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

**Part 215:
Application protocol: Ship arrangement**

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

Partie 215: Protocole d'application: Aménagement des navires



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Published in Switzerland

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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 the 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 10303 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

This part of ISO 10303 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*.

ISO 10303 is organized as a series of parts, each published separately. The structure of ISO 10303 is described in ISO 10303-1.

Each part of ISO 10303 is 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/>>

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.

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 product data representing a ship's internal subdivision information between different organizations with a need for that data. Such organizations include ship owners, design agents, fabricators, and classification societies.

This part of ISO 10303 is one of a series of shipping industry application protocols that together aim to provide an integrated computer interpretable product model for ships.

The series of shipping industry application protocols assumes that the ship product model can be divided into separate ship systems that each cover a key element of the ship for its whole life cycle. These key elements are: ship moulded forms, ship arrangement, ship distribution systems, ship structures, ship mechanical systems, ship outfit and furnishings, and ship mission systems. Each separate system is described by one or more different application protocols. The full series of ship application protocols is shown in Figure 1. Those aspects of the ship product model that are common to each shipbuilding application protocol are described consistently and identically in each application protocol. Annex K provides additional information on the shipbuilding application protocols and their elements. It also contains information on data common to the shipbuilding application protocols.

This application protocol has been developed to support the shipbuilding activities and computer applications associated with the functional design, detail design, production engineering, and operations life cycle phases for commercial or military ships. The types of design activities and computer applications supported include the arrangement of spaces within a ship, definition of the intended function of the compartments and zones, detail design of the compartments and zones, geometric representation of compartments and zones, compartment property requirements, compartment property as-designed and as-built values, identification of the outfitting items contained in a compartment, definition of cargoes, association of cargoes to a compartment, definition of design and operating loading conditions, and damage stability analysis. Figure 2 illustrates the major types of data supported by this application protocol. This planning model was created from the in-scope data from the activities of the application activity model (AAM) and grouped into logical units of functionality. This planning model is used as a guide in developing the application reference model (ARM).

This application protocol defines the context, scope, and information requirements for the exchange of ship arrangement definitions, geometric representations of compartments and zones, compartment properties, cargoes, cargo assignments, loading conditions, and damage stability information, and specifies the integrated resources necessary to satisfy these requirements.

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 summarises the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers towards defined elsewhere. An application activity model, that is the basis for the definition of the

scope, is provided by 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.

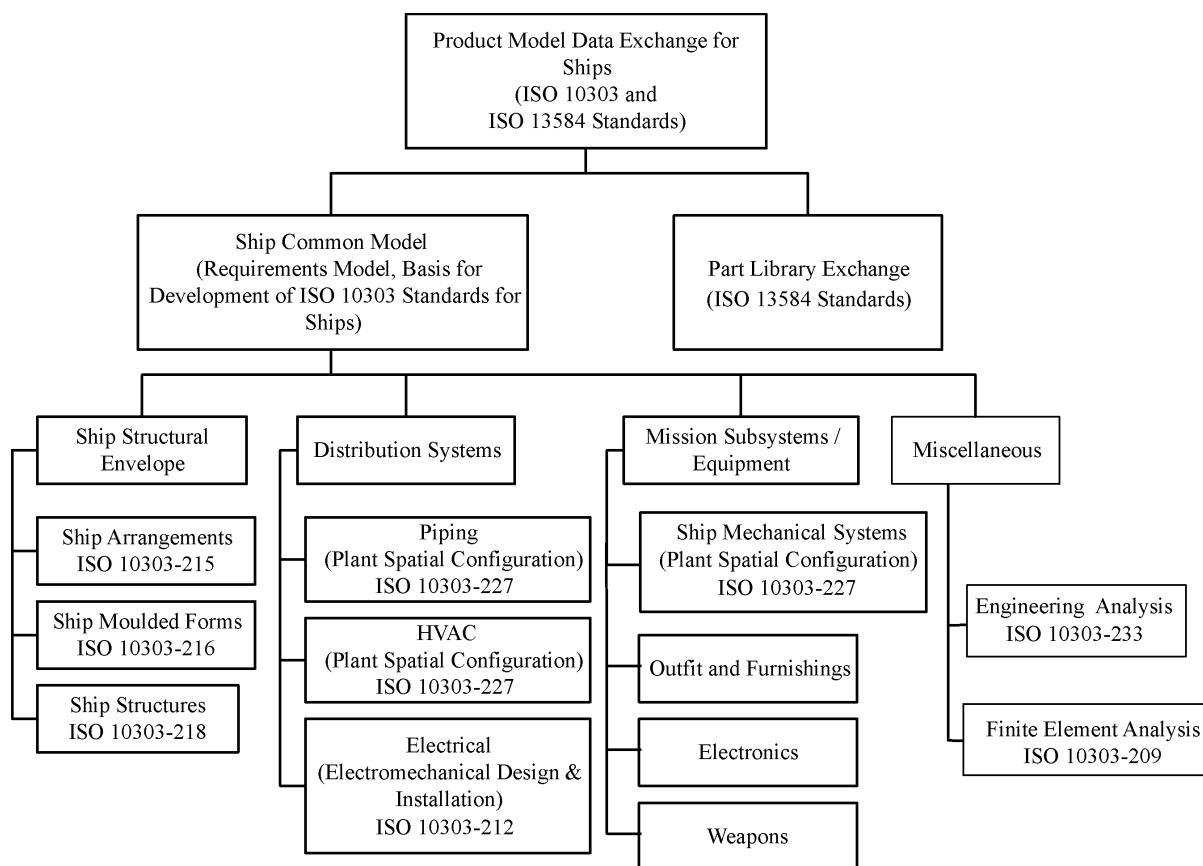


Figure 1 — The full series of ship application protocols

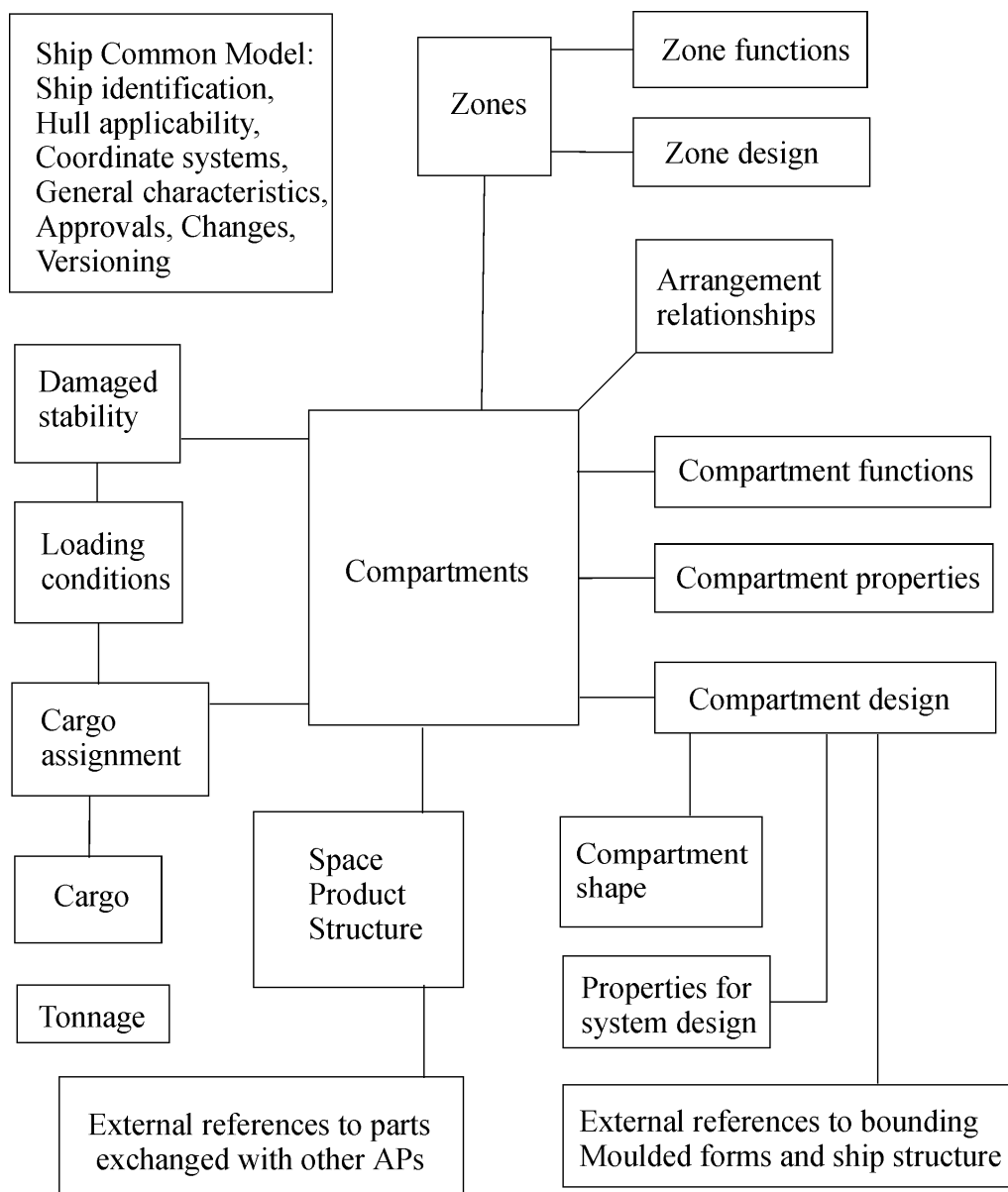


Figure 2 — Data planning model

www.iso.org/ava

Industrial automation systems and integration — Product data representation and exchange — Part 215: Application protocol: Ship arrangement

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 three-dimensional product definition data and its configuration status information for naval and commercial ship arrangements. Configuration in this context pertains to data specific to revision tracking and change history of selected ship spatial entities within the product model. The term exchange is used to narrow the scope to only those data that are transferred between enterprise systems. This is to distinguish it from a data model supporting distributed, multi-user database applications.

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.

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

- data describing the general subdivision of a ship into spatially bounded regions;
- data identifying physical boundaries partitioning the ship into compartments suitable for the stowage of cargo, operation of machinery, and occupancy by crew and passengers;
- data identifying logical boundaries subdividing the ship into zones for the purpose of controlling access, designating design authority, or applying specific design requirements;
- data required for the definition of spatial boundaries based on references to moulded form regions or geometric surfaces;
- configuration management data for identification of versions of compartment designs and for management of changes to the design during the design life cycle phase;
- data identifying the intended functions of compartments and zones;
- data required for recording the volumetric capacities of cargo compartments at various combinations of vessel heel and vessel trim;
- data required for calculation of the magnitude and location of loads acting upon the structural systems of a ship due to the weight of cargoes contained in compartments;
- data required for the determination of adjacency of compartments;
- data identifying spaces related by common functional purpose, position within the ship, or connection by engineering systems;

EXAMPLE Port and starboard wing tank pairs are spaces related by position.

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- data identifying dimensional aspects of spaces;
- data identifying the product structuring of engineering parts and structural parts contained within a space;
- data identifying the product structuring of compartments in an area of the ship;
- data required for the definition of design requirements placed on a space by systems within the ship;
- data required for the identification of cargoes, stores and consumables and allocation of those items to compartments and tanks for design analysis or on specific voyages during the operation of the ship;
- definition of loading conditions for analysis of the floating position of the ship under different cargo loading scenarios;
- data required for the analysis of stability of the ship after damage;
- data applicable to a single ship, or to multiple ships in a hull class.

NOTE 2 Annex K provides additional information pertaining to the industrial use of this part of ISO 10303.

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

- data defining the representation of moulded surfaces of structural or non-structural bulkheads;

NOTE 3 Moulded forms are referenced by external instance references to ISO 10303-216.

- data defining the representation of structural systems and parts;

NOTE 4 Structural systems and parts are referenced by external instance references to ISO 10303-218.

- data defining the location, orientation, or geometry of engineering parts and structural parts within a space.

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 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO/IEC 8824-1, *Information Technology — Open Systems Interconnection — Abstract Syntax Notation One (ASN.1) — Part 1: Specification of Basic notation*

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

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

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

ISO 10303-22, *Industrial automation systems and integration — Product data representation and exchange — Part 22: Implementation methods: Standard data access interface*

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

ISO 10303-216, *Industrial automation systems and integration — Product data representation and exchange — Part 216: Application Protocol: Ship moulded forms*

ISO 10303-218, *Industrial automation systems and integration — Product data representation and exchange — Part 218: Application Protocol: Ship structures*

ISO 10303-508, *Industrial automation systems and integration — Product data representation and exchange — Part 508: Application interpreted construct: Non-manifold surface*

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

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IMO IC110E, *International Convention for the Safety of Life at Sea (SOLAS), Consolidated edition*

IMO ID200E, *International Maritime Dangerous Goods Code (IMDG Code)*

IMO IB520E, *International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), Consolidated edition*

IMO IA701E, *International Convention on Loadlines*

IMO I713E, *International Convention on Tonnage Measurement of Ships*

IMO IA772E, *Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code)*

3 Terms, definitions and abbreviations

3.1 Terms defined in ISO 10303-1

For the purposes of this document, the following terms defined in ISO 10303-1 apply:

- application;
- application activity model (AAM);
- application context;
- application interpreted model (AIM);
- application object;
- application protocol (AP);
- application reference model (ARM);
- computer aided design (CAD);
- computer aided manufacture (CAM);
- conformance class;
- conformance requirement;
- data;
- data exchange;
- implementation method;
- information;
- integrated resource;
- interpretation;
- PICS proforma;

- product;
- product data;
- unit of functionality (UoF).

3.2 Terms defined in ISO 10303-21

For the purposes of this document, the following term defined in ISO 10303-21 applies:

- implementation methods.

3.3 Terms defined in ISO 10303-31

For the purposes of this document, the following terms defined in ISO 10303-31 apply:

- conformance testing;
- postprocessor;
- preprocessor.

3.4 Terms defined in ISO 10303-42

For the purposes of this document, the following terms defined in ISO 10303-42 apply:

- axis2_placement_3d;
- bounded curve;
- non-manifold.

3.5 Terms defined in ISO 10303-216

For the purposes of this document, the following terms defined in ISO 10303-216 apply:

- aft perpendicular;
- after perpendicular;
- amidships;
- baseline;
- breadth;
- bulkhead;
- buttock line;
- centreline;
- centroid;
- classification;
- classification society;

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- configuration management;
- coordinate system;
- deck;
- deck house;
- depth;
- design waterline;
- forward perpendicular;
- frame;
- furnishings;
- general arrangements;
- hullform;
- hydrostatics;
- hydrostatic property;
- length between perpendiculars;
- longitudinal;
- main deck;
- main dimensions;
- midship;
- moulded form;
- outfitting;
- ship structure;
- station;
- summer load waterline;
- superstructure;
- transom;
- transverse;
- vertical;
- waterline;
- weather deck.

3.6 Terms defined in ISO 10303-218

For the purposes of this document, the following terms defined in ISO 10303-218 apply:

- builder;
- builder hull number;
- combat systems;
- deadweight;
- definition geometry;
- design change process;
- design load;
- design phase;
- engineering parts;
- freeboard;
- hull number;
- lightship;
- main machinery;
- maintenance phase;
- plate;
- predesign phase;
- production engineering;
- ship class;
- ship range;
- stiffener;
- tanks;
- weight of steel.

3.7 Other terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.7.1

collective-protective system zone

a region of a ship completely isolated from the outside environment by maintaining a positive air pressure with respect to non-protected regions for the purpose of protecting the crew from breathing toxic or germ infected air

3.7.2

compartment

a subdivision of a ship, equivalent to a room in a building, used for crew or passenger living space, ship operations, stowage of cargo or supplies, or stowage of fuel and other liquids for the operation of the ship

3.7.3

design zone

a subdivision of a ship product model that may or may not correspond to a compartment subdivision that is used for configuration management of the product modeling process during the design phase

3.7.4

fire zone

an abstract boundary defining a region of the ship requiring special consideration with regard to its ability to contain or withstand a fire

3.7.5

ship arrangement

subdivision of a ship into compartments of various function for use in the operation of the ship, habitation by crew and passengers, and for stowage of cargoes

3.7.6

subdivision

the internal partitioning of a ship into volumetric-based zones or compartments for the purposes of improving survivability in the event of damage or to segregate areas of the vessel for different purposes

3.7.7

subsafe zone

an abstract boundary defining a region of a ship with special design or production requirements with regard to criteria for use on a submersible vessel

3.7.8

vessel heel

rotation of a ship about the longitudinal axis

3.7.9

vessel trim

rotation of a ship about the transverse axis

3.7.10

zone

an abstract boundary identifying a region of a ship with unique requirements or characteristics which must be specially treated in the design or manufacturing process

3.8 Abbreviations

AAM	Application Activity Model
AIM	Application Interpreted Model

AP	Application Protocol
ARM	Application Reference Model
CAD	Computer Aided Design
CAM	Computer Aided Manufacture
CoG	Centre of Gravity
CPS	Collective Protection System
GUID	globally unambiguous identifier
HVAC	Heating, Ventilation, and Air Conditioning
IMO	International Maritime Organization
PICS	Protocol Implementation Conformance Statement
SCM	Ship Common Model
SI	Système International
SOLAS	Safety of Life at Sea
UoF	Units of Functionality
WT	Watertight

4 Information requirements

This clause specifies the information required for the exchange of ship compartmentation definitions, geometric representations and related design and operational properties.

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 within the scope of this application protocol in annex F.

NOTE 3 The mapping specification specified in 5.1 shows how the integrated resources and application interpreted constructs are used to meet the information requirements of this application protocol.

4.1 Units of functionality

This subclause specifies the units of functionality for the ship arrangement application protocol. This part of ISO 10303 specifies the following units of functionality:

- arrangement_relationships;
- cargoes;
- coatings;
- compartment_design_definitions;
- compartment_properties;

- compartment_requirements;
- configuration_management;
- damaged_stability;
- definitions;
- external_references;
- hull_class_applicability;
- items;
- loading_conditions;
- location_concepts;
- product_structures;
- ship_general_characteristics;
- ship_measures;
- spaces;
- surface_representations;
- tonnage;
- weights.

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 arrangement_relationships

The arrangement_relationships UoF provides information relating to the relationships between compartments that can be used to automate the generation of a preliminary compartmentation arrangement or identify relationships between compartments after they have been populated in the product model.

The following application objects are used by the arrangement_relationships UoF:

- Adjacent_space_surface_area;
- Space_adjacency_relationship;
- Space_arrangement_relationship;
- Space_connection_relationship;
- Space_enclosing_relationship;
- Space_positional_relationship.

4.1.2 cargoes

The cargoes UoF provides the identification of cargoes that can be carried by the ship, applicable properties of those cargoes, and the assignment of those cargoes to compartments in the ship for the purpose of design or operational analysis.

The following application objects are used by the cargoes UoF:

- Absolute_cargo_position;
- Bay_cell_position;
- Bay_position;
- Bulk_cargo;
- Bulk_cargo_assignment;
- Cargo;
- Cargo_assignment;
- Cargo_footprint;
- Cargo_position;
- Compartment_cargo_assignment;
- Dangerous_goods_code;
- Deck_cargo_assignment;
- Detailed_cargo_material_properties;
- Dry_cargo;
- Gaseous_cargo;
- Gaseous_cargo_assignment;
- General_cargo_material_properties;
- Lane_position;
- Liquid_cargo;
- Liquid_cargo_assignment;
- Person_group;
- Relative_cargo_position;
- Unit_cargo;
- Unit_cargo_assignment;
- Unit_cargo_bounding_box;

— Unit_cargo_group.

4.1.3 coatings

The coatings UoF provides the identification of the type of coating used to prevent corrosion of the ship or to protect the ship in the event of fire.

The following application objects are used by the coatings UoF:

- Coating;
- Coating_certification;
- Corrosion_control_coating;
- Fire_safe_coating;
- Primer_coating.

4.1.4 compartment_design_definitions

The compartment_design_definitions UoF provides the design life cycle stage requirements, as-designed definition, and representations for compartments and zones.

The following application objects are used by the compartment_design_definitions UoF:

- Cargo_bay_definition;
- Compartment_design_definition;
- Deck_zone_design_definition;
- Zone_design_definition.

4.1.5 compartment_properties

The compartment_properties UoF provides the required, as-designed, as-built, and operational properties appropriate to a compartment.

The following application objects are used by the compartment_properties UoF:

- Capacity_properties;
- Cargo_compartment_property;
- Coating_level;
- Compartment_abbreviated_name;
- Compartment_acceleration;
- Compartment_access_authorization;
- Compartment_air_circulation_rate;
- Compartment_area_property;

- Compartment_coating;
- Compartment_horizontal_cross_sectional_area_property;
- Compartment_illumination;
- Compartment_insulation;
- Compartment_naval_administrative_property;
- Compartment_noise_category;
- Compartment_nuclear_classification;
- Compartment_occupancy;
- Compartment_property;
- Compartment_safety_class;
- Compartment_security_classification;
- Compartment_stiffened_surface_area_property;
- Compartment_tightness;
- Compartment_unstiffened_surface_area_property;
- Compartment_vertical_longitudinal_cross_sectional_area_property;
- Compartment_vertical_transverse_cross_sectional_area_property;
- Compartment_volume_permeability_property;
- Compartment_volume_property;
- Compartment_ziplist_number;
- Corrosion_protection;
- General_compartment_property;
- Moments_of_inertia;
- Tank_compartment_property;
- Tank_geometric_parameters;
- Tank_piping_design_properties.

4.1.6 compartment_requirements

The compartment_requirements UoF provides the required parameters for which the ship compartmentation must be designed to meet mission requirements or as specified by the applicable classification society.

The following application objects are used by the compartment_requirements UoF:

- Class_bulk_load_requirement_definition;
- Class_compartment_requirement_definition;
- Class_deck_load_requirement_definition;
- Class_tank_requirement_definition;
- Compartment_design_requirement;
- Vehicle_load_description.

4.1.7 configuration_management

The configuration_management UoF covers the characterization of a definition under these principal aspects: its approval, its controlled changes, and the identity and the relationship of different versions within a version history.

The approval information provide when, who and what has been approved and to what level of approval, as well as how approvals are related to each other. The controlled changes information describes when and who modified what definition. Also it describes the impact of the change in terms of whether or not other definitions are created, modified or deleted.

Versions describe what definition is subject to versioning and how different versions are related to each other to provide a version history.

The following application objects are used by the configuration_management UoF:

- Alternative_version_relationship;
- Approval_event;
- Approval_history;
- Change;
- Change_definition;
- Change_impact;
- Change_plan;
- Change_realization;
- Change_request;
- Check;
- Envisaged_version_creation;
- Event;
- Revision;

- Revision_with_context;
- Version_creation;
- Version_deletion;
- Version_history;
- Version_modification;
- Version_relationship;
- Versionable_object_change_event.

4.1.8 damaged_stability

The damaged_stability UoF provides the constructs for predicting the stability of the ship after it has sustained damage to the hull and an identifiable portion of the compartments.

The following application objects are used by the damaged_stability UoF:

- Damage_case;
- Damage_position;
- Damage_stability_definition;
- Floating_position;
- Stability_definition;
- Stability_properties_for_one_floating_position;
- Stability_property;
- Stability_table.

4.1.9 definitions

The definitions UoF describes the abstract concept for the definition of items, item structures and item relationships. The definitions provide the versioned sets of data for each object for various lifecycle phases.

The following application objects are used by the definitions UoF:

- Definition;
- Design_definition;
- Design_requirement;
- Functional_definition;
- General_characteristics_definition.

4.1.10 external_references

The external_references UoF provides the capability and mechanisms by which references can be made to information in other product model data set or refer to information outside a given data exchange or data sharing context, and defines constructs for the identification and reference of standards and documents defined outside of the scope of ISO 10303.

The following application objects are used by the external_references UoF:

- Document;
- Document_portion;
- Document_reference;
- Document_reference_with_address;
- External_instance_reference;
- External_reference;
- External_storage;
- Universal_resource_locator.

4.1.11 hull_class_applicability

The hull_class_applicability UoF allows an element to be related to all hulls in the ship class, or to a specific hull. In a class design, all elements are related to the ship class. By default, an element is applicable to all hulls in the class. Hull specific changes result in elements that are applicable to specific hulls. These changes may be applied at the item level or may be applied at the definition level.

EXAMPLE 1 Types of hull applicability at the item level would be adding a new system, compartment, or equipment.

EXAMPLE 2 Types of hull applicability at the definition level would be different revisions used to call out hull-specific changes to properties or geometry.

The following application object is used by the hull_class_applicability UoF:

- Hull_applicability.

4.1.12 items

The items UoF defines the abstract concepts that comprise the generic product structure for a ship, including the basic objects, relationships between the objects, and the grouping of objects into structures. This UoF also defines the Ship object and the globally unique persistent identifier that is required for certain objects.

The following application objects are used by the items UoF:

- Definable_object;
- Global_id;

- Item;
- Item_relationship;
- Item_structure;
- Ship;
- Versionable_object.

4.1.13 loading_conditions

The loading_conditions UoF provides design and operational definitions the weight of the ship including assigned cargoes and occupants.

The following application objects are used by the loading_conditions UoF:

- Deadweight;
- Floating_position;
- Loading_condition_definition;
- Loading_condition_design_definition;
- Loading_condition_operating_definition.

4.1.14 location_concepts

The location_concepts UoF specifies the information to locate a ship, or any part of it, in a right handed 3D cartesian axis system. Also, it specifies the information required to subdivide any axis into intervals so that they form the reference basis for points in the axis system.

NOTE A coordinate system is either the one and only global coordinate system of the product description and root in the hierarchy, or a local coordinate system. Any number of local coordinate systems may exist. Spacing positions may be defined for any of the three global coordinate system axes. In case, the underlying coordinate system is the global coordinate system, the local origin maybe defined with reference to spacing positions.

The following application objects are used by the location_concepts UoF:

- Buttock_table;
- Frame_table;
- Global_axis_placement;
- Local_co_ordinate_system;
- Local_co_ordinate_system_with_position_reference;
- Longitudinal_position;
- Longitudinal_table;
- Spacing_position;
- Spacing_position_with_offset;

- Spacing_table;
- Station_table;
- Transversal_position;
- Transversal_table;
- Vertical_position;
- Vertical_table;
- Waterline_table.

4.1.15 product_structures

The product_structures UoF provides the constructs for identifying which structural, mechanical, or distributed system parts are contained within or form the boundary of a compartment or zone.

The following application objects are used by the product_structures UoF:

- Space_product_structure;
- Space_product_structure_revision.

4.1.16 ship_general_characteristics

The ship_general_characteristics UoF specifies the basic information that details the ship dimensions and identification. This information is independent of any geometric context. This information includes values for principal dimensions of a ship, designation information for ship related companies, ship class notations, and all relevant rules and regulations. Also the information about the lightship weight distribution and freeboard characteristics is included in this UoF.

The following application objects are used by the ship_general_characteristics UoF:

- Carrier;
- Class_and_statutory_designation;
- Class_notation;
- Class_parameters;
- Freeboard_characteristics;
- Lightship_definition;
- Lightship_weight_item.
- Loadline;
- Navy_ship;
- Owner_designation;
- Principal_characteristics;

- Regulation;
- Research_ship;
- Ship_designation;
- Shiptype;
- Shipyard_designation;
- Working_ship.

4.1.17 ship_measures

The ship_measures UoF specifies the information for representing measures for physical quantities.

The following application objects are used by the ship_measures UoF:

- Centre_location;
- Derived_unit;
- Named_unit;
- Precision.

NOTE See L.1.1 for additional discussion on the use of measures and units in this part of ISO 10303.

4.1.18 spaces

The spaces UoF provides the identification and functional information about the compartments that constitute the spatial partitioning of the interior volume of the ship. It supports both the physical subdivision of the space into compartments, and the logical subdivision of the space into zones.

The following application objects are used by the spaces UoF:

- Compartment;
- Compartment_functional_definition;
- Deck_zone;
- Deck_zone_functional_definition;
- Space;
- Zone;
- Zone_functional_definition.

4.1.19 surface_representations

The surface_representations UoF specifies the information required to represent a compartment or zone as connected surfaces. The UoF combines topological and geometric information together to describe a surface model as a set of connected surface patches. This UoF describes simple geometry such as planes and straight lines, as well as complex geometry such as B-spline curves and surfaces.

If the curves and surfaces are inter-connected then such information is stated explicitly by the use of topology.

The following application object is used by the surface_representations UoF:

- Non_manifold_surface_shape.

4.1.20 tonnage

The tonnage UoF provides the estimated capacity of the ship using rules established by the international classification societies.

The following application objects are used by the tonnage UoF:

- Compartment_group;
- Compensated_gross_tonnage;
- Gross_tonnage;
- Net_tonnage;
- Tonnage_definition;
- Tonnage_measurement.

4.1.21 weights

The weights UoF provides the constructs for weight and centres of gravity of ship items.

The following application objects are used by the weights UoF:

- Moment_3d;
- Weight_and_centre_of_gravity.

4.2 Application objects

This subclause specifies the application objects for the ship arrangement 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.

NOTE Those attributes inherited from supertype application objects in the Application Reference Model are not repeated in the subtype application object definitions in this subclause. Refer to the appropriate supertype application object definition for the specification of these inherited attributes.

4.2.1 Absolute_cargo_position

An Absolute_cargo_position is a type of Cargo_position (see 4.2.17) that is the position of a Unit_cargo in terms of a position in the global coordinate system of the ship.

The data associated with an Absolute_cargo_position are the following:

- orientation;

- parent_coordinate_system;
- position.

4.2.1.1 orientation

The orientation specifies the orientation of the Unit_cargo. It specifies the angle between the X-axis of the local coordinate system of the Unit_cargo and the X-axis of the global coordinate system of the ship, given that the Z-axes of the two coordinate systems are parallel. The angle is positive if the rotation of the Unit_cargo X-axis is in a counter-clockwise direction with respect to the global X-axis of the ship.

4.2.1.2 parent_coordinate_system

The parent_coordinate_system specifies the parent coordinate system relative to which the unit cargo is placed. See 4.3.1 for the application assertion.

4.2.1.3 position

The position specifies the location of the origin of the local coordinate system of the Unit_cargo within the global coordinate system of the ship.

4.2.2 Adjacent_space_surface_area

An Adjacent_space_surface_area is the area of that portion of the boundary between adjacent spaces that is common to both spaces.

EXAMPLE Two compartments are divided by a longitudinal bulkhead 8 feet high. One compartment is 10 feet wide and the other is 6 feet wide. The adjacent_space_surface_area would be 48 square feet (8 feet x 6 feet).

The data associated with an Adjacent_space_surface_area are the following:

- surface_area.

4.2.2.1 surface_area

The surface_area specifies the area measure of shared boundary between the adjacent spaces.

4.2.3 Alternative_version_relationship

An Alternative_version_relationship is a relationship between two Versionable_object objects (see 4.2.179) of the same type. Each Versionable_object is an alternative to another Versionable_object.

The data associated with an Alternative_version_relationship are the following:

- alternative_1;
- alternative_2;
- reason.

4.2.3.1 alternative_1

The alternative_1 specifies an alternative design for the Versionable_object defined by alternative_2. See 4.3.2 for the application assertion.

4.2.3.2 alternative_2

The alternative_2 specifies an alternative design for the Versionable_object defined by alternative_1. See 4.3.2 for the application assertion.

4.2.3.3 reason

The reason specifies the description of the relationship between the two alternative designs.

4.2.4 Approval_event

An Approval_event is a type of Event (see 4.2.91) that records a change in the status of the organizational review and acceptance or certification of some product data.

The data associated with an Approval_event are the following:

- approval_reference;
- result;
- user_defined_result.

4.2.4.1 approval_reference

The approval_reference specifies the Approval_history effected by the event. Every Approval_event shall refer to exactly one Approval_history. See 4.3.3 for the application assertion.

4.2.4.2 result

The result specifies product data for a version of the design is to be reviewed, or has been reviewed by an authorized member of the organization and has been approved, rejected, or has some other project-specific status.

The value of result is one of the following:

- approved;
- rejected;
- unapproved;
- user_defined.

NOTE See 4.2.4.2.1 - 4.2.4.2.4 for the definition of each allowable value for result.

4.2.4.2.1 approved

The product data has been reviewed by the appropriate organization and is approved for use in the ship.

4.2.4.2.2 rejected

The product data has been reviewed by the appropriate organization and is not approved for use in the ship. Other product data would normally be created to replace the rejected product data.

4.2.4.2.3 unapproved

The product data has not yet been reviewed or is in the process of being reviewed for approval by the organization.

4.2.4.2.4 user_defined

The product data is assigned a project-specific approval status code to be determined by two or more exchanging organizations.

4.2.4.3 user_defined_result

The user_defined_result specifies a user-defined approval status. The user_defined_result need not be specified for a particular Approval_event. The user_defined_result shall be specified if the result has the value of user_defined.

4.2.5 Approval_history

An Approval_history is a collection of all Approval_events of a specific type defined for a portion of product data.

The data associated with an Approval_history are the following:

- approvals;
- status;
- subject.

4.2.5.1 approvals

The approvals specifies the sequence of Approval_events having occurred up to this point in time. The history must consist of at least one Approval_event. The sequence of Approval_events is assumed to be in chronological order.

4.2.5.2 status

The status specifies the current approval status.

The value of status is one of the following:

- approved;
- rejected;
- unapproved;
- user_defined.

NOTE See 4.2.5.2.1 - 4.2.5.2.4 for the definition of each allowable value for status.

4.2.5.2.1 approved

The product data has been reviewed by the appropriate organization and is approved for use in the ship.

4.2.5.2.2 rejected

The product data has been reviewed by the appropriate organization and is not approved for use in the ship. Other product data would normally be created to replace the rejected product data.

4.2.5.2.3 unapproved

The product data has not yet been reviewed or is in the process of being reviewed for approval by the organization.

4.2.5.2.4 user_defined

The product data is assigned a project-specific approval status code to be determined by two or more exchanging organizations.

4.2.5.3 subject

The subject specifies the product data to which this approval is related. See 4.3.4 for the application assertion.

NOTE A Definition may have zero, one, or many associated approvals. In case it has more than one associated approval, all of them shall be different.

4.2.6 Bay_cell_position

A Bay_cell_position is a type of Bay_position (see 4.2.7) that is the position of a Unit_cargo in terms of cargo bays in a ship, a compartment, or on a deck.

The data associated with a Bay_cell_position are the following:

- bay_number;
- row;
- tier.

4.2.6.1 bay_number

The bay_number specifies the transverse position of the bay within the cargo bay definition. See 4.3.6 for the application assertion.

4.2.6.2 row

The row specifies the longitudinal position of the bay within the cargo bay definition. See 4.3.5 for the application assertion.

4.2.6.3 tier

The tier specifies the vertical position of the bay within the cargo bay definition. See 4.3.7 for the application assertion.

4.2.7 Bay_position

A Bay_position is a type of Cargo_position (see 4.2.17) that defines a bay as a vertical section of the ship, in a transverse orientation, that is one container-length wide but encompasses all of the tiers and

rows in that section. Each Bay_position may be one of the following: a Bay_cell_position (see 4.2.6), or a Lane_position (see 4.2.112).

The data associated with a Bay_position are the following:

- relating_to.

4.2.7.1 relating_to

The relating_to specifies the cargo bays in the ship. See 4.3.8 for the application assertion.

4.2.8 Bulk_cargo

A Bulk_cargo is a type of Dry_cargo (see 4.2.89) that is solid cargo that is not packed, but is carried loose.

EXAMPLE Grain and coal are bulk cargo.

The data associated with a Bulk_cargo are the following:

- natural_angle_of_repose;

- type_of.

4.2.8.1 natural_angle_of_repose

The natural_angle_of_repose specifies the angle naturally subtended with the horizontal by the upper surface of the conic pile, made by the Bulk_cargo when loaded into a hold by a chute using gravity alone.

4.2.8.2 type_of

The type_of specifies the type of Bulk_cargo that can be loaded into the ship.

The value of type_of is one of the following:

- cement;

- coal;

- fish;

- general;

- grain;

- mud;

- ore;

- sugar;

- timber;

- unspecified;

- user_defined.

NOTE See 4.2.8.2.1 - 4.2.8.2.11 for the definition of each allowable value for type_of.

4.2.8.2.1 cement

The Bulk_cargo is cement.

4.2.8.2.2 coal

The Bulk_cargo is coal.

4.2.8.2.3 fish

The Bulk_cargo is fish.

4.2.8.2.4 general

The Bulk_cargo is of a general, non-specific type.

4.2.8.2.5 grain

The Bulk_cargo is grain.

4.2.8.2.6 mud

The Bulk_cargo is mud.

4.2.8.2.7 ore

The Bulk_cargo is ore.

4.2.8.2.8 sugar

The Bulk_cargo is sugar.

4.2.8.2.9 timber

The Bulk_cargo is timber.

4.2.8.2.10 unspecified

The Bulk_cargo is of an unspecified type.

4.2.8.2.11 user_defined

The cargo type is defined by the user.

4.2.9 Bulk_cargo_assignment

A Bulk_cargo_assignment is a type of Compartment_cargo_assignment (see 4.2.43) that is an allocation of Bulk_cargo to a compartment for loading analysis during the design phase or to identify an actual cargo loading during the operating phase.

The data associated with a Bulk_cargo_assignment are the following:

- actual_angle_of_repose;
- cargo_height;

— trimmed.

4.2.9.1 actual_angle_of_repose

The `actual_angle_of_repose` specifies the actual angle subtended with the horizontal by the upper surface of the conic pile, made by the `Bulk_cargo` when loaded into a hold.

4.2.9.2 cargo_height

The `cargo_height` specifies the actual height of the `Bulk_cargo` loaded. This should be taken as the highest point of the cargo at the top of the cone.

4.2.9.3 trimmed

The `trimmed` specifies that the natural pile of `Bulk_cargo` has been flattened and spread out to fill the compartment. A value of `TRUE` indicates that the `Bulk_cargo` has been flattened.

4.2.10 Buttock_table

A `Buttock_table` is a type of `Transversal_table` (see 4.2.167) that has positions that reference the location of buttocks that are located on the global Y-axis.

4.2.11 Capacity_properties

A `Capacity_properties` is a measure of volumetric characteristics of a tank or cargo type of compartment computed at some specific combination of level, trim, and heel angle. The level represents the imaginary planar surface at the cargo to non-cargo interface and is relative to a capacity level origin established for the compartment. The attitude of the plane is adjusted to coincide with a vector having a magnitude equal to the level and a direction reflecting the vessel heel and trim. A compartment may have any number of combinations of capacity values, each having a different value for `capacity_context`.

The data associated with a `Capacity_properties` are the following:

- `capacity_centre`;
- `capacity_context`;
- `capacity_heel_angle`;
- `capacity_level`;
- `capacity_level_origin`;
- `capacity_trim_angle`;
- `capacity_volume`;
- `user_defined_capacity_context`.

4.2.11.1 capacity_centre

The `capacity_centre` specifies the position of the volumetric centre of the interior region of space formed by the compartment boundaries and the imaginary plane representing the cargo to non-cargo interface. See 4.3.9 for the application assertion.

4.2.11.2 capacity_context

The capacity_context specifies the values representing the significant capacity states.

The value of capacity_context is one of the following:

- full_95_percent;
- full_98_percent;
- pressed_full;
- slack;
- user_defined.

NOTE See 4.2.11.2.1 - 4.2.11.2.5 for the definition of each allowable value for capacity_context.

4.2.11.2.1 full_95_percent

The capacity properties are defined for a 95 percent full tank or cargo compartment.

4.2.11.2.2 full_98_percent

The capacity properties are defined for a 98 percent full tank or cargo compartment.

4.2.11.2.3 pressed_full

The capacity properties are defined for a full tank or cargo compartment in which no volume is left for expansion and the cargo is hard against the tank top and into the vent pipe.

4.2.11.2.4 slack

The capacity properties are defined for a value other than 95 percent, 98 percent, or pressed_full.

4.2.11.2.5 user_defined

The capacity properties are defined for a tank filled to a level specified in the user_defined_capacity_context attribute.

4.2.11.3 capacity_heel_angle

The capacity_heel_angle specifies the amount of rotation about the longitudinal axis of the ship that has been factored into the capacity calculation for the plane representing the interface between the cargo and non-cargo regions of the compartment.

4.2.11.4 capacity_level

The capacity_level specifies the distance between the bottom of the compartment expressed as the capacity_level_origin and the top of an imaginary plane representing the cargo to non-cargo interface. It is measured along a vector offset from the vertical to reflect the capacity heel angle and the capacity trim angle.

4.2.11.5 capacity_level_origin

The `capacity_level_origin` specifies the point associated with a tank or cargo compartment that represents the vertical reference for measuring the capacity depth levels corresponding to a set of compartment capacities. It may be chosen to represent the bottom of the compartment, the bottom of the sounding tube, or any other convenient location. See 4.3.9 for the application assertion.

4.2.11.6 capacity_trim_angle

The `capacity_trim_angle` specifies the amount of rotation about the transverse axis of the ship that has been factored into the capacity calculation for the plane representing the interface between the cargo and non-cargo regions of the compartment.

4.2.11.7 capacity_volume

The `capacity_volume` specifies the enclosed volumetric measurement of the interior region of space formed by the compartment and the imaginary plane representing the cargo to non-cargo interface.

4.2.11.8 user_defined_capacity_context

The `user_defined_capacity_context` specifies the context for the capacity properties when the value of `capacity_context` equals "user_defined". The `user_defined_capacity_context` need not be specified for a particular `Capacity_properties`.

4.2.12 Cargo

A Cargo is any item of temporary nature loaded onboard a ship for the purpose of being consumed during the voyage, used by the crew or passengers, transferred to another ship while underway, or offloaded at one of the destination ports. Cargo may be secured from shifting during the voyage, but is not permanently affixed to the ship. Each Cargo is either a `Dry_cargo` (see 4.2.89), a `Gaseous_cargo` (see 4.2.100), or a `Liquid_cargo` (see 4.2.115).

The data associated with a Cargo are the following:

- `cargo_hazard`;
- `description`;
- `flash_point`;
- `material_properties`;
- `pollution_code`;
- `references`;
- `required_carriage_temperature`;
- `un_type_code`;
- `user_def_cargo`.

4.2.12.1 cargo_hazard

The `cargo_hazard` specifies the classification of the hazards associated with the cargo. The `cargo_hazard` need not be specified for a particular Cargo. See 4.2.73 for the application assertion.

4.2.12.2 description

The description specifies a free text description of the cargo.

4.2.12.3 flash_point

The flash_point specifies the temperature at which the cargo will spontaneously combust. The flash_point need not be specified for a particular Cargo.

4.2.12.4 material_properties

The material_properties specifies the physical properties of the material which makes up the cargo on the ship. The material_properties need not be specified for a particular Cargo. See 4.3.12 for the application assertion.

4.2.12.5 pollution_code

The pollution_code specifies the degree to which the cargo will cause pollution of the sea if released. This shall be the code as specified in IMO IB520E.

The value of pollution_code is one of the following:

- code_A;
- code_B;
- code_C;
- code_D.

NOTE See 4.2.12.5.1 - 4.2.12.5.4 for the definition of each allowable value for pollution_code.

4.2.12.5.1 code_A

The cargo cannot be released into the sea.

4.2.12.5.2 code_B

The cargo within 0.1 cubic metres per tank can be released into the sea.

4.2.12.5.3 code_C

The cargo within 0.3 cubic metres per tank can be released into the sea.

4.2.12.5.4 code_D

The cargo can be released into the sea so long as it is diluted.

4.2.12.6 references

The references specifies the documents that may be of relevance to the carriage of the cargo. These may be material data sheets, technical specifications, or additional safety information. The references need not be specified for a particular Cargo. There may be more than one references for a Cargo. See 4.3.11 for the application assertion.

4.2.12.7 required_carriage_temperature

The `required_carriage_temperature` specifies the required temperature of the cargo while it is stowed. The `required_carriage_temperature` need not be specified for a particular Cargo.

4.2.12.8 un_type_code

The `un_type_code` specifies the type of the cargo. This shall be the number relating to each product as specified in IMO ID200E, IMO IA772E, and IMO IB520E.

4.2.12.9 user_def_cargo

The `user_def_cargo` specifies the type of cargo if other than one of the pre-defined cargo types. The `user_def_cargo` need not be specified for a particular Cargo.

4.2.13 Cargo_assignment

A `Cargo_assignment` is the allocation of a cargo to a space within a ship. Each `Cargo_assignment` is either a `Compartment_cargo_assignment` (see 4.2.43), a `Deck_cargo_assignment` (see 4.2.75), or a `Unit_cargo_assignment` (see 4.2.169).

The data associated with a `Cargo_assignment` are the following:

- `allocated_weight`;
- `assignment_context`;
- `cargo_identifier`.

4.2.13.1 allocated_weight

The `allocated_weight` specifies the weight and centre of gravity of the cargo with respect to the compartment or deck to which it is assigned. The `allocated_weight` need not be specified for a particular `Cargo_assignment`. See 4.3.13 for the application assertion.

4.2.13.2 assignment_context

The `assignment_context` specifies the context for the loading of cargo on the ship.

The value of `assignment_context` is one of the following:

- `accommodation`;
- `cargo_load`;
- `consumables`;
- `stores`;
- `unspecified`.

NOTE See 4.2.13.2.1 - 4.2.13.2.5 for the definition of each allowable value for `assignment_context`.

4.2.13.2.1 accommodation

The `Cargo_assignment` is the furnishings installed on the ship.

4.2.13.2.2 cargo_load

The Cargo_assignment is an allocation of Cargo for design analysis or for an actual voyage during the operation of the ship.

4.2.13.2.3 consumables

The Cargo_assignment is the allocation of consumables that may be depleted during a voyage.

4.2.13.2.4 stores

The Cargo_assignment is the allocation of stores for possible use by the passengers and crew on the journey.

4.2.13.2.5 unspecified

The Cargo_assignment is of no specific type. This can be used for defining theoretical loads for analytical purposes.

4.2.13.3 cargo_identifier

The cargo_identifier specifies the label used to identify each cargo that is assigned.

4.2.14 Cargo_bay_definition

A Cargo_bay_definition is a type of Definition (see 4.2.80) that represents a grid of positions within a compartment that are used to specify the location of placement of cargo within that compartment.

The data associated with a Cargo_bay_definition are the following:

- cargo_positions;
- defined_for.

4.2.14.1 cargo_positions

The cargo_positions specifies a set of Spacing_tables, which may be either Longitudinal_table, Transversal_table, or Vertical_table. These tables each provide a set of Spacing_positions, constrained in orientation, to locate cargo within spaces. There may be more than one cargo_positions for a Cargo_bay_definition. See 4.3.15 for the application assertion.

4.2.14.2 defined_for

The defined_for specifies the Compartment for which the Cargo_bay_definition is applicable. There may be more than one defined_for for a Cargo_bay_definition. See 4.3.14 for the application assertion.

4.2.15 Cargo_compartment_property

A Cargo_compartment_property is a type of Compartment_property (see 4.2.56) that describes properties for cargo capacities and cargo densities for which the cargo compartment is designed.

The data associated with a Cargo_compartment_property are the following:

- bulk_cargo_capacity;

— design_stowage_density.

4.2.15.1 bulk_cargo_capacity

The bulk_cargo_capacity specifies volumetric characteristic of a cargo compartment. The bulk_cargo_capacity need not be specified for a particular Cargo_compartment_property.

4.2.15.2 design_stowage_density

The design_stowage_density specifies the measure of the quantity per unit volume of the Bulk_cargo for which the cargo compartment is designed.

4.2.16 Cargo_footprint

A Cargo_footprint is the size and position of the area of contact of a cargo with the structure of the ship.

The data associated with a Cargo_footprint are the following:

- contact_material;
- shape;
- transferred_mass.

4.2.16.1 contact_material

The contact_material specifies the type of material that is in contact with the structure of the ship.

The value of contact_material is one of the following:

- metal;
- other;
- pneumatic;
- rubber.

NOTE See 4.2.16.1.1 - 4.2.16.1.4 for the definition of each allowable value for contact_material.

4.2.16.1.1 metal

Metal is in contact with the ship structure.

4.2.16.1.2 other

The material in contact with the ship structure is not specified.

4.2.16.1.3 pneumatic

Air filled material is in contact with the ship structure.

4.2.16.1.4 rubber

Solid rubber is in contact with the ship structure.

4.2.16.2 shape

The shape specifies the definition of the shape of the footprint. The footprint bounding curve is relative to the local coordinate system.

4.2.16.3 transferred_mass

The transferred_mass specifies the mass of the cargo that is transferred to the structure of the ship via the footprint.

4.2.17 Cargo_position

A Cargo_position is the position of a Unit_cargo in terms of either the bays in a compartment or on the deck of a ship or by a ship coordinate. Each Cargo_position may be one of the following: an Absolute_cargo_position (see 4.2.1), a Bay_position (see 4.2.7), or a Relative_cargo_position (see 4.2.137).

4.2.18 Carrier

A Carrier is a type of Shiptype (see 4.2.143) that represents a ship that transports goods or passengers.

The data associated with a Carrier are the following:

— has_type.

4.2.18.1 has_type

The has_type specifies the type of the carrier ship.

The value of has_type is one of the following:

- barge;
- barge_for_deck_loading;
- barge_for_liquefied_gas;
- barge_for_oil;
- barge_pontoon;
- bulk_carrier;
- car_carrier;
- car_ferry;
- cargo_ship_carrying_passengers;
- chemical_tanker;
- chemical_tanker_type_1;
- container_carrier;

- cruise_liner;
- dry_cargo_vessel;
- ferry;
- gas_carrier;
- general_cargo_carrier;
- highspeedcraft_cargo;
- highspeedcraft_passenger;
- hydrofoil;
- liquefied_gas_tanker;
- LNG_carrier;
- LPG_carrier;
- oil_tanker;
- ore_carrier;
- passenger_vessel;
- product_tanker;
- refrigerated_cargo_carrying_ship;
- roro_vessel;
- tanker_for_refrigerated_fruit_juice;
- user_defined.

NOTE See 4.2.18.1.1 - 4.2.18.1.31 for the definition of each allowable value for has_type.

4.2.18.1.1 barge

The ship is a carrier that has no machinery for self-propulsion and is designed for transporting cargo.

4.2.18.1.2 barge_for_deck_loading

The ship is a carrier designed as a service platform for loading decks on ships.

4.2.18.1.3 barge_for_liquefied_gas

The ship is a carrier that has no machinery for self-propulsion and is designed for the carriage of liquefied gas.

4.2.18.1.4 barge_for_oil

The ship is a carrier that has no machinery for self-propulsion and is designed for the carriage of oil .

4.2.18.1.5 barge_pontoon

The ship is a carrier with pontoons coupled to a barge that serves as a floating utility platform.

4.2.18.1.6 bulk_carrier

The ship is a cargo carrier constructed for the transportation of bulk cargo.

4.2.18.1.7 car_carrier

The ship is a carrier used for transportation of cars from the manufacturer to the end-user.

4.2.18.1.8 car_ferry

The ship is a carrier constructed for the transport of automobiles.

4.2.18.1.9 cargo_ship_carrying_passengers

The ship is a cargo carrier constructed for the transport of passengers.

4.2.18.1.10 chemical_tanker

The ship is a cargo carrier specially designed to transport chemicals.

4.2.18.1.11 chemical_tanker_type_1

The ship is a cargo carrier specially designed to transport Type 1 chemicals.

4.2.18.1.12 container_carrier

The ship is a cargo carrier constructed for the transport of containers.

4.2.18.1.13 cruise_liner

The ship is a carrier constructed for the transport of passengers for pleasure.

4.2.18.1.14 dry_cargo_vessel

The ship is a cargo carrier constructed to transport dry, loose cargo.

EXAMPLE Types of dry cargo are grain or coal.

4.2.18.1.15 ferry

The ship is a carrier constructed for the transport of passengers, coaches, lorries, and trains across water.

NOTE The ferry could be designed for only one type of cargo such as passengers.

4.2.18.1.16 gas_carrier

The ship is a cargo carrier specially designed for transportation of gaseous products.

4.2.18.1.17 general_cargo_carrier

The ship is a cargo carrier specially designed for transportation of general cargo.

NOTE The general_cargo_carrier carries any dry cargo which is carried loose such as grain or coal.

4.2.18.1.18 highspeedcraft_cargo

The ship is a carrier designed for carrying cargo at high speeds.

4.2.18.1.19 highspeedcraft_passenger

The ship is a carrier designed for carrying passengers at high speeds.

4.2.18.1.20 hydrofoil

The ship is a carrier designed to achieve speed by raising the hull of the vessel out of the water on hydrofoil surfaces, thus avoiding hull drag and wave resistance.

4.2.18.1.21 liquefied_gas_tanker

The ship is a cargo carrier specially designed for transportation of liquefied gas products.

4.2.18.1.22 LNG_carrier

The ship is a carrier specially designed to transport liquid natural gas.

4.2.18.1.23 LPG_carrier

The ship is a carrier specially designed to transport liquid petroleum gas.

4.2.18.1.24 oil_tanker

The ship is a carrier specially designed for the transportation of oil.

4.2.18.1.25 ore_carrier

The ship is a carrier constructed for the transportation of ore.

4.2.18.1.26 passenger_vessel

The ship is a carrier constructed for the transport of passengers.

4.2.18.1.27 product_tanker

The ship is a cargo carrier specially designed for transportation of oil products.

4.2.18.1.28 refrigerated_cargo_carrying_ship

The ship is a carrier constructed for transporting freight which requires cooling or chilling.

4.2.18.1.29 roro_vessel

The ship is a carrier constructed for the transport of roll-on, roll-off type vehicles.

4.2.18.1.30 tanker_for_refrigerated_fruit_juice

The ship is a tanker carrier specially designed for transportation of fruit juices which require cooling or chilling.

4.2.18.1.31 user_defined

The ship is any carrier type that is other than one of the pre-defined types. Details can be found in the description attribute for Shiptype.

4.2.19 Centre_location

The Centre_location is a location in terms of the three principal axis directions of the ship global coordinate system.

The data associated with a Centre_location are the following:

- longitudinal_location;
- transversal_location;
- vertical_location.

4.2.19.1 longitudinal_location

The longitudinal_location specifies the distance along the X axis from the origin of the global coordinate system of the ship.

4.2.19.2 transversal_location

The transversal_location specifies the distance along the Y axis from the origin of the global coordinate system of the ship.

4.2.19.3 vertical_location

The vertical_location specifies the distance along the Z axis from the origin of the global coordinate system of the ship.

4.2.20 Change

A Change is a type of Item (see 4.2.109) that represents the focus of all stages associated with a potential or actual change to the product model resulting from a customer or design organization change order. The change may or may not result in modifications to the product model data. Any planned or actual changes to the product model are documented in the associated Change_definitions.

The data associated with a Change are the following:

- the_class.

4.2.20.1 the_class

The the_class specifies the qualification of the organizational role of the change.

EXAMPLE Headquater Modification Request or Engineering Change Proposal.

4.2.21 Change_definition

A Change_definition is a type of Definition (see 4.2.80) that is the generalization of the major discrete stages of a Change. Each Change_definition is either a Change_request (see 4.2.25), a Change_plan (see 4.2.23), or a Change_realization (see 4.2.24).

The data associated with a `Change_definition` are the following:

- `author`;
- `date_time`;
- `defined_for`;
- `local_units`.

4.2.21.1 `author`

The `author` specifies the person or organization responsible for the `Change` activities during the period lasting from the end of the previous, if it exists, up to the end of this `Change_definition`.

4.2.21.2 `date_time`

The `date_time` specifies the date and time when the state of the `Change_definition` was reached.

4.2.21.3 `defined_for`

The `defined_for` specifies the `Change` to which the `Change_definition` is applicable. There may be more than one `defined_for` for a `Change_definition`. See 4.3.17 for the application assertion.

4.2.21.4 `local_units`

The `local_units` specifies the units that the Definition makes use of if they differ from the units globally defined for the ship.

NOTE For `Change_definition`, the `local_units` attribute inherited from Definition (see 4.2.80.3) has been redeclared in the ARM to be a set of zero, which is interpreted to mean that the attribute shall not be populated in the AIM.

4.2.22 `Change_impact`

A `Change_impact` defines the effect a `Change` will cause or has caused.

The data associated with a `Change_impact` are the following:

- `impact`.

4.2.22.1 `impact`

The `impact` specifies the effect of a `Change` in terms of the creation, modification or deletion of some Definitions, `Item_structures`, or `Item_relationships`. There may be more than one `impact` for a `Change_impact`. See 4.3.18 for the application assertion.

4.2.23 `Change_plan`

A `Change_plan` is a type of `Change_definition` (see 4.2.21) that defines the proposed solution for a `Change`. It is the basis for the activities, the `Versionable_object_change_events`, necessary to implement the `Change` in the product model.

The data associated with a `Change_plan` are the following:

- `checks`;

- chosen_solution_for;
- planned_impact.

4.2.23.1 checks

The checks specifies the verifications planned for the Change. The checks need not be specified for a particular Change_plan. There may be more than one checks for a Change_plan. See 4.3.21 for the application assertion.

4.2.23.2 chosen_solution_for

The chosen_solution_for specifies identification of the Change_request for which a Change_plan is applicable. See 4.3.20 for the application assertion.

4.2.23.3 planned_impact

The planned_impact specifies the estimated or calculated effects of the Change. This impact is usually chosen from the set of solution alternatives of a Change_request. See 4.3.19 for the application assertion.

4.2.24 Change_realization

A Change_realization is a type of Change_definition (see 4.2.21) that defines the actual, observed effects of a Change.

The data associated with a Change_realization are the following:

- checks;
- impact;
- realization_of.

4.2.24.1 checks

The checks specifies organizational approval of the product model revisions made to implement the Change. The checks need not be specified for a particular Change_realization. There may be more than one checks for a Change_realization. See 4.3.24 for the application assertion.

4.2.24.2 impact

The impact specifies identification of the revisions made to the product model. See 4.3.22 for the application assertion.

4.2.24.3 realization_of

The realization_of specifies the Change_plan for which a product model Change is being implemented. See 4.3.23 for the application assertion.

4.2.25 Change_request

A Change_request is a type of Change_definition (see 4.2.21) that is the first phase of a Change, where the need for a Change and possible solution alternatives are established.