
**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 10303-227:2005(E)

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Published in Switzerland

CONTENTS	PAGE
Overview of this document	xii
Changes from the previous edition	xiv
1 Scope	1
2 Normative references	4
3 Terms, definitions, and abbreviations	5
3.1 Terms defined in ISO 10303-1	5
3.2 Terms defined in ISO 10303-31	5
3.3 Other definitions	6
3.4 Abbreviations	14
4 Information requirements	15
4.1 Units of functionality	16
4.1.1 associative_schematics UoF	16
4.1.2 cableway_component_characterization UoF	17
4.1.3 change_information UoF	18
4.1.4 connection UoF	20
4.1.5 connector UoF	20
4.1.6 hvac_component_characterization UoF	21
4.1.7 hvac_system_functional_characterization UoF	23
4.1.8 hybrid_shape_representation UoF	24
4.1.9 mechanical_component_characterization UoF	24
4.1.10 mechanical_system_functional_characterization UoF	25
4.1.11 piping_component_characterization UoF	26
4.1.12 piping_inspection UoF	29
4.1.13 piping_system_functional_characterization UoF	29
4.1.14 plant_characterization UoF	30
4.1.15 plant_csg_shape_representation UoF	31
4.1.16 plant_item_characterization UoF	32
4.1.17 shape UoF	35
4.1.18 site_characterization UoF	36
4.2 Application objects	37
4.3 Application assertions	234
5 Application interpreted model	270
5.1 Mapping specification	270
5.2 AIM EXPRESS short listing	1029
6 Conformance requirements	1184
6.1 Conformance class 1, piping system functional information	1185
6.2 Conformance class 2, equipment and component spatial information	1185
6.3 Conformance class 3, plant layout and piping design information along with HVAC, cableway, and mechanical system information	1185
6.4 Conformance class 4, piping fabrication and installation information	1188
6.5 Conformance class 5, piping inspection information	1188
6.6 Conformance class 6, HVAC system functional information	1189
6.7 Conformance class 7, HVAC spatial information	1190
6.8 Conformance class 8, cableway spatial information	1191

ISO 10303-227:2005(E)

6.9 Conformance class 9, piping and HVAC analysis information	1192
6.10 Conformance class 10, mechanical system functional information	1192
6.11 Conformance class 11, mechanical system spatial information	1192
6.12 Options within a conformance class	1193
Annex A (normative) AIM EXPRESS expanded listing	1212
Annex B (normative) AIM short names of entities	1384
Annex C (normative) Implementation method-specific requirements	1402
Annex D (normative) Protocol Information Conformance Statement (PICS) proforma	1403
Annex E (normative) Information object registration	1405
Annex F (informative) Application activity model	1406
Annex G (informative) Application reference model	1452
Annex H (informative) AIM EXPRESS-G	1500
Annex J (informative) AIM EXPRESS listing	1556
Annex K (informative) Application protocol usage guide	1557
Annex L (informative) Technical discussions	1558
Bibliography	1564
INDEX	1565

Figures

Figure 1 — Data planning model	xii
Figure 2 — Process plant life cycle activity coverage	1
Figure 3 — Base_elbow_support	40
Figure 4 — Base_line_support	41
Figure 5 — Bent_pipe	42
Figure 6 — Blind flange	43
Figure 7 — Boss	45
Figure 8 — Bushing	46
Figure 9 — Cap	49
Figure 10 — Pipe clamp	58
Figure 11 — Socket weld coupling	66
Figure 12 — Sleeve	67
Figure 13 — Butt-weld cross	67
Figure 14 — Cross_section_flat_oval	69
Figure 15 — Cross_section_radiused_corner	70

Figure 16 — Dummy_leg	74
Figure 17 — Eccentric_base_elbow_support	74
Figure 18 — Eccentric_reducer	75
Figure 19 — Elbow.....	76
Figure 20 — Expander_flange.....	80
Figure 21 — Female_end.....	83
Figure 22 — Ferrule.....	84
Figure 23 — Hole_straddle_centrelines_orientation.....	86
Figure 24 — Flanged_end	87
Figure 25 — Raised face flange	88
Figure 26 — Flat face flange	88
Figure 27 — Ring type joint flange	88
Figure 28 — Male and female flange	88
Figure 29 — Tongue and groove flange	89
Figure 30 — Grooved_end	94
Figure 31 — Gusset	95
Figure 32 — Hangers both without_spring and with_spring.....	96
Figure 33 — Hvac_elbow_90deg_reducing	107
Figure 34 — Hvac_elbow_centred	108
Figure 35 — Hvac_elbow_mitre.....	109
Figure 36 — Hvac_offset_ogee_centred	116
Figure 37 — Transition - rectangular to round	124
Figure 38 — Transition - rectangle to round slanted	125
Figure 39 — Insert_fitting	127
Figure 40 — Lap_joint_flange.....	131
Figure 41 — Lap_joint_stub_end	131
Figure 42 — Lateral.....	133
Figure 43 — Lug.....	137
Figure 44 — Mitre_bend_pipe.....	147
Figure 45 — Nipple	148
Figure 46 — Olet	149
Figure 47 — Orifice_flange.....	151
Figure 48 — Orifice_plate	152

ISO 10303-227:2005(E)

Figure 49 — Pad	154
Figure 50 — Paddle_blank	155
Figure 51 — Paddle_spacer	155
Figure 52 — Perforated_cap	156
Figure 53 — Butt-weld Pipe Cap.....	158
Figure 54 — Plate	186
Figure 55 — Plug.....	187
Figure 56 — Reducer.....	190
Figure 57 — Reducing_flange.....	191
Figure 58 — Reinforcing_plate	192
Figure 59 — Reinforcing_ring.....	193
Figure 60 — Ring_spacer	194
Figure 61 — Forward and aft pointing ship's axes	203
Figure 62 — Shoe	205
Figure 63 — Slip_on_flange.....	208
Figure 64 — Slip_on_jacket_flange	209
Figure 65 — Socket	209
Figure 66 — Socket_weld_flange.....	210
Figure 67 — Spectacle_blind.....	212
Figure 68 — Stay	214
Figure 69 — Stopper.....	215
Figure 70 — Stub_in.....	219
Figure 71 — Tee	224
Figure 72 — Threaded	225
Figure 73 — Threaded_flange	226
Figure 74 — Trunnion	228
Figure 75 — Union	229
Figure 76 — Weld_neck_flange	231
Figure 77 — Weld_neck_jacket_flange	232
Figure 78 — Y_type_lateral	233
Figure F.1 — IDEF0 basic notation.....	1425
Figure F.2 — A-0: Process plants.....	1426
Figure F.3 — A0: Perform process plant life-cycle activities	1427

Figure F.4 — A1: Manage and plan project	1428
Figure F.5 — A2: Design and engineer plant	1429
Figure F.6 — A21: Produce conceptual process design	1430
Figure F.7 — A22: Produce conceptual plant design	1431
Figure F.8 — A23: Produce final process design	1432
Figure F.9 — A24: Produce final plant design	1433
Figure F.10 — A242: Finalize layout and spatial design.....	1434
Figure F.11 — A2426: Finalize piping.....	1435
Figure F.12 — A24262: Finalize 3D piping details.....	1436
Figure F.13 — A3: Procure goods and services	1437
Figure F.14 — A4: Construct and commission plant	1438
Figure F.15 — A42: Obtain construction services.....	1439
Figure F.16 — A423: Obtain piping systems	1440
Figure F.17 — A4233: Shop fabricate piping.....	1441
Figure F.18 — A42331: Prepare shop fabrication piping.....	1442
Figure F.19 — A42332: Shop fabricate piping.....	1443
Figure F.20 — A42333: Inspect shop fabricated piping.....	1444
Figure F.21 — A42334: Complete and ship shop fabricated piping	1445
Figure F.22 — A5: Manage, operate, and maintain plant.....	1446
Figure F.23 — A6: Decommission and dispose of plant	1447
Figure G.1 — Off-page connectors.....	1452
Figure G.2 — ARM diagram 1 of 47	1453
Figure G.3 — ARM diagram 2 of 47	1454
Figure G.4 — ARM diagram 3 of 47	1455
Figure G.5 — ARM diagram 4 of 47	1456
Figure G.6 — ARM diagram 5 of 47	1457
Figure G.7 — ARM diagram 6 of 47	1458
Figure G.8 — ARM diagram 7 of 47	1459
Figure G.9 — ARM diagram 8 of 47	1460
Figure G.10 — ARM diagram 9 of 47	1461
Figure G.11 — ARM diagram 10 of 47	1462
Figure G.12 — ARM diagram 11 of 47	1463
Figure G.13 — ARM diagram 12 of 47	1464

ISO 10303-227:2005(E)

Figure G.14 — ARM diagram 13 of 47	1465
Figure G.15 — ARM diagram 14 of 47	1466
Figure G.16 — ARM diagram 15 of 47	1467
Figure G.17 — ARM diagram 16 of 47	1468
Figure G.18 — ARM diagram 17 of 47	1469
Figure G.19 — ARM diagram 18 of 47	1470
Figure G.20 — ARM diagram 19 of 47	1471
Figure G.21 — ARM diagram 20 of 47	1472
Figure G.22 — ARM diagram 21 of 47	1473
Figure G.23 — ARM diagram 22 of 47	1474
Figure G.24 — ARM diagram 23 of 47	1475
Figure G.25 — ARM diagram 24 of 47	1476
Figure G.26 — ARM diagram 25 of 47	1477
Figure G.27 — ARM diagram 26 of 47	1478
Figure G.28 — ARM diagram 27 of 47	1479
Figure G.29 — ARM diagram 28 of 47	1480
Figure G.30 — ARM diagram 29 of 47	1481
Figure G.31 — ARM diagram 30 of 47	1482
Figure G.32 — ARM diagram 31 of 47	1483
Figure G.33 — ARM diagram 32 of 47	1484
Figure G.34 — ARM diagram 33 of 47	1485
Figure G.35 — ARM diagram 34 of 47	1486
Figure G.36 — ARM diagram 35 of 47	1487
Figure G.37 — ARM diagram 36 of 47	1488
Figure G.38 — ARM diagram 37 of 47	1489
Figure G.39 — ARM diagram 38 of 47	1490
Figure G.40 — ARM diagram 39 of 47	1491
Figure G.41 — ARM diagram 40 of 47	1492
Figure G.42 — ARM diagram 41 of 47	1493
Figure G.43 — ARM diagram 42 of 47	1494
Figure G.44 — ARM diagram 43 of 47	1495
Figure G.45 — ARM diagram 44 of 47	1496
Figure G.46 — ARM diagram 45 of 47	1497

Figure G.47 — ARM diagram 46 of 47	1498
Figure G.48 — ARM diagram 47 of 47	1499
Figure H.1 — AIM EXPRESS-G diagram 1 of 55	1501
Figure H.2 — AIM EXPRESS-G diagram 2 of 55	1502
Figure H.3 — AIM EXPRESS-G diagram 3 of 55	1503
Figure H.4 — AIM EXPRESS-G diagram 4 of 55	1504
Figure H.5 — AIM EXPRESS-G diagram 5 of 55	1505
Figure H.6 — AIM EXPRESS-G diagram 6 of 55	1506
Figure H.7 — AIM EXPRESS-G diagram 7 of 55	1507
Figure H.8 — AIM EXPRESS-G diagram 8 of 55	1508
Figure H.9 — AIM EXPRESS-G diagram 9 of 55	1509
Figure H.10 — AIM EXPRESS-G diagram 10 of 55	1510
Figure H.11 — AIM EXPRESS-G diagram 11 of 55	1511
Figure H.12 — AIM EXPRESS-G diagram 12 of 55	1512
Figure H.13 — AIM EXPRESS-G diagram 13 of 55	1513
Figure H.14 — AIM EXPRESS-G diagram 14 of 55	1514
Figure H.15 — AIM EXPRESS-G diagram 15 of 55	1515
Figure H.16 — AIM EXPRESS-G diagram 16 of 55	1516
Figure H.17 — AIM EXPRESS-G diagram 17 of 55	1517
Figure H.18 — AIM EXPRESS-G diagram 18 of 55	1518
Figure H.19 — AIM EXPRESS-G diagram 19 of 55	1519
Figure H.20 — AIM EXPRESS-G diagram 20 of 55	1520
Figure H.21 — AIM EXPRESS-G diagram 21 of 55	1521
Figure H.22 — AIM EXPRESS-G diagram 22 of 55	1522
Figure H.23 — AIM EXPRESS-G diagram 23 of 55	1523
Figure H.24 — AIM EXPRESS-G diagram 24 of 55	1524
Figure H.25 — AIM EXPRESS-G diagram 25 of 55	1525
Figure H.26 — AIM EXPRESS-G diagram 26 of 55	1526
Figure H.27 — AIM EXPRESS-G diagram 27 of 55	1527
Figure H.28 — AIM EXPRESS-G diagram 28 of 55	1528
Figure H.29 — AIM EXPRESS-G diagram 29 of 55	1529
Figure H.30 — AIM EXPRESS-G diagram 30 of 55	1530
Figure H.31 — AIM EXPRESS-G diagram 31 of 55	1531

ISO 10303-227:2005(E)

Figure H.32 — AIM EXPRESS-G diagram 32 of 55.....	1532
Figure H.33 — AIM EXPRESS-G diagram 33 of 55.....	1533
Figure H.34 — AIM EXPRESS-G diagram 34 of 55.....	1534
Figure H.35 — AIM EXPRESS-G diagram 35 of 55.....	1535
Figure H.36 — AIM EXPRESS-G diagram 36 of 55.....	1536
Figure H.37 — AIM EXPRESS-G diagram 37 of 55.....	1537
Figure H.38 — AIM EXPRESS-G diagram 38 of 55.....	1538
Figure H.39 — AIM EXPRESS-G diagram 39 of 55.....	1539
Figure H.40 — AIM EXPRESS-G diagram 40 of 55.....	1540
Figure H.41 — AIM EXPRESS-G diagram 41 of 55.....	1541
Figure H.42 — AIM EXPRESS-G diagram 42 of 55.....	1542
Figure H.43 — AIM EXPRESS-G diagram 43 of 55.....	1543
Figure H.44 — AIM EXPRESS-G diagram 44 of 55.....	1544
Figure H.45 — AIM EXPRESS-G diagram 45 of 55.....	1545
Figure H.46 — AIM EXPRESS-G diagram 46 of 55.....	1546
Figure H.47 — AIM EXPRESS-G diagram 47 of 55.....	1547
Figure H.48 — AIM EXPRESS-G diagram 48 of 55.....	1548
Figure H.49 — AIM EXPRESS-G diagram 49 of 55.....	1549
Figure H.50 — AIM EXPRESS-G diagram 50 of 55.....	1550
Figure H.51 — AIM EXPRESS-G diagram 51 of 55.....	1551
Figure H.52 — AIM EXPRESS-G diagram 52 of 55.....	1552
Figure H.53 — AIM EXPRESS-G diagram 53 of 55.....	1553
Figure H.54 — AIM EXPRESS-G diagram 54 of 55.....	1554
Figure H.55 — AIM EXPRESS-G diagram 55 of 55.....	1555
Figure L.1 — Relationship between logical connectivity and physical connectivity.....	1563

Tables

Table 1 — Plant_item_shape interference clash detection	183
Table 2 — Conformance classes.....	1195
Table 3 — Conformance class (1 –11) elements	1197
Table B. 1 — Short names of entities	1384
Table F.1 — AAM ICOM to ARM UoF/entity mapping	1449

Foreword

ISO (the 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 2.

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 part of ISO 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 second edition of ISO 10303-227 cancels and replaces the first edition (ISO 10303-227:2001), of which it constitutes a technical revision.

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.

Each part of this International Standard is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the application protocols series.

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

http://www.tc184-sc4.org/titles/STEP_titles.htm

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

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the 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.

Overview of this document

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 industrial facilities, for example, process plants, ships and their supporting systems. This information includes the shape, spatial arrangement and connection characteristics of piping, HVAC (heating, ventilation and air-conditioning), mechanical, and cableway system components as well as the shape and spatial arrangement characteristics of other related plant systems (for example, instrumentation and controls, and structural systems). Users of this standard should understand the basic principles and concepts of plant design, and piping, HVAC, cableway, and mechanical system design.

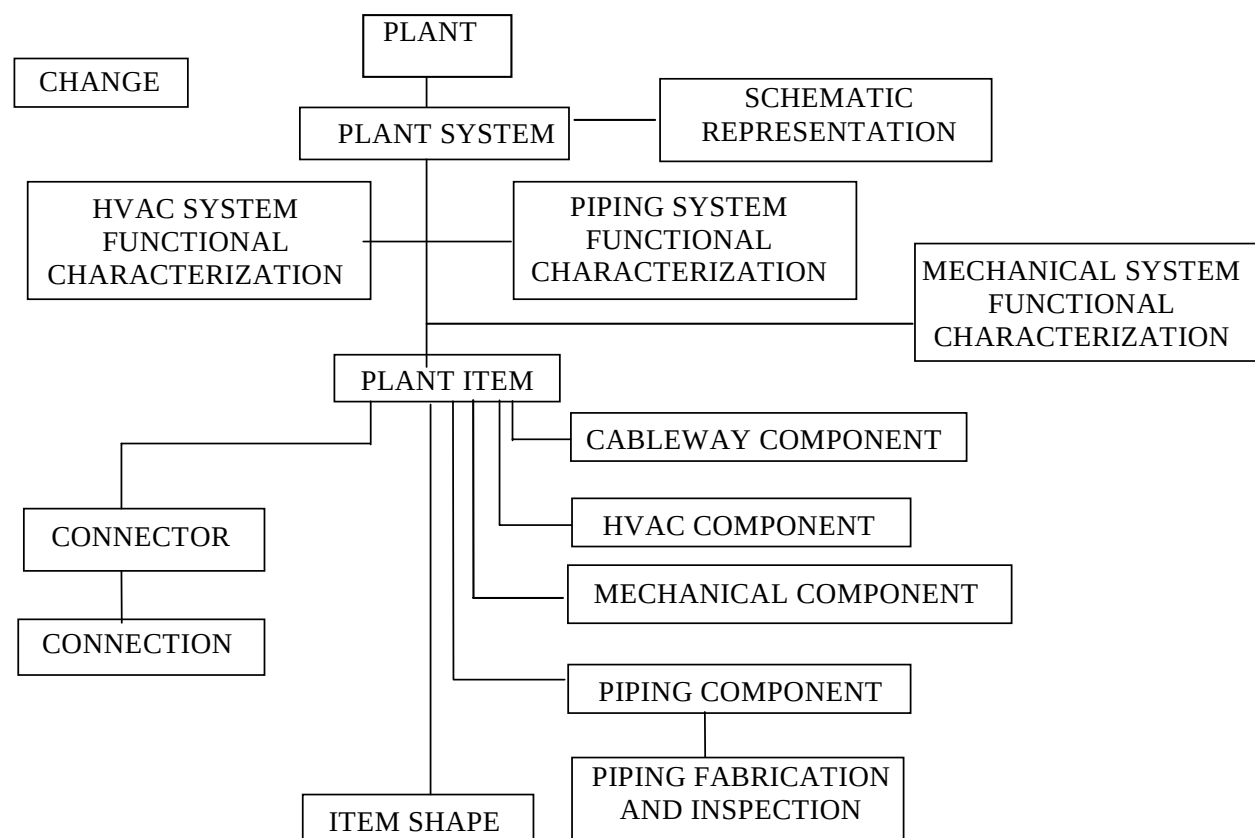


Figure 1 — Data planning model

This AP specifies requirements for the exchange of information required for the design, analysis, fabrication and installation of piping components and piping systems and information on the inspection of

fabricated piping. This AP specifies requirements for the exchange of information required for the design, analysis and installation of HVAC components and HVAC systems. This AP specifies requirements for the exchange of information required for the design, analysis and installation of mechanical components and mechanical systems. This AP specifies requirements for the exchange of information required for the design and installation of cableway components and cableway systems. This AP also specifies requirements for the exchange of functional characteristics for HVAC, mechanical, and piping components and systems. This AP also specifies requirements for the exchange of schematic representations of this data. A Piping and Instrumentation Diagram (P&ID) is a type of drawing that could be developed from the Associated Schematic representation.

The design information for a piping system may specify a pump capable of maintaining a pressure and flow rate. The design may also specify the shape limitations or requirements and the location of the pump in the system, but the design will not include sufficient information for the fabrication of the pump.

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 concepts. The data planning model illustrates that a plant consists of plant systems, plant systems consist of plant items and plant items may be connected to one another using connectors on the plant item. 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 (Brep) 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.

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 process plant, plant systems, ship systems, system components and equipment between different agents over the life cycle of the facility and specifies the integrated resources necessary to satisfy these requirements. The reasons for exchanging this information include:

- exchange of requirements from an owner to an engineering firm;
- exchange of cableway, HVAC, mechanical, piping and equipment designs between a design engineer and a system engineer;
- exchange of cableway, HVAC, mechanical, piping and equipment designs between a design engineer and a fabricator;
- exchange of changes to cableway, HVAC, mechanical, piping and equipment designs between a design engineer and a system engineer or a fabricator;
- exchange of piping fabrication information, fabricated piping inspection results and installation information between engineering, fabrication and construction firms;
- integration of designs created by different engineers;

ISO 10303-227:2005(E)

- detection of physical interferences of systems and components with components of other systems;
- exchange of cableway, HVAC, mechanical, and piping installation information between engineering and construction firms and with owner organizations;
- exchange of as-built facility and system configurations among owners, engineering firms and construction firms.

Application protocols provide the basis for developing implementations of ISO 10303 and an AP227 Edition 2 Usage Guide [16] has been developed to aid in 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.

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.

Changes from the previous edition

This edition incorporates modifications that are upwardly compatible with the previous edition. Modifications to EXPRESS specification are upwardly compatible if:

- instances encoded according to ISO 10303-21, and that conform to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;
- interfaces that conform to ISO 10303-22 and to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;
- the mapping table of ISO 10303 application protocols based on the previous edition of this part remain valid in a revision of that application protocol based on this edition.

This edition provides an extension of ISO 10303-227:2001 to include the representation and exchange of piping configurations and properties specific to support prefabrication and inspection of piping assembled in a shop and the installation of the prefabricated piping. It extends the AP 227 support for information about HVAC (heating, ventilation, and air-conditioning) components and systems, mechanical components and systems, cableway spatial information, analysis data, and adds refinements to make AP 227 more useful to the general building and shipbuilding industries. It also extends AP227 to support the information required for a schematic representation of the distributed system.

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 industrial facilities, for example, process plants, ships and their supporting systems. The spatial configuration information focuses on the shape and spatial arrangement of the components of the systems. The spatial configuration information principally supports the engineering, fabrication and installation life-cycle phases, but may be useful in the downstream life-cycle phases of operations and maintenance. This part accommodates the disciplines of plant design, system design, fabrication, inspection, installation and construction.

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 life-cycle phases for which AP 227 is useful are enclosed in the rounded rectangles labeled “AP 227 ed2”.

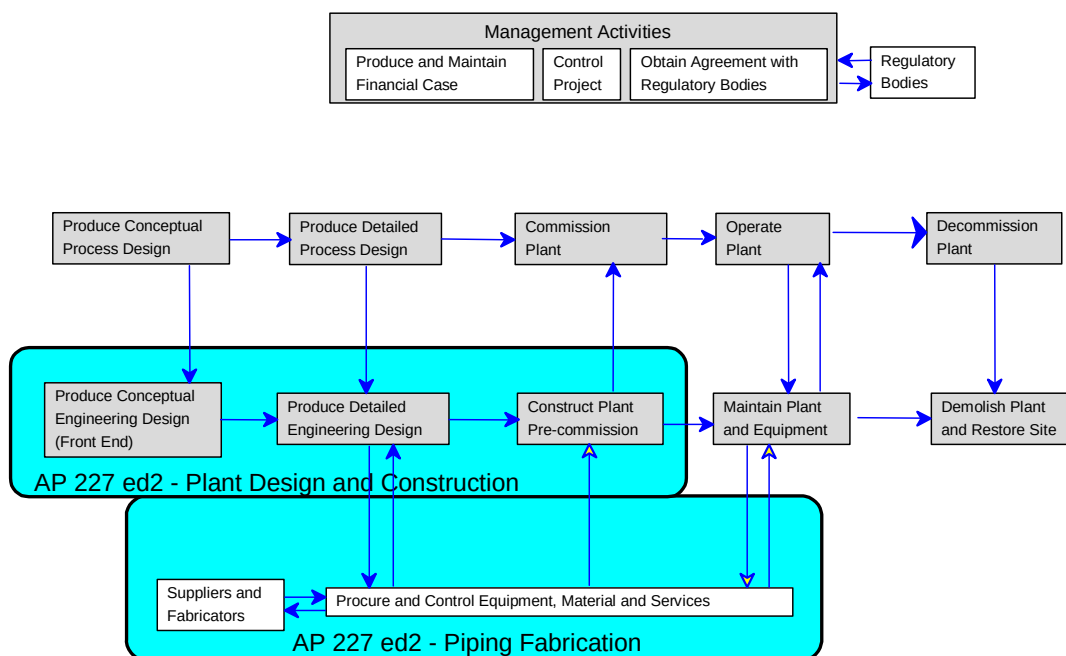


Figure 2 — Process plant life cycle activity coverage

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

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

ISO 10303-227:2005(E)

- explicit representation of the 3D shape of systems and components;
- explicit representation of the 3D external shape of 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 HVAC, mechanical, and piping systems and the relationship of the functional configurations to the physical system design;
- information required for the design, analysis, fabrication and installation of piping components and piping systems;
- information required for the design, analysis, fabrication and installation of mechanical components and mechanical systems;
- information on the inspection of fabricated piping;

NOTE 3 The functional configuration entails connectivity, sequencing, component size, and schedule, 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 systems;
- references to functional requirements of plant systems, such as stream data and operational characteristics;
- references to or designation of functional characteristics of components and connected equipment as required for system design;
- the identification, shape, location, and orientation of reserved areas, volumes, and space-occupying elements of a plant;
- references to specifications, standards, guidelines, or regulations for the systems, components, or connected equipment that may specify physical characteristics or performance 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 component;
- the identification of catalogues that contain component definitions;
- status of components and connected equipment and of their spatial arrangement;

NOTE 4 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 fabrication" 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 cableway, HVAC, mechanical, and piping components and equipment;
- definition of components in sufficient detail to support the acquisition of the components;
- change request approval, notification, and verification, tracking of differences between versions of system information, and tracking of changes to plant items and attributes of plant items;

NOTE 5 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 piping and HVAC systems in sufficient detail to evaluate the suitability of components for the desired process;
- data exchange;
- external reference to classification systems;
- external reference to standard parts;
- external reference to representations of standard parts;
- information necessary to exchange schematic representation of the distributed systems.

EXAMPLE 3 Schematic representations include P&IDs and process flow diagrams (PFDs).

NOTE 6 Only the information to generate Associated Schematics described in this part of ISO 10303 is in scope. The actual P&ID drawing itself is not in the scope.

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

- the contents of specifications, standards, guidelines, or regulations;
- preparation of piping specifications;
- logistics and materials management;
- specification of the chemical composition of the streams carried by the piping system in sufficient detail for process flow design;
- process design and conceptual engineering;

EXAMPLE 4 Process design includes activities such as process material and heat balances, process flow diagram development, and determination of equipment sizes.

- testing, commissioning, hand over, maintenance, and disposal of a plant;
- plant operating procedures;
- commercial aspects of procurement and contracting;

EXAMPLE 5 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

ISO 10303-28, *Industrial automation systems and integration — Product data representation and exchange — Part 28: Implementation methods: XML representations of EXPRESS schemas and data*

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

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

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

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

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

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

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

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

ISO 10303-101, *Industrial automation systems and integration — Product data representation and exchange — Part 101: Integrated application resources: Draughting*

ISO 10303-511, *Industrial automation systems and integration — Product data representation and exchange — Part 511: Application interpreted construct: Topologically bounded surface*

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

ISO 13584-42, *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;
- 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 3.3.38) has properties that can be measured or observed

NOTE 1 The terms actual, planned (see 3.3.38), and required (see 3.3.48) 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 (see 3.3.38). An actual item can be the realization of an planned item.

3.3.2 arrangement

a logical component of a system. An arrangement is composed of a collection of interconnected segments which together form a (logical) part of a system.

NOTE 1 Within the scope of this part of ISO 10303, an arrangement may refer to the layout of either the functional or physical design of a mechanical system.

NOTE 2 An arrangement is analogous to that of a line (see 3.3.23) within a piping system (see 3.3.37).

3.3.3 arrangement less

an arrangement consisting of no segments. It is an arrangement without any logical segmentation of its components.

NOTE An arrangement less system is analogous to that of a line less one used to represent a piping system (see 3.3.37).

3.3.4 arrangement segment

an element of an arrangement (see 3.3.2).

NOTE An arrangement segment is analogous to that of a line segment (see 3.3.24) within a piping system (see 3.3.37).

3.3.5 arrangement segment termination

one of two logical end points of an arrangement segment (see 3.3.4).

NOTE An arrangement segment termination is analogous to that of a line segment termination (see 3.3.25) within a piping system (see 3.3.37).

3.3.6 arrangement segment termination connection

a logical linkage between two arrangement segments (see 3.3.4) or between an arrangement segment and a plant item (see 3.3.39).

NOTE An arrangement segment termination connection is analogous to that of a line segment termination connection (see 3.3.26) within a piping system (see 3.3.37).

3.3.7 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 3.3.39)

3.3.8 basic engineering data

parameters and descriptions that specify design (see 3.3.16) characteristics and boundaries for the plant item (see 3.3.39) that are required to support piping system (see 3.3.37) design

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

3.3.9 branch

a portion of a piping system (see 3.3.37) that diverges or divides from the main flow path

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

3.3.10 catalogue

a collection (see 3.3.11) 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 3.3.39), that the definition of a specific occurrence of a plant item in the design (see 3.3.16) of a process plant (see 3.3.44) can be selected from.

3.3.11 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 3.3.39).

3.3.12 component

an item that may be part of another item

ISO 10303-227:2005(E)

NOTE 1 Within the scope of this part of ISO 10303, an item that is a component can be part of a functional (see 3.3.18) or physical (see 3.3.29) plant item (see 3.3.39) or part of a process material (see 3.3.43) that is a mixture.

NOTE 2 A component can itself have components.

3.3.13 connection

an association between two items that enables the flow of process material (see 3.3.43), 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 3.3.18) or physical (see 3.3.29) plant items (see 3.3.39).

NOTE 2 A connection can be the result of a physical (see 3.3.29) joining.

NOTE 3 A functional connection can exist between two plant items (see 3.3.39) without a physical (see 3.3.29) joining of the plant items.

3.3.14 connector

a physical (see 3.3.29) or functional (see 3.3.18) property of a plant item (see 3.3.39) 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 3.3.43), or signals through the connected plant items

3.3.15 construction material

the substance or substances that a physical (see 3.3.29) plant item (see 3.3.39) is made from

3.3.16 design

a representation (see 3.3.47) of a process plant (see 3.3.44), portion of a process plant, or plant item (see 3.3.39), 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 3.3.43). A P&ID is a design that represents the logical functionality of a piping system (see 3.3.37). A three-dimensional geometric model is a design that represents the physical (see 3.3.29) shape and arrangement of the components (see 3.3.12) of a process plant (see 3.3.44) or plant system (see 3.3.40).

3.3.17 equipment

a plant item (see 3.3.39) that carries out an operation and that is treated as a single item for the purpose of design (see 3.3.16), acquisition, or operation

NOTE An equipment has both physical (see 3.3.29) and functional (see 3.3.18) aspects.

3.3.18 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 3.3.39) that provides functional capability in a process plant (see 3.3.44) is typically denoted by a tag number.

3.3.19 functional characteristics

nomenclature, codes, and named values that describe or specify the performance or behaviour of a plant item (see 3.3.39)

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

3.3.20 functional requirements

nomenclature, codes, and named values that describe or specify the performance or behaviour to be met by a plant item (see 3.3.39)

3.3.21 instrument

an individually identifiable plant item (see 3.3.39) or combination of plant items, that is part of a system that monitors or controls a process plant (see 3.3.44)

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

3.3.22 insulation

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

3.3.23 line

a logical component (see 3.3.12) of a piping system (see 3.3.37) that is composed of a collection (see 3.3.11) of line segments (see 3.3.24)

NOTE Further explanation of lines is provided in K.7.

3.3.24 line segment

an element of a line (see 3.3.23)

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

3.3.25 line segment termination

one of two logical end-points of a line segment (see 3.3.24)

NOTE Lines (see 3.3.23) are composed of line segments (see 3.3.24). Line segments are connected through line segment terminations.

3.3.26 line segment termination connection

a logical linkage between two line segments (see 3.3.24) or between a line segment and a plant item (see 3.3.39)

ISO 10303-227:2005(E)

3.3.27 material

a quantity of matter

3.3.28 material stream

a flow of process material (see 3.3.43) past a defined point along a path

3.3.29 mechanical arrangement specification

the design specification of various aspects of a mechanical system (see 3.3.30). It may include component parameters, materials, design notes, fabrication notes and layout drawings. It is also used to refer to a document or electronic file that contains such information.

3.3.30 mechanical system

a type of plant system (see 3.3.40), that is a system of interconnected plant item (see 3.3.39) objects that conveys mechanical power or control for a specific function.

EXAMPLE Functions that require the conveyence of power distribution include (but is not limited to), power trains, propulsion systems, steering gear systems, mechanical separation systems, cranes, winches, and lifts.

3.3.31 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 3.3.39), and can be identified by a serial number.

3.3.32 pipe

a plant item (see 3.3.39) 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 3.3.27)

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

3.3.33 pipe fitting

a plant item (see 3.3.39) that is used, or is intended to be used, to join or terminate pipes (see 3.3.32) or other items in a piping system (see 3.3.37) or equipment (see 3.3.17) connectors (see 3.3.14), or to provide changes of pipe direction or branching within a piping system

3.3.34 piping and instrumentation diagram

a piping and instrumentation diagram schematic representation (see 3.3.47) that consists, as a minimum, of the functional (see 3.3.18) connection (see 3.3.13) and assembly (see 3.3.7) of plant items (see 3.3.39), and the identification of principal plant items

NOTE The piping and instrumentation diagram can also present the functional (see 3.3.18) and physical (see 3.3.29) aspects of plant items (see 3.3.39).

3.3.35 piping class

a functional (see 3.3.18) performance envelope defined by a set or range of common physical (see 3.3.29) properties, and an identification of the pipes (see 3.3.32), pipe fittings (see 3.3.33), 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.

3.3.36 piping specification

a definition of various aspects of a piping system (see 3.3.37). It is also used to refer to a document or electronic file that contains such a definition

NOTE Piping system (see 3.3.37) aspects that may be included in a piping specification include design (see 3.3.16) pressures and temperatures, piping construction materials (see 3.3.15), 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.

3.3.37 piping system

a plant system (see 3.3.40) that performs a transport function, and that is composed primarily of pipes (see 3.3.32), pipe fittings (see 3.3.33), and valves subject to the same set or sets of design (see 3.3.16) conditions

3.3.38 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 (see 3.3.38), and required (see 3.3.48) 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 3.3.39);
- an association between plant items such as a connection (see 3.3.13);
- 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 (see 3.3.1) and planned. An actual item can be the realization of a planned item.

ISO 10303-227:2005(E)

3.3.39 plant item

a physical (see 3.3.29) object or volume of space that is, or is intended to be, a part of a process plant (see 3.3.44). A plant item can be an assembly (see 3.3.7) of other plant items. A plant item has both physical (see 3.3.29) and functional (see 3.3.18) aspects

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

3.3.40 plant system

a part of a process plant (see 3.3.44) 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 3.3.7) of one or more plant items (see 3.3.39). A plant system has both physical (see 3.3.29) and functional (see 3.3.18) aspects

3.3.41 process activity

an activity that transforms or transports process material (see 3.3.43) between its input to a process plant (see 3.3.44) 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 3.3.29) state, a physical separation or mixing, or a biological or chemical process.

3.3.42 process flow diagram

a schematic representation (see 3.3.47) that consists, as a minimum, of the connection of process activities (see 3.3.41) by material streams (see 3.3.28) and the identification of plant items (see 3.3.39) that perform the process activities

NOTE 1 The process activities (see 3.3.41) 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 (see 3.3.41) and material streams (see 3.3.28) 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.

3.3.43 process material

the material (see 3.3.27) that is transformed or transported by a process activity (see 3.3.41)

3.3.44 process plant

an assembly (see 3.3.7) of one or more plant systems (see 3.3.40) and plant items (see 3.3.39) that can, or is intended to perform, a chemical, physical (see 3.3.29) 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 3.3.18) aspects

3.3.45 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 3.3.39)

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.

3.3.46 range value

an indication of variation of a dimension, parameter, or nominal size on an actual physical (see 3.3.29) plant item (see 3.3.39). A range value is not a toleranced dimension. A range value, like the range of values (see 3.3.45), 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 those attributes that use range of values (see 3.3.45) by an explanatory note that follows the attribute definition.

EXAMPLE Insulation (see 3.3.22) may be described as 6 inches thick, but in reality it may be 5-7 inches thick. Range values permit this to be specified.

3.3.47 representation

a description, drawing, or depiction of something

3.3.48 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 3.3.18) need

NOTE 1 The terms actual (see 3.3.1), planned (see 3.3.38), 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 3.3.39);
- an association between plant items such as a connection (see 3.3.13);
- an activity or an association between a plant item and an activity;
- a possession of a property by a plant item or activity.

3.3.49 site

an area of land or water that one or more process plants (see 3.3.44) is or may be situated on

3.3.50 spatial configuration

the location, orientation, and relative position of the components (see 3.3.12) of a plant system (see 3.3.40)

ISO 10303-227:2005(E)

3.4 Abbreviations

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

3D	three dimensional
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
Brep	boundary representation
BOP	bottom of pipe
CAD	computer-aided design
CC	conformance class
COP	centre of pipe
COM	Center of Machine
CSG	constructive solid geometry
ECN	engineering change notice
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
GIS	geographic information system

GUID	globally unambiguous identifier
HVAC	heating, ventilation, and air conditioning
id	identifier
ICOM	input, control, output, or mechanism
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
IUT	Implementation under Test
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.

ISO 10303-227:2005(E)

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:

- associative_schematics UoF;
- cableway_component_characterization UoF;
- change_information UoF;
- connection UoF;
- connector UoF;
- hvac_component_characterization UoF;
- hvac_system_functional_characterization UoF;
- hybrid_shape_representation UoF;
- mechanical_component_characterization UoF;
- mechanical_system_functional_characterization UoF;
- piping_component_characterization UoF;
- piping_inspection UoF
- piping_system_functional_characterization UoF;
- plant_characterization UoF;
- plant_csg_shape_representation 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 associative_schematics UoF

The associative_schematics UoF describes the physical representation needed to define Piping and Instrumentation Diagrams.

The following application objects are used by the associative_schematics UoF:

- Schematic;
- Schematic_callout;
- Schematic_callout_dependency;
- Schematic_curve;
- Schematic_element;
- Schematic_point;
- Schematic_presentation_component;
- Schematic_presentation_component_composition;
- Schematic_symbol_definition;
- Schematic_symbol_occurrence;
- Schematic_text;
- Title_block.

4.1.2 cableway_component_characterization UoF

The cableway_component_characterization UoF describes the physical representation of cableway systems and elements. This UoF extends the plant_characterization UoF for characterization of cableway systems and extends the plant_item_characterization UoF for representation of cableway components. The geometry of cableway components is specified using the shape UoF.

The following application objects are used by the cableway_component_characterization UoF:

- Cable;
- Cableway_component;
- Cableway_connector;
- Cableway_fitting;
- Cableway_piece;
- Cableway_size_description;
- Conduit;
- Conduit_size_description;
- Raceway;

ISO 10303-227:2005(E)

- Raceway_lane;
- Raceway_size_description.

4.1.3 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_cableway_size_description;
- Changed_component_size_description;
- Changed_document;
- Changed_hvac_access_opening;
- Changed_hvac_branch_connection;
- Changed_hvac_component_thickness;
- Changed_hvac_connector_service_characteristic;
- Changed_hvac_cross_section;
- Changed_hvac_plant_item_branch_connection;
- Changed_hvac_run;
- Changed_hvac_section;
- Changed_hvac_section_insulation;
- Changed_hvac_section_to_section_connection;
- Changed_hvac_specification;

- 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.

ISO 10303-227:2005(E)

4.1.4 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.

4.1.5 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;
- Clamped;
- Connector_definition;
- Electrical_connector;
- Female_end;

- Flanged;
- Flanged_end;
- Flared_end;
- Functional_connector;
- Functional_connector_definition_satisfaction;
- Functional_connector_occurrence_satisfaction;
- Grooved_end;
- Male_end;
- Mechanical_connector;
- Node;
- Physical_connector;
- Piping_connector;
- Piping_connector_service_characteristic;
- Plant_item_connector;
- Plant_item_connector_occurrence;
- Pressure_fit;
- Service_operating_case;
- Socket;
- Structural_load_connector;
- Stub_in;
- Threaded.

4.1.6 hvac_component_characterization UoF

The hvac_component_characterization UoF describes the physical representation of HVAC systems and elements. This UoF extends the plant_item_characterization UoF for representation of Hvac_component objects. The geometry of Hvac_component objects is specified using the shape UoF.

ISO 10303-227:2005(E)

The following application objects are used by the hvac_component_characterization UoF:

- Cross_section_flat_oval;
- Cross_section_non_standard;
- Cross_section_radiused_corner;
- Cross_section_rectangular;
- Cross_section_round;
- Hvac_access_opening;
- Hvac_band_support;
- Hvac_bend;
- Hvac_component;
- Hvac_component_thickness;
- Hvac_connector;
- Hvac_connector_service_characteristic;
- Hvac_coupling;
- Hvac_cross_section;
- Hvac_ducting;
- Hvac_elbow_90deg_reducing;
- Hvac_elbow_centred;
- Hvac_elbow_mitre;
- Hvac_end_fitting;
- Hvac_equipment;
- Hvac_fitting;
- Hvac_flow_control_device;
- Hvac_gasket;
- Hvac_hanger;
- Hvac_instrument;

- Hvac_intermediate_reinforcement;
- Hvac_joint_reinforcement;
- Hvac_offset_centred;
- Hvac_offset_ogee_centred;
- Hvac_plant_item_branch_connector;
- Hvac_plant_item_connector;
- Hvac_plenum;
- Hvac_reinforcement;
- Hvac_single_wire_support;
- Hvac_support;
- Hvac_takeoff;
- Hvac_transition;
- Hvac_transition_slanted;
- Hvac_trapeze_bar;
- Hvac_trapeze_support;
- Splitter.

4.1.7 hvac_system_functional_characterization UoF

The hvac_system_functional_characterization UoF describes the functional representation of HVAC systems and elements. It extends the plant_characterization UoF.

The following application objects are used by the hvac_system_functional_characterization UoF:

- Hvac_branch_connection;
- Hvac_plant_item_branch_connection;
- Hvac_plant_item_connection;
- Hvac_plant_item_termination;
- Hvac_run;
- Hvac_run_termination;

ISO 10303-227:2005(E)

- Hvac_section;
- Hvac_section_branch_termination;
- Hvac_section_component_assignment;
- Hvac_section_insulation;
- Hvac_section_termination;
- Hvac_section_to_section_connection;
- Hvac_section_to_section_termination;
- Hvac_specification.

4.1.8 hybrid_shape_representation UoF

The hybrid_shape UoF specifies the representation of Plant_item shapes using Brep 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.

4.1.9 mechanical_component_characterization UoF

The mechanical_component_characterization UoF describes the basic elements of the mechanical_system within a Plant. This UoF provides a number of generic objects that enables the regulation, control or conveyance of mechanical power.

NOTE 1 The conveyance of mechanical power may be for (but not limited to) purposes such as propulsion, manouvering or lifting.

NOTE 2 This UoF is similar to the piping_component_characterization and to the hvac_component_characterization UoF.

The following application objects are used by the mechanical_component_characterization UoF:

- Component_size_description;
- Mechanical_component;
- Mechanical_family_definition.

4.1.10 mechanical_system_functional_characterization UoF

The mechanical_system_functional_characterization UoF describes the functional connectivity of mechanical systems and elements. It extends the plant_characterization UoF. This UoF provides the information that describes the functional links and properties of a mechanical system arrangement. It includes information about the segments in the arrangement and the specifications for these segments, such as design criteria, load conditions, and arrangement identifier.

NOTE This UoF is similar to the piping_system_functional_characterization and to the hvac_system_functional_characterization UoF.

The following application objects are used by the mechanical_system_functional_characterization UoF:

- Arrangement_branch_connection;
- Arrangement_branch_termination;
- Arrangement_load;
- Arrangement_mechanical_system_component_assignment;
- Arrangement_plant_item_branch_connection;
- Arrangement_plant_item_branch_connector;
- Arrangement_plant_item_connection;
- Arrangement_plant_item_connector;
- Arrangement_plant_item_termination;
- Arrangement_to_arrangement_connection;
- Arrangement_to_arrangement_termination;
- Design_arrangement_performance;
- Mechanical_system_arrangement;
- Mechanical_system_arrangement_segment;

ISO 10303-227:2005(E)

- Mechanical_arrangement_specification;
- Mechanical_system_arrangement_termination;
- Mechanical_system_arrangement_segment_termination.

4.1.11 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:

- Base_elbow_support;
- Base_line_support;
- Bent_pipe;
- Blank;
- Blind_flange;
- Boss;
- Bushing;
- Cap;
- Coupling;
- Cross;
- Dummy_leg;
- Eccentric_base_elbow_support;
- Eccentric_reducer;
- Elbow;
- Expander_flange;
- Family_definition;
- Ferrule;
- Fitting;
- Flange;

- Gasket;
- Gusset;
- Hanger;
- Inline_equipment;
- Inline_instrument;
- Insert_fitting;
- Inside_and_thickness;
- Lap_joint_flange;
- Lap_joint_stub_end;
- Lateral;
- Lined_piping;
- Lug;
- Mitre_bend_pipe;
- Nipple;
- Olet;
- Orifice_flange;
- Orifice_plate;
- Outside_and_thickness;
- Pad;
- Paddle_blank;
- Paddle_spacer;
- Perforated_cap;
- Perforated_plate;
- Pipe;
- Pipe_closure;
- Piping_component;

ISO 10303-227:2005(E)

- Piping_size_description;
- Piping_spool;
- Piping_support;
- Plate;
- Plug;
- Pressure_class;
- Reducer;
- Reducing_flange;
- Reinforcing_component;
- Reinforcing_plate;
- Reinforcing_ring;
- Ring_spacer;
- Schedule;
- Shoe;
- Slip_on_flange;
- Slip_on_jacket_flange;
- Socket_weld_flange;
- Spacer;
- Specialty_item;
- Spectacle_blind;
- Stay;
- Stopper;
- Straight_pipe;
- Swept_bend_pipe;
- Tee;
- Threaded_flange;

- Union;
- Valve;
- Weld_neck_flange;
- Weld_neck_jacket_flange;
- Y_type_lateral.

4.1.12 piping_inspection UoF

The `piping_inspection` UoF describes inspection information and inspection documentation for `Piping_component` objects and `Piping_spool` objects.

The following application objects are used by the `hvac_component_characterization` UoF:

- `Connection_inspection_record`;
- `Inspection_condition`;
- `Piping_component_inspection_record`;
- `Piping_spool_inspection_record`;
- `Shape_inspection_record`.

4.1.13 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`;

ISO 10303-227:2005(E)

- 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.

4.1.14 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

- Arrangement_less_mechanical_system;
- Cableway_system;
- Ducting_system;
- Electrical_system;
- External_classification;
- Functional_plant;
- Functional_plant_satisfaction;
- Hvac_system;
- Instrumentation_and_control_system;
- Line_less_piping_system;

- Location_in_plant;
- Location_in_ship;
- Manufacturing_line;
- Mechanical_system;
- Piping_system;
- Planned_physical_plant;
- Plant;
- Plant_process_capability;
- Plant_system;
- Plant_system_assembly;
- Ship;
- Structural_system;
- Sub_plant_relationship;
- Train;
- Unit.

4.1.15 plant_csg_shape_representation 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;

ISO 10303-227:2005(E)

- 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.

4.1.16 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:

- Analysis_data_point;
- Bolt;

- Bolt_and_nut_component;
- Bolt_and_nut_set;
- Bolt_with_head;
- Cable_support;
- Catalogue_definition;
- Catalogue_item;
- Catalogue_item_substitute;
- Clamp;
- Clamp_set;
- Connected_collection;
- Connection_component;
- Connection_material;
- Design_project;
- Document;
- Ducting_component;
- Electrical_component;
- Equipment;
- Equipment_breaching;
- Equipment_trim_piping;
- External_schema_context;
- Externally_defined_document;
- Externally_defined_user_defined_attribute_value;
- Functional_design_view;
- Functional_plant_item_satisfaction;
- Hierarchically_organized_collection;
- Hull_applicability;

ISO 10303-227:2005(E)

- Installed_physical_design_view;
- Instrument;
- Instrumentation_and_control_component;
- Insulation;
- Material_specification_selection;
- Material_specification_subset_reference;
- Mechanical_system_component;
- Nozzle;
- Nut;
- Offline_instrument;
- Physical_design_view;
- Piping_assembly;
- Piping_assembly_assignment;
- Piping_system_component;
- Plain_washer;
- 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;
- Spring_washer;
- Structural_component;
- Stud_bolt;
- Supplied_equipment;
- Supplier;
- Support_component;
- Support_constraints;
- Support_usage;
- Support_usage_connection;
- System_space;
- Toothed_lock_washer;
- Trunnion;
- User_defined_attribute_value;
- Washer.

4.1.17 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;

ISO 10303-227:2005(E)

- 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.

4.1.18 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;