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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

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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.

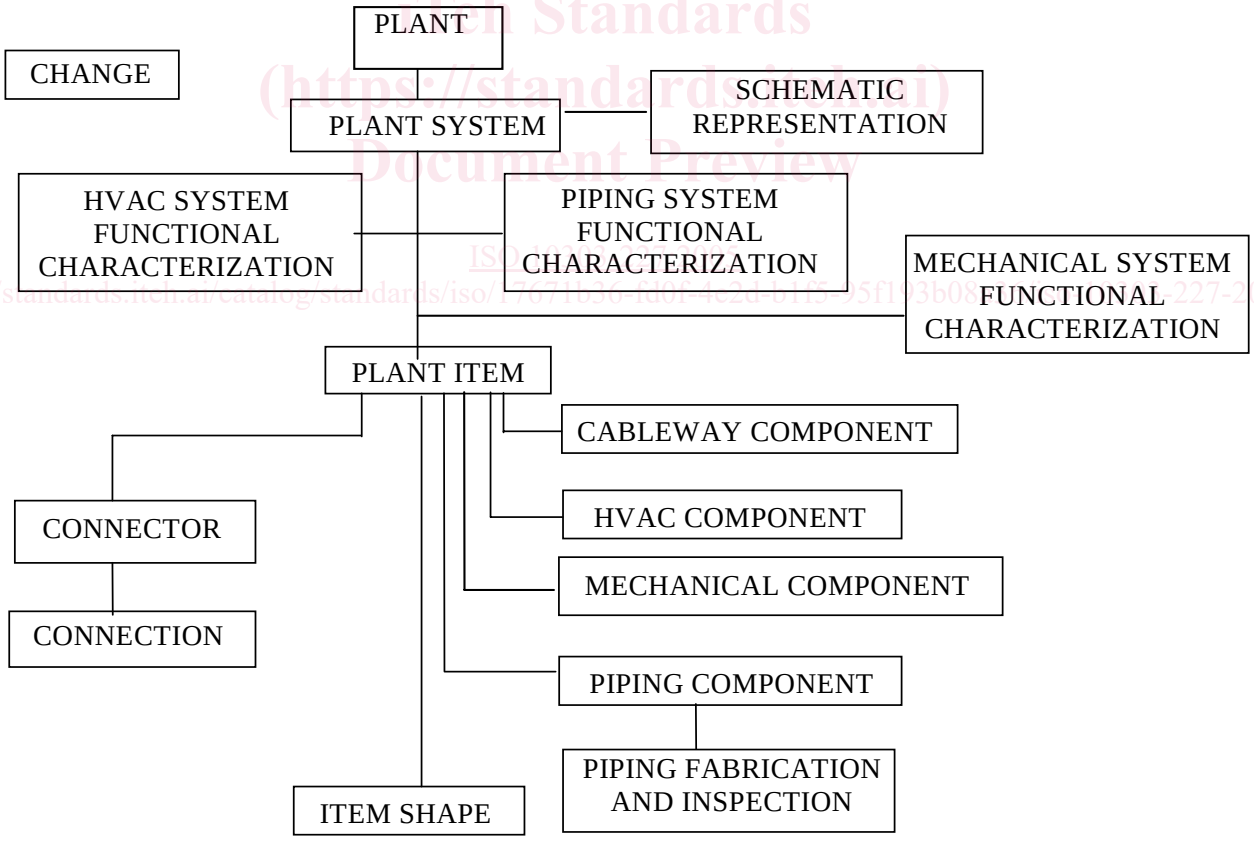

Figure 1 — Data planning model

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;

— 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.

