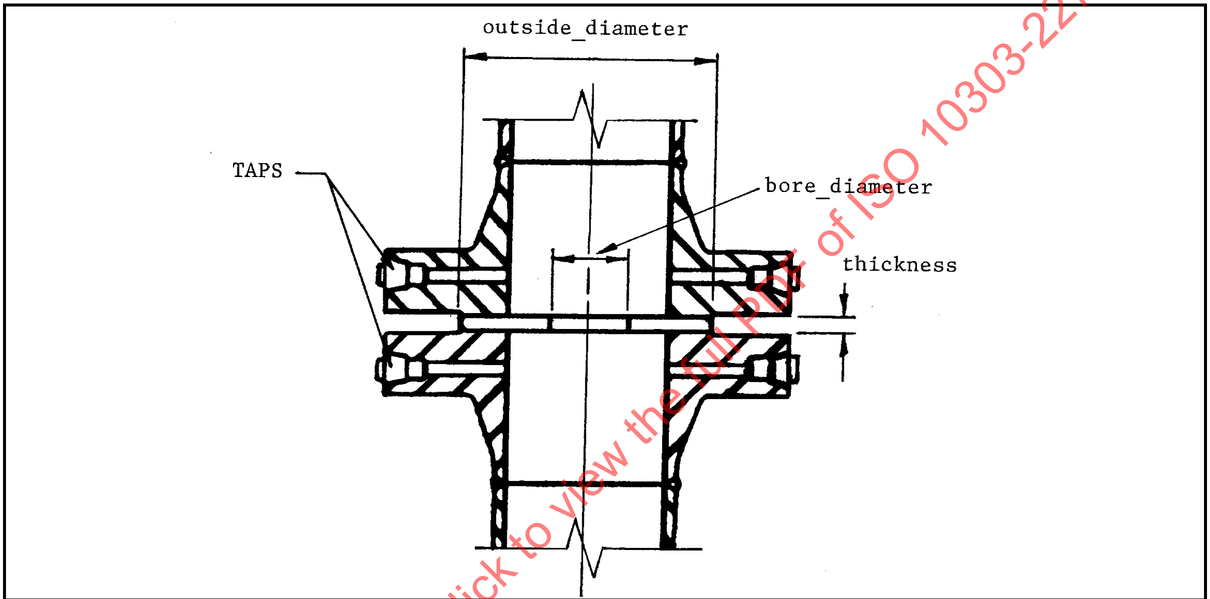


**Figure 19 - Orifice flange and orifice plate**

The data associated with an Orifice_plate are the following:

— beta_ratio;

— bore_diameter;

— outside_diameter;

— thickness.

#### 4.2.147.1 beta_ratio

The beta_ratio specifies a value that indicates the length of pipe required on either side of the Orifice_-plate to ensure non-turbulent flow past the orifice.



 

#### 4.2.147.2 bore_diameter

The bore_diameter specifies the diameter of the hole in the Orifice_plate. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.147.3 outside_diameter

The outside_diameter specifies the external diameter of the Orifice_plate. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.147.4 thickness

The thickness specifies the perpendicular distance between the two faces of the Orifice_plate. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.148 Outline_shape

An Outline_shape is a type of shape_representation (see 4.2.215)that is a 3D spatial volume that corresponds to the bounding surface features of a Plant_item (see 4.2.174).

NOTE Contrast with Detail_shape (see 4.2.58) and Envelope_shape (see 4.2.71). An Outline_shape is a simple geometric representation of plant item; this representation may be called a cartoon. The representation is a more accurate representation of the shape of the plant_item than that provided by an Envelope_shape, but not nearly as precise as a Detailed_shape.

### 4.2.149 Outside_and_thickness

An Outside_and_thickness is a type of Piping_size_description (see 4.2.160) that describes the size by providing the outside diameter and thickness values.

The data associated with an Outside_and_thickness are the following:

— outside_diameter;

— thickness.

### 4.2.149.1 outside_diameter

The outside_diameter specifies the external diameter of the Piping_system_component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.149.2 thickness

The thickness specifies the minimum distance between the inside and outside piping wall surfaces of the Piping_system_component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

## 4.2.150 Paddle_blank

A Paddle_blank is a type of Blank (see 4.2.2) that reserves space between two Flange (see 4.2.84) objects and blocks the flow of material.

NOTE 1 A Paddle_blank has a handle that permits removal or repositioning of the Paddle_blank. The name is derived from the fact that the Paddle_blank looks like a ping pong paddle.

NOTE 2 Figure 20 depicts a typical Paddle_blank.

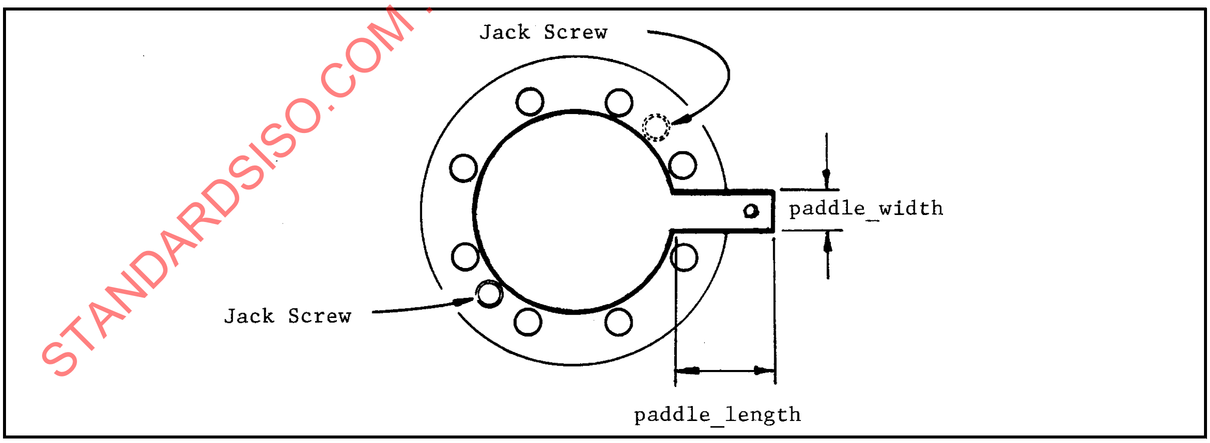


**Figure 20 - Paddle blank**



 

The data associated with a Paddle_blank are the following:

— paddle_length;

— paddle_width.

#### 4.2.150.1 paddle_length

The paddle_length specifies the length of the handle on the Paddle_blank. It may be specified as a single value or as a range of values.

NOTE 1 The length is measured from the outside diameter of the Blank (see 4.2.2).

NOTE 2 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.150.2 paddle_width

The paddle_width specifies the width of the handle on the Paddle_blank. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.151 Paddle_spacer

A Paddle_spacer is a type of Spacer (see 4.2.226) that reserves space between two Flange (see 4.2.84) objects and permits flow through the Pipe (see 3.3.25, 4.2.154).

NOTE 1 A Paddle_spacer has a handle that permits its removal or repositioning. The inner diameter of the Paddle_spacer may be less than the diameter of the Pipe, thus altering flow.

NOTE 2 Figure 21 depicts a typical Paddle_spacer.

The data associated with a Paddle_spacer are the following:

— inside_diameter;

— paddle_length;

— paddle_width.

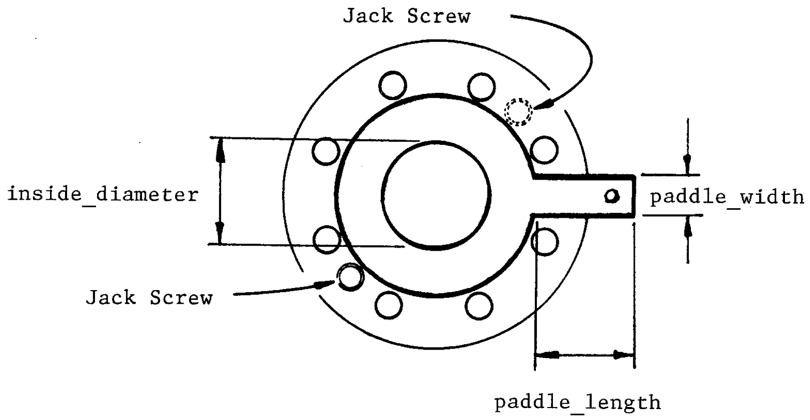


**Figure 21 - Paddle spacer**



### 4.2.151.1 inside_diameter

The inside_diameter specifies the diameter of the bore hole through the Paddle_spacer. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.151.2 paddle_length

The paddle_length specifies the length of the handle of the Paddle_spacer. It may be specified as a single value or as a range of values.

NOTE 1 The length is measured from the outside diameter of the Blank (see 4.2.2).

NOTE 2 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.151.3 paddle_width

The paddle_width specifies the width of the handle of the Paddle_spacer. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.152 Physical_connector

A Physical_connector is a type of Plant_item_connector_occurrence (see 4.2.180) that represents the physical aspects of the plant_item_connector_occurrence.

 

### 4.2.153 Physical_design_view

A Physical_design_view is a type of Plant_item_design_view (see 4.2.182) that describes the physical and spatial characteristics of a Plant_item (see 4.2.174).

### 4.2.154 Pipe

A Pipe is a type of Piping_component (see 4.2.157) that is a hollow cylindrical conveyance, with a constant radius for the cross-sectional circle, for directing fluid, vapour, or particulate flow. Each Pipe may be one of the following: a Mitre_bend_pipe (see ?), a Nipple (see 4.2.143), a Straight_pipe (see 4.2.232), or a Swept_bend_pipe (see 4.2.248).

NOTE 1 In most cases, the Pipe will conform to the dimensional requirements for nominal pipe size as tabulated in national standards such as American National Standards Institute (ANSI) B36.10 and ANSI B36.19.

NOTE 2 This definition does not exclude tubing and flex hoses from consideration as Pipe.

### 4.2.155 Pipe_bend

A Pipe_bend is a section of Pipe (see 3.3.25, 4.2.154) that changes the direction of flow along a circular arc. Pipe_bend objects are aggregated into a Swept_bend_pipe (see 4.2.248).

The data associated with a Pipe_bend are the following:

— centreline_radius;

— sweep_angle.

#### 4.2.155.1 centreline_radius

The centreline_radius specifies the radius of the Pipe_bend circular arc as measured to the centreline of the Pipe (see 3.3.25, 4.2.154).

#### 4.2.155.2 sweep_angle

The sweep_angle specifies the subtended angle of the Pipe_bend circular arc.

### 4.2.156 Pipe_closure

A Pipe_closure is a type of Fitting (see 4.2.83) used to close an end of a Piping_component (see 4.2.157).

NOTE 1 Blind_flange (see 4.2.3) objects also perform the function of closing a Piping_system. However, industry terminology treats them differently and they have been defined as separate objects.



 

NOTE 2 Figure 22 depicts a typical butt-weld Pipe cap, which is a kind of Pipe_closure.

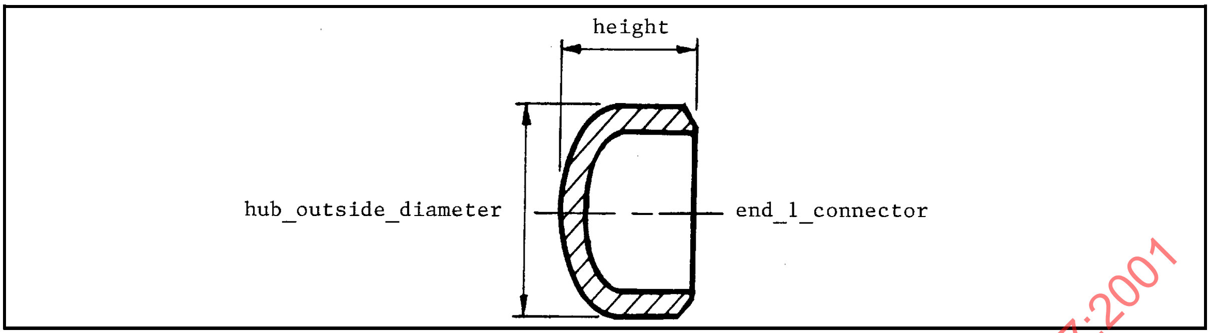


**Figure 22 - Pipe cap**

The data associated with a Pipe_closure are the following:

— cap_or_plug;

— end_1_connector;

— height;

— shape_type.

### 4.2.156.1 cap_or_plug

The cap_or_plug specifies a designation that identifies the Pipe_closure as a cap or a plug.

### 4.2.156.2 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) that connects to the Pipe (see 3.3.25, 4.2.154).

### 4.2.156.3 height

The height specifies the distance between the end-one face and the opposing end of the Pipe_closure. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.156.4 shape_type

The shape_type specifies a designation that classifies a Pipe_closure based on its shape.

EXAMPLE Examples of the shape_type of a Pipe_closure include square and round.



 

### 4.2.157 Piping_component

A Piping_component is a type of Piping_system_component (see 4.2.165) whose primary function is the conveyance or control of fluid flow. Each Piping_component may be one of the following: a Fitting (see 4.2.83), a Pipe (see 3.3.25, 4.2.154), or a Valve (see 4.2.264).

### 4.2.158 Piping_connector

A Piping_connector is a type of Plant_item_connector (see 4.2.179) that is intended to establish a material flow connection between two Plant_item (see 4.2.174) objects. Each Piping_connector may be one of the following: a Buttweld (see 4.2.9), a Flanged (see 4.2.85), a Pressure_fit (see 4.2.197), a Socket (see 4.2.223), or a Threaded (see 4.2.251). Each Piping_connector may be one of the following: a Branch_hole (see 4.2.5), a Female_end (see 4.2.82), a Flanged_end (see 4.2.86), or a Male_end (see 4.2.138).

The data associated with a Piping_connector are the following:

— connector_flow_direction;

— connector_specifications;

— name.

#### 4.2.158.1 connector_flow_direction

The connector_flow_direction specifies an indication of the way process fluid moves past the Plant_item (see 4.2.174).

#### 4.2.158.2 connector_specifications

The connector_specifications identifies the specifications associated with the Piping_connector.

EXAMPLE Examples of the identified connector_specifications include insulation specification, end preparation specification, and thread specification.

#### 4.2.158.3 name

The name specifies a textual label given to the Piping_connector.

### 4.2.159 Piping_connector_service_characteristic

A Piping_connector_service_characteristic is the conditions that the Piping_connector (see 4.2.158) is designed to withstand.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range value.

The data associated with a Piping_connector_service_characteristic are the following:

— design_pressure;

— design_temperature.

### 4.2.159.1 design_pressure

The design_pressure specifies the maximum allowable pressure at the Piping_connector (see 4.2.158). It may be specified as a single value or as a range value.

NOTE This value is normally created as part of doing 3D analysis of the piping system design.

### 4.2.159.2 design_temperature

The design_temperature specifies the maximum allowable temperature at the Piping_connector (see 4.2.158). It may be specified as a single value or as a range value.

NOTE This value is normally created as part of doing 3D analysis of the piping system design.

## 4.2.160 Piping_size_description

A Piping_size_description is used to explain or summarize the physical size of a Piping_connector (see 4.2.158) or Piping_system_component (see 4.2.165), based on a set of dimensional characteristics, and an optional dimensional standard. Each Piping_size_description is either an Inside_and_thickness (see 4.2.110), an Outside_and_thickness (see 4.2.149), a Pressure_class (see 4.2.196), or a Schedule (see 4.2.210).

NOTE A Piping_size_description is used to specify the size of a piping component as a whole (where the size is constant over the extant of the component) or to each individual connector of the piping component (where the sizes of each different connector differ.)

The data associated with a Piping_size_description are the following:

— dimensional_standard;

— ovality_allowance.



 

#### 4.2.160.1 dimensional_standard

The dimensional_standard specifies a designation for the standard used to dimension the Pipe (see 3.3.25, 4.2.154). The dimensional_standard need not be specified for a particular Piping_size_description.

EXAMPLE Examples of dimensional_standard designations include ANSI and DIN.

#### 4.2.160.2 ovality_allowance

The ovality_allowance specifies the acceptable deviation or tolerance allowed in the `out-of-roundness' of the Piping_connector (see 4.2.158) or Piping_system_component (see 4.2.165). In other words, it specifies how much the Piping_connector or Piping_system_component can deviate from a perfect circle. The ovality_allowance need not be specified for a particular Piping_size_description.

### 4.2.161 Piping_specification

A Piping_specification is a specification of conditions such as pressure, material, and corrosion allowance that must be met in a Piping_system_line_segment (see 4.2.167) and may include a list of Piping_component (see 4.2.157) objects by size range that meet these conditions.

NOTE The Piping_specification is used in Spec-driven design, where the user specifies the size and component type, and the Piping_specification is used to look-up the correct component characteristics. The components listed in the Piping_specification may reference component catalogues.

The data associated with a Piping_specification are the following:

— name;

— owner;

— piping_specification_id;

— service_description.

#### 4.2.161.1 name

The name specifies a textual label given to the Piping_specification.

#### 4.2.161.2 owner

The owner specifies the designation given to the person or organization that created and maintains the Piping_specification.

#### 4.2.161.3 piping_specification_id

The piping_specification_id specifies a unique identifier for the Piping_specification. Piping_specification_id is required for each Piping_specification.

#### 4.2.161.4 service_description

The service_description specifies a textual explanation or summary of the process stream conditions that are supported by the Plant_item (see 4.2.174) objects described in the Piping_specification.

### 4.2.162 Piping_spool

A Piping_spool is a collection of piping Plant_item (see 4.2.174) objects.

The data associated with a Piping_spool are the following:

— piping_spool_number.

The piping_spool_number specifies an alphanumeric identifier assigned to the Piping_spool.

NOTE A Piping_spool may be defined to meet transportation, fabrication, or erection requirements.

### 4.2.163 Piping_spool_assignment

A Piping_spool_assignment is the identification of the Piping_spool (see 4.2.162) that a Piping_-component (see 4.2.157) belongs to.

### 4.2.164 Piping_system

A Piping_system is a type of Plant_system (see 4.2.190) that is a system of interconnected Plant_item (see 4.2.174) objects that convey fluid, vapour, or particulate flow throughout a plant. Each Piping_-system may be a Line_less_piping_system (see 4.2.124).

EXAMPLE Methods of flow conveyance through the Piping_system include mechanical, gravitational, and electromagnetic induction.

The data associated with a Piping_system are the following:

— code;

— description.

#### 4.2.164.1 code

The code specifies the name of the specification that the Piping_system needs to conform to.



 

#### 4.2.164.2 description

The description specifies a textual explanation or summary of the Piping_system.

### 4.2.165 Piping_system_component

A Piping_system_component is a type of Plant_item (see 4.2.174) that is a constituent element of a Piping_system (see 4.2.164). Each Piping_system_component may be one of the following: an Inline_-equipment (see 4.2.107), an Inline_instrument (see 4.2.108), a Piping_component (see 4.2.157), a Process_ducting (see 4.2.198), or a Specialty_item (see 4.2.228).

The data associated with a Piping_system_component are the following:

— coating_reference;

— corrosion_allowance;

— heat_tracing_type;

— lining.

#### 4.2.165.1 coating_reference

The coating_reference specifies a reference to the specification of the substances used to coat the surfaces of a Piping_system_component. For a given Piping_system_component, the value of this attribute overrides any global specification.

#### 4.2.165.2 corrosion_allowance

The corrosion_allowance specifies the depth that corrosion may encroach below the surface of a piping_-system_component before action is required. For a given Piping_system_component, the value of this attribute overrides any global specification. It may be specified as a single value or as a range value.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range value. The depth of the corrosion may vary over the extent of the piping_component.

#### 4.2.165.3 heat_tracing_type

The heat_tracing_type specifies the means utilized to impart a temperature increase to the Piping_-system_component by an external wrapping or coiling. For a given Piping_system_component, the value of this attribute overrides any global specification.

NOTE Types may include electrical or steam.

#### 4.2.165.4 lining

The lining specifies a description of the substances used to line the internal surfaces of a Piping_system_-component.

### 4.2.166 Piping_system_line

A Piping_system_line is a logical component of a Piping_system and is composed of a collection of interconnected Piping_system_line_segment (see 4.2.167) objects.

The data associated with a Piping_system_line are the following:

— line_number;

— P_and_I_reference;

— piping_system_line_id.

#### 4.2.166.1 line_number

The line_number specifies an alphanumeric identifier assigned to the Piping_system_line and can be used to uniquely define the Piping_system_line. Line_number is required for each Piping_system_line.

EXAMPLE A1A-PX-100-4-150, is a coded number that identifies the Piping_system_line and the main design criteria - specification = A1A, process = PX, line number = 100, line size = 4, and pressure rating = 150.

#### 4.2.166.2 P_and_I_reference

The P_and_I_reference specifies the piping and instrumentation diagram that depicts the Piping_system_-line.

#### 4.2.166.3 piping_system_line_id

The piping_system_line_id specifies a unique identifier for the Piping_system_line.

NOTE It is normally a subset of the line_number.

### 4.2.167 Piping_system_line_segment

A Piping_system_line_segment is an element of a Piping_system_line (see 4.2.166). A Piping_system_-line_segment terminates at a functional plant_item_connector (see 4.2.179), a tap into a Piping_system_-line (see 4.2.166), a point where the stream diverges or converges, a vent, or a drain.



 

The data associated with a Piping_system_line_segment are the following:

— coating_reference;

— corrosion_allowance;

— design_pressure;

— design_temperature;

— elevation;

— heat_tracing_type;

— line_size;

— segment_id.

#### 4.2.167.1 coating_reference

The coating_reference specifies a reference to the specification that details the coating requirements of the Piping_component (see 4.2.157) objects associated with the Piping_system_line (see 4.2.166).

#### 4.2.167.2 corrosion_allowance

The corrosion_allowance specifies the depth that corrosion may encroach below the surface of components on a piping_system_line_segment before action is required. For a given Piping_-system_component, the value of this attribute overrides any global specification.

#### 4.2.167.3 design_pressure

The design_pressure specifies the requirement for maximum allowable pressure of the Piping_component (see 4.2.157) objects associated with the Piping_system_line (see 4.2.166).

#### 4.2.167.4 design_temperature

The design_temperature specifies the requirement for maximum allowable temperature of the Piping_-component (see 4.2.157) objects associated with the Piping_system_line (see 4.2.166).

#### 4.2.167.5 elevation

The elevation specifies the distance above sea level that the piping assigned to the line should exist.



 

#### 4.2.167.6 heat_tracing_type

The heat_tracing_type specifies the heating method used to maintain temperature in the Piping_system_-line (see 4.2.166).

EXAMPLE Heating method designations include steam tracing and electrical.

#### 4.2.167.7 line_size

The line_size specifies the intended diameter of the piping to be selected to satisfy the Piping_system_-line (see 4.2.166). The line_size need not be specified for a particular Piping_system_line_segment where the Piping_system_line_segment corresponds to one Piping_system_component (see 4.2.165).

NOTE When the line_size is not specified, it is either ambiguous due to the nature of the Piping_-system_component such as a Reducer, or derivable from one or more of the connecting Piping_system_-line_segments.

#### 4.2.167.8 segment_id

The segment_id specifies a unique identifier for the Piping_system_line_segment.

### 4.2.168 Piping_system_line_segment_termination

A Piping_system_line_segment_termination is one of two logical end-points of a Piping_system_line_-segment (see 4.2.167). Each Piping_system_line_segment_terminationis either: a Line_branch_-termination (see 4.2.123), a Line_to_line_termination (see 4.2.132), a Line_plant_item_termination (see 4.2.130), or Piping_system_line_termination (see 4.2.169).

NOTE Piping_system_line objects are composed of individual Piping_system_line_segment objects. Piping_system_line_segment objects are connected through Piping_system_line_segment_termination objects.

The data associated with a Piping_system_line_segment_termination are the following:

— flow_direction.

#### 4.2.168.1 flow_direction

The flow_direction specifies the direction of material flow at the Piping_system_line_segment_-termination. The value of the flow_direction attribute shall be one of the following:

— both;

— in;



 

— not_specified;

— out.

**4.2.168.1.1 both:** material may flow in either direction past the Piping_system_line_segment_-termination.

**4.2.168.1.2 in:** material flows into the line segment past the Piping_system_line_segment_-termination.

**4.2.168.1.3 not_specified:** the direction of material flow past the Piping_system_line_segment_-termination is not specified.

**4.2.168.1.4 out:** material flows out of the line segment past the Piping_system_line_segment_-termination

### 4.2.169 Piping_system_line_termination

A Piping_system_line_termination is a type of Piping_system_line_segment_termination (see 4.2.168) that begins or ends a Piping_system_line (see 4.2.166).

The data associated with a Piping_system_line_termination are the following:

— location;

— position_on_pipe;

— start_or_end.

#### 4.2.169.1 location

The location specifies the relative distance in the X, Y, Z directions of the position of the end of the Piping_system_line (see 4.2.166), from the plant origin. The line_start_location position may also be defined by where it connects to an upstream piece of Equipment (see 3.3.12, 4.2.72) or Piping_system_line.

#### 4.2.169.2 position_on_pipe

The position_on_pipe specifies an indicator of the relationship between the point and the Piping_component (see 4.2.157) that will eventually satisfy it.

NOTE If the indicator is not specified, the assumed value is Centre Of Pipe (COP).

EXAMPLE A position_on_pipe may be COP or BOP indicating that the location of the Piping_system_line_termination location is on the centre or bottom of the pipe.

#### 4.2.169.3 start_or_end

The start_or_end specifies an enumerated value that defines the side of the pipe on which the line termination lies. A value of ‘start’ indicates the line termination is on the upstream end, and a value of ‘end’ indicates that the line termination is on the downstream end.

### 4.2.170 Planned_physical_plant

A Planned_physical_plant is the set of physical and spatial characteristics that a Plant (see 4.2.172) can have, including siting, location, and orientation.

NOTE A Planned_physical_plant can also be the basis for locating other items such as Plant_item (see 4.2.174) objects, Plant_item_location.

### 4.2.171 Planned_physical_plant_item

A Planned_physical_plant_item is a type of Plant_item_instance (see 4.2.183) that is intended to have physical existence in the real world and that has been used or instanced in a design.

NOTE Additionally, a Planned_physical_plant_item is always intended to be `physical' as opposed to purely volumetric. In general, this means that anything that would pose a hard physical impediment to a kick (e.g., a pump) is a physical item, and anything that does not (e.g., an escape route or the water in a cooling pond) is purely volumetric.

The data associated with a Planned_physical_plant_item are the following:

— type.

The type specifies a designation that classifies the Plant_item (see 4.2.174).

EXAMPLE Type designations may include all major categories of Plant_item objects.

### 4.2.172 Plant

A Plant is a portion of an installation (or the entire installation) required to operate to produce products. Each Plant may be one of the following: a Manufacturing_line (see 4.2.139), a Train (see 4.2.254), or a Unit (see 4.2.262). The z-axis of the local coordinate system of the Plant shall be considered the elevation of the coordinate space.

NOTE Manufacturing_lines, Trains, and Units, may be considered as sub-plants of a plant because they perform all of the same functions as a plant and may be considered as a plant. They are distinct, they produce products based on input resources, and they are (relatively) independent of other plant/sub-plants. Trains, for instance, provide duplicate functionality of one another in case of failure.



 

The data associated with a Plant are the following:

— definition_coordinate_system;

— description;

— name;

— operators;

— owners;

— plant_id.

#### 4.2.172.1 definition_coordinate_system

The definition_coordinate_system is the origin and axes of the Plant that serve as the basis for the location and orientation of Plant_items (see 4.2.174) and subplants in the Plant.

#### 4.2.172.2 description

The description specifies a textual explanation or summary of the Plant. The description need not be specified for a particular Plant. There may be more than one description for a Plant.

#### 4.2.172.3 name

The name specifies a textual label given to the Plant.

#### 4.2.172.4 operators

The operators specifies the name of the organization(s) responsible for the operation of the Plant. For a given plant, the operators need not be specified.

#### 4.2.172.5 owners

The owners specifies the name of the organization(s) that owns the Plant. For a given plant, the owners need not be specified.

#### 4.2.172.6 plant_id

The plant_id specifies a unique identifier for the Plant. Plant_id is required for each Plant.

### 4.2.173 Plant_csg_shape_representation

A Plant_csg_shape_representation is a type of shape_representation (see 4.2.215).

### 4.2.174 Plant_item

A Plant_item is an identifiable item that has a shape and that may be used as a component of the Plant (see 4.2.172). The Plant_item need not be a physical item, but may be an allocation of space reserved for a purpose. Each Plant_item is either: a Plant_item_definition (see 4.2.181) or a Plant_item_instance (see 4.2.183). Each Plant_item may be one of the following: a Ducting_component (see 4.2.59), an Electrical_component (see 4.2.67), an Equipment (see 3.3.12, 4.2.72), an Hvac_component (see 4.2.103), an Instrumentation_and_control_component (see 4.2.113), an Insulation (see 3.3.17, 4.2.115), a Piping_-system_component (see 4.2.165), a Structural_component (see 4.2.235), or a Support_component (see 4.2.241).

The data associated with a Plant_item are the following:

— description;

— name;

— plant_item_id.

#### 4.2.174.1 description

The description specifies a textual explanation or summary of the Plant_item.

#### 4.2.174.2 name

The name specifies a textual label given to the Plant_item.

#### 4.2.174.3 plant_item_id

The plant_item_id specifies a unique identifier for the Plant_item. Plant_item_id is required for each Plant_item.

### 4.2.175 Plant_item_centreline

A Plant_item_centreline is a type of Reference_geometry (see 4.2.204) that is a center of symmetry of an aspect of the shape of the Plant_item (see 4.2.174).

### 4.2.176 Plant_item_collection

A Plant_item_collection is an association that indicates that a component Plant_item (see 4.2.174) is part of an aggregate Plant_item. Each Plant_item_collection may be a Connected_collection (see 4.2.49). Each Plant_item_collection may be a Hierarchically_organized_collection (see 4.2.102).



 

EXAMPLE A Plant_item_collection may be defined for a kit, where the members are not connected, or for an assembly, where the members are connected. Collections that are not hierarchically organized may be physical systems where a single component plays a role in multiple systems, such as a gauge.

The data associated with a Plant_item_collection are the following:

— location_and_orientation.

The location_and_orientation specifies the relative position and orientation of the Plant_item (see 4.2.174) within the Plant_item_collection. The location_and_orientation need not be specified for a particular Plant_item_collection.

## 4.2.177 Plant_item_connection

A Plant_item_connection is a linkage between two or more Plant_item_connector (see 4.2.179) objects. The joining conditions may be specified for the connection. Each Plant_item_connection is either a Connection_definition (see 4.2.50) or a Plant_item_connection_occurrence (see 4.2.178). Each Plant_item_connection is either a Flexible_connection (see 4.2.87) or a Locked_orientation_connection (see 4.2.137). Each Plant_item_connection may be an Electricity_transference (see 4.2.70). Each Plant_item_connection may be a Fluid_transference (see 4.2.88). Each Plant_item_connection may be a Load_transference (see 4.2.133). Each Plant_item_connection can have many function types, for the purpose of describing the role that the connection plays in the plant.

NOTE 1 In most cases, such as piping components, a Plant_item_connection links only two Plant_item_connector objects.

NOTE 2 The term connection does not imply functional continuity beyond the connectors involved in the connection.

The data associated with a Plant_item_connection are the following:

— connection_commitment_target;

— connection_id;

— connection_material;

— description.

### 4.2.177.1 connection_commitment_target

The connection_commitment_target specifies when in the life_cycle phases of the plant system that a connection is actually made.



 

EXAMPLE Examples of connection_commitment_targets include fabrication, field-fit, commissioning, or others.

#### 4.2.177.2 connection_id

The connection_id specifies a unique identifier for the Plant_item_connection. Connection_id is required for each Plant_item_connection.

#### 4.2.177.3 connection_material

The connection_material specifies the substances or other Plant_item (see 4.2.174) objects used at the connection of two Plant_item_connector (see 4.2.179) objects. This may be one or more specifications and one or more Plant_item (see 4.2.174) objects.

EXAMPLE At a connection of two butt-weld connectors, there is a welding specification that applies to the connection. At a connection of two flanged connectors there are bolts and gaskets that are part of the connection, as well as a specification for the use of these items.

#### 4.2.177.4 description

The description specifies the textual explanation or summary of the function of the Plant_item_-connection.

### 4.2.178 Plant_item_connection_occurrence

A Plant_item_connection_occurrence is a type of Plant_item_connection (see 4.2.177) that involves a physical linkage between two or more Plant_item_connector_occurrence (see 4.2.180) objects.

### 4.2.179 Plant_item_connector

A Plant_item_connector is a feature of a Plant_item (see 4.2.174) that is designed to connect to a connector on another Plant_item. Each Plant_item_connector may have specified its design type as one of the following: an Electrical_connector (see 4.2.68), a Piping_connector (see 4.2.158), or a Structural_-load_connector (see 4.2.236). Each Plant_item_connector is either a Connector_definition (see 4.2.51) (a definitional type) or a Plant_item_connector_occurrence (4.2.180) (a specified type).

NOTE The definitional type is used as the connector definition for a Plant_item_definition (see 4.2.181). A specified type is used for a Plant_item_instance (see 4.2.183).

The data associated with a Plant_item_connector are the following:

— connect_point;

— plant_item_connector_id.



 

#### 4.2.179.1 connect_point

The connect_point specifies a point on or in the connector where the terminal interface with another connector occurs.

#### 4.2.179.2 plant_item_connector_id

The plant_item_connector_id specifies a unique identifier for the Plant_item_connector. Plant_item_connector_id is required for each Plant_item_connector.

### 4.2.180 Plant_item_connector_occurrence

A Plant_item_connector_occurrence is a type of Plant_item_connector (see 4.2.179) that is a physical feature of a Plant_item (see 4.2.174) that connects or mates with a like type of connector on another Plant_item. Each Plant_item_connector_occurrence is either: a Functional_connector (see 4.2.92) or a Physical_connector (see 4.2.152).

The data associated with a Plant_item_connector_occurrence are the following:

— orientation.

The orientation specifies the relative orientation of the Plant_item_connector_occurrence to a defined point on the Plant_item (see 4.2.174).

### 4.2.181 Plant_item_definition

A Plant_item_definition is a type of Plant_item (see 4.2.174) that has been designed to some level of completeness, but has not been used as the design for physical Plant_item (see 4.2.174) objects.

### 4.2.182 Plant_item_design_view

A Plant_item_design_view is the collection of information about a Plant_item (see 4.2.174) that is associated with a particular design phase. Each Plant_item_design_view is either: a Functional_-design_view (see 4.2.95, 4.2.95) or a Physical_design_view (see 4.2.153).

### 4.2.183 Plant_item_instance

A Plant_item_instance is a planned type of Plant_item (see 4.2.174), as instanced in a spatial, functional or other design. Each Plant_item_instance is either a Planned_physical_plant_item (see 4.2.171) or a Plant_volume (see 4.2.192).

NOTE A Plant_item_instance is created through the use or instancing of a Plant_item_definition (see 4.2.181) by placing it in a design.

### 4.2.184 Plant_item_interference

A Plant_item_interference is where the spatial volume occupied by a Plant_item (see 4.2.174) overlaps the space occupied by one or more Plant_item objects.

The data associated with a Plant_item_interference are the following:

— interference_id;

— type.

#### 4.2.184.1 interference_id

The interference_id specifies an identifier for the Plant_item_interference.

#### 4.2.184.2 type

The type specifies the classification assigned to the Plant_item_interference (see 4.2.184) based on the criticality of the clash.

NOTE The criticality is an assessment of the importance or significance of the clash for a particular project. The values are project dependent.

### 4.2.185 Plant_item_interference_status

A Plant_item_interference_status is a designation indicating the state of resolution of an identified interference.

The data associated with a Plant_item_interference_status are the following:

— assessor;

— status.

#### 4.2.185.1 assessor

The assessor specifies the individual or organization assigned the responsibility for resolving the Plant_item_interference (see 4.2.184).

#### 4.2.185.2 status

The status specifies a designation indicating the state of resolution of an identified Plant_item_interference (see 4.2.184).



 

### 4.2.186 Plant_item_location

A Plant_item_location is the position of the Plant_item (see 4.2.174) within a Plant (see 4.2.172). The position of a Plant_item is specified as the transformation (translation and rotation) of a point and axes on the Plant_item to a point and axes in the destination coordinate system. Each Plant_item_location is either a Location_in_building (see 4.2.134), a Location_in_plant (see 4.2.135), a Location_in_site (see 4.2.136), or a Relative_item_location (see 4.2.205).

The data associated with a Plant_item_location are the following:

— location_and_orientation;

— location_id.

#### 4.2.186.1 location_and_orientation

The location_and_orientation specifies the relative position and orientation of the Plant_item (see 4.2.174) within the Plant (see 4.2.172).

#### 4.2.186.2 location_id

The location_id specifies a unique identifier for the Plant_item_location.

### 4.2.187 Plant_item_shape

A Plant_item_shape is the volumetric representation of a Plant_item (see 4.2.174). Each Plant_item_-shape may be one of the following: a Detail_shape (see 4.2.58), an Envelope_shape (see 4.2.71), or an Outline_shape (see 4.2.148). The z-axis of the local coordinate system of the Plant_item_shape shall be considered the elevation of the coordinate space.

The data associated with a Plant_item_shape are the following:

— clash_detection_class;

— origin;

— shape_id.

#### 4.2.187.1 clash_detection_class

The clash_detection_class specifies a designation that classifies a Plant_item_shape for the purposes of interference checking. The value of the clash_detection_class attribute shall be one of the following:

— hard;

— ignore;

— soft.

**4.2.187.1.1 hard:** the Plant_item_shape is used for clash detection and indicates that the shape cannot occupy the same physical space with another hard shape.

**4.2.187.1.2 ignore:** the Plant_item_shape is not used for clash detection.

**4.2.187.1.3 soft:** the Plant_item_shape is used for clash detection and indicates that the shape can occupy the same space with another soft shape and, depending on the circumstances, may occupy the same space as a hard object.

NOTE See table 1. Table 1 represents a comparison between the clash_detection_class designations for two Plant_item_shapes and indicates whether the resulting interference would be designated as hard clash, soft clash, or no clash. A hard clash refers to an interference between two Plant_item_shapes whose clash_detection_class is hard. A soft clash refers to an interference between two Plant_item_-shapes where at least one of the Plant_item_shapes has a clash_detection_class of soft. A no clash refers to an interference between two Plant_item_shapes where at least one of the Plant_item_shapes has a clash_detection_class of ignore.

**Table 1 - Plant_item_shape interference clash detection**

| | Hard | Ignore | Soft |
|---|---|---|---|
| Hard | hard clash | no clash | soft clash |
| Ignore | no clash | no clash | no clash |
| Soft | soft clash | no clash | soft clash |

#### 4.2.187.2 origin

The origin specifies the locating point for the geometric shape of a Plant_item (see 4.2.174).



 

#### 4.2.187.3 shape_id

The shape_id specifies a unique identifier for the Plant_item_shape.

### 4.2.188 Plant_item_weight

A Plant_item_weight is an estimate or the measure of the force experienced by the Plant_item (see 4.2.174) as a result of the earth's gravity.

NOTE Before the plant_item actually exists, weight is simply an estimate. The actual weight may be provided if the plant_item does exist and has been measured.

The data associated with a Plant_item_weight are the following:

— centre_of_gravity;

— weight_state;

— weight_value.

#### 4.2.188.1 centre_of_gravity

The centre_of_gravity specifies the point where the entire weight of a Plant_item (see 4.2.174) may be considered as concentrated so that if supported at this point the Plant_item (see 4.2.174) would remain in equilibrium in any position.

#### 4.2.188.2 weight_state

The weight_state specifies a designation of the condition of the Plant_item (see 4.2.174) that corresponds to the Plant_item_weight.

NOTE The value of the weight_state may be one of a set of predefined values or may be user supplied.

The value of the weight_state attribute may be one of the following:

— empty;

— full;

— operating;

— shipping;

— test.

**4.2.188.2.1 empty:** the Plant_item does not contain any process materials.

**4.2.188.2.2 full:** the Plant_item contains maximum amount of process materials.

**4.2.188.2.3 operating:** the Plant_item is in normal operating conditions.

**4.2.188.2.4 shipping:** the Plant_item and its transportation and packing materials are included.

**4.2.188.2.5 test:** the Plant_item is for purposes of structural load calculations.

**4.2.188.2.6 weight_value:** the weight_value specifies a measure of the force experienced by the Plant_item (see 4.2.174) as a result of the earth's gravity.

### 4.2.189 Plant_process_capability

A Plant_process_capability is a functional behaviour that can be executed by the Plant (see 4.2.172).

The data associated with a Plant_process_capability are the following:

— plant_process_capability_id;

— production_capacity;

— production_type.

EXAMPLE A plant with a production_type of POWER may produce power at a production_capacity of 500 million kilowatts per hour. If this process capability is provided by a combination of a piping system (for steam, for example) and an electrical system, both of these systems can be combined as a subplant; the subplant has the process capability and is part of a plant.

#### 4.2.189.1 plant_process_capability_id

The plant_process_capability_id uniquely identifies a particular plant_process_capability.

#### 4.2.189.2 production_capacity

The production_capacity specifies the rated output of the Plant (see 4.2.172) with respect to a Plant_-process_capability.

#### 4.2.189.3 production_type

The production_type specifies a designation that classifies the Plant (see 4.2.172) based on the products it produces.



 

### 4.2.190 Plant_system

A Plant_system is a combination of Plant_item (see 4.2.174) objects that perform a function required for the Plant (see 4.2.172) to operate to produce products. Each Plant_system may be one of the following: an Electrical_system (see 4.2.69), a Ducting_system (see 4.2.60), an Instrumentation_and_control_-system (see 4.2.114), a Piping_system (see 4.2.164), or a Structural_system (see 4.2.237).

NOTE A Plant_system is one of the types of systems indicated or can have a designation drawn from the classification tables in annex M of ISO 10303-221 [3].

The data associated with a Plant_system are the following:

— name;

— plant_system_id;

— service_description.

#### 4.2.190.1 name

The name specifies a textual label given to the Plant_system.

#### 4.2.190.2 plant_system_id

The plant_system_id specifies a unique identifier for the Plant_system. Plant_system_id is required for each Plant_system.

#### 4.2.190.3 service_description

The service_description specifies a textual or summary label for the system.

EXAMPLE Examples of service_description labels include Boiler Feedwater System, Paraxylene System, Pipe Rack K, and 4160V Power System.

### 4.2.191 Plant_system_assembly

A Plant_system_assembly is a collection of Plant_system (see 4.2.190) objects into a higher-level system to perform a functional capability.

### 4.2.192 Plant_volume

A Plant_volume is a type of Plant_item_instance (see 4.2.183) that is a specifically defined volume located within a Plant (see 4.2.172) that may, but need not be occupied by physical Plant_item (see 4.2.174) objects. Each Plant_volume may be one of the following: a Reserved_space (see 4.2.207), a Route (see 4.2.209), or a System_space (see 4.2.249).

The data associated with a Plant_volume are the following:

— type.

The type specifies a designation that classifies the Plant_volume.

EXAMPLE Examples of Plant_volume object type classifications include reserved space, zone-area, area classification zone, equipment pull space, and egress for personnel.

### 4.2.193 Point

A Point is a type of Wire_and_surface_element (see 4.2.267) that is a dimensionless location in space.

### 4.2.194 Point_and_line_representation

A Point_and_line_representation is a type of Site_shape_representation (see 4.2.220) represented as a collection of Point (see 4.2.193) objects that define the surface grid of the topography of a Site (see 3.3.42, 4.2.218).

### 4.2.195 Polygon

A Polygon is a type of Curve (see 4.2.55) that is composed of a set of points connected by line segments that form a planar, closed, non-self-intersecting figure.

### 4.2.196 Pressure_class

A Pressure_class is a type of Piping_size_description (see 4.2.160) based on pressure rating or classification and a nominal size value.

NOTE This type of piping size description is commonly associated with a dimensional specification, such as the ANSI B16.5 specification for Flange objects.

The data associated with a Pressure_class are the following:

— nominal_size;

— pressure_rating.

#### 4.2.196.1 nominal_size

The nominal_size specifies a standard size designation of the Piping_system_component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.



 

NOTE 1 The nominal size need not represent an actual dimension.

NOTE 2 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.196.2 pressure_rating

The pressure_rating specifies a nominal pressure for the design of the Piping_system_component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.

NOTE 1 When specified with a dimensional standard, such as ANSI B16.1, its value corresponds to a selection out of a set of available values (e.g., 150 PSI, 300 PSI).

NOTE 2 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.197 Pressure_fit

A Pressure_fit is a type of Piping_connector (see 4.2.158) that is a physical feature of a Plant_item (see 4.2.174) that intended to establish a connection with another connector through pressure between the connector rather than by means of threading, welds, or fasteners.

### 4.2.198 Process_ducting

A Process_ducting is a type of Ducting_component (see 4.2.59) and Piping_system_component (see 4.2.165) that consists of Piping_component (see 4.2.157) objects or ductwork that is used to convey process streams in a Plant (see 4.2.172).

NOTE Process_ducting is used for venting gaseous portions of the process stream. It is part of the system that handles the process stream, but is ductwork rather than piping.

The data associated with a Process_ducting are the following:

— gauge.

The gauge specifies a designation that refers to the thickness of the Process_ducting.

### 4.2.199 Project_design_assignment

A Project_design_assignment is an assignment of a Plant_item (see 4.2.174) to a Design_project (see 4.2.57).

NOTE The set of Project_design_assignment instances for a project defines the items and areas that are part of the project.

## 4.2.200 Pyramid

A Pyramid is a type of Csg_element (see 4.2.54) that is a 3D volume with a rectangular base and four triangular sides that meet at an apex. The axis of a pyramid is the line segment from the centre of the base to the apex.

## 4.2.201 Reducer

A Reducer is a type of Fitting (see 4.2.83) that provides a reduction from one Pipe (see 3.3.25, 4.2.154) size to another. Each Reducer may be an Eccentric_reducer (see 4.2.64).

NOTE Figure 23 depicts a typical butt-weld Reducer.

The data associated with a Reducer are the following:

— end_1_connector;

— end_2_connector;

— end_to_end_length.

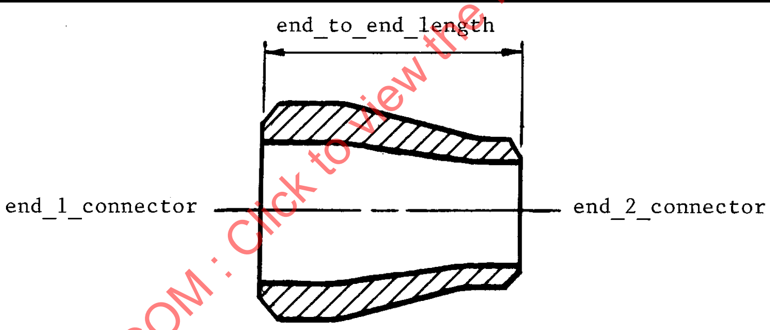


**Figure 23 - Reducer**



### 4.2.201.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) that connects to the larger size Pipe (see 3.3.25, 4.2.154).

### 4.2.201.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) that connects to the smaller size Pipe (see 3.3.25, 4.2.154).

 

#### 4.2.201.3 end_to_end_length

The end_to_end_length specifies the external distance between the end-one face and the end-two face of the Reducer. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.202 Reducing_flange

A Reducing_flange is a type of Flange (see 4.2.84) used to make a flanged joint between Pipe (see 3.3.25, 4.2.154) objects of different nominal sizes that has the dimensional characteristics of the larger Pipe and the bore of the smaller Pipe.

EXAMPLE Examples of reducing_flange types include weld-neck flange, slip-on flange, socket-weld flange, and threaded flange.

### 4.2.203 Reducing_torus

A Reducing_torus is a type of Csg_element (see 4.2.54) that is formed by sweeping a circle that uniformly decreases in size through a circular sweep angle of less that 360 degrees.

### 4.2.204 Reference_geometry

A Reference_geometry is the identification of one or more Shape_representation_element (see 4.2.216) objects in a model that are not part of a component shape, but provide additional geometric information relative to the shape of the Plant_item (see 4.2.174). Each Reference_geometry may be a Plant_item_-centreline (see 4.2.175).

The data associated with a Reference_geometry are the following:

— name;

— reference_geometry_id.

#### 4.2.204.1 name

The name specifies a textual label given to the Reference_geometry.

#### 4.2.204.2 reference_geometry_id

The reference_geometry_id specifies a unique identifier assigned to the Reference_geometry.

### 4.2.205 Relative_item_location

A Relative_item_location is a type of Plant_item_location (see 4.2.186) that is the relative position of the Plant_item (see 4.2.174) with respect to another Plant_item.

### 4.2.206 Required_material_description

A Required_material_description is a specification of the substances or the requirements of the substances that a component is to be made from.

The data associated with a Required_material_description are the following:

— description;

— material_requirement_id.

#### 4.2.206.1 description

The description specifies a textual explanation or summary of the required materials.

#### 4.2.206.2 material_requirement_id

The material_requirement_id specifies a unique identifier for the specification that provides the required material. Material_requirement_id is required for each Required_material_description.

NOTE The identifier is normally a coded value that is company-specific.

### 4.2.207 Reserved_space

A Reserved_space is a type of Plant_volume (see 4.2.192) that is a region of space that is not to be obstructed by physical objects for reasons related to plant operation.

NOTE Reserved spaces are normally prescriptive.

EXAMPLE Reserved_spaces include maintenance volume, operator access, and safety zone.

### 4.2.208 Ring_spacer

A Ring_spacer is a type of Spacer (see 4.2.226) that fits between Flange (see 4.2.84) objects in a flanged joint to bridge a large gap or fill a slight angle between the Flange objects that cannot be accommodated by standard Flange gaskets.

The data associated with a Ring_spacer are the following:

— inside_diameter.



 

The inside_diameter specifies the diameter of the bore hole through the Ring_spacer. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.209 Route

A Route is a type of Plant_volume (see 4.2.192) that is a 3D path from one location to another.

NOTE 1 A Route is a conceptual engineered path that reserves space for a piping system. This space need not be occupied by a Plant_item (see 4.2.174) at a future time.

NOTE 2 - The shape of the reserved volume of a route is a specified Plant_item_shape (see 4.2.187).

EXAMPLE A cable trench is a kind of route that goes through and runs underneath the surface of a site.

### 4.2.210 Schedule

A Schedule is a type of Piping_size_description (see 4.2.160) that gives the Pipe (see 3.3.25, 4.2.154) or Piping_component (see 4.2.157) size in terms of nominal size and a sizing schedule.

NOTE When a Schedule entity is used, the dimensional standard attribute of Piping_size_description (see 4.2.160) must be specified.

The data associated with a Schedule are the following:

— nominal_size;

— pipe_schedule.

#### 4.2.210.1 nominal_size

The nominal_size specifies a standard size designation of the Piping_system_component (see 4.2.165) or Piping_connector (see 4.2.158). It may be specified as a single value or as a range of values.

NOTE 1 The nominal size need not represent an actual dimension.

NOTE 2 See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.210.2 pipe_schedule

The pipe_schedule specifies a designation of a standard wall thickness and external diameter for a nominal pipe size through a reference to the dimensional standard.

### 4.2.211 Segment_insulation

A Segment_insulation is a logical connection between a Piping_system_line_segment (see 4.2.167) and the insulation attached to the Pipe (see 3.3.25, 4.2.154) associated with the Piping_system_line_segment.

The data associated with a Segment_insulation are the following:

— boundaries;

— description;

— thickness;

— type.

#### 4.2.211.1 boundaries

The boundaries specifies a description that defines the boundaries for insulation on the Piping_system_-line (see 4.2.166).

EXAMPLE An example description for the insulation boundaries of a Piping_system_line is personnel protection insulation shall extend to 12 feet above grade or walkway.

#### 4.2.211.2 description

The description specifies a textual explanation or summary of the reasons for providing insulation.

EXAMPLE Examples of Piping_system_line insulation descriptions include provided for heat conservation and provided for personnel protection.

#### 4.2.211.3 thickness

The thickness specifies the distance between the inside and outside surfaces of the insulation. It may be specified as a single value or as a range value.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range value. The thickness of the insulation may vary over the extent of the insulation.

#### 4.2.211.4 type

The type specifies the insulation material.



 

## 4.2.212 Service_operating_case

A Service_operating_case is a stream condition that may exist at a Plant_item_connector (see 4.2.179).

EXAMPLE Examples of Service_operating_case conditions include normal, upset, and shutdown.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range value.

The data associated with a Service_operating_case are the following:

— duration;

— frequency;

— name;

— operating_case_id;

— operating_pressure;

— operating_temperature.

### 4.2.212.1 duration

The duration specifies the expected time span of the Service_operating_case. It may be specified as a single value or as a range value.

### 4.2.212.2 frequency

The frequency specifies the expected number of times that the Service_operating_case will occur over a defined period of time. It may be specified as a single value or as a range value.

### 4.2.212.3 name

The name specifies a textual label given to the condition that the Equipment (see 3.3.12, 4.2.72) operating characteristics are being defined under.

### 4.2.212.4 operating_case_id

The operating_case_id specifies a unique identifier for the Service_operating_case.

#### 4.2.212.5 operating_pressure

The operating_pressure specifies the force per unit area exerted by the process stream on the Plant_item (see 4.2.174) under a specific Service_operating_case. It may be specified as a single value or as a range value.

#### 4.2.212.6 operating_temperature

The operating_temperature specifies the temperature of the process stream on the Plant_item (see 4.2.174) under a specific Service_operating_case. It may be specified as a single value or as a range value.

### 4.2.213 Shape_interference_zone_usage

A Shape_interference_zone_usage is the representational elements that define the shape of a volume that encloses the region of space where the interference of clashing Plant_items (see 4.2.174) occurs.

### 4.2.214 Shape_parameter

A Shape_parameter is a type of Shape_representation_element that is a name-value pair that specifies the dimensional value of some aspect of the Plant_item_shape (see 4.2.187). The meaning of the name-value pair is not specified in this part of ISO 10303.

NOTE 1 A use of this structure is to provide a generic capability to reference classes of Plant_items (see 4.2.174) by a dimensional characteristic, such as 5 centimeter pipe.

NOTE 2 It was not the intent of this object to use this structure to create a geometric representation of an item. The effective use of this structure requires an agreement between the exchanging parties as to the meanings of the names so that they can understand the information being exchanged.

The data associated with a Shape_parameter are the following:

— name;

— value.

#### 4.2.214.1 name

The name specifies a textual label given to a dimension or parameter of a Plant_item_shape (see 4.2.187).

EXAMPLE An example of this is the name "diameter".



 

#### 4.2.214.2 value

The value specifies a number that represents the measure of the dimension or parameter of the Plant_-item_shape.

EXAMPLE An example of this is the value "5.6".

### 4.2.215 Shape_representation

A Shape_representation is a combination of geometric elements that describe or define the general or specific surface boundaries of a Plant_item (see 4.2.174). Shape_representation is either a hybrid_shape_representation or plant_csg_shape_representation.

NOTE Shape representation need not be the exact or specific shape of the item.

### 4.2.216 Shape_representation_element

A Shape_representation_element is a geometric model that is used to represent the shape or some aspect of the shape of a Plant_item (see 4.2.174). Each Shape_representation_element is either a B_rep_element (see 4.2.1), a Csg_element (see 4.2.54), a Shape_parameter (see 4.2.214), or a Wire_and_surface_-element (see 4.2.267).

The data associated with a Shape_representation_element are the following:

— element_id.

The element_id specifies the unique identifier of the Shape_representation_element.

### 4.2.217 Shape_representation_element_usage

A Shape_representation_element_usage is an assignment of a Shape_representation_element to a Shape_representation (see 4.2.215) of a Plant_item (see 4.2.174).

NOTE Shape_representation_element_usage is the mechanism that aggregates the geometric elements that represent the shape of the plant_item. The rules are constraints for what constitutes a valid aggregation are delineated by conformance class.

The data associated with a Shape_representation_element_usage are the following:

— element_colour;

— layer.



 

#### 4.2.217.1 element_colour

The element_colour specifies the colour that displays the element.

#### 4.2.217.2 layer

The layer specifies the collection of displayable items for the purpose of controlling visibility and presentation style.

### 4.2.218 Site

A Site is a geographical location where the Plant (see 4.2.172) is located. The z-axis of the local coordinate system of the Site shall be considered the elevation of the coordinate space.

The data associated with a Site are the following:

— address;

— coordinates;

— elevation;

— environmental_references;

— locality;

— name;

— orientation;

— owners;

— site_id.

#### 4.2.218.1 address

The address specifies the street address (including city, state, and zip code as appropriate) of the Site.

#### 4.2.218.2 coordinates

The coordinates specifies the longitude and latitude coordinates of the Site with respect to a known point on the Site.



 

#### 4.2.218.3 elevation

The elevation specifies the distance that the Site is located above sea level with respect to a known point on the Site.

NOTE The point referenced here is the same point referenced under coordinates.

#### 4.2.218.4 environmental_references

The environmental_references specifies a reference to a document that provides environmental information relevant to the Site.

EXAMPLE Environmental_references specify documents that describe the conditions of the environment that a plant operates in that affect the design, such as snow loads, wind loads, and seismic data.

#### 4.2.218.5 locality

The locality specifies the municipality or region where the Site is located.

#### 4.2.218.6 name

The name specifies a textual label given to the Site.

#### 4.2.218.7 orientation

The orientation specifies the relative alignment of the Site with respect to a given compass direction.

#### 4.2.218.8 owners

The owners specify the company or organization that is financially responsible the Site.

#### 4.2.218.9 site_id

The site_id specifies a unique identifier for the Site. Site_id is required for each Site.

### 4.2.219 Site_feature

A Site_feature is the composition, proportions, form, or outward appearance of some thing of interest on a Site (see 3.3.42, 4.2.218).

EXAMPLE A Site_feature may be man-made, such as a building, road, railway, water tower or they may be natural, such as a river, hill, or forest.

The data associated with a Site_feature are the following:

— location_and_orientation;

— man_made_or_natural;

— shape;

— site_feature_id;

— type.

### 4.2.219.1 location_and_orientation

The location_and_orientation specifies the position of the Site_feature relative to the site coordinate system and the orientation of the Site_feature relative to a specified direction.

### 4.2.219.2 man_made_or_natural

The man_made_or_natural specifies that the Site_feature is either man-made or natural, and provides a short descriptive name or title of the feature.

### 4.2.219.3 shape

The shape specifies a 3D spatial volume that completely encloses or bounds a feature.

NOTE The shape of the Site_feature is necessary for the spatial layout of buildings and the piping between buildings.

### 4.2.219.4 site_feature_id

The site_feature_id specifies a unique identifier for the Site_feature.

### 4.2.219.5 type

The type specifies a designation that classifies a Site_feature based on its physical and functional characteristics.

### 4.2.220 Site_shape_representation

A Site_shape_representation is a replica of the topography of a specific area. Each Site_shape_representation is either a Faceted_surface_representation (see 4.2.80) or a Point_and_line_representation (see 4.2.194).



 

The data associated with a Site_shape_representation are the following:

— site_shape_representation_id.

The site_shape_representation_id specifies a unique identifier for the Site_shape_representation.

#### 4.2.221 Sited_plant

A Sited_plant is a Planned_physical_plant (see 4.2.170) that a site location has been defined for.

The data associated with a Sited_plant are the following:

— plant_site_location;

— plant_site_orientation.

##### 4.2.221.1 plant_site_location

The plant_site_location specifies the geographic position of the plant relative to the Site (see 3.3.42, 4.2.218) or a feature of the Site.

##### 4.2.221.2 plant_site_orientation

The plant_site_orientation specifies the directional orientation of the plant with respect to the Site (see 3.3.42, 4.2.218).

#### 4.2.222 Slip_on_flange

A Slip_on_flange is a type of Flange (see 4.2.84) that slips over the end of a Pipe (see 3.3.25, 4.2.154) or Fitting (see 4.2.83) and is fillet welded in place.

The data associated with a Slip_on_flange are the following:

— stand_off.

The stand_off specifies the measure of the distance between the face of the Slip_on_flange and the end of the pipe that is inserted into the Slip_on_flange. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

## 4.2.223 Socket

A Socket is a type of Piping_connector (see 4.2.158) that is a physical feature of a Plant_item (see 4.2.174) that allows partial insertion of the male end of another Plant_item.

NOTE 1 The location of the connect point should be based on the dimension from the centreline to the bottom of the socket of a Valve (see 4.2.264) or Fitting (see 4.2.83) plus the root_gap.

NOTE 2 Figure 24 depicts a typical Socket.

The data associated with a Socket are the following:

— root_gap.

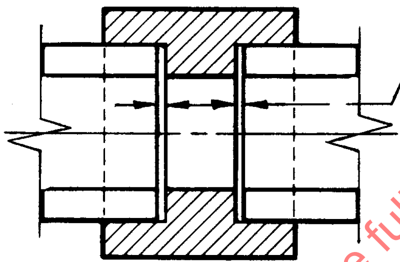


**Figure 24 - Socket**

The root_gap specifies the distance between the connect point of the Plant_item_connector of the fitting and the base of the Socket.

## 4.2.224 Socket_weld_flange

A Socket_weld_flange is a type of Flange (see 4.2.84) having a socket configuration that fits the end of a pipe for fillet welding.

## 4.2.225 Solid_of_revolution

A Solid_of_revolution is a type of Csg_element (see 4.2.54) that is formed by sweeping a 2D shape about an axis. The 2D shape may be closed or open; if open, then the ends of the 2D shape must lie on the sweep axis.

## 4.2.226 Spacer

A Spacer is a type of Fitting (see 4.2.83) that is placed between two Flange (see 4.2.84) objects to enable the flow of material between the pipelines on either side of the Spacer. Each Spacer may be one of the following: a Paddle_spacer (see 4.2.151), or a Ring_spacer (see 4.2.208).



 

The data associated with a Spacer are the following:

— outside_diameter;

— thickness.

#### 4.2.226.1 outside_diameter

The outside_diameter specifies the external diameter of the Spacer. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.226.2 thickness

The thickness specifies the distance between the two parallel faces of the Spacer. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.227 Spare_plant_item_usage

A Spare_plant_item_usage is an association between a primary Plant_item (see 4.2.174) and a Plant_item used as a spare for the primary Plant_item.

### 4.2.228 Specialty_item

A Specialty_item is a type of Piping_system_component (see 4.2.165) whose specific dimensional design or configuration is not met by some standard commodity item.

The data associated with a Specialty_item are the following:

— type.

The type specifies a category that the item is part of.

EXAMPLE Examples of Specialty_item types include flange and valve.

## 4.2.229 Spectacle_blind

A Spectacle_blind is a type of Blank (see 4.2.2) that consists of two paddles connected by an arm. One paddle blocks the flow of material (see Paddle_blank in 4.2.150) and the other is a ring that permits or alters the flow (see Paddle_spacer in 4.2.151). A spectacle either allows or disallows flow in a pipe depending on which end of the spectacle is installed in line. It is often used to isolate a section of the Piping_system (see 4.2.164) or Equipment (see 3.3.12, 4.2.72).

NOTE 1 The term spectacle refers to shape of the item, that resembles a pair of spectacles (i.e., reading glasses).

NOTE 2 Figure 25 depicts a typical Spectacle_blind.

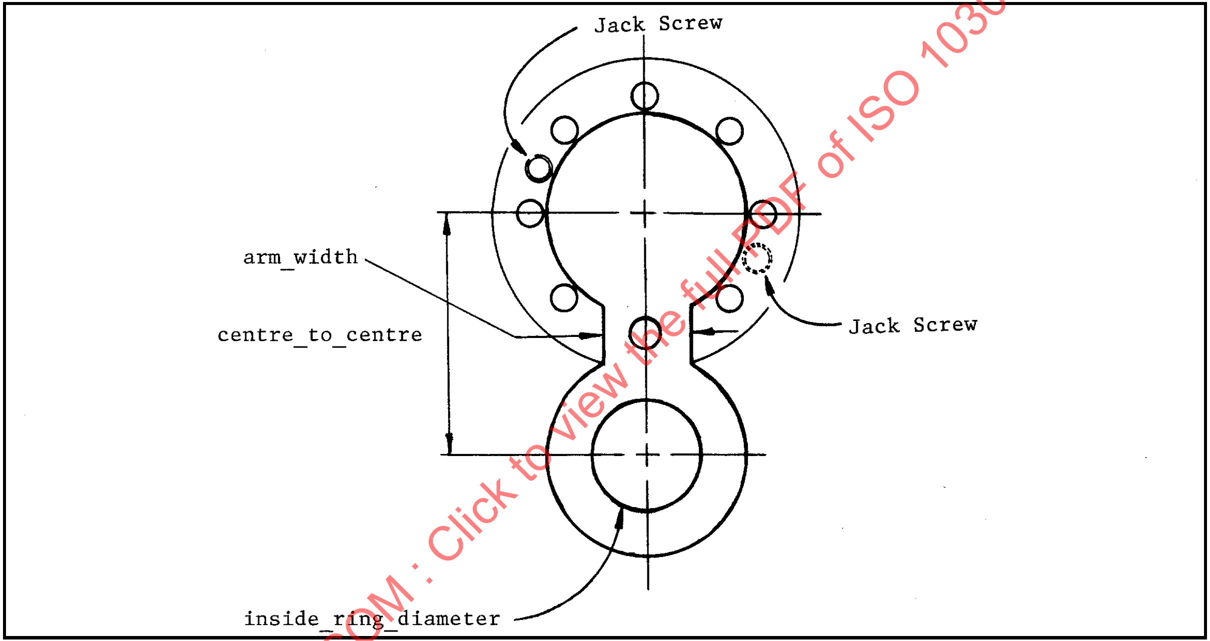


**Figure 25 - Spectacle blind**



The data associated with a Spectacle_blind are the following:

— arm_width;

— centre_to_centre;

— inside_ring_diameter.

### 4.2.229.1 arm_width

The arm_width specifies the width of the arm connecting the paddles. It may be specified as a single value or as a range of values.

 

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.229.2 centre_to_centre

The centre_to_centre specifies the distance between the geometric centres of the paddles. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.229.3 inside_ring_diameter

The inside_ring_diameter specifies the diameter of the bore hole through the ring paddle. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.230 Sphere

A Sphere is a type of Csg_element (see 4.2.54) that is a solid bounded by a surface at a constant radius from a centre point.

### 4.2.231 Square_to_round

A Square_to_round is a type of Csg_element (see 4.2.54) that consists of a planar, rectangular surface, a planar circular surface parallel to the rectangular surface, and an enclosing, transitional surface that connects the boundaries of the rectangular surface and circular surface.

### 4.2.232 Straight_pipe

A Straight_pipe is a type of Pipe (see 3.3.25, 4.2.154) that does not change the direction of fluid flow.

The data associated with a Straight_pipe are the following:

— end_to_end_length.

The end_to_end_length specifies the external length of the Straight_pipe. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.233 Stream_design_case

A Stream_design_case is the set of characteristics of a gas, liquid, vapour, or solid stream under a specific circumstance at the termination of a Piping_system_line_segment (see 4.2.167) or a plant_item_-connector_occurrence (see 4.2.180).

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range value.

The data associated with a Stream_design_case are the following:

— description;

— flow_rate;

— pressure;

— stream_case_type;

— stream_data_reference;

— stream_design_id.

#### 4.2.233.1 description

The description specifies a textual explanation or summary of the Stream_design_case.

#### 4.2.233.2 flow_rate

The flow_rate specifies the stream volume, mass, or molar units per unit time. It may be specified as a single value or as a range value.

#### 4.2.233.3 pressure

The pressure specifies the amount of force applied by the stream over a unit area. It may be specified as a single value or as a range value.

#### 4.2.233.4 stream_case_type

The stream_case_type specifies the condition that the stream characteristics are being defined under. Stream_case_type is required for each Stream_design_case.

Example of stream_case_type conditions include normal, upset, and shutdown.



 

#### 4.2.233.5 stream_data_reference

The stream_data_reference specifies the sources that provide the basis for the stream data.

#### 4.2.233.6 stream_design_id

The stream_design_id specifies a unique identifier for the Stream_design_case. Stream_design_id is required for each Stream_design_case.

### 4.2.234 Stream_phase

A Stream_phase is the set of characteristics of a single gas, liquid, vapour, or solid stream that may be composed into a Stream_design_case (see 4.2.233).

The data associated with a Stream_phase are the following:

— constituent_mole_fraction;

— constituents;

— phase_density;

— phase_fraction;

— specific_gravity;

— surface_tension;

— temperature;

— viscosity.

#### 4.2.234.1 constituent_mole_fraction

The constituent_mole_fraction specifies the mass ratio of any given component to the whole for the Stream_phase.

#### 4.2.234.2 constituents

The constituents specifies the various chemicals for the Stream_phase.

#### 4.2.234.3 phase_density

The phase_density specifies the amount of mass per unit volume for the Stream_phase.



 

#### 4.2.234.4 phase_fraction

The phase_fraction specifies the percentage of the mass of this Stream_phase in the Stream_design_case (see 4.2.233).

#### 4.2.234.5 specific_gravity

The specific_gravity specifies the ratio of the mass of a liquid to the mass of an equal volume of distilled water at 4 degrees Celsius.

#### 4.2.234.6 surface_tension

The surface_tension specifies the force per unit area of the cohesive forces at or near the surface of a liquid Stream_phase.

#### 4.2.234.7 temperature

The temperature specifies the measure of molecular motion of a stream. It may be specified as a single value or as a range value.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range value.

#### 4.2.234.8 viscosity

The viscosity specifies a measure of the resistance of a stream to deformation when subjected to a shear stress.

### 4.2.235 Structural_component

A Structural_component is a type of Plant_item (see 4.2.174) that is an individually identifiable item or combination of items that is part of the Plant (see 4.2.172) Structural_system (see 4.2.237).

NOTE Structural_component objects include structural steel members, load resisting walls, stairs, platforms foundations, supports (excluding pipe supports) for Plant_item (see 4.2.174) objects, and have a primary function to transfer or resist live or dead loads.

The data associated with a Structural_component are the following:

— exact_section;

— size_designator;

— type.



 

#### 4.2.235.1 exact_section

The exact_section specifies the detailed shape of a cross section of the structural element.

#### 4.2.235.2 size_designator

The size_designator specifies the designation given to some types of plant structural elements to define cross-sectional size and general shape based on industry-standard practice.

EXAMPLE W30 X 132 is the U.S. American Institute of Steel Construction (AISC) designation for a wide flange beam of nominal 76.20 centimetres (30 inches) depth weighing 194.88 kilograms per metre (132 pounds per foot) of length. Similar designations exist for other plant structural elements such as angles, channels, and structural tee shapes. Also, like designations exist for other structural elements, e.g., reinforcing bar (#8 rebar).

#### 4.2.235.3 type

The type specifies a designation that classifies a structural element based on its function in the Structural_system (see 4.2.237).

EXAMPLE Examples of structural element types include beam, column, brace, support, grade beam, and pile.

### 4.2.236 Structural_load_connector

A Structural_load_connector is a type of Plant_item_connector (see 4.2.179) that connects two Structural_component (see 4.2.235) objects for the purpose of load transfer.

The data associated with a Structural_load_connector are the following:

— type.

The type specifies either a shear, moment, or shear and moment type of load at the connector.

### 4.2.237 Structural_system

A Structural_system is a type of Plant_system (see 4.2.190) that is an assembly of one or more Structural_component (see 4.2.235) objects and Structural_load_connector (see 4.2.236) objects.

The data associated with a Structural_system are the following:

— type.

The type specifies a designation that classifies the Structural_system based on the kind of service that it provides.



 

### 4.2.238 Sub_plant_relationship

A Sub_plant_relationship is the relationship between Plant (see 4.2.172) objects and sub-plants and defines their relative locations.

EXAMPLE Sub_plant_relationships include manufacturing line, train, and plant unit.

The data associated with a Sub_plant_relationship are the following:

— location_and_orientation.

The location_and_orientation specifies the relative position and orientation of the sub-plant within the Plant (see 4.2.172).



### 4.2.239 Supplied_equipment

A Supplied_equipment is an Equipment (see 3.3.12, 4.2.72) that is, or is to be, provided by a Supplier (see 4.2.240) for use in a Plant (see 4.2.172).

The data associated with a Supplied_equipment are the following:

— delivery_date;

— purchase_order_number;

— requisition_number.

#### 4.2.239.1 delivery_date

The delivery_date specifies the calendar day-month-year and time when the Equipment (see 3.3.12, 4.2.72) was, or is, scheduled to be delivered to the Site (see 3.3.42, 4.2.218).

NOTE A specific ordering of the day, month, and year within the date is not required.

#### 4.2.239.2 purchase_order_number

The purchase_order_number specifies an identifier assigned to the Equipment (see 3.3.12, 4.2.72) purchase order.

#### 4.2.239.3 requisition_number

The requisition_number specifies an identifier assigned to a written request for a piece of Equipment (see 3.3.12, 4.2.72).

 

#### 4.2.240 Supplier

A Supplier is the organization that produces a piece of Equipment (see 3.3.12, 4.2.72) or publishes a catalogue.

The data associated with a Supplier are the following:

— supplier_id;

— vendor_name.

##### 4.2.240.1 supplier_id

The supplier_id specifies a unique identifier for the supplier. Supplier_id is required for each Supplier.

##### 4.2.240.2 vendor_name

The vendor_name specifies a textual label used by the company or organization that is providing the Equipment (see 3.3.12, 4.2.72).

#### 4.2.241 Support_component

A Support_component is a type of Plant_item (see 4.2.174) that is designed to support other Plant_item objects. This support includes carrying the weight of the Plant_item, including internal fluids and external insulation, permitting thermal expansion and contraction, and dampening any vibrational or seismic forces applied to the Plant_item. Each Support_component may be a Cable_support (see 4.2.10).

EXAMPLE If a Support_component is not a Cable_support, it may be a branch reinforcing pad, a hanger, a footer, pipe rack, or anything that supports the weight of a Plant_item.

#### 4.2.242 Support_constraints

A Support_constraints is a limitation on the movement of a Plant_item (see 4.2.174) support, normally in specified directions.

The data associated with a Support_constraints are the following:

— gap;

— K;

— restrained;

— support_constraint_id.

#### 4.2.242.1 gap

The gap specifies the allowable space between a Plant_item (see 4.2.174) and a Plant_item support.

#### 4.2.242.2 K

The K specifies the ratio between the force applied to the support and the support deflection produced by that force.

#### 4.2.242.3 restrained

The restrained specifies a boolean indicator that specifies whether the Plant_item (see 4.2.174) support limits movement of the Plant_item in a specified direction.

#### 4.2.242.4 support_constraint_id

The support_constraint_id specifies a unique identifier for the Support_constraints.

### 4.2.243 Support_usage

A Support_usage is the relationship between a defined load bearing element and the Plant_item (see 4.2.174) that it provides support for. Each Support_usage may be a Support_usage_connection (see 4.2.244).

The data associated with a Support_usage are the following:

— detail_sheet_reference;

— function.

#### 4.2.243.1 detail_sheet_reference

The detail_sheet_reference specifies the support detail drawings that define the support.

#### 4.2.243.2 function

The function specifies the role or purpose of using the Plant_item (see 4.2.174) as a support.

EXAMPLE Examples of function designations include anchor, guide, restraint, and support.

### 4.2.244 Support_usage_connection

A Support_usage_connection is a type of Support_usage (see 4.2.243) that specifies the actual Plant_-item_connection_occurrence (see 4.2.178) where the support occurs.



 

### 4.2.245 Surface

A Surface is a type of Wire_and_surface_element (see 4.2.267) that is a set of connected points in 3D geometric space that is always locally 2D, but need not be a manifold.

NOTE Surface has many subtypes. Besides being a self-contained object, Surface is used in the definition of other geometric objects such as Point (see 4.2.193) objects and Curve (see 4.2.55) objects. It will not be instantiated as it has no attributes.

### 4.2.246 Survey_point

A Survey_point is a particular location (position and elevation) on a Site (see 3.3.42, 4.2.218) relative to a known geographic location.

NOTE Survey_point data are established by performing a survey. The collection of Survey_point data can be interpolated to generate a faceted or surface representation of the topography of the Site.

### 4.2.247 Swage

A Swage is a type of Fitting (see 4.2.83) that provides a reduction from Pipe (see 3.3.25, 4.2.154) size to another. Each Swage may be an Eccentric_swage (see 4.2.65).

NOTE 1 A Swage will always have at least one male end_type and either a male or butt-weld end.

NOTE 2 Figure 26 depicts a typical butt-weld Swage.

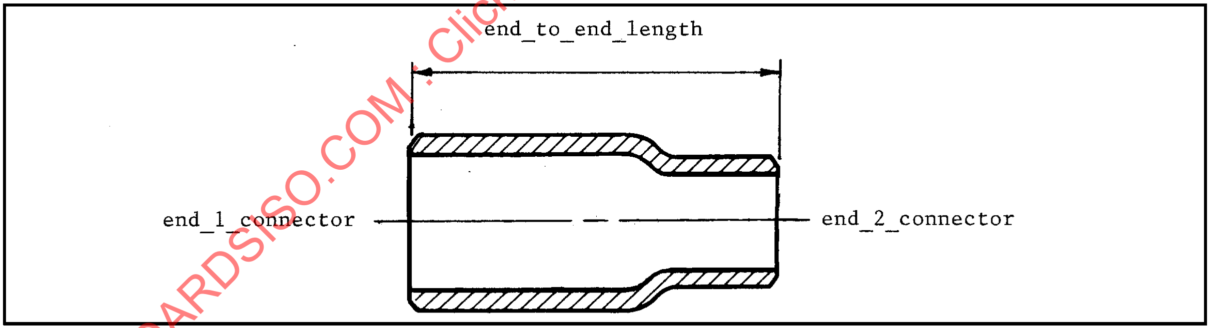


**Figure 26 - Swage**



The data associated with a Swage are the following:

— end_1_connector;

— end_2_connector;

— end_to_end_length.

#### 4.2.247.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) that corresponds to the larger diameter end of the Swage.

#### 4.2.247.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) that corresponds to the smaller diameter end of the Swage.

#### 4.2.247.3 end_to_end_length

The end_to_end_length specifies the external distance between the larger diameter end face and the smaller diameter end face of the swage. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.248 Swept_bend_pipe

A Swept_bend_pipe is a type of Pipe (see 3.3.25, 4.2.154) that is bent to alter the direction of flow of its contents.

NOTE A Swept_bend_pipe is composed of one or more Pipe_bend (see 4.2.155) objects.

The data associated with a Swept_bend_pipe are the following:

— wall_thinning_allowance.

The wall_thinning_allowance specifies the amount of pipe wall material that must be provided to compensate for reduction in wall thickness of the pipe caused by bending.

NOTE As a pipe is bent, the wall thickness on the outside portion of the bend will reduce as material stretches.

### 4.2.249 System_space

A System_space is a type of Plant_volume (see 4.2.192) that is used to describe or allocate a volume of space for use by a Plant_system (see 4.2.190).

EXAMPLE Examples of System_space type designations include electrical chases, HVAC chases, and instrumentation and control chases.



 

## 4.2.250 Tee

A Tee is a type of Fitting (see 4.2.83) that is a single branched outlet Fitting consisting of a straight run and a perpendicular branch used to permit straight-through and 90-degree flow.

NOTE Figure 27 depicts a typical butt-weld Tee.

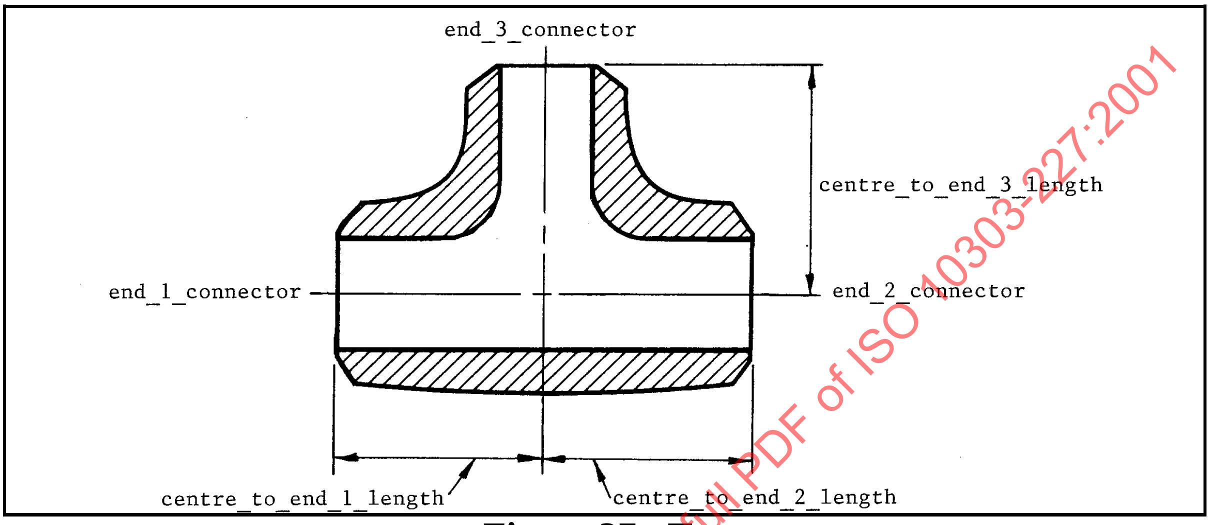


**Figure 27 - Tee**



The data associated with a Tee are the following:

— centre_to_end_1_length;

— centre_to_end_2_length;

— centre_to_end_3_length;

— end_1_connector;

— end_2_connector;

— end_3_connector.

### 4.2.250.1 centre_to_end_1_length

The centre_to_end_1_length specifies the distance from the intersection of the Tee straight-run centreline and branch-run centreline to the end-one face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

 

### 4.2.250.2 centre_to_end_2_length

The centre_to_end_2_length specifies the distance from the intersection of the Tee straight-run centreline and branch-run centreline to the end-two face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.250.3 centre_to_end_3_length

The centre_to_end_3_length specifies the distance from the intersection of the Tee straight-run centreline and branch-run centreline to the end-three face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.250.4 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) along the straight-run centreline designated as end one.

### 4.2.250.5 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) along the straight-run centreline designated as end two.

### 4.2.250.6 end_3_connector

The end_3_connector specifies the Piping_connector (see 4.2.158) along the branch-run centreline designated as end three.

### 4.2.251 Threaded

A Threaded is a type of Piping_connector (see 4.2.158) that is a physical feature of a Plant_item (see 4.2.174) that allows partial insertion of a male threaded connector.

NOTE Figure 28 depicts a typical Threaded end.

The data associated with a Threaded are the following:

— thread_engagement_depth.



 

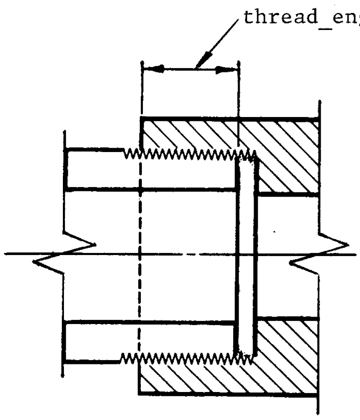


Figure 28 - Threaded

The thread_engagement_depth specifies the insertion distance of the male threaded connector into a female threaded connector.

### 4.2.252 Threaded_flange

A Threaded_flange is a type of Flange (see 4.2.84) whose bore is threaded and that is connected to a Pipe (see 3.3.25, 4.2.154) by screwing a threaded Pipe end into the Flange (see 4.2.84).

### 4.2.253 Torus

A Torus is a type of Csg_element (see 4.2.54) that is defined by sweeping the area of a circle (with minor radius) about a larger circle. A Torus may be an Reducing_torus (see 4.2.203). A Torus may be a Trimmed_torus (see 4.2.260).

### 4.2.254 Train

A Train is a type of Plant (see 4.2.172) that consists of connected Plant_items (see 4.2.174) that perform a distinct function. It is one of two or more distinct but similar portions of a system that perform the same function.

### 4.2.255 Trimmed_block

A Trimmed_block is a type of Csg_element (see 4.2.54) that is formed by cutting a Block (see 4.2.4) with one or more planes and removing one or more of the resulting sections.

### 4.2.256 Trimmed_cone

A Trimmed_cone is a type of Csg_element (see 4.2.54) that is formed by cutting a Cone (see 4.2.47) with one or more planes and removing one or more of the resulting sections.

### 4.2.257 Trimmed_cylinder

A Trimmed_cylinder is a type of Csg_element (see 4.2.54) that is formed by cutting a Cylinder (see 4.2.56) with one or more planes and removing one or more of the resulting sections.

### 4.2.258 Trimmed_pyramid

A Trimmed_pyramid is a type of Csg_element (see 4.2.54) that is formed by cutting a Pyramid (see 4.2.200) with one or more planes and removing one or more of the resulting sections.

### 4.2.259 Trimmed_sphere

A Trimmed_sphere is a type of Csg_element (see 4.2.54) that is formed by cutting a Sphere (see 4.2.230) with one or more planes and removing one or more of the resulting sections.

### 4.2.260 Trimmed_torus

A Trimmed_torus is a type of Csg_element (see 4.2.54) that is formed by cutting a Torus (see 4.2.253) with one or more planes and removing one or more of the resulting sections.

### 4.2.261 Union

A Union is a type of Fitting (see 4.2.83) composed of multiple pieces that allows the joining or separating of piping without rotating the piping. It consists of two internally threaded ends and a centre piece that draws the two ends together when rotated.

NOTE Figure 29 depicts a typical socket-weld Union.

The data associated with a Union are the following:

— end_1_connector;

— end_2_connector;

— end_to_end_length;

— major_outside_diameter;

— minor_outside_diameter.



 

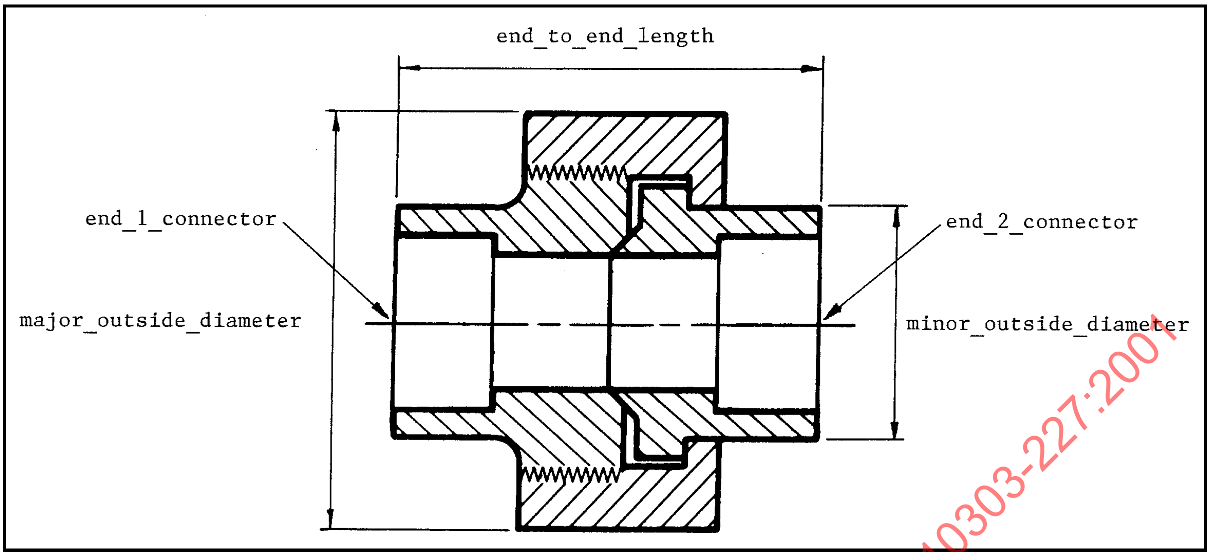


Figure 29 - Union



#### 4.2.261.1 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) that corresponds to the end with the major_outside_diameter.

#### 4.2.261.2 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) that corresponds to the end with the minor_outside_diameter.

#### 4.2.261.3 end_to_end_length

The end_to_end_length specifies the external distance between the end-one face and the end-two face. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.261.4 major_outside_diameter

The major_outside_diameter specifies the maximum diameter of the Union along the centreline, normally at the joint between the two internal pieces of the Union. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

 

#### 4.2.261.5 minor_outside_diameter

The minor_outside_diameter specifies the external diameter of the Union at the end-one and end-two connections. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.262 Unit

A Unit is a type of Plant (see 4.2.172) that is the designation (name or number) for a Plant or portion of a Plant that produces the same product by different means.

NOTE A Unit may perform a unique function for the Plant such as oxygen production, or there may be several units that perform the same function such as multiple units in a power generation installation. The underground or offsite portion of a Plant may be a Unit.

### 4.2.263 User_defined_attribute_value

A User_defined_attribute_value is a name-value pair for any characteristic that is not specified by an explicit attribute of an application object. The User_defined_attribute_value enables the exchange of characteristics and their values that are not defined explicitly by an application object attribute.

The data associated with a User_defined_attribute_value are the following:

— name;

— value.

#### 4.2.263.1 name

The name specifies a label that characterizes the User_defined_attribute_value.

#### 4.2.263.2 value

The value specifies the data for the User_defined_attribute_value.

### 4.2.264 Valve

A Valve is a type of Piping_component (see 4.2.157) that provides isolation or controls fluid direction or flow rate.



 

The data associated with a Valve are the following:

— actuator_type;

— operation_mode;

— type.

#### 4.2.264.1 actuator_type

The actuator_type specifies a descriptive designation of device or mechanism used to open, position, or close a Valve.

#### 4.2.264.2 operation_mode

The operation_mode specifies the failure mode, as in the state of being open or closed when the actuator either has no power or is in the default position.

#### 4.2.264.3 type

The type specifies a designation that classifies a Valve based on its purpose that defines the design of its internals and externals.

EXAMPLE Examples of Valve type designations include gate, globe, check, and relief.

### 4.2.265 Vector

A Vector is a type of Curve (see 4.2.55). It is specifies a direction in 3D space.

### 4.2.266 Weld_neck_flange

A Weld_neck_flange is a type of Flange (see 4.2.84) with a tapered hub bored to match the inside diameter of matching Plant_item (see 4.2.174) and with the hub beveled for butt welding to the Plant_-item.

### 4.2.267 Wire_and_surface_element

A Wire_and_surface_element is a type of Shape_representation_element (see 4.2.216) that is composed of geometric elements. Each Wire_and_surface_element is either: a Curve (see 4.2.55), a Point (see 4.2.193), or a Surface (see 4.2.245).

### 4.2.268 Y_type_lateral

A Y_type_lateral is a type of Fitting (see 4.2.83) that is a three-way fitting whose branches are at equal angles from the straight-run centreline forming a flow passage shaped like the letter "Y".

The data associated with a Y_type_lateral are the following:

— angle;

— centre_to_end_1_length;

— centre_to_end_2_length;

— centre_to_end_3_length;

— end_1_connector;

— end_2_connector;

— end_3_connector.

### 4.2.268.1 angle

The angle specifies the angle of the branch portions of the Y_type_lateral with respect to the straight run. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.268.2 centre_to_end_1_length

The centre_to_end_1_length specifies the distance from the intersection of the Y_type_lateral straight-run centreline and branch-run centreline to the end-one working point. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

### 4.2.268.3 centre_to_end_2_length

The centre_to_end_2_length specifies the distance from the intersection of the Y_type_lateral straight-run centreline and branch-run centreline to the end-two working point. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.



 

#### 4.2.268.4 centre_to_end_3_length

The centre_to_end_3_length specifies the distance from the intersection of the Y_type_lateral straight-run centreline and branch-run centreline to the end-three working point. It may be specified as a single value or as a range of values.

NOTE See annex L for a discussion of attributes that may be assigned a single value or a range of values.

#### 4.2.268.5 end_1_connector

The end_1_connector specifies the Piping_connector (see 4.2.158) designated as end one.

#### 4.2.268.6 end_2_connector

The end_2_connector specifies the Piping_connector (see 4.2.158) designated as end two.

#### 4.2.268.7 end_3_connector

The end_3_connector specifies the Piping_connector (see 4.2.158) designated as end three.

## 4.3 Application assertions

This subclause specifies the application assertions for the plant spatial configuration application protocol. Application assertions specify the relationships among application objects, the cardinality of the relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

### 4.3.1 Breakline to Survey_point

Each Breakline is defined by one or more Survey_point objects. Each Survey_point defines zero, one, or many Breakline objects.

### 4.3.2 Building to Location_in_building

Each Building is a reference frame for zero, one, or many Location_in_building objects. Each Location_-in_building has a reference frame provided by exactly one Building.

### 4.3.3 Building to Reference_geometry

Each Building has zero, one, or more column lines defined by a reference_geometry object. Each reference_geometry object defines the column lines for zero or one building object.

### 4.3.4 Catalogue_connector to Connector_definition

Each Catalogue_connector defines zero, one, or many Connector_definition objects. Each Connector_-definition is defined by zero, one, or many Catalogue_connector objects.

### 4.3.5 Catalogue_definition to Catalogue_connector

Each Catalogue_definition contains zero, one, or many Catalogue_connector objects. Each Catalogue_-connector is part of exactly one Catalogue_definition.

### 4.3.6 Catalogue_definition to Catalogue_item

Each Catalogue_definition contains zero, one, or many Catalogue_item objects. Each Catalogue_item is contained by exactly one Catalogue_definition.

### 4.3.7 Catalogue_item to Catalogue_item_substitute

Each Catalogue_item has zero, one, or many Catalogue_item_substitute objects. Each Catalogue_item_-substitute identifies a substitute for exactly one Catalogue_item.

Each Catalogue_item is a substitute in zero, one, or many Catalogue_item_substitute objects. Each Catalogue_item_substitutes identifies as a substitute exactly one Catalogue_item.

### 4.3.8 Catalogue_item to Plant_item_definition

Each Catalogue_item is defined by zero, one, or many Plant_item_definition objects. Each Plant_item_-definition defines zero, one, or many Catalogue_item objects.

### 4.3.9 Change to Change_item

Each Change changes one or more Change_item objects. Each Change_item is changed by zero, one, or many Change objects.

### 4.3.10 Change to Change_life_cycle_stage_usage

Each Change is assigned by one or more Change_life_cycle_stage_usage objects. Each Change_life_-cycle_stage_usage assigns exactly one Change.

### 4.3.11 Change_life_cycle_stage to Change_life_cycle_stage_sequence

Each Change_life_cycle_stage is the predecessor in zero or one Change_life_cycle_stage_sequence objects. Each Change_life_cycle_stage_sequence has exactly one Change_life_cycle_stage as the predecessor.



 

Each Change_life_cycle_stage is the successor in zero, one, or many Change_life_cycle_stage_sequence objects. Each Change_life_cycle_stage_sequence has exactly one Change_life_cycle_stage as the successor.

### 4.3.12 Change_life_cycle_stage to Change_life_cycle_stage_usage

Each Change_life_cycle_stage has changes assigned by zero or one Change_life_cycle_stage_usage objects. Each Change_life_cycle_stage_usage assigns changes for exactly one Change_life_cycle_stage.

### 4.3.13 Change_life_cycle_stage_usage to Change_approval

Each Change_life_cycle_stage_usage is approved by zero or one Change_approval objects. Each Change_approval approves exactly one Change_life_cycle_stage_usage.

### 4.3.14 Connected_collection to Plant_item_connection

Each Connected_collection contains zero, one, or many Plant_item_connection objects. Each Plant_item_connection participates in zero, one, or many Connected_collection objects.

### 4.3.15 Connection_definition to Connector_definition

Each Connection_definition connects two or more Connector_definition objects. Each Connector_definition is connected by zero or one Connection_definition.

### 4.3.16 Connection_definition to Functional_connection_definition_satisfaction

Each Connection_definition is the functional requirements for zero, one, or many Functional_connection_definition_satisfaction objects. Each Functional_connection_definition_satisfaction gets the functional requirements from exactly one Connection_definition.

Each Connection_definition satisfies requirements for zero, one, or many Functional_connection_definition_satisfaction objects. Each Functional_connection_definition_satisfaction has requirements satisfied by exactly one Connection_definition.

### 4.3.17 Connection_definition to Plant_item_connection_occurrence

Each Connection_definition defines zero, one, or many Plant_item_connection_occurrence objects. Each Plant_item_connection_occurrence is defined by zero or one Connection_definition.

### 4.3.18 Connector_definition to Catalogue_connector

Each Catalogue_connector is defined by zero, one, or many Connector_definition objects. Each Connector_definition is used as zero, one, or many Catalogue_connector objects.

### 4.3.19 Connector_definition to Functional_connector_definition_satisfaction

Each Connector_definition is the functional requirements for zero, one, or many Functional_connector_-definition_satisfaction objects. Each Functional_connector_definition_satisfaction gets the functional requirements from exactly one Connector_definition.

Each Connector_definition satisfies requirements for zero, one, or many Functional_connector_-definition_satisfaction objects. Each Functional_connector_definition_satisfaction has requirements satisfied by exactly one Connector_definition.

### 4.3.20 Connector_definition to Plant_item_connector_occurrence

Each Connector_definition defines zero, one, or many Plant_item_connector_occurrence objects. Each Plant_item_connector_occurrence is defined by zero or one Connector_definition.

### 4.3.21 Design_project to Project_design_assignment

Each Design_project is performed in one or more Project_design_assignment objects. Each Project_-design_assignment assigns a task to exactly one Design_project.

### 4.3.22 Ducting_system to Stream_design_case

Each Ducting_system transports material for zero, one, or many Stream_design_case objects. Each Stream_design_case defines potential material for zero, one, or many Ducting_system objects.

### 4.3.23 Equipment to Equipment_trim_piping

Each Equipment requires zero, one, or many Equipment_trim_piping objects. Each Equipment_trim_-piping is required by exactly one Equipment.

### 4.3.24 Equipment to Supplied_equipment

Each Equipment is used as zero, one, or many Supplied_equipment objects. Each Supplied_equipment is exactly one Equipment.

### 4.3.25 Facet_trigon to Survey_point

Each Facet_trigon is defined by exactly three Survey_point objects. Each Survey_point defines zero, one, or many Facet_trigon objects.

### 4.3.26 Faceted_surface_representation to Facet_trigon

Each Faceted_surface_representation is composed of one or more Facet_trigon objects. Each Facet_trigon is a component of exactly one Faceted_surface_representation.



 

### 4.3.27 Functional_connector to Functional_connector_occurrence_satisfaction

Each Functional_connector is the functional requirements for zero, one, or many Functional_connector_occurrence_satisfaction objects. Each Functional_connector_occurrence_satisfaction gets the functional requirements from exactly one Functional_connector.

### 4.3.28 Functional_plant to Functional_plant_satisfaction

Each Functional_plant is the functional requirements for zero, one, or many Functional_plant_satisfaction. Each Functional_plant_satisfaction gets the functional requirements from exactly one Functional_plant.

### 4.3.29 Functional_plant to Plant_system

Each Functional_plant is made up of zero, one, or many Plant_system objects. Each Plant_system is part of exactly one Functional_plant.

### 4.3.30 Functional_design_view to Functional_plant_item_satisfaction

Each Functional_design_view is the functional requirements for zero, one, or many Functional_plant_item_satisfaction. Each Functional_plant_item_satisfaction gets the functional requirements from exactly one Functional_design_view.

### 4.3.31 Line_branch_connection to Changed_line_branch_connection

Each Line_branch_connection is changed by zero, one, or many Changed_line_branch_connection objects. Each Changed_line_branch_connection changes exactly one Line_branch_connection.

### 4.3.32 Line_branch_termination to Line_branch_connection

Each Line_branch_termination is branched from exactly one Line_branch_connection. Each Line_branch_connection branches exactly one Line_branch_termination.

### 4.3.33 Line_less_piping_system to Piping_system_component

Each Line_less_piping_system is composed of zero, one, or many Piping_system_component objects. Each Piping_system_component is a component of zero, one, or many Line_less_piping_system objects.

### 4.3.34 Line_less_piping_system to Stream_design_case

Each Line_less_piping_system transports material for zero, one, or many Stream_design_case objects. Each Stream_design_case defines potential material for zero, one, or many Line_less_piping_system objects.



 

### 4.3.35 Line_piping_system_component_assignment to Changed_line_assignment

Each Line_piping_system_component_assignment is changed by zero, one, or many Changed_line_assignment objects. Each Changed_line_assignment changes exactly one Line_piping_system_component_assignment.

### 4.3.36 Line_plant_item_branch_connection to Changed_line_plant_item_branch_connection

Each Line_plant_item_branch_connection is changed by zero, one, or many Changed_line_plant_item_branch_connection objects. Each Changed_line_plant_item_branch_connection changes exactly one Line_plant_item_branch_connection.

### 4.3.37 Line_plant_item_branch_connector to Line_plant_item_branch_connection

Each Line_plant_item_branch_connector is connected to zero or one Line_plant_item_branch_connection. Each Line_plant_item_branch_connection connects exactly one Line_plant_item_branch_connector.

### 4.3.38 Line_plant_item_connection to Changed_line_plant_item_connection

Each Line_plant_item_connection is changed by zero, one, or many Changed_line_plant_item_connection objects. Each Changed_line_plant_item_connection changes exactly one Line_plant_item_connection.

### 4.3.39 Line_plant_item_connector to Line_plant_item_connection

Each Line_plant_item_connector is connected to zero or one Line_plant_item_connection. Each Line_plant_item_connection connects exactly one Line_plant_item_connector.

### 4.3.40 Line_plant_item_termination to Line_plant_item_connection

Each Line_plant_item_termination is connected to exactly one Line_plant_item_connection. Each Line_plant_item_connection connects exactly one Line_plant_item_termination.

### 4.3.41 Line_to_line_connection to Changed_line_to_line_connection

Each Line_to_line_connection is changed by zero, one, or many Changed_line_to_line_connection objects. Each Changed_line_to_line_connection changes exactly one Line_to_line_connection.



 

### 4.3.42 Line_to_line_connection to Line_to_line_termination

Each Line_to_line_connection connects two or more Line_to_line_termination objects. Each Line_to_-line_termination is connected by exactly one Line_to_line_connection.

### 4.3.43 Material_specification_selection to Material_specification_subset_reference

Each Material_specification_selection is used by zero, one, or many Material_specification_subset_-reference objects. Each Material_specification_subset_reference uses exactly one Material_-specification_selection.

### 4.3.44 Physical_connector to Functional_connector_occurrence_satisfaction

Each Physical_connector satisfies requirements for zero, one, or many Functional_connector_-occurrence_satisfaction objects. Each Functional_connector_occurrence_satisfaction has requirements satisfied by exactly one Physical_connector.

### 4.3.45 Physical_design_view to Functional_plant_item_satisfaction

Each Physical_design_view satisfies requirements for zero, one, or many Functional_plant_item_-satisfaction objects. Each Functional_plant_item_satisfaction has requirements satisfied by exactly one Physical_design_view.

### 4.3.46 Physical_design_view to Installed_physical_design_view

Each Physical_design_view is used as zero or one Installed_physical_design_view. Each Installed_-physical_design_view is exactly one Physical_design_view.

### 4.3.47 Piping_component to Family_definition

Each Piping_component defines zero or one Family_definition. Each Family_definition is defined by zero or one Piping_component.

### 4.3.48 Piping_connector to Piping_connector_service_characteristic

Each Piping_connector provides zero or one Piping_connector_service_characteristic. Each Piping_-connector_service_characteristic is provided by exactly one Piping_connector.

### 4.3.49 Piping_connector to Piping_size_description

Each Piping_connector has a size described by zero, one, or many Piping_size_description objects. Each Piping_size_description describes the size of zero, one, or many Piping_connector objects.



 

### 4.3.50 Piping_connector_service_characteristic to Service_operating_case

Each Piping_connector_service_characteristic supports zero, one, or many Service_operating_case objects. Each Service_operating_case is supported by exactly one Piping_connector_service_-characteristic.

### 4.3.51 Piping_specification to Changed_piping_specification

Each Piping_specification is changed by zero, one, or many Changed_piping_specification objects. Each Changed_piping_specification changes exactly one Piping_specification.

### 4.3.52 Piping_specification to Family_definition

Each Piping_specification is composed of one or more Family_definition objects. Each Family_definition is part of exactly one Piping_specification.

### 4.3.53 Piping_specification to Piping_system_line_segment

Each Piping_specification specifies components for zero, one, or many piping_system_line_segment objects. Each Piping_system_line_segment has components specified by exactly one Piping_-specification.

### 4.3.54 Piping_spool to Piping_spool_assignment

Each Piping_spool is the spool in zero, one, or many Piping_spool_assignment objects. Each Piping_-spool_assignment has exactly one Piping_spool as the spool.

### 4.3.55 Piping_system to Piping_system_line

Each Piping_system is made up of zero, one, or many Piping_system_line objects. Each Piping_system_-line is part of exactly one Piping_system.

### 4.3.56 Piping_system_component to Equipment_trim_piping

Each Piping_system_component is used as zero, one, or many Equipment_trim_piping objects. Each Equipment_trim_piping is exactly one Piping_system_component.

### 4.3.57 Piping_system_component to Line_piping_system_component_assign-ment

Each Piping_system_component satisfies zero, one, or many Line_piping_system_component_-assignment objects. Each Line_piping_system_component_assignment is satisfied by exactly one Piping_system_component.



 

### 4.3.58 Piping_system_component to Piping_size_description

Each Piping_system_component has a size described by zero, one, or many Piping_size_description objects. Each Piping_size_description describes the size of zero, one, or many Piping_system_component objects.

### 4.3.59 Piping_system_line to Changed_piping_system_line

Each Piping_system_line is changed by zero, one, or many Changed_piping_system_line objects. Each Changed_piping_system_line changes exactly one Piping_system_line.

### 4.3.60 Piping_system_line to Piping_system_line_segment

Each Piping_system_line is composed of one or more Piping_system_line_segment objects. Each Piping_system_line_segment is a component of exactly one Piping_system_line.

### 4.3.61 Piping_system_line to Piping_system_line_termination

Each Piping_system_line is start or ended by zero, one, or two piping_system_line_terminations. Each piping_system_line_termination starts or ends exactly one piping_system_line.

### 4.3.62 Piping_system_line_segment to Changed_piping_system_line_segment

Each Piping_system_line_segment is changed by zero, one, or many Changed_piping_system_line_-segment objects. Each Changed_piping_system_line_segment changes exactly one Piping_system_line_-segment.

### 4.3.63 Piping_system_line_segment to Line_branch_connection

Each Piping_system_line_segment has branches defined by zero, one, or many Line_branch_connection objects. Each Line_branch_connection defines the branches of exactly one Piping_system_line_segment.

### 4.3.64 Piping_system_line_segment to Line_plant_item_branch_connection

Each Piping_system_line_segment is connected to zero, one, or many Line_plant_item_branch_-connection objects. Each Line_plant_item_branch_connection defines the branches of exactly one Piping_system_line_segment.

### 4.3.65 Piping_system_line_segment to Line_piping_system_component_as-signment

Each Piping_system_line_segment defines the need for zero, one, or many Line_piping_system_-component_assignment objects. Each Line_piping_system_component_assignment satisfies the need defined by exactly one Piping_system_line_segment.

### 4.3.66 Piping_system_line_segment to Piping_system_line_segment_termination

Each Piping_system_line_segment is terminated by exactly two Piping_system_line_segment_-termination objects; one is termination_1 and the other is termination_2. Each Piping_system_line_-segment_termination terminates exactly one Piping_system_line_segment.

### 4.3.67 Piping_system_line_segment to Segment_insulation

Each Piping_system_line_segment requires zero, one, or many Segment_insulation objects. Each Segment_insulation is required by exactly one Piping_system_line_segment.

### 4.3.68 Piping_system_line_segment to Stream_design_case

Each Piping_system_line_segment defines transport needs for zero, one, or many Stream_design_case objects. Each Stream_design_case defines potential material for zero, one, or many Piping_system_line_-segment objects.

### 4.3.69 Piping_system_line_segment_termination to Changed_piping_system_line_segment_termination

Each Piping_system_line_segment_termination is changed by zero, one, or many Changed_piping_-system_line_segment_termination objects. Each Changed_piping_system_line_segment_termination changes exactly one Piping_system_line_segment_termination.

### 4.3.70 Planned_physical_plant to Changed_planned_physical_plant

Each Planned_physical_plant is changed by zero, one, or many Changed_planned_physical_plant objects. Each Changed_planned_physical_plant changes exactly one Planned_physical_plant.

### 4.3.71 Planned_physical_plant to Functional_plant_satisfaction

Each Planned_physical_plant satisfies requirements for zero, one, or many Functional_plant_satisfaction objects. Each Functional_plant_satisfaction has requirements satisfied by exactly one Planned_physical_-plant.

### 4.3.72 Planned_physical_plant to Location_in_plant

Each Planned_physical_plant contains zero, one, or many Location_in_plant objects. Each Location_in_-plant is located in zero, one, or many Planned_physical_plant objects.

### 4.3.73 Planned_physical_plant to Sited_plant

Each Planned_physical_plant is used as zero or one Sited_plant. Each Sited_plant is exactly one Planned_physical_plant.



 

### 4.3.74 Planned_physical_plant_item to Plant_item_connector_occurrence

Each Planned_physical_plant_item has zero, one, or many Plant_item_connector_occurrence objects. Each Plant_item_connector_occurrence is part of exactly one Planned_physical_plant_item.

### 4.3.75 Planned_physical_plant_item to Piping_spool_assignment

Each Planned_physical_plant_item is assigned a spool by zero or one Piping_spool_assignment. Each Piping_spool_assignment assigns a spool to exactly one Planned_physical_plant_item.

### 4.3.76 Planned_physical_plant_item to Support_usage

Each Planned_physical_plant_item is supported by zero, one, or many Support_usage objects. Each Support_usage identifies exactly one Planned_physical_plant_item that supports another.

Each Planned_physical_plant_item supports zero, one, or many Support_usage objects. Each Support_-usage identifies exactly one Planned_physical_plant_item that is supported.

### 4.3.77 Plant to Changed_plant

Each Plant is changed by zero, one, or many Changed_plant objects. Each Changed_plant changes exactly one Plant.

### 4.3.78 Plant to External_classification

Each Plant is classified by zero, one, or many External_classification objects. Each External_-classification classifies zero, one, or many Plant objects.

### 4.3.79 Plant to Functional_plant

Each Plant is used as zero or one Functional_plant. Each Functional_plant is exactly one Plant.

### 4.3.80 Plant to Planned_physical_plant

Each Plant is realized as zero, one, or many Planned_physical_plant objects. Each Planned_physical_-plant is the realization of exactly one Plant.

### 4.3.81 Plant to Plant_process_capability

Each Plant produces zero, one, or many Plant_process_capability objects. Each Plant_process_capability is produced by exactly one Plant.

### 4.3.82 Plant to Sub_plant_relationship

Each Plant contains zero, one, or many Sub_plant_relationship objects. Each Sub_plant_relationship is contained in exactly one Plant.

Each Plant is used in zero, one, or many Sub_plant_relationship objects. Each Sub-plant_relationship uses exactly one Plant.

### 4.3.83 Plant_item to Changed_plant_item

Each Plant_item is changed by zero, one, or many Changed_plant_item objects. Each Changed_plant_item changes exactly one Plant_item.

### 4.3.84 Plant_item to External_classification

Each Plant_item is classified by zero, one, or many External_classification objects. Each External_classification classifies zero, one, or many Plant_item objects.

### 4.3.85 Plant_item to Insulation

Each Plant_item is insulated by zero, one, or many Insulation objects. Each Insulation insulates zero or one Plant_item.

### 4.3.86 Plant_item to Plant_item_collection

Each Plant_item is an element in zero, one, or many Plant_item_collection objects. Each Plant_item_collection identifies as an element of a collection exactly one Plant_item.

Each Plant_item is a group of zero, one, or many Plant_item_collection objects. Each Plant_item_collection identifies as a group exactly one Plant_item.

### 4.3.87 Plant_item to Plant_item_design_view

Each Plant_item is defined as one or more Plant_item_design_view objects. Each Plant_item_design_view defines exactly one Plant_item.

### 4.3.88 Plant_item to Plant_item_shape

Each Plant_item is spatially described by zero or one Plant_item_shape objects. Each Plant_item_shape spatially describes exactly one Plant_item.

### 4.3.89 Plant_item to Plant_item_weight

Each Plant_item is measured as having zero, one, or many Plant_item_weight objects. Each Plant_item_weight is the measured weight of exactly one Plant_item.

 

### 4.3.90 Plant_item to Reference_geometry

Each Plant_item references zero, one, or many Reference_geometry objects. Each Reference_geometry is referenced by zero, one, or many Plant_item objects.

### 4.3.91 Plant_item to Required_material_description

Each Plant_item satisfies zero, one, or many Required_material_description objects. Each Required_-material_description is satisfied by zero, one, or many Plant_item objects.

### 4.3.92 Plant_item to Spare_plant_item_usage

Each Plant_item is the primary plant item in zero, one, or many Spare_plant_item_usage objects. Each Spare_plant_item_usage has as a primary plant item exactly one Plant_item.

Each Plant_item is the spare plant item in zero, one, or many Spare_plant_item_usage objects. Each Spare_plant_item_usage has as a spare plant item exactly one Plant_item.

### 4.3.93 Plant_item to User_defined_attribute_value

A Plant_item is characterized by zero or more User_defined_attribute_value objects.

### 4.3.94 Plant_item_collection to Changed_plant_item_collection

Each Plant_item_collection is changed by zero, one, or many Changed_plant_item_collection objects. Each Changed_plant_item_collection changes exactly one Plant_item_collection.

### 4.3.95 Plant_item_connection to Changed_plant_item_connection

Each Plant_item_connection is changed by zero, one, or many Changed_plant_item_connection objects. Each Changed_plant_item_connection changes exactly one Plant_item_connection.

### 4.3.96 Plant_item_connection_occurrence to Functional_connection_occurrence_satisfaction

Each Plant_item_connection_occurrence is the functional requirements for zero, one, or many Functional_connection_occurrence_satisfaction objects. Each Functional_connection_occurrence_-satisfaction gets the functional requirements from exactly one Plant_item_connection_occurrence.

Each Plant_item_connection_occurrence satisfies requirements for zero, one, or many Functional_-connection_occurrence_satisfaction objects. Each Functional_connection_occurrence_satisfaction has requirements satisfied by exactly one Plant_item_connection_occurrence.

### 4.3.97 Plant_item_connection_occurrence to Plant_item_connector_occurrence

Each Plant_item_connection_occurrence connects two or more Plant_item_connector_occurrence objects. Each Plant_item_connector_occurrence is connected by zero or one Plant_item_connection_occurrence.

### 4.3.98 Plant_item_connector to Changed_plant_item_connector

Each Plant_item_connector is changed by zero, one, or many Changed_plant_item_connector objects. Each Changed_plant_item_connector changes exactly one Plant_item_connector.

### 4.3.99 Plant_item_connector to External_classification

Each Plant_item_connector is classified by zero, one, or many External_classification objects. Each External_classification classifies zero, one, or many Plant_item_connector objects.

### 4.3.100 Plant_item_connector to Required_material_description

Each Plant_item_connector has material requirements defined by zero, one, or many Required_material_description objects. Each Required_material_description defines material requirements for zero, one, or many Plant_item_connector objects.

### 4.3.101 Plant_item_connector to Shape_representation

Each Plant_item_connector has shape and orientation defined by zero, one, or many Shape_representation objects. Each Shape_representation defines the shape and orientation of zero, one, or many Plant_item_connector objects.

### 4.3.102 Plant_item_definition to Catalogue_item

Each Plant_item_definition is defined as zero or one Catalogue_item objects. Each Plant_item_definition is used as zero or one Catalogue_item. Each Catalogue_item defines zero or one Plant_item_definition. Each Catalogue_item is defined by zero or one Plant_item_definition objects.

### 4.3.103 Plant_item_definition to Connector_definition

Each Plant_item_definition has zero, one, or many Connector_definition objects. Each Connector_definition is part of exactly one Plant_item_definition.

### 4.3.104 Plant_item_definition to Planned_physical_plant_item

Each Plant_item_definition defines zero, one, or many Planned_physical_plant_item objects. Each Planned_physical_plant_item is defined by zero or one Plant_item_definition.



 

### 4.3.105 Plant_item_instance to Plant_item_interference

Each Plant_item_instance is the first item in zero, one, or many Plant_item_interference objects. Each Plant_item_interference has as its first item exactly one Plant_item_instance.

Each Plant_item_instance is the second item in zero, one, or many Plant_item_interference objects. Each Plant_item_interference has as its second item exactly one Plant_item_instance.

### 4.3.106 Plant_item_instance to Plant_item_location

Each Plant_item_instance is located by zero, one, or many Plant_item_location objects. Each Plant_item_location locates exactly one Plant_item_instance. A Plant_item_instance shall be located only once in either a plant, site, or building or multiple times with respect to other Plant_item objects. A Plant_item_instance shall not be located more than once in a plant, site, or building.

### 4.3.107 Plant_item_instance to Project_design_assignment

Each Plant_item_instance is assigned a project by zero, one, or many Project_design_assignment objects. Each Project_design_assignment assigns a project to exactly one Plant_item_instance.

### 4.3.108 Plant_item_instance to Relative_item_location

Each Plant_item_instance is the referenced item for zero, one, or many Relative_item_location objects. Each Relative_item_location references exactly one Plant_item_instance.

### 4.3.109 Plant_item_interference to Interfering_shape_element

Each Plant_item_interference has intersecting geometry of zero, one, or many Interfering_shape_element objects. Each Interfering_shape_element is the intersecting geometry for exactly one Plant_item_interference.

### 4.3.110 Plant_item_interference to Plant_item_interference_status

Each Plant_item_interference has a status of one or more Plant_item_interference_status objects. Each Plant_item_interference_status provides the status for exactly one Plant_item_interference.

### 4.3.111 Plant_item_interference to Shape_interference_zone_usage

Each Plant_item_interference has a zone of interference defined by zero, one, or many Shape_interference_zone_usage objects. Each Shape_interference_zone_usage defines the zone of interference for exactly one Plant_item_interference.

### 4.3.112 Plant_item_location to Changed_plant_item_location

Each Plant_item_location is changed by zero, one, or many Changed_plant_item_location objects. Each Changed_plant_item_location changes exactly one Plant_item_location.

### 4.3.113 Plant_item_shape to Changed_plant_item_shape

Each Plant_item_shape is changed by zero, one, or many Changed_plant_item_shape objects. Each Changed_plant_item_shape changes exactly one Plant_item_shape.

### 4.3.114 Plant_item_shape to Shape_representation

Each Plant_item_shape is defined using zero, one, or many Shape_representation objects. Each Shape_-representation defines exactly one Plant_item_shape.

### 4.3.115 Plant_process_capability to Changed_plant_process_capability

Each Plant_process_capability is changed by zero, one, or many Changed_plant_process_capability objects. Each Changed_plant_process_capability changes exactly one Plant_process_capability.

### 4.3.116 Plant_system to Changed_plant_system

Each Plant_system is changed by zero, one, or many Changed_plant_system objects. Each Changed_-plant_system changes exactly one Plant_system.

### 4.3.117 Plant_system to External_classification

Each Plant_system is classified by zero, one, or many External_classification objects. Each External_-classification classifies zero, one, or many Plant_system objects.

### 4.3.118 Plant_system to Plant_item

Each Plant_system is composed of zero, one, or many Plant_item objects. Each Plant_item is part of zero, one, or many Plant_system objects.

### 4.3.119 Plant_system to Plant_system_assembly

Each Plant_system is the sub-system in zero, one, or many Plant_system_assembly objects. Each Plant_-system_assembly has exactly one Plant_system as the sub-system.

Each Plant_system is the super-system in zero, one, or many Plant_system_assembly objects. Each Plant_system_assembly has exactly one Plant_system as the super-system.



 

### 4.3.120 Point_and_line_representation to Survey_point

Each Point_and_line_representation is defined by one or more Survey_point objects. Each Survey_point defines zero, one, or many Point_and_line_representation objects.

### 4.3.121 Reference_geometry to Changed_reference_geometry

Each Reference_geometry is changed by zero, one, or many Changed_reference_geometry objects. Each Changed_reference_geometry changes exactly one Reference_geometry.

### 4.3.122 Reference_geometry to Shape_representation_element

Each Reference_geometry is described by zero, one, or many Shape_representation_element objects. Each Shape_representation_element provides description for zero, one, or many Reference_geometry objects.

### 4.3.123 Required_material_description to Changed_required_material_description

Each Required_material_description is changed by zero, one, or many Changed_required_material_description objects. Each Changed_required_material_description changes exactly one Required_material_description.

### 4.3.124 Required_material_description to Material_specification_selection

Each Required_material_description is satisfied by zero, one, or many Material_specification_selection objects. Each Material_specification_selection satisfies zero, one, or many Required_material_description objects.

### 4.3.125 Route to Piping_system_line_segment

Each Route is composed of zero, one, or many Piping_system_line_segment objects. Each Piping_system_line_segment is a component of zero or one Route.

### 4.3.126 Shape_representation to Shape_representation_element_usage

Each Shape_representation is defined by one or more Shape_representation_element_usage objects. Each Shape_representation_element_usage defines exactly one Shape_representation.

### 4.3.127 Shape_representation_element to Shape_interference_zone_usage

Each Shape_representation_element defines a volume for zero or one Shape_interference_zone_usage. Each Shape_interference_zone_usage has a volume defined by exactly one Shape_representation_element.



 

### 4.3.128 Shape_representation_element to Shape_representation_element_usage

Each Shape_representation_element provides a definition for zero or one Shape_representation_element_usage. Each Shape_representation_element_usage uses as a definition exactly one Shape_representation_element.

### 4.3.129 Shape_representation_element_usage to Interfering_shape_element

Each Shape_representation_element_usage is the intersecting geometry of zero, one, or many Interfering_shape_element objects. Each Interfering_shape_element uses as intersecting geometry exactly one Shape_representation_element_usage.

### 4.3.130 Site to Building

Each Site has located on it zero, one, or many Building objects. Each Building is located on exactly one Site.

### 4.3.131 Site to Changed_site

Each Site is changed by zero, one, or many Changed_site objects. Each Changed_site changes exactly one Site.

### 4.3.132 Site to Location_in_site

Each Site is a reference frame for zero, one, or many Location_in_site objects. Each Location_in_site has a reference frame provided by exactly one Site.

### 4.3.133 Site to Site_feature

Each Site contains zero, one, or many Site_feature objects. Each Site_feature object is contained in exactly one Site.

### 4.3.134 Site to Site_shape_representation

Each Site has shape defined by zero, one, or many Site_shape_representation objects. Each Site_shape_representation defines the shape of exactly one Site.

### 4.3.135 Site to Sited_plant

Each Site has located on it one or more Sited_plant objects. Each Sited_plant is located on exactly one Site.



 

### 4.3.136 Site_feature to Changed_site_feature

Each Site_feature is changed by zero, one, or many Changed_site_feature objects. Each Changed_site_-feature changes exactly one Site_feature.

### 4.3.137 Site_shape_representation to Breakline

Each Site_shape_representation is constrained by zero, one, or many Breakline objects. Each Breakline constrains zero or one Site_shape_representation.

### 4.3.138 Site_shape_representation to Gis_position

Each Site_shape_representation has a global position specified by zero or one Gis_position. Each Gis_-position specifies the global position for exactly one Site_shape_representation.

### 4.3.139 Sited_plant to Changed_sited_plant

Each Sited_plant is changed by zero, one, or many Changed_sited_plant objects. Each Changed_sited_-plant changes exactly one Sited_plant.

### 4.3.140 Stream_design_case to Service_operating_case

Each Stream_design_case defines zero, one, or many Service_operating_case objects. Each Service_-operating_case is defined by exactly one Stream_design_case.

### 4.3.141 Stream_design_case to Stream_phase

Each Stream_design_case is composed of one or more Stream_phase objects. Each Stream_phase is defined by exactly one Stream_design_case.

### 4.3.142 Sub_plant_relationship to Changed_sub_plant_relationship

Each Sub_plant_relationship is changed by zero, one, or many Changed_sub_plant_relationship objects. Each Changed_sub_plant_relationship changes exactly one Sub_plant_relationship.

### 4.3.143 Supplier to Catalogue_definition

Each Supplier publishes zero, one, or many Catalogue_definition objects. Each Catalogue_definition is published by zero or one Supplier.

### 4.3.144 Supplier to Supplied_equipment

Each Supplier supplies one or more Supplied_equipment objects. Each Supplied_equipment is supplied by exactly one Supplier.



 

### 4.3.145 Support_constraints to Support_usage

Each Support_constraints constrains the motion in the negative x-direction of zero, one, or many Support_usage objects. Each Support_usage has motion in the negative x-direction constrained by zero or one Support_constraints object.

Each Support_constraints constrains the motion in the positive x-direction of zero, one, or many Support_usage objects. Each Support_usage has motion in the positive x-direction constrained by zero or one Support_constraints object.

Each Support_constraints constrains the motion in the negative y-direction of zero, one, or many Support_usage objects. Each Support_usage has motion in the negative y-direction constrained by zero or one Support_constraints object.

Each Support_constraints constrains the motion in the positive y-direction of zero, one, or many Support_usage objects. Each Support_usage has motion in the positive y-direction constrained by zero or one Support_constraints object.

Each Support_constraints constrains the motion in the negative z-direction of zero, one, or many Support_usage objects. Each Support_usage has motion in the negative z-direction constrained by zero or one Support_constraints object.

Each Support_constraints constrains the motion in the positive z-direction of zero, one, or many Support_usage objects. Each Support_usage has motion in the positive z-direction constrained by zero or one Support_constraints object.

Each Support_constraints constrains the negative rotation about the x-axis of zero, one, or many Support_usage objects. Each Support_usage has the negative rotation about the x-axis constrained by zero or one Support_constraints object.

Each Support_constraints constrains the positive rotation about the x-axis of zero, one, or many Support_usage objects. Each Support_usage has the positive rotation about the x-axis constrained by zero or one Support_constraints object.

Each Support_constraints constrains the negative rotation about the y-axis of zero, one, or many Support_usage objects. Each Support_usage has the negative rotation about the y-axis constrained by zero or one Support_constraints object.

Each Support_constraints constrains the positive rotation about the y-axis of zero, one, or many Support_usage objects. Each Support_usage has the positive rotation about the y-axis constrained by zero or one Support_constraints object.

Each Support_constraints constrains the negative rotation about the z-axis of zero, one, or many Support_usage objects. Each Support_usage has the negative rotation about the z-axis constrained by zero or one Support_constraints object.



 

Each Support_constraints constrains the positive rotation about the z-axis of zero, one, or many Support_usage objects. Each Support_usage has the positive rotation about the z-axis constrained by zero or one Support_constraints object.

### 4.3.146 Support_usage_connection to Plant_item_connection_occurrence

Each Support_usage_connection is detailed by zero, one, or many Plant_item_connection_occurrence objects. Each Plant_item_connection_occurrence gives the details for zero or one Support_usage_connection.

### 4.3.147 Swept_bend_pipe to Pipe_bend

Each Swept_bend_pipe contains zero, one, or many Pipe_bend objects. Each Pipe_bend is contained in exactly one Swept_bend_pipe.

# 5 Application interpreted model

## 5.1 Mapping table

This clause contains the mapping table that shows how each UoF and application object of this part of ISO 10303 (see clause 4) maps to one or more AIM constructs (see annex A). The mapping table is organized in five columns.

Column 1) Application element: Name of an application element as it appears in the application object definition in 4.2. Application object names are written in uppercase. Attribute names and assertions are listed after the application object to which they belong and are written in lower case.

Column 2) AIM element: Name of an AIM element as it appears in the AIM (see annex A), the term `IDENTICAL MAPPING', or the term `PATH'. AIM entities are written in lower case. Attribute names of AIM entities are referred to as <entity name>.<attribute name>. The mapping of an application element may result in several related AIM elements. Each of these AIM elements requires a line of its own in the table. The term `IDENTICAL MAPPING' indicates that both application objects of an application assertion map to the same AIM element. The term `PATH' indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those AIM elements that are interpreted from the integrated resources, this is the number of the corresponding part of ISO 10303. For those AIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part. For those AIM elements that are directly incorporated from an application interpreted protocol (AIC), this is the AIC reference.

Column 4) Rules: One or more numbers may be given that refer to rules that apply to the current AIM element or reference path. For rules that are derived from relationships between application objects, the same rule is referred to by the mapping entries of all the involved AIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application object, it may be necessary to specify a reference path through several related AIM elements. The reference path column documents the role of an AIM element relative to the AIM element in the row succeeding it. Two or more such related AIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application object. For each AIM element that has been created for use within this part of ISO 10303, a reference path up to its supertype from an integrated resource is specified.

For the expression of reference paths and the relationships between AIM elements the following notational conventions apply:

a) []: multiple AIM elements or sections of the reference path are required to satisfy an information requirement;

b) (): multiple AIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;



 

c) {}: enclosed section constrains the reference path to satisfy an information requirement;

d) ->: attribute references the entity or select type given in the following row;

e) <-: entity or select type is referenced by the attribute in the following row;

f) [i]: attribute is an aggregation of which a single member is given in the following row;

g) [n]: attribute is an aggregation of which member n is given in the following row;

h) =>: entity is a supertype of the entity given in the following row;

i) <=: entity is a subtype of the entity given in the following row;

j) =: the string, select, or enumeration type is constrained to a choice or value;

k) \: line continuation for strings that wrap.



 

## Table 2 - Mapping table for change_information UoF

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGE | change_action | 227 | 4, 21 | change_action <=<br>directed_action |
| business_unit | organization.name | 41 | | change_action<br>plant_spatial_configuration_organization_item = change_action<br>plant_spatial_configuration_organization_item <-<br>plant_spatial_configuration_organization_assignment.items[i]<br>plant_spatial_configuration_organization_assignment <=<br>organization_assignment<br>organization_assignment.assigned_organization -><br>organization<br>organization.name |
| change_id | action.name | 41 | | change_action <=<br>directed_action <=<br>executed_action <=<br>action<br>action.name |
| change_reason | action_method.purpose | 41 | | change_action <=<br>directed_action <=<br>executed_action <=<br>action<br>action.chosen_method -><br>action_method<br>action_method.purpose |
| change_summary | action_method.description | 41 | | change_action <=<br>directed_action <=<br>executed_action <=<br>action<br>action.chosen_method -><br>action_method<br>action_method.description |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| date | (calendar_date)<br>([calendar_date]<br>[local_time]) | 41<br>41<br>41 | 4 | change_action<br>(dated_item = change_action<br>dated_item <-<br>applied_date_assignment.items[i]<br>applied_date_assignment <=<br>date_assignment<br>date_assignment.assigned_date -><br>date =><br>calendar_date)<br>(date_and_time_item = change_action<br>date_and_time_item <-<br>applied_date_and_time_assignment.items[i]<br>applied_date_and_time_asssignment<br>applied_date_and_time_assignment.assigned_date_and_time -><br>date_and_time<br>[date_and_time.date_component -><br>date =><br>calendar_date]<br>[date_and_time.time_component -><br>local_time]) |
| project_number | organizational_project.name | 41 | | change_action<br>plant_spatial_configuration_organization_item = change_action<br>plant_spatial_configuration_organization_item <-<br>plant_spatial_configuration_organization_assignment.items[i]<br>plant_spatial_configuration_organization_assignment <=<br>organization_assignment<br>organization_assignment.assigned_organization -><br>organization <-<br>organizational_project.responsible_organizations[i]<br>organizational_project<br>organizational_project.name |

# Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| revision | action_relationship | 41 | | change_action <=<br>directed_action <=<br>executed_action <=<br>action <-<br>(action_relationship.relating_action)<br>(action_relationship.related_action)<br>{action_relationship<br>action_relationship.name = `change revision'}<br>action_relationship |
| title | action_method.name | 41 | | change_action <=<br>directed_action <=<br>executed_action <=<br>action<br>action.chosen_method -><br>action_method<br>action_method.name |
| change to change_item | PATH | | | change_action <=<br>directed_action <=<br>executed_action <=<br>action <-<br>action_assignment.assigned_action<br>action_assignment =><br>plant_spatial_configuration_change_assignment<br>plant_spatial_configuration_change_assignment.items[i] -><br>change_item |
| change to change_life_-<br>cycle_stage_usage | PATH | | 21 | change_action <=<br>directed_action<br>directed_action.directive -><br>action_directive<br>action_directive.requests[i] -><br>versioned_action_request |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGE_APPROVAL | applied_approval_assignment | 227 | 7 | applied_approval_assignment <=<br>approval_assignment |
| approval_date | (calendar_date)<br>([calendar_date]<br>[local_time]) | 41<br>41<br>41 | 2 | applied_approval_assignment <=<br>approval_assignment<br>approval_assignment.assigned_approval -><br>approval <-<br>approval_date_time.dated_approval<br>approval_date_time<br>approval_date_time.date_time -><br>date_time_select<br>(date_time_select = date<br>date =><br>calendar_date)<br>(date_time_select = date_and_time<br>date_and_time<br>[date_and_time.date_component -><br>date =><br>calendar_date]<br>[date_and_time.time_component -><br>local_time]) |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| approver | person | 41 | 3 | applied_approval_assignment <=<br>approval_assignment<br>approval_assignment.assigned_approval -><br>approval <-<br>approval_person_organization.authorized_approval<br>approval_person_organization<br>approval_person_organization.person_organization -><br>person_organization_select<br>(person_organization_select = person)<br>(person_organization_select = person_and_organization<br>person_and_organization<br>person_and_organization.the_person -><br>person)<br>person |
| approver_role | approval_role.role | 41 | 3 | applied_approval_assignment <=<br>approval_assignment<br>approval_assignment.assigned_approval -><br>approval <-<br>approval_person_organization.authorized_approval<br>approval_person_organization<br>approval_person_organization.role -><br>approval_role<br>approval_role.role |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGE_ITEM | change_item | 227 | 21 | {change_item<br>(change_item = line_branch_connection)<br>(change_item = line_plant_item_branch_connection)<br>(change_item = line_plant_item_connection)<br>(change_item = line_termination_connection)<br>(change_item = plant)<br>(change_item = axis2_placement_2d)<br>(change_item = axis2_placement_3d)<br>(change_item = product)<br>(change_item = product_definition_relationship)<br>(change_item = reference_geometry)<br>(change_item = electrical_system)<br>(change_item = externally_defined_plant_item_definition)<br>(change_item = ducting_system)<br>(change_item = instrumentation_and_control_system)<br>(change_item = piping_system)<br>(change_item = plant_item_connection)<br>(change_item = plant_item_connector)<br>(change_item = plant_line_definition)<br>(change_item = plant_line_segment_definition)<br>(change_item = plant_line_segment_termination)<br>(change_item = process_capability)<br>(change_item = product_definition)<br>(change_item = product_definition_shape)<br>(change_item = sited_plant)<br>(change_item = structural_system)<br>(change_item = document)<br>(change_item = site)<br>(change_item = site_feature)} |

# Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| change_item_id | change_item_id_assignment | 227 | 6 | change_item <-<br>change_item_id_assignment.items[i]<br>change_item_id_assignment <=<br>name_assignment |

**Table 2 - Mapping table for change_information UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| creation_date | (calendar_date)<br><br>([calendar_date]<br>[local_time]) | 41<br><br>41<br>41 | 5 | change_item<br>(dated_item = change_item<br>dated_item <-<br>applied_date_assignment.items[i]<br>applied_date_assignment <=<br>{date_assignment<br>date_assignment.role -><br>date_role<br>date_role.name = `creation date'}<br>date_assignment<br>date_assignment.assigned_date -><br>date =><br>calendar_date)<br>(date_and_time_item = change_item<br>date_and_time_item <-<br>applied_date_and_time_assignment.items[i]<br>applied_date_and_time_assignment <=<br>{date_and_time_assignment<br>date_and_time_assignment.role -><br>date_time_role<br>date_time_role.name = `creation date'}<br>date_and_time_asssignment<br>date_and_time_assignment.assigned_date_and_time -><br>date_and_time<br>[date_and_time.date_component -><br>date =><br>calendar_date]<br>[date_and_time.time_component -><br>local_time]) |

# Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| description | action.description | 41 | | change_item <-<br>plant_spatial_configuration_change_assignment.items[i]<br>plant_spatial_configuration_change_assignment <=<br>action_assignment<br>action_assignment.assigned_action -><br>action<br>action.description |
| item_owner | person_and_organization | 41 | | change_item<br>plant_spatial_configuration_person_and_organization_item = change_item<br>plant_spatial_configuration_person_and_organization_item <-<br>plant_spatial_configuration_person_and_organization_assignment.items[i]<br>plant_spatial_configuration_person_and_organization_assignment <=<br>{person_and_organization_assignment<br>person_and_organization_assignment.role -><br>person_and_organization_role<br>person_and_organization_role.name = `owner'}<br>person_and_organization_assignment<br>person_and_organization_assignment.assigned_person_and_organization -><br>person_and_organization |
| from_or_to | object_role.name | 41 | 21 | change_item <-<br>plant_spatial_configuration_change_assignment.items[i]<br>plant_spatial_configuration_change_assignment <=<br>action_assignment<br>role_select = action_assignment<br>role_select <-<br>role_association.item_with_role<br>role_association<br>role_association.role -><br>object_role<br>object_role.name<br>{(object_role.name = `from')<br>(object_role.name = `to')} |

**Table 2 - Mapping table for change_information UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| supersedence_status | action_status.status | 41 | | change_item <-<br>plant_spatial_configuration_change_assignment.items[i]<br>plant_spatial_configuration_change_assignment <=<br>action_assignment<br>action_assignment.assigned_action -><br>action =><br>executed_action <-<br>action_status.assigned_action<br>action_status<br>action_status.status |
| CHANGE_LIFE_-<br>CYCLE_STAGE | group | 41 | 8 | |
| name | group.name | 41 | | |
| change_life_cycle_stage<br>to change_life_cycle_-<br>stage_sequence<br>(as predecessor) | PATH | | | group <-<br>group_relationship.relating_group<br>{group_relationship<br>group_relationship.name = `change life cycle stage sequence'}<br>group_relationship |
| change_life_cycle_stage<br>to change_life_cycle_-<br>stage_sequence<br>(as successor) | PATH | | | group <-<br>group_relationship.related_group<br>{group_relationship<br>group_relationship.name = `change life cycle stage sequence'}<br>group_relationship |
| change_life_cycle_stage<br>to change_life_cycle_-<br>stage_usage | PATH | | 8 | group <-<br>group_assignment.assigned_group<br>group_assignment =><br>change_life_cycle_stage_assignment |
| CHANGE_LIFE_-<br>CYCLE_STAGE_-<br>SEQUENCE | group_relationship | 41 | | {group_relationship<br>group_relationship.name = `change life cycle stage sequence'} |

# Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGE_LIFE_-<br>CYCLE_STAGE_USAGE | change_life_cycle_stage_assignment | 227 | | change_life_cycle_stage_assignment <=<br>group_assignment |
| date_of_activation | (calendar_date)<br>([calendar_date]<br>[local_time]) | 41<br>41<br>41 | | change_life_cycle_stage_assignment<br>(dated_item = change_life_cycle_stage_assignment<br>dated_item <-<br>applied_date_assignment.items[i]<br>applied_date_assignment <=<br>{date_assignment<br>date_assignment.role -><br>date_role<br>date_role.name = `activation date'}<br>date_assignment<br>date_assignment.assigned_date -><br>date =><br>calendar_date)<br>(date_and_time_item = change_life_cycle_stage_assignment<br>date_and_time_item <-<br>applied_date_and_time_assignment.items[i]<br>applied_date_and_time_assignment <=<br>{date_and_time_assignment<br>date_and_time_assignment.role -><br>date_time_role<br>date_time_role.name = `activation date'}<br>date_and_time_asssignment<br>date_and_time_assignment.assigned_date_and_time -><br>date_and_time<br>[date_and_time.date_component -><br>date =><br>calendar_date]<br>[date_and_time.time_component -><br>local_time]) |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| date_of_completion | (calendar_date)<br>([calendar_date]<br>[local_time]) | 41<br>41<br>41 | | change_life_cycle_stage_assignment<br>(dated_item = change_life_cycle_stage_assignment<br>dated_item <-<br>applied_date_assignment.items[i]<br>applied_date_assignment <=<br>{date_assignment<br>date_assignment.role -><br>date_role<br>date_role.name = `completion date'}<br>date_assignment<br>date_assignment.assigned_date -><br>date =><br>calendar_date)<br>(date_and_time_item = change_life_cycle_stage_assignment<br>date_and_time_item <-<br>applied_date_and_time_assignment.items[i]<br>applied_date_and_time_assignment <=<br>{date_and_time_assignment<br>date_and_time_assignment.role -><br>date_time_role<br>date_time_role.name = `completion date'}<br>date_and_time_asssignment<br>date_and_time_assignment.assigned_date_and_time -><br>date_and_time<br>[date_and_time.date_component -><br>date =><br>calendar_date]<br>[date_and_time.time_component -><br>local_time]) |

# Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| description | group.description | 41 | | change_life_cycle_stage_assignment <=<br>group_assignment<br>group_assignment.assigned_group -><br>group<br>group.description |
| change_life_cycle_-<br>stage_usage to change_-<br>approval | PATH | | 7 | change_life_cycle_stage_assignment<br>change_life_cycle_stage_assignment.items[i] -><br>change_life_cycle_stage_item<br>change_life_stage_item = action_directive<br>action_directive <-<br>directed_action.directive<br>directed_action =><br>change_action<br>approval_item = change_action<br>approval_item <-<br>applied_approval_assignment.items[i]<br>applied_approval_assignment |
| CHANGED_LINE_-<br>ASSIGNMENT | product_definition_relationship | 41 | | {product_definition_relationship<br>change_item = product_definition_relationship} |
| CHANGED_LINE_-<br>BRANCH_CONNECTION | line_branch_connection | 227 | | line_branch_connection <=<br>shape_aspect_relationship<br>{line_branch_connection<br>change_item = line_branch_connection} |
| CHANGED_LINE_-<br>PLANT_ITEM_-<br>BRANCH_CONNECTION | line_plant_item_branch_connection | 227 | | line_plant_item_branch_connection <=<br>shape_aspect_relationship<br>{line_plant_item_branch_connection<br>change_item = line_plant_item_branch_connection} |
| CHANGED_LINE_-<br>PLANT_ITEM_-<br>CONNECTION | line_plant_item_connection | 227 | | line_plant_item_connection <=<br>shape_aspect_relationship<br>{line_plant_item_connection<br>change_item = line_plant_item_connection} |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGED_LINE_TO_-<br>LINE_CONNECTION | line_termination_connection | 227 | | line_termination_connection <=<br>shape_aspect_relationship<br>{line_termination_connection<br>change_item = line_termination_connection} |
| CHANGED_PIPING_-<br>SPECIFICATION | document | 41 | | {document<br>[document.kind -><br>document_type<br>document_type.product_data_type = `piping specification']<br>[change_item = document]} |
| CHANGED_PIPING_-<br>SYSTEM_LINE | plant_line_definition | 227 | 19 | plant_line_definition <=<br>product_definition_with_associated_documents<br>{plant_line_definition<br>change_item = plant_line_definition} |
| CHANGED_PIPING_-<br>SYSTEM_LINE_-<br>SEGMENT | plant_line_segment_definition | 227 | 19 | plant_line_segment_definition <=<br>product_definition<br>{plant_line_segment_definition<br>change_item = plant_line_segment_definition} |
| CHANGED_PIPING_-<br>SYSTEM_LINE_-<br>SEGMENT_-<br>TERMINATION | plant_line_segment_termination | 227 | | plant_line_segment_termination <=<br>shape_aspect<br>{plant_line_segment_termination<br>change_item = plant_line_segment_termination} |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGED_PLANNED_-<br>PHYSICAL_PLANT | product_definition | 41 | 1, 9,<br>11, 13,<br>14<br>19 | {product_definition<br>[product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>product =><br>plant]<br>[product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `physical occurrence']<br>[change_item = product_definition]} |
| CHANGED_PLANT | plant | 227 | 19 | plant <=<br>product<br>{plant<br>change_item = plant} |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGED_PLANT_-ITEM | (product_definition)<br>(externally_defined_plant_item_-definition)<br>(product) | 41<br>227<br><br>41 | 17, 18, 19 | ({[product_definition<br>change_item = product_definition]<br>[product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>(externally_defined_plant_item_definition <=<br>[product_definition]<br>[externally_defined_item]<br>{[externally_defined_plant_item_definition<br>change_item = externally_defined_plant_item_definition]<br>[externally_defined_plant_item_definition <=<br>product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>({[product<br>change_item = product]<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element |

# Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGED_PLANT_-<br>ITEM_COLLECTION | product_definition_relationship | 41 | | {product_definition_relationship<br>change_item = product_definition_relationship} |
| CHANGED_PLANT_-<br>ITEM_CONNECTION | plant_item_connection | 227 | | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>change_item = plant_item_connection} |
| CHANGED_PLANT_-<br>ITEM_CONNECTOR | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>change_item = plant_item_connector} |
| CHANGED_PLANT_-<br>ITEM_LOCATION | (axis2_placement_2d)<br>(axis2_placement_3d) | 42<br>42 | | {(axis2_placement_2d<br>change_item = axis2_placement_2d)<br>(axis2_placement_3d<br>change_item = axis2_placement_3d)} |
| CHANGED_PLANT_-<br>ITEM_SHAPE | product_definition_shape | 41 | 19 | {product_definition_shape<br>change_item = product_definition_shape} |
| CHANGED_PLANT_-<br>PROCESS_CAPABILITY | process_capability | 227 | | process_capability <=<br>property_definition<br>{process_capability<br>change_item = process_capability} |

## Table 2 - Mapping table for change_information UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGED_PLANT_-<br>SYSTEM | (electrical_system)<br>(ducting_system)<br>(instrumentation_and_control_system)<br>(piping_system)<br>(structural_system) | 227<br>227<br>227<br>227<br>227 | | (electrical_system <=)<br>(ducting_system <=)<br>(instrumentation_and_control_system <=)<br>(piping_system <=)<br>(structural_system <=)<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant system'}<br>{(electrical_system<br>change_item = electrical_system)<br>(ducting_system<br>change_item = ducting_system)<br>(instrumentation_and_control_system<br>change_item = instrumentation_and_control_system)<br>(piping_system<br>change_item = piping_system)<br>(structural_system<br>change_item = structural_system)} |
| CHANGED_-<br>REFERENCE_-<br>GEOMETRY | reference_geometry | 227 | | reference_geometry <=<br>derived_shape_aspect<br>{reference_geometry<br>change_item = reference_geometry} |

## Table 2 - Mapping table for change_information UoF (concluded)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CHANGED_-<br>REQUIRED_-<br>MATERIAL_-<br>DESCRIPTION | product_definition | 41 | 19 | {product_definition<br>change_item = product_definition} |
| CHANGED_SITE | site | 227 | 15 | site <=<br>[characterized_object]<br>[property_definition]<br>{site<br>change_item = site} |
| CHANGED_SITE_-<br>FEATURE | site_feature | 227 | | site_feature <=<br>property_definition<br>{site_feature<br>change_item = site_feature} |
| CHANGED_SITED_-<br>PLANT | sited_plant | 227 | | sited_plant <=<br>property_definition<br>{sited_plant<br>change_item = sited_plant} |
| CHANGED_SUB_-<br>PLANT_RELATIONSHIP | product_definition_relationship | 41 | | {product_definition_relationship<br>change_item = product_definition_relationship} |

## Table 3 - Mapping table for connection UoF

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CONNECTION_-<br>DEFINITION | plant_item_connection | 227 | 1, 9,<br>11,<br>13, 14 | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional definition')<br>(application_context_element.name = `physical definition')} |

# Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connection_definition to connector_definition | PATH | | | (plant_item_connection <=<br>shape_aspect_relationship<br>[shape_aspect_relationship.relating_shape_aspect ->]<br>[shape_aspect_relationship.related_shape_aspect ->]<br>shape_aspect =><br>plant_item_connector)<br>([plant_item_connection <=<br>shape_aspect_relationship<br>[shape_aspect_relationship.relating_shape_aspect ->]<br>[shape_aspect_relationship.related_shape_aspect ->]<br>shape_aspect =><br>plant_item_connector]<br>[plant_item_connection <=<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship.name = 'connection involvement'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect =><br>plant_item_connector]) |

**Table 3 - Mapping table for connection UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connection_definition to functional_connection_-definition_satisfaction (as functional requirements) | PATH | | | plant_item_connection <=<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `functional definition'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>shape_aspect_relationship<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connection definition satisfaction'} |

# Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connection_definition to functional_connection_-definition_satisfaction (as requirements satisfaction) | PATH | | | plant_item_connection <=<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `physical definition'}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect<br>shape_aspect_relationship<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connection definition satisfaction'} |

**Table 3 - Mapping table for connection UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connection_definition to plant_item_connection_-occurrence | PATH | | | plant_item_connection <=<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `usage'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional occurrence')<br>(application_context_element.name = `physical occurrence')}<br>shape_aspect =><br>plant_item_connection |

**Table 3 - Mapping table for connection UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ELECTRICITY_-<br>TRANSFERENCE | plant_item_connection | 227 | | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>classification_item = plant_item_connection<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connection_functional_class]<br>[group<br>group.name = `electricity transference']} |
| FLEXIBLE_-<br>CONNECTION | plant_item_connection | 227 | | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>classification_item = plant_item_connection<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connection_motion_class]<br>[group<br>group.name = `flexible']} |

**Table 3 - Mapping table for connection UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FLUID_TRANSFERENCE | plant_item_connection | 227 | | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>classification_item = plant_item_connection<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connection_functional_class]<br>[group<br>group.name = `fluid transference']} |

**Table 3 - Mapping table for connection UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FUNCTIONAL_-<br>CONNECTION_-<br>DEFINITION_-<br>SATISFACTION | shape_aspect_relationship | 41 | 1, 9,<br>11,<br>13, 14 | {shape_aspect_relationship<br>[shape_aspect_relationship.name = `connection definition satisfaction']<br>[[shape_aspect_relationship.relating_shape_aspect ->]<br>[shape_aspect_relationship.related_shape_aspect ->]<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional definition')<br>(application_context_element.name = `physical definition')}<br>shape_aspect =><br>plant_item_connection]]} |

**Table 3 - Mapping table for connection UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FUNCTIONAL_-<br>CONNECTION_-<br>OCCURRENCE_-<br>SATISFACTION | shape_aspect_relationship | 41 | 1, 9,<br>11,<br>13, 14 | {shape_aspect_relationship<br>[shape_aspect_relationship.name = `connection occurrence satisfaction']<br>[[shape_aspect_relationship.relating_shape_aspect ->]<br>[shape_aspect_relationship.related_shape_aspect ->]<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional occurrence')<br>(application_context_element.name = `physical occurrence')}<br>shape_aspect =><br>plant_item_connection]} |

# Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| LOAD_TRANSFERENCE | plant_item_connection | 227 | | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>classification_item = plant_item_connection<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connection_functional_class]<br>[group<br>group.name = `load transference']} |
| LOCKED_-<br>ORIENTATION_-<br>CONNECTION | plant_item_connection | 227 | | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>classification_item = plant_item_connection<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connection_motion_class]<br>[group<br>group.name = `locked orientation']} |

## Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| PLANT_ITEM_-<br>CONNECTION | plant_item_connection | 227 | 1, 9,<br>11,<br>13, 14 | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{plant_item_connection<br>classification_item = plant_item_connection<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connection_motion_class]<br>[group<br>(group.name = `flexible')<br>(group.name = `locked orientation')]}<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional definition')<br>(application_context_element.name = `physical definition')<br>(application_context_element.name = `functional occurrence')<br>(application_context_element.name = `physical occurrence')} |

## Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connection_-<br>commitment_target | shape_aspect.description | 41 | | plant_item_connection <=<br>shape_aspect<br>shape_aspect.description |
| connection_id | shape_aspect.name | 41 | | plant_item_connection <=<br>shape_aspect<br>shape_aspect.name |
| connection_material | material_designation | 45 | | plant_item_connection <=<br>shape_aspect_relationship<br>shape_definition = shape_aspect_relationship<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>material_designation.definitions[i]<br>material_designation |
| description | shape_aspect_relationship.description | 41 | | plant_item_connection <=<br>shape_aspect_relationship<br>shape_aspect_relationship.description |
| plant_item_connection to<br>changed_plant_item_-<br>connection | IDENTICAL MAPPING | | | |

## Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| PLANT_ITEM_-<br>CONNECTION_-<br>OCCURRENCE | plant_item_connection | 227 | 1, 9,<br>11,<br>13, 14 | plant_item_connection <=<br>[shape_aspect_relationship]<br>[shape_aspect]<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional occurrence')<br>(application_context_element.name = `physical occurrence')} |

## Table 3 - Mapping table for connection UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| plant_item_connection_-occurrence to functional_connection_-occurrence_satisfaction (as functional requirements) | PATH | | | plant_item_connection <=<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `functional occurrence'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>shape_aspect_relationship<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connection occurrence satisfaction'} |

**Table 3 - Mapping table for connection UoF (concluded)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| plant_item_connection_-occurrence to functional_connection_-occurrence_satisfaction (as requirements satisfaction) | PATH | | | plant_item_connection <=<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `physical occurrence'}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect<br>shape_aspect_relationship<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connection occurrence satisfaction'} |
| plant_item_connection_-occurrence to plant_-item_connector_-occurrence | PATH | | | plant_item_connection <=<br>shape_aspect_relationship<br>[shape_aspect_relationship.relating_shape_aspect ->]<br>[shape_aspect_relationship.related_shape_aspect ->]<br>shape_aspect =><br>plant_item_connector |

**Table 4 - Mapping table for connector UoF**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| BRANCH_HOLE | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connector_end_type_class]<br>[group<br>group.name = `branch hole']} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| diameter<br><br>#1: The diameter is for the individual connector.<br><br>#2: The diameter is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `diameter'})<br>#2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| diameter<br><br>(concluded) | | | | property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum diameter')<br>(representation_item.name = `minimum diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| BUTTWELD | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>piping_connector_class]<br>[group<br>group.name = `buttweld']} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_preparation | descriptive_representation_item.-<br>description | 45 | | plant_item_connector <=<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `end preparation'}<br>representation_item =><br>descriptive_representation_item<br>descriptive_representation_item.description |
| CATALOGUE_-<br>CONNECTOR | catalogue_connector | 227 | 15, 17 | catalogue_connector <=<br>[externally_defined_item]<br>[shape_aspect<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object}] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| catalogue_connector to connector_definition (is defined by) | PATH | | | catalogue_connector <=<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `definition usage'}<br>shape_aspect_relationship<br>shape_aspect_relationship.relating_shape_aspect -><br>shape_aspect =><br>plant_item_connector |
| CONNECTOR_-DEFINITION | plant_item_connector | 227 | 1, 9, 11, 13, 14 | plant_item_connector <=<br>shape_aspect<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional definition')<br>(application_context_element.name = `physical definition')} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connector_definition to catalogue_connector (is defined as) | PATH | | | plant_item_connector <=<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `catalogue usage'}<br>shape_aspect_relationship<br>shape_aspect_relationship.relating_shape_aspect -><br>shape_aspect =><br>catalogue_connector |
| connector_definition to functional_connector_-definition_satisfaction (as functional requirements for) | PATH | | | plant_item_connector <=<br>shape_aspect<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `functional definition'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>shape_aspect_relationship<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector definition satisfaction'} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connector_definition to functional_connector_-definition_satisfaction (as satisfies requirements for) | PATH | | | plant_item_connector <=<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `physical definition'}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect<br>shape_aspect_relationship<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector definition satisfaction'} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connector_definition to plant_item_connector_-occurrence | PATH | | 1, 9, 11, 13 | plant_item_connector <=<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `usage'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = `functional occurrence')<br>(application_context_element.name = `physical occurrence')}<br>shape_aspect =><br>plant_item_connector |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ELECTRICAL_-<br>CONNECTOR | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group =><br>electrical_connector_class} |
| type | group.name | 41 | | plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>{classification_assignment<br>classification_assignment.role -><br>classification_role<br>classification_role.name = `electrical connector type classification'}<br>classification_assignment<br>classification_assignment.assigned_classification -><br>{group =><br>electrical_connector_class}<br>group<br>group.name |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FEMALE_END | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_group -><br>[group =><br>connector_end_type_class]<br>[group<br>group.name = `female end']} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| depth<br><br>#1: The depth is for the individual connector.<br><br>#2: The depth is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `depth'}) |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| depth<br><br>(continued) | | | | #2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum depth')<br>(representation_item.name = `minimum depth')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum depth'}]<br>[representation.items[i] -> |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| depth<br><br>(concluded) | | | | representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_inside_diameter<br><br>#1: The diameter is for the individual connector.<br><br>#2: The diameter is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `hub inside diameter'})<br>#2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_inside_diameter<br><br>(concluded) | | | | property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum hub inside diameter')<br>(representation_item.name = `minimum hub inside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum hub inside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum hub inside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_length<br><br>#1: The length is for the individual connector.<br><br>#2: The length is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `hub length'}) |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_length<br><br>(continued) | | | | #2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum hub length')<br>(representation_item.name = `minimum hub length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum hub length'}]<br>[representation.items[i] -> |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_length<br><br>(concluded) | | | | representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_outside_diameter<br><br>#1: The diameter is for the individual connector.<br><br>#2: The diameter is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `hub outside diameter'})<br>#2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_outside_diameter<br><br>(concluded) | | | | property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum hub outside diameter')<br>(representation_item.name = `minimum hub outside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum hub outside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum hub outside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FLANGED | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>piping_connector_class]<br>[group<br>group.name = `flanged']} |
| FLANGED_END | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connector_end_type_class]<br>[group<br>group.name = `flanged end']} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| face_finish | descriptive_representation_item.-<br>description | 45 | | plant_item_connector <=<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `face finish'}<br>representation_item =><br>descriptive_representation_item<br>descriptive_representation_item.description |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_inside_diameter<br><br>#1: The diameter is for the individual connector.<br><br>#2: The diameter is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `flange inside diameter'})<br>#2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_inside_diameter<br><br>(concluded) | | | | property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum flange inside diameter')<br>(representation_item.name = `minimum flange inside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum flange inside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum flange inside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_outside_diameter<br><br>#1: The diameter is for the individual connector.<br><br>#2: The diameter is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `flange outside diameter'})<br>#2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_outside_diameter<br><br>(concluded) | | | | property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum flange outside diameter')<br>(representation_item.name = `minimum flange outside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum flange outside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum flange outside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_thickness<br><br>#1: The thickness is for the individual connector.<br><br>#2: The thickness is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `flange thickness'}) |

# Table 4 - Mapping table for connector UoF (continued)



| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_thickness<br><br>(continued) | | | | #2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum flange thickness')<br>(representation_item.name = `minimum flange thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum flange thickness'}]<br>[representation.items[i] -> |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| flange_thickness | | | | representation_item => |
| | | | | measure_representation_item <= |
| (concluded) | | | | {measure_with_unit => |
| | | | | length_measure_with_unit} |
| | | | | measure_with_unit |
| | | | | [measure_with_unit.value_component] |
| | | | | [measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| raised_face_diameter<br><br>#1: The diameter is for the individual connector.<br><br>#2: The diameter is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `raised face diameter'})<br>#2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| raised_face_diameter<br><br>(concluded) | | | | property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum raised face diameter')<br>(representation_item.name = `minimum raised face diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum raised face diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum raised face diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| raised_face_height<br><br>#1: The height is for the individual connector.<br><br>#2: The height is for the definition of a family of piping components. | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | plant_item_connector <=<br>#1: (shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `raised face height'}) |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| raised_face_height<br><br>(continued) | | | | #2: ({shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class}<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `piping connector class dimension'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum raised face height')<br>(representation_item.name = `minimum raised face height')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum raised face height'}]<br>[representation.items[i] -> |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| raised_face_height<br><br>(concluded) | | | | representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| ring_bottom_radius | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | plant_item_connector <=<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `ring bottom radius'}<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ring_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | plant_item_connector <=<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `ring diameter'}<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ring_width | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | plant_item_connector <=<br>shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `ring width'}<br>representation_item => |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ring_width<br><br>(concluded) | | | | measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| FUNCTIONAL_-<br>CONNECTOR | plant_item_connector | 227 | 1, 9,<br>11, 13 | plant_item_connector <=<br>shape_aspect<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `functional occurrence'} |
| functional_connector to<br>functional_connector_-<br>occurrence_satisfaction | PATH | | | plant_item_connector <=<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector occurrence satisfaction'} |
| FUNCTIONAL_-<br>CONNECTOR_-<br>DEFINITION_-<br>SATISFACTION | shape_aspect_relationship | 41 | | {shape_aspect_relationship<br>shape_aspect_relationship.name = `connector definition satisfaction'} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FUNCTIONAL_-<br>CONNECTOR_-<br>OCCURRENCE_-<br>SATISFACTION | shape_aspect_relationship | 41 | | {shape_aspect_relationship<br>shape_aspect_relationship.name = `connector occurrence satisfaction'} |
| MALE_END | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>connector_end_type_class]<br>[group<br>group.name = `male end']} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| PHYSICAL_-<br>CONNECTOR | plant_item_connector | 227 | 1, 9,<br>11, 13,<br>14 | plant_item_connector <=<br>shape_aspect<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>application_context_element.name = `physical occurrence'} |
| physical_connector to<br>functional_connector_-<br>occurrence_satisfaction | PATH | | | plant_item_connector <=<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector occurrence satisfaction'} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| PIPING_CONNECTOR | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group =><br>piping_connector_class}<br>{(plant_item_connector)<br>(plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group =><br>connector_end_type_class)} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connector_flow_direction | descriptive_representation_item.-<br>description | 45 | | plant_item_connector <=<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `flow direction'}<br>representation_item =><br>descriptive_representation_item<br>descriptive_representation_item.description |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| connector_specifications | document_usage_constraint.-<br>subject_element_value | 41 | | plant_item_connector<br>document_item = plant_item_connector<br>document_item <-<br>applied_document_reference.items[i]<br>applied_document_reference <=<br>document_reference<br>document_reference.assigned_document -><br>{document<br>document.kind -><br>document_type<br>document_type.product_data_type = `connector specification'}<br>document <-<br>document_usage_constraint.source<br>document_usage_constraint<br>document_usage_constraint.subject_element_value |
| name | shape_aspect.description | 41 | | plant_item_connector <=<br>shape_aspect<br>shape_aspect.description |
| piping_connector to<br>piping_connector_-<br>service_characteristic | PATH | | | plant_item_connector <=<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>{property_definition<br>property_definition.name = `service characteristics'}<br>property_definition |

**Table 4 - Mapping table for connector UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| piping_connector to piping_size_description | PATH | | | plant_item_connector <=<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation |
| PIPING_CONNECTOR_-SERVICE_-CHARACTERISTIC | property_definition | 41 | | {property_definition<br>property_definition.name = `service characteristics'} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| design_pressure | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `design service characteristics'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `pressure')<br>(representation_item.name = `maximum pressure')<br>(representation_item.name = `minimum pressure')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum pressure'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum pressure'}])<br>representation_item =><br>measure_representation_item <=<br>measure_with_unit<br>[{measure_with_unit.value_component -><br>measure_value<br>measure_value = ratio_measure}<br>measure_with_unit.value_component]<br>[{measure_with_unit.unit_component -><br>unit<br>unit = derived_unit}<br>measure_with_unit.unit_component] |

**Table 4 - Mapping table for connector UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| design_temperature | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `design service characteristics'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `temperature')<br>(representation_item.name = `maximum temperature')<br>(representation_item.name = `minimum temperature')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum temperature'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum temperature'}])<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>thermodynamic_temperature_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| piping_connector_-<br>service_characteristic to<br>service_operating_case | PATH | | | property_definition <-<br>property_definition_relationship.related_property_definition<br>property_definition_relationship |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| PLANT_ITEM_-<br>CONNECTOR | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{shape_aspect<br>shape_aspect.product_definitional = TRUE} |
| connect_point | cartesian_point | 42 | | plant_item_connector <=<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `connect point'}<br>representation_item =><br>geometric_representation_item =><br>point =><br>cartesian_point |
| plant_item_connector_id | shape_aspect.name | 41 | | plant_item_connector <=<br>shape_aspect<br>shape_aspect.name |
| plant_item_connector to<br>changed_plant_item_-<br>connector | IDENTICAL MAPPING | | | |

**Table 4 - Mapping table for connector UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| plant_item_connector to external_classification | PATH | | | plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group =><br>externally_defined_class |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| plant_item_connector to required_material_-description | PATH | | | plant_item_connector <=<br>shape_aspect<br>shape_definition = shape_aspect<br>shape_definition<br>characterized_definition = shape_definition<br>characterized_definition <-<br>property_definition.definition<br>{property_definition =><br>material_property =><br>required_material_property}<br>property_definition <-<br>property_definition_relationship.related_property_definition<br>{property_definition_relationship<br>property_definition_relationship.name = `requirement allocation'}<br>property_definition_relationship<br>property_definition_relationship.relating_property_definition -><br>{property_definition =><br>material_property}<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| plant_item_connector to shape_representation | PATH | | 16 | plant_item_connector <=<br>shape_aspect<br>represented_definition = shape_aspect<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation =><br>shape_representation =><br>(plant_csg_shape_representation)<br>(hybrid_shape_representation) |
| PLANT_ITEM_-<br>CONNECTOR_-<br>OCCURRENCE | plant_item_connector | 227 | 1, 9, 11, 13, 14 | plant_item_connector <=<br>shape_aspect<br>{shape_aspect<br>shape_aspect.of_shape -><br>product_definition_shape <=<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition<br>product_definition.frame_of_reference -><br>product_definition_context <=<br>application_context_element<br>(application_context_element.name = 'functional occurrence')<br>(application_context_element.name = 'physical occurrence')} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| orientation | (axis2_placement_2d)<br>(axis2_placement_3d) | 42<br>42 | | plant_item_connector <=<br>shape_aspect<br>represented_definition = shape_aspect<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `connector orientation'}<br>representation_item =><br>geometric_representation_item =><br>{placement<br>placement.location -><br>cartesian_point <=<br>point <=<br>geometric_representation_item <=<br>representation_item<br>representation_item.name = `connect point'}<br>placement =><br>(axis2_placement_2d)<br>(axis2_placement_3d) |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| PRESSURE_FIT | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>piping_connector_class]<br>[group<br>group.name = `pressure fit']} |
| SERVICE_OPERATING_-<br>CASE | property_definition_relationship | 45 | | {property_definition_relationship<br>[property_definition_relationship.relating_property_definition -><br>property_definition =><br>stream_design_case]<br>[property_definition_relationship.related_property_definition -><br>property_definition<br>property_definition.name = `service characteristics']} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| duration | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | property_definition_relationship<br>property_definition_relationship.related_property_definition -><br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `service operating characteristics'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `duration')<br>(representation_item.name = `maximum duration')<br>(representation_item.name = `minimum duration')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum duration'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum duration'}])<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>time_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
| --- | --- | --- | --- | --- |
| frequency | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | property_definition_relationship<br>property_definition_relationship.related_property_definition -><br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `service operating characteristics'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `frequency')<br>(representation_item.name = `maximum frequency')<br>(representation_item.name = `minimum frequency')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum frequency'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum frequency'}])<br>representation_item =><br>measure_representation_item <=<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| name | property_definition_relationship.-<br>description | 45 | | |
| operating_case_id | property_definition_relationship.name | 45 | | |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| operating_pressure | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | property_definition_relationship<br>property_definition_relationship.related_property_definition -><br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `service operating characteristics'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `pressure')<br>(representation_item.name = `maximum pressure')<br>(representation_item.name = `minimum pressure')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum pressure'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum pressure'}])<br>representation_item =><br>measure_representation_item <=<br>measure_with_unit<br>[{measure_with_unit.value_component -><br>measure_value<br>measure_value = ratio_measure}<br>measure_with_unit.value_component]<br>[{measure_with_unit.unit_component -><br>unit<br>unit = derived_unit} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| operating_temperature | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | property_definition_relationship<br>property_definition_relationship.related_property_definition -><br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `service operating characteristics'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `temperature')<br>(representation_item.name = `maximum temperature')<br>(representation_item.name = `minimum temperature')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum temperature'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum duration'}])<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>thermodynamic_temperature_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
| --- | --- | --- | --- | --- |
| SOCKET | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>piping_connector_class]<br>[group<br>group.name = `socket']} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| root_gap | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | plant_item_connector <=<br>shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `root gap'}<br>representation_item => |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| root_gap<br><br>(concluded) | | | | measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| STRUCTURAL_LOAD_-<br>CONNECTOR | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>{classification_assignment<br>classification_assignment.role -><br>classification_role<br>classification_role.name = `structural connector type classification'}<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group =><br>structural_load_connector_class} |

## Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| type | group.name | 41 | | plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>{classification_assignment<br>classification_assignment.role -><br>classification_role<br>classification_role.name = `structural connector type classification'}<br>classification_assignment<br>classification_assignment.assigned_classification -><br>{group =><br>structural_load_connector_class}<br>group<br>group.name |
| THREADED | plant_item_connector | 227 | | plant_item_connector <=<br>shape_aspect<br>{plant_item_connector<br>classification_item = plant_item_connector<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>piping_connector_class]<br>[group<br>group.name = `threaded']} |

# Table 4 - Mapping table for connector UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
| --- | --- | --- | --- | --- |
| thread_engagement_-depth | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | plant_item_connector <=<br>shape_aspect <-<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect_relationship.relating_shape_aspect<br>{shape_aspect_relationship<br>shape_aspect_relationship.name = `connector dimensional aspect'}<br>shape_aspect_relationship<br>shape_aspect_relationship.related_shape_aspect -><br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `piping connector dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `thread engagement depth'}<br>representation_item => |

## Table 4 - Mapping table for connector UoF (concluded)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| thread_engagement_-depth<br><br>(concluded) | | | | measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 5 - Mapping table for hybrid_shape UoF

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| B_REP_ELEMENT | manifold_solid_brep | 42 | | |
| CONIC | conic | 42 | | |
| CURVE | curve | 42 | | |
| FREE_FORM_CURVE | b_spline_curve | 42 | | |
| LINE | line | 42 | | |
| POINT | point | 42 | | |
| POLYGON | polyline | 42 | | |
| SURFACE | surface | 42 | | |
| VECTOR | vector | 42 | | |
| WIRE_AND_SURFACE_-<br>ELEMENT | geometric_representation_item | 42 | | |

## Table 6 - Mapping table for piping_component_characterization UoF

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| BLANK<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name= `blank']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br><br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| outside_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `blank fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `outside diameter'}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| outside_diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `blank fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum outside diameter')<br>(representation_item.name = `minimum outside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum outside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum outside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| thickness | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `blank fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `thickness'}) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| thickness<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `blank fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum thickness')<br>(representation_item.name = `minimum thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum thickness'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum thickness'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| BLIND_FLANGE | piping_component_definition | 227 | 19 | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>flange_fitting_class]<br>[group<br>group.name = `blind flange']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name= `flange']<br>[product |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| BUSHING<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `bushing']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_to_end_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 1']}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 2']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_to_end_length<br><br>(concluded) | | | | representation.items[i] -><br>{representation_item<br>representation_item.name = `end to end length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `bushing fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum end to end length')<br>(representation_item.name = `minimum end to end length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum end to end length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum end to end length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| COUPLING<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `coupling']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_to_end_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 1']}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 2']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_to_end_length<br><br>(concluded) | | | | representation.items[i] -><br>{representation_item<br>representation_item.name = `end to end length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `coupling fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum end to end length')<br>(representation_item.name = `minimum end to end length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum end to end length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum end to end length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| CROSS<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `cross']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_1_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = \`centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = \`end 1']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = \`cross fitting dimensional shape'} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_1_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 1 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `cross fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 1 length')<br>(representation_item.name = `minimum centre to end 1 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 1 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 1 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_2_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 2']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `cross fitting dimensional shape'} |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_2_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 2 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `cross fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 2 length')<br>(representation_item.name = `minimum centre to end 2 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 2 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 2 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_3_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 3']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `cross fitting dimensional shape'} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_3_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 3 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `cross fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 3 length')<br>(representation_item.name = `minimum centre to end 3 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 3 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 3 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_4_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 4']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `cross fitting dimensional shape'} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_4_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 4 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `cross fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 4 length')<br>(representation_item.name = `minimum centre to end 4 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 4 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 4 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_3_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 3'}<br>shape_aspect =><br>plant_item_connector |
| end_4_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 4'}<br>shape_aspect =><br>plant_item_connector |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ECCENTRIC_REDUCER | piping_component_definition | 227 | 19 | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>reducer_fitting_class]<br>[group<br>group.name = `eccentric reducer']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `reducer']<br>[product |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centreline_offset | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect shape_aspect.description = 'centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = 'centre'}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `reducer fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centreline_offset<br><br>(concluded) | | | | {measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| flat_side_orientation | shape_aspect.description | 41 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.name = `flat side'}<br>shape_aspect<br>shape_aspect.description |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ECCENTRIC_SWAGE | piping_component_definition | 227 | 19 | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>swage_fitting_class]<br>[group<br>group.name = `eccentric swage']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `swage']<br>[product |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centreline_offset | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect shape_aspect.description = 'centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = 'centre'}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>representation<br>{representation.name = `swage fitting dimensional shape'}<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centreline offset'} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centreline_offset<br><br>(concluded) | | | | measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |
| flat_side_orientation | shape_aspect.description | 41 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.name = `flat side'}<br>shape_aspect<br>shape_aspect.description |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ELBOW<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `elbow']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_1_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15,<br>16, 19 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 1']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `elbow fitting dimensional shape'} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_1_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 1 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `elbow fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 1 length')<br>(representation_item.name = `minimum centre to end 1 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 1 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 1 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
| --- | --- | --- | --- | --- |
| centre_to_end_2_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 2']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `elbow fitting dimensional shape'} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_2_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 2 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `elbow fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 2 length')<br>(representation_item.name = `minimum centre to end 2 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 2 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 2 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centreline_radius | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect shape_aspect.description = 'inner bend centre point'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{shape_aspect shape_aspect.name = 'sweep angle centre point'}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `elbow fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centreline radius' |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centreline_radius<br><br>(concluded) | | | | #2:(piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = \`elbow fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = \`maximum centreline radius')<br>(representation_item.name = \`minimum centreline radius')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = \`maximum centreline radius'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = \`minimum centreline radius'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| sweep_angle | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>{dimensional_location =><br>angular_location}<br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `elbow fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `sweep angle'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| sweep_angle<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `elbow fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum sweep angle')<br>(representation_item.name = `minimum sweep angle')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum sweep angle'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum sweep angle'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>plane_angle_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| type | group.name | 41 | | piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br><br>{classification_assignment<br>classification_assignment.role -><br>classification_role<br>classification_role.name = `elbow fitting type classification'}<br>classification_assignment<br>classification_assignment.assigned_classification -><br>{group =><br>elbow_fitting_class}<br>group<br>group.name |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| EXPANDER_FLANGE | piping_component_definition | 227 | 19 | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>flange_fitting_class]<br>[group<br>group.name = `expander flange']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `flange']<br>[product |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FAMILY_DEFINITION | piping_component_class | 227 | 15 | piping_component_class <=<br>[group]<br>[characterized_object] |
| family_classification_-<br>description | group_relationship.related_group | 41 | | piping_component_class <=<br>group<br>group_relationship.related_group |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FITTING | (piping_component_definition)<br>(piping_component_class) | 227<br>227 | 15, 19 | (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `fittings']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>(piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| FLANGE<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `flange']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_through_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `flange fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `hub through length'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_through_length<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = \`flange fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = \`maximum hub through length')<br>(representation_item.name = \`minimum hub through length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = \`maximum hub through length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = \`minimum hub through length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_weld_point_-<br>diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `flange fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `hub weld point diameter'}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| hub_weld_point_-<br>diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `flange fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum hub weld point diameter')<br>(representation_item.name = `minimum hub weld point diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum hub weld point diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum hub weld point diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| GASKET<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `gasket']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| compressed_thickness | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `gasket fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `thickness'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| compressed_thickness<br><br>(concluded) | | | | property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `gasket fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum thickness')<br>(representation_item.name = `minimum thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum thickness'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum thickness'}]))<br>representation_item =><br>{qualified_representation_item<br>qualified_representation_item.qualifiers[i] -><br>value_qualifier<br>value_qualifier = type_qualifier<br>type_qualifier<br>type_qualifier.name = `compressed'}<br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| uncompressed_thickness | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `gasket fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `thickness'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| uncompressed_thickness<br><br>(concluded) | | | | property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `gasket fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum thickness')<br>(representation_item.name = `minimum thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum thickness'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum thickness'}])<br>representation_item =><br>{qualified_representation_item<br>qualified_representation_item.qualifiers[i] -><br>value_qualifier<br>value_qualifier = type_qualifier<br>type_qualifier<br>type_qualifier.name = `uncompressed'}<br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component] |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| INLINE_EQUIPMENT | inline_equipment | 227 | 19 | inline_equipment <=<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group<br>group.name = `equipment'}<br>piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item'} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| INLINE_INSTRUMENT | piping_component_definition | 227 | | piping_component_definition <=<br>product_definition<br>{[piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>group<br>group.name = `instrument']<br>[piping_component_definition <=<br>product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| INSERT<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `insert']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_to_end_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 1']}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 2']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_to_end_length<br><br>(concluded) | | | | representation.items[i] -><br>{representation_item<br>representation_item.name = `end to end length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `insert fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum end to end length')<br>(representation_item.name = `minimum end to end length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum end to end length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum end to end length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| INSIDE_AND_-<br>THICKNESS<br><br>#1: The attributes are for an individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (shape_dimension_representation)<br>#2: (representation) | 47<br>43 | 15, 16 | #1: ({shape_dimension_representation <=<br>shape_representation <=<br>[representation<br>representation.name = `piping component dimensions']<br>[representation <-<br>property_definition_representation.used_representation<br>property_definition_representation<br>property_definition_representation.definition -><br>(represented_definition<br>represented_definition = property_definition<br>{property_definition =><br>product_definition_shape}<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition =><br>piping_component_definition)<br>(represented_definition<br>represented_definition = shape_aspect<br>shape_aspect =><br>plant_item_connector)]}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| INSIDE_AND_-<br>THICKNESS<br><br>(concluded) | | | | #2: ({[representation<br>representation.name = `piping component class size']<br>[representation <-<br>property_definition_representation.used_representation<br>property_definition_representation<br>property_definition_representation.definition -><br>represented_definition<br>represented_definition = property_definition<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_object<br>characterized_object =><br>piping_component_class]}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| inside_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | #1: (shape_dimension_representation <=<br>shape_representation <=<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `inside diameter'})<br>#2: (representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum inside diameter')<br>(representation_item.name = `minimum inside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum inside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum inside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| thickness | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 16 | #1: (shape_dimension_representation <=<br>shape_representation <=<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `thickness'})<br>#2: (representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum thickness')<br>(representation_item.name = `minimum thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum thickness'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum thickness'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)



| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| LAP_JOINT_FLANGE | piping_component_definition | 227 | 19 | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>flange_fitting_neck_type_class]<br>[group<br>group.name = `lap joint flange']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `flange']<br>[product |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| LAP_JOINT_STUB_END<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `lap joint stub end']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lap joint stub end fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `length'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| length<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lap joint stub end fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum length')<br>(representation_item.name = `minimum length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| stub_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lap joint stub end fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `stub diameter'}) |

Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| stub_diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lap joint stub end fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum stub diameter')<br>(representation_item.name = `minimum stub diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum stub diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum stub diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| stub_thickness | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lap joint stub end fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `stub thickness'}) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| stub_thickness<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lap joint stub end fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum stub thickness')<br>(representation_item.name = `minimum stub thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum stub thickness'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum stub thickness'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| LATERAL<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `lateral']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| branch_angle | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>{dimensional_location =><br>angular_location}<br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lateral fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `branch angle'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| branch_angle<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lateral fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum branch angle')<br>(representation_item.name = `minimum branch angle')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum branch angle'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum branch angle'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>plane_angle_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_1_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{[shape_aspect shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 1']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lateral fitting dimensional shape'} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_1_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 1 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lateral fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 1 length')<br>(representation_item.name = `minimum centre to end 1 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 1 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 1 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_2_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 2']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lateral fitting dimensional shape'} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_2_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 2 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lateral fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 2 length')<br>(representation_item.name = `minimum centre to end 2 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 2 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 2 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_3_length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>[shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `centre'}<br>shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect.of_shape<br>{[shape_aspect =><br>plant_item_connector]<br>[shape_aspect<br>shape_aspect.description = `end 3']}<br>shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `lateral fitting dimensional shape'} |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| centre_to_end_3_length<br><br>(concluded) | | | | representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `centre to end 3 length'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lateral fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum centre to end 3 length')<br>(representation_item.name = `minimum centre to end 3 length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum centre to end 3 length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum centre to end 3 length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit} |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_3_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 3'}<br>shape_aspect =><br>plant_item_connector |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| MITRE_BEND_PIPE<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>pipe_class]<br>[group<br>group.name = `mitre bend pipe']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `pipe'] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| MITRE_BEND_PIPE<br><br>(concluded) | | | | [product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| number_of_segments | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `pipe characteristics'}<br>representation<br>{representation_item<br>representation_item.name = `number of segments'})<br>#2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `pipe class characteristics'}<br>representation |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| number_of_segments<br><br>(concluded) | | | | (representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum number of segments')<br>(representation_item.name = `minimum number of segments')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum number of segments'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum number of segments'}]))<br>representation_item =><br>measure_representation_item <=<br>measure_with_unit<br>[measure_with_unit.value_component<br>{measure_with_unit.value_component -><br>measure_value<br>measure_value = count_measure}]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| radius | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `pipe dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `radius'}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| radius<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `pipe class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum radius')<br>(representation_item.name = `minimum radius')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum radius'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum radius'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| sweep_angle | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>{dimensional_location =><br>angular_location}<br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `pipe dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `sweep angle'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| sweep_angle<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `pipe class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum sweep angle')<br>(representation_item.name = `minimum sweep angle')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum sweep angle'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum sweep angle'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>plane_angle_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| NIPPLE | piping_component_definition | 227 | | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>pipe_class]<br>[group<br>group.name = `nipple']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `pipe']<br>[product |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| OLET<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `olet']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = `plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| base_outside_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = \`olet fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = \`base outside diameter'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| base_outside_diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `olet fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum base outside diameter')<br>(representation_item.name = `minimum base outside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum base outside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum base outside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| branch_angle | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>{dimensional_location =><br>angular_location}<br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `olet fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `branch angle'}) |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| branch_angle<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `lateral fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum branch angle')<br>(representation_item.name = `minimum branch angle')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum branch angle'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum branch angle'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>plane_angle_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| end_1_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 1'}<br>shape_aspect =><br>plant_item_connector |
| end_2_connector | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `end 2'}<br>shape_aspect =><br>plant_item_connector |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| length | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `olet fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `length'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| length<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `olet fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum length')<br>(representation_item.name = `minimum length')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum length'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum length'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| skirt_outside_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `olet fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `skirt outside diameter'}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| skirt_outside_diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `olet fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum skirt outside diameter')<br>(representation_item.name = `minimum skirt outside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum skirt outside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum skirt outside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ORIFICE_FLANGE | piping_component_definition | 227 | 19 | piping_component_definition <=<br>product_definition<br>{piping_component_definition<br>classification_item = piping_component_definition<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>[group =><br>flange_fitting_class]<br>[group<br>group.name = `orifice flange']}<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = `flange']<br>[product |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| jacking_screw_-orientation | shape_aspect.description | 41 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.name = `jacking screw'}<br>shape_aspect<br>shape_aspect.description |
| tap | plant_item_connector | 227 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>{shape_aspect<br>shape_aspect.description = `tap'}<br>shape_aspect =><br>plant_item_connector |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| ORIFICE_PLATE<br><br>#1: The attributes are for the individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (piping_component_definition)<br>#2: (piping_component_class) | 227<br>227 | 15, 19 | #1: (piping_component_definition <=<br>product_definition<br>{product_definition<br>product_definition.formation -><br>product_definition_formation<br>product_definition_formation.of_product -><br>[product<br>classification_item = product<br>classification_item <-<br>applied_classification_assignment.items[i]<br>applied_classification_assignment <=<br>classification_assignment<br>classification_assignment.assigned_classification -><br>(group)<br>(group <-<br>group_relationship.related_group<br>group_relationship<br>group_relationship.relating_group -><br>group)<br>group.name = \`orifice plate']<br>[product<br>product.frame_of_reference[i] -><br>product_context<=<br>application_context_element<br>application_context_element.name = \`plant item']})<br>#2: (piping_component_class <=<br>[characterized_object]<br>[group]) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| beta_ratio | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | | piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `beta ratio'}<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>ratio_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| bore_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `orifice plate fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `bore diameter'}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| bore_diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `orifice plate fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum bore diameter')<br>(representation_item.name = `minimum bore diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum bore diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum bore diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| outside_diameter | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>shape_aspect <-<br>dimensional_size.applies_to<br>dimensional_size<br>dimensional_characteristic = dimensional_size<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `orifice plate fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `outside diameter'}) |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| outside_diameter<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `orifice plate fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum outside diameter')<br>(representation_item.name = `minimum outside diameter')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum outside diameter'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum outside diameter'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

## Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| thickness | [measure_with_unit.value_component]<br>[measure_with_unit.unit_component] | 41<br>41 | 15, 16 | #1: (piping_component_definition <=<br>product_definition<br>characterized_product_definition = product_definition<br>characterized_product_definition<br>characterized_definition = characterized_product_definition<br>characterized_definition <-<br>property_definition.definition<br>property_definition =><br>product_definition_shape <-<br>shape_aspect.of_shape<br>[shape_aspect <-<br>shape_aspect_relationship.relating_shape_aspect]<br>[shape_aspect <-<br>shape_aspect_relationship.related_shape_aspect]<br>shape_aspect_relationship =><br>dimensional_location<br>dimensional_characteristic = dimensional_location<br>dimensional_characteristic <-<br>dimensional_characteristic_representation.dimension<br>dimensional_characteristic_representation<br>dimensional_characteristic_representation.representation -><br>shape_dimension_representation <=<br>shape_representation <=<br>{representation<br>representation.name = `orifice plate fitting dimensional shape'}<br>representation<br>representation.items[i] -><br>{representation_item<br>representation_item.name = `thickness'}) |

**Table 6 - Mapping table for piping_component_characterization UoF (continued)**

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| thickness<br><br>(concluded) | | | | #2: (piping_component_class <=<br>characterized_object<br>characterized_definition = characterized_object<br>characterized_definition <-<br>property_definition.definition<br>property_definition<br>represented_definition = property_definition<br>represented_definition <-<br>property_definition_representation.definition<br>property_definition_representation<br>property_definition_representation.used_representation -><br>{representation<br>representation.name = `orifice plate fitting class dimensions'}<br>representation<br>(representation.items[i] -><br>{representation_item<br>(representation_item.name = `maximum thickness')<br>(representation_item.name = `minimum thickness')})<br>([representation.items[i] -><br>{representation_item<br>representation_item.name = `maximum thickness'}]<br>[representation.items[i] -><br>{representation_item<br>representation_item.name = `minimum thickness'}]))<br>representation_item =><br>measure_representation_item <=<br>{measure_with_unit =><br>length_measure_with_unit}<br>measure_with_unit<br>[measure_with_unit.value_component]<br>[measure_with_unit.unit_component] |

# Table 6 - Mapping table for piping_component_characterization UoF (continued)

| Application element | AIM element | Source | Rules | Reference path |
|---|---|---|---|---|
| OUTSIDE_AND_-<br>THICKNESS<br><br>#1: The attributes are for an individual piping component.<br><br>#2: The attributes are for the definition of a family of piping components. | #1: (shape_dimension_representation)<br>#2: (representation) | 47<br>43 | 15, 16 | #1: ({shape_dimension_representation <=<br>shape_representation <=<br>[representation<br>representation.name = `piping component dimensions']<br>[representation <-<br>property_definition_representation.used_representation<br>property_definition_representation<br>property_definition_representation.definition -><br>(represented_definition<br>represented_definition = property_definition<br>{property_definition =><br>product_definition_shape}<br>property_definition<br>property_definition.definition -><br>characterized_definition<br>characterized_definition = characterized_product_definition<br>characterized_product_definition<br>characterized_product_definition = product_definition<br>product_definition =><br>piping_component_definition)<br>(represented_definition<br>represented_definition = shape_aspect<br>shape_aspect =><br>plant_item_connector)]]}) |