

GENERAL SPECIFICATION

DEVELOPMENT

GS EP DEV 002

Reference Data Library

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1. Scope

1.1 Purpose

This specification defines the minimum requirements to be applied for the handover of engineering information to the Company.

This specification aims to obtain standardized information delivered from the Contractor, through all the project phases, allowing simplified exchange and rational use of data between the Contractors and the Company.

1.2 Applicability

This specification is **not** retroactive.

This specification shall apply to all concerned data produced by the Contractors, its sub-Contractors and Vendors during project execution phases (Basic/FEED and detailed engineering stages) and field operation phases.

The quantity and details of delivered information shall be consistent with the requirements of the different phases of the Asset lifecycle as defined in this specification.

This specification shall apply to onshore and offshore Greenfield projects.

This specification can apply to onshore and offshore Brownfield projects considering adequate adjustments to be approved by the Company.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

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External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
CFIHOS Specification	Capital Facilities Information Handover Specification
Energistics	Energistics Unit of Measure Dictionary
ISO 14224	Petroleum, petrochemical and natural gas industries -- Collection and exchange of reliability and maintenance data for equipment
ISO 15926-2	Industrial automation systems and integration – Integration of life-cycle data for process plants including oil and gas production facilities – Part 2: Data model
ISO 15926-4	Industrial automation systems and integration – Integration of life-cycle data for process plants including oil and gas production facilities – Part 4: Initial reference data
ISO 16739	Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP DEV 001	Asset Objects Tagging
GS EP ICS 001	2D CAD Layouts
GS EP ICS 002	2D CAD Process Schematics
GS EP ICS 004	3D CAD Models
GS EP ICS 005	3D CAD Model Administration & Catalogues
GS EP PJC 701	Documents Identification & Numbering at Project Execution and Field Operations Phases

3. Terminology

3.1 Definition

There are five types of **statements** in this specification, the “shall”, “should”, “may”, “can” and “must” statements. They are to be understood as follows:

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Shall	Is to be understood as mandatory. Deviating from a “shall” statement requires derogation approved by Company.
Should	Is to be understood as strongly recommended to comply with the requirements of the specification. Alternatives shall provide the same level of protection or performance and this shall be documented.
May	Is to be understood as permission.
Can	Is to be understood as a physical possibility.
Must	Expresses a regulatory obligation

Note that “will” is not to be understood as a statement.

The following terms as defined below have been used throughout this specification.

3D CAD Model	Databases centric three (3) dimensional digital model of the facility
Company	TOTAL S.A.
Contractor	Entity that enters into a contract with the Company
Alias tag	Represents a tag that aligns to a Company Master tag as defined in this specification but which has an alternative format and/or rule set. Suppliers for example may create aliases for their own internal use. Some Company's Métier/Discipline applications may have also some format constraints which does require to create aliases of the Master tags.
Asset	Oil & Gas facility considered as a set of objects which are linked and grouped in order to realize a function. Examples: FPSO, FPU, Compression Platform, LNG Plant, etc.
Asset Breakdown Structure	Hierarchical representation of the Asset resulting from an orderly and exhaustive identification of its successive levels of decomposition down to indecomposable Asset Object.
Asset Data Library	Contractor deliverable which represents the instantiation of the RDL for a specific Asset (limited to Contractor scope of work). The corresponding tables contains the core set of information required to store all the data requested by the Company for an Asset.
Asset Object	An element or a thing which “owns” some technical information likely to evolve over Asset lifecycle. Most objects have physical existence (e.g. main equipment, lines, cables, buildings, etc.) but some do not (e.g. soft instrumentation). An object can appear at different levels of the Asset Breakdown Structure(s) and is identified by a tag
Attribute	Property or characteristic of an object

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Capital Facilities Information Handover Specification

Capital Facilities Information Handover Specification (CFIHOS - pronounced "see-fos") is an emerging standard for a consistent approach to information handover. Started by the Owner Operator community, its purpose is to reduce the inefficiencies and costs in the information supply chain.

CFIHOS is driving standardisation of terminology and deliverables across the industry. This standardisation will realise benefits across all stages of an asset life cycle, from design through to decommissioning.

The CFIHOS standard determines the reference data library used to manage asset-related information, and the related documents that are mandatory to managing that stage of the design or change project.

Data

Information converted into binary digital form.

Database

Organized collection of data. The data is typically organized to model aspects of reality in a way that supports processes requiring information.

Equipment

Includes major and minor equipment, valves, instruments, cables, lines, etc. and, if necessary their component parts, in such a way that they can be easily located with a unique reference (tag).

An equipment can be moved from its functional location and often has an OEM nameplate with a serial number.

Information

Stimuli that has meaning in some context for its receiver. When information is entered into and stored in a computer, it is generally referred to as data. After processing (such as formatting and printing), output data can again be perceived as information.

Lifecycle

Collection of phases in the life of an asset, from the preliminary, up to the restitution, through its design, construction and exploitation life.

Original Equipment Manufacturer

An entity that manufactures equipment and component parts such as motors, pumps, instruments, valves, etc.

Package Supplier

An entity that designs and builds a skid, package or unit from its own manufacture and from several OEMs. Examples include compressor package, hydraulic package, instrument air skid, etc.

Reference Data Library

Managed collection of process plant lifecycle data that represents information about classes or individuals which are common to many process plants or of interest to many users. The Reference Data Library entities represent the "vocabulary" and the "grammar" authorized by the Company which shall be used by the Contractor. The corresponding tables contain data invariant between assets.

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Standard	Documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for purpose. It does not imply technical validation and establishment of a consensus, as for a de jure standard
Standard de jure ("Norme" in French)	Referential published by a normalization organism like for instance AFNOR, CEN, ISO, OASIS, IETF, based on consensus. For our purpose, we will use the term "norm" in English as well.
Suppliers	Used to mean Package Suppliers and OEMs
Tag	A unique code that defines the function of an object within an Asset.
Technical data	All information required from a technical perspective to contract, specify, define, design, assemble, maintain and support assets. This information is embodied in documents, objects, attributes, models (e.g.: CAD data, specification, simulation model, etc.).
World Wide Web Consortium	An international community that develops open standards to ensure the long-term growth of the Web.

3.2 Abbreviations

ADL	Asset Data Library
ABS	Asset Breakdown Structure
ARDL	Asset Reference Data Library
CAD	Computer Aided Design
CFIHOS	Capital Facilities Information Handover Specification
CMMS	Computerized Maintenance Management System
EPC	Engineering, Procurement and Construction
FEED	Front End Engineering Design
MDM	Master Data Model
MRDL	Master Reference Data Library
OEM	Original Equipment Manufacturer
RDL	Reference Data Library
W3C	World Wide Web Consortium

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4. General Requirements

4.1 Digital Approach

The Company is committed to continuously improve performances and reliability of its producing assets, ensuring delivery of its projects and reducing time to first oil for its developments. To achieve these targets, the Company has the ambition to move from a document centric management system to a data centric management system based on digital representation of the asset: for each physical component there is always a trusted digital twin anytime, anywhere.

This ambition is realized through the **Quantum (Digital Twin)** program. This program is an approach to leverage the value of technical data, structured around a common company/industry wide language, and ensure its coherence amongst disciplines all along the asset lifecycle. It enables a faster and better decision-making process and to manage the evolution of design data through the asset lifecycle.

4.2 Information Management Standardization

The Company Information Management requirements are developed in accordance with existing standards de-jure (e.g. [ISO 15926-2](#), [ISO 15926-4](#), [ISO 14224](#), [ISO 16739](#)) and standards de-facto ([CFIHOS](#)) to ensure practicality and sustainability of the adopted approach and leverage on the advantages of standardizations across all stakeholders (Owner Operators, EPC, Maintenance Contractors, Vendors, Authorities & Software Editors). The main goal of the standardization is to improve efficiency of information delivery and quality from EPC who can integrate information requirements into their corporate business processes and systems independent of the Owner Operator requirements.

4.3 Master Data Model & Reference Data Library

The Company is providing Master Data Model (MDM) that is the basis for mapping and aligning the requested information with created or to be created information.

The MDM consists of a set of entities which defines in detail the classes and their attributes required for the electronic handover of information. The MDM contains the RDL which fixes the data to be captured irrespective of the asset.

5. Information Handover

5.1 Requirements on Information Management

The Contractors shall issue, at the start of engineering activities, an Information Management Plan for the Company's review and approval. This document shall be updated all along the project execution and shall be part of the final project's deliverables.

The Information Management Plan shall define unambiguously, in accordance with this General Specification and [CFIHOS](#) guidelines, which information (data), when and in which format should be delivered to the Company. The document shall additionally contain as a minimum the following information:

- Information Management processes and data handover procedure with corresponding workflows,
- Deviations from this General Specification previously granted by the Company,

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- Roles and Responsibilities of persons involved in the Contractor Information Management teams;
- Information Management organization with sub-Contractors, Suppliers and third parties,
- Data quality control and management procedure with corresponding workflows,
- Data consistency control between 1D, 2D, 3D & 4D and management procedure with corresponding workflows;
- Data handover progress measurement procedure, including quantity and level of maturity of data at each handover.

5.2 1D data handover

The functional and physical properties (1D data) defining Asset Objects are essential to enable the Company's business processes and applications that support Asset Integrity and Operations, including but not limited to:

- Identification of safety & environmental critical elements and operational performance assurance tasks,
- Risk and reliability maintenance analysis to identify relevant maintenance activities,
- Population of the enterprise asset management systems,
- Spare Parts interchangeability,
- Procurement systems, manufacturing evaluation and certification.

Fundamental to these processes and applications is the availability of a complete and accurate 1D data.

The Contractor should handover to the Company on a monthly basis or at a frequency to be agreed between the Company and the Contractor, a complete 1D database for their entire scope (including Sub-contractors and vendors Tags) in accordance with the data model defined in this General Specification and requirements specified in **GS EP DEV 001**.

The 1D data shall be delivered in one or several of the following formats, ordered by preference, to be agreed between the Company and the Contractor:

- Postgres database dump,
- Microsoft Access database dump,
- Microsoft Excel (only in addition to a hereabove database format).

The delivered 1D data shall be in accordance with the Asset Breakdown Structure, of which higher levels (Sites & Sectors) shall be frozen at the start of engineering activities. The ABS provides an exhaustive, hierarchical tree structure of deliverables that make up the asset, arranged in whole-part relationship. The structure takes into account physical aspects (where is it located) and functional aspects (what it does).

The Company reserves the right to request the delivery of data and databases anytime during the project definition and execution phases to check that the databases are correctly populated, that this specification is properly applied and to perform all required tests to ensure the full functionality at final handover for further use during operation.

5.3 2D & 3D data handover

Engineering data (2D & 3D data) shall strictly adhere to the requirements of **GS EP ICS 001**, **GS EP ICS 002**, **GS EP ICS 004** & **GS EP ICS 005**.

The Contractor shall ensure that 1D, 2D and 3D data are consistent at each handover to the Company.

6. Master Data Model

6.1 Master Data Model Structure

The MDM provided by Company is a database entity relationship model, intrinsically linked to a relational database.

The Figure 1 provides a simplified conceptual diagram giving the main principles of the MDM.

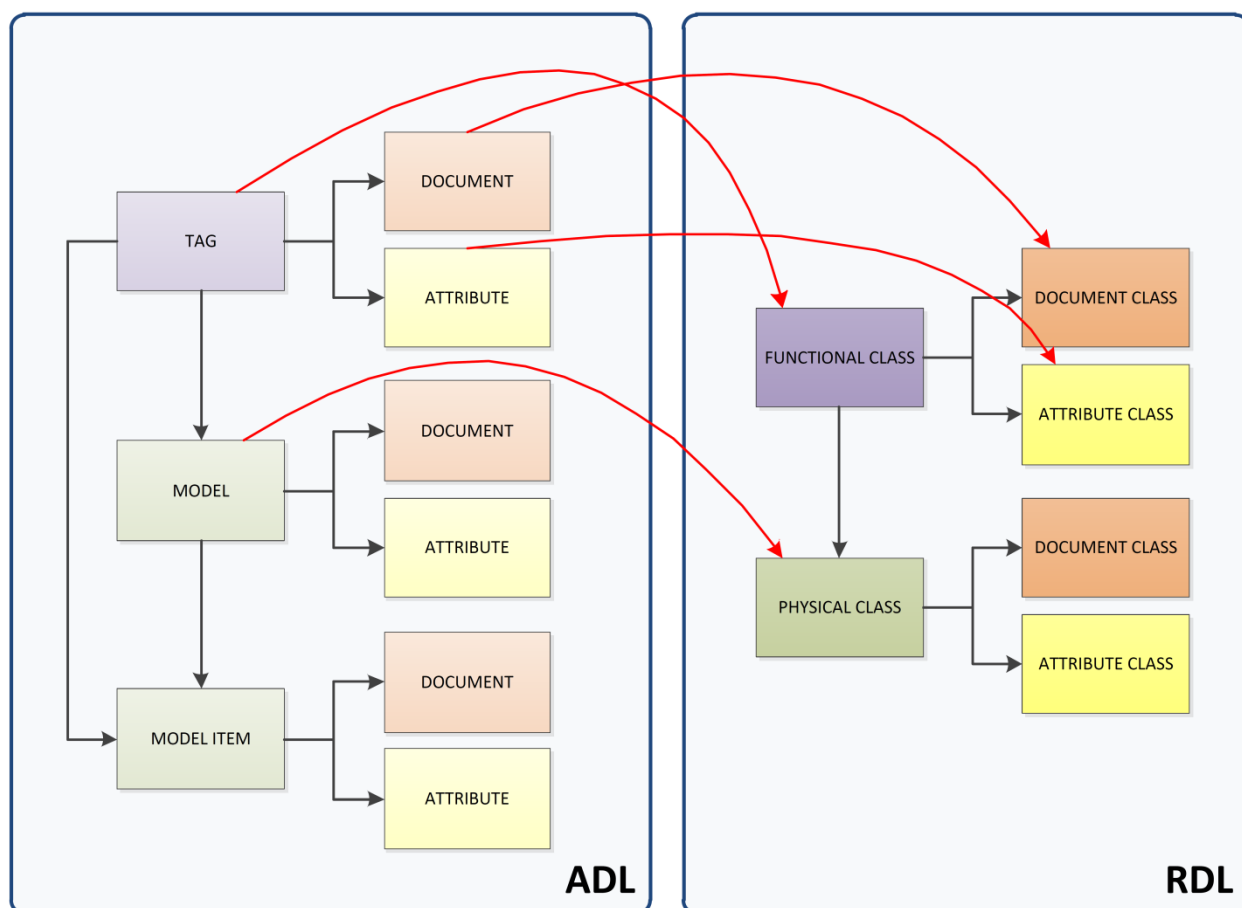


Figure 1 – MDM simplified conceptual scheme

The MDM covers both the Reference Data Library (RDL) and the Asset Data Library (ADL).

The ADL entities represent the instantiable part of the MDM and shall be populated by the Contractor for a specific asset. The corresponding tables contain the core set of information required to store all the data requested by the Company for an Asset. The ADL includes, but not limited to:

- All the tags of the Asset with their properties and relationship with the corresponding relevant documents. This information represents the functional dimension of the equipment

- All the models that can be purchased for each tag, with their properties and relationship with the corresponding relevant documents. This information represents the physical dimension of the equipment. The split between tag and model allows to define, for instance, a single document for a model applicable to several tags.
- All the model items corresponding to the serialized models, with their properties and relationship with the corresponding relevant documents (if specific to the serialized model)

The RDL entities represent the “vocabulary” authorized by the Company, in accordance with [ISO 15926-4](#) & [CFIHOS](#) requirements, which shall be used by the Contractor to characterize the equipment information provided in the ADL. The corresponding tables contain data invariant between assets. The RDL provides, but not limited to:

- All the functional classes which shall be used to characterize a tag. The functional class specifies through attributes and documents classes the expected attributes and documents to be provided by the Contractor
- All the physical classes which shall be used to characterize a model. The physical class specifies through attributes and documents classes the expected attributes and documents to be provided by the Contractor

The Figure 2 provides the complete entity relationship diagram of the MDM.

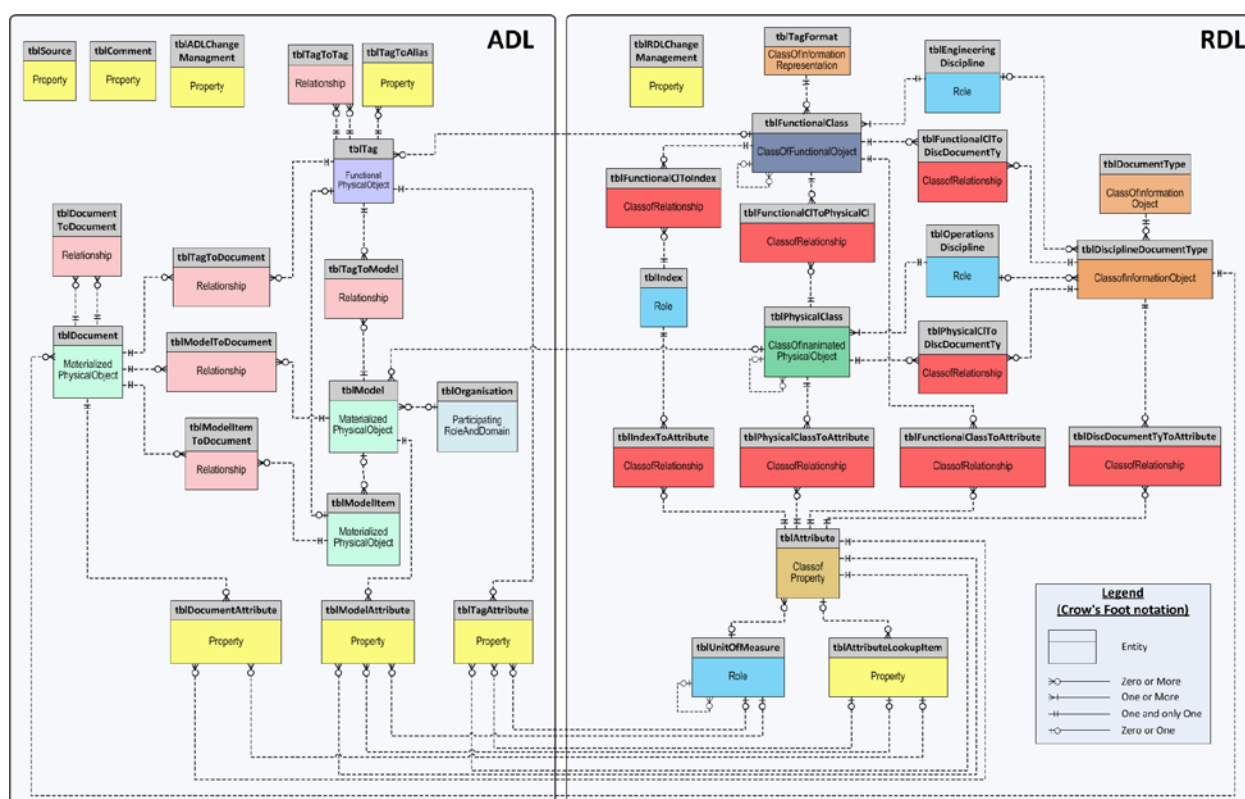


Figure 2 - MDM Structure & mapping to ISO 15926-2

The description of each table of the MDM is provided in **Appendix 2**.

The complete MDM database is provided in **Appendix 3** in several formats.

6.2 Master Data Model Instantiation

The Contractor shall instantiate the ADL entities and corresponding relationships with the RDL entities. The instantiation workflow presented in Figure 3 is indicated, for information only, to provide a better understanding of the MDM.

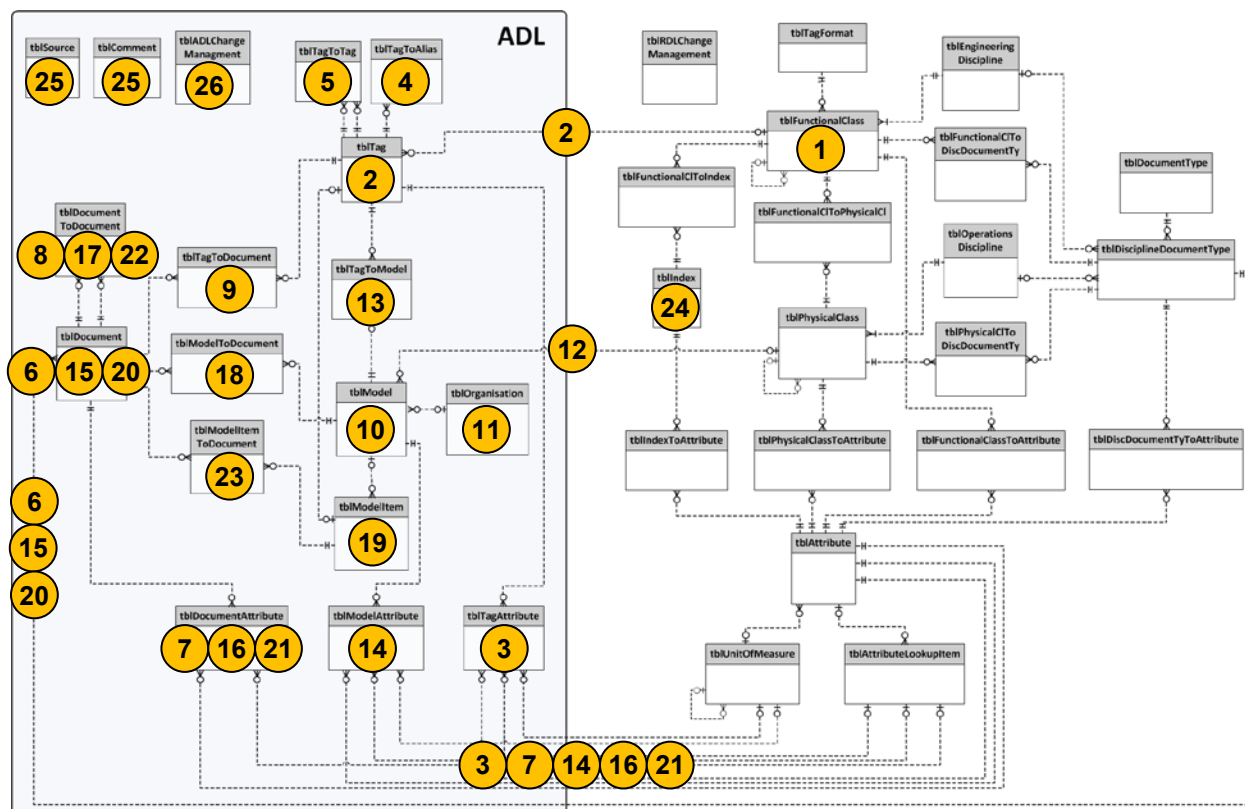


Figure 3 – MDM Instantiation Guideline

1. Selection of a Functional Class in the RDL, (e.g. Pump function)
2. Creation of an Asset Object pertaining to the selected Functional Class in accordance with the acceptable tag format provided in the RDL, (e.g. 12-27-PZ-0002 performs the function of Pump)
3. Fill in of the functional attributes required for the selected Functional Class with acceptable unit of measure and available look-up values provided in the RDL; (e.g. Maximum Design Pressure= 15barg)
4. Creation of corresponding Tag alias, if any, (e.g. /12-27-PZ-0002 for 3D CAD Model)
5. Creation of the Asset Breakdown Structure, i.e. Tag to Tag relationship, if any, (e.g. 12-27-UZ-0001 PARENT of 12-27-PZ-0002)
6. Creation of a Document Object related to the Tag and assignment to a Discipline Document Type of the RDL, (e.g. NO-HLD-10-TPSH-022003 is a MEC-GEA discipline document type)
7. Fill in of the document attributes given by the Document Discipline Type to Attribute relationship defined in the RDL, with look-up values provided in the RDL;

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- (e.g. Acceptance Class = 1)
8. Creation of Document to Document relationship, if any,
(e.g. NO-HLD-10-TPSH-022003 linked to NO-HLD-10-TPSH-022004)
9. Assignment of the Document Object to the corresponding Asset Object using Tag to Document relationship;
(e.g. NO-HLD-10-TPSH-022003 references 12-27-PZ-0002)
10. Creation of the Model purchased for the Asset Object
(e.g. BCL 804)
11. Creation of the OEM and assignment to the corresponding Model,
(e.g. Nuovo Pignone OEM of BCL 804)
12. Assignment of the Model to a Physical Class of the RDL following available classes given by the Functional class to Physical Class,
(e.g. BCL 804 is a Centrifugal Pump)
13. Assignment of the Model to the Asset Object using Tag to Model relationship,
(e.g. BCL 804 model of the item purchased for 12-27-PZ-0002)
14. Fill in of the physical attributes of the Model with acceptable unit of measure and available look-up values are given by the RDL,
(e.g. Dry Weight= 1500kg)
15. Creation of a Document Object related to the Model and assignment to a Discipline Document Type of the RDL,
(e.g. NO-HLD-10-TPSH-055008 is a PRD-MAN discipline document type)
16. Fill in of the document attributes given by the Document Discipline Type to Attribute relationship defined in the RDL, with look-up values provided in the RDL;
(e.g. Document Title = BCL 804 Maintenance Procedure)
17. Creation of Document to Document relationship, if any,
(e.g. NO-HLD-10-TPSH-055008 linked to NO-HLD-10-TPSH-055009)
18. Assignment of the Document Object to the corresponding Model using Model to Document relationship;
(e.g. NO-HLD-10-TPSH-055008 Maintenance Procedure of BCL 804)
19. Creation of the Model Item and assignment to the corresponding Model,
(e.g. SN120009945876 Serial Number of item purchased for model BCL 804)
20. Creation of a Document Object specific to the Model Item (and not to the Model) and assignment to a Discipline Document Type of the RDL,
(e.g. NO-HLD-10-TPSH-066009 is a HSE;SEC-CRT discipline document type)
21. Fill in of the document attributes given by the Document Discipline Type to Attribute relationship defined in the RDL, with look-up values provided in the RDL;
(e.g. Originator = Bureau Veritas)
22. Creation of Document to Document relationship, if any,
(e.g. NO-HLD-10-TPSH-066009 linked to NO-HLD-10-TPSH-055008)
23. Assignment of the Document Object to the Model Item using Model Item to Document relationship;
(e.g. NO-HLD-10-TPSH-066009 Certificate of Conformity of SN120009945876)
24. Extraction of lists and register using predefined template of functional class to index and index to attributes relationship defined in the RDL;
(e.g. Main Equipment List)
25. Fill in comments and source information, if relevant, against any tag, model or document;
26. For each of the above actions a Change Record is created,

(e.g. CreatedObject with an EffectiveStartDate from the day 12-27-PZ-0002 was created in step #1 above).

6.3 MDM vs ISO 15926-2

The MDM is in accordance with [ISO 15926-2](#) requirements, so that entities of the MDM can be mapped to an equivalent class of the [ISO 15926-2](#) data model.

The MDM accommodates Company's Information Management requirements and is structured logically to separate data for ease of use. Consequently, only a subset of [ISO 15926-2](#) classes is used and the same class can cover several MDM entities.

The Figure 2 and Figure 4 illustrate which classes from [ISO 15926-2](#) are covered and how they map with the MDM.

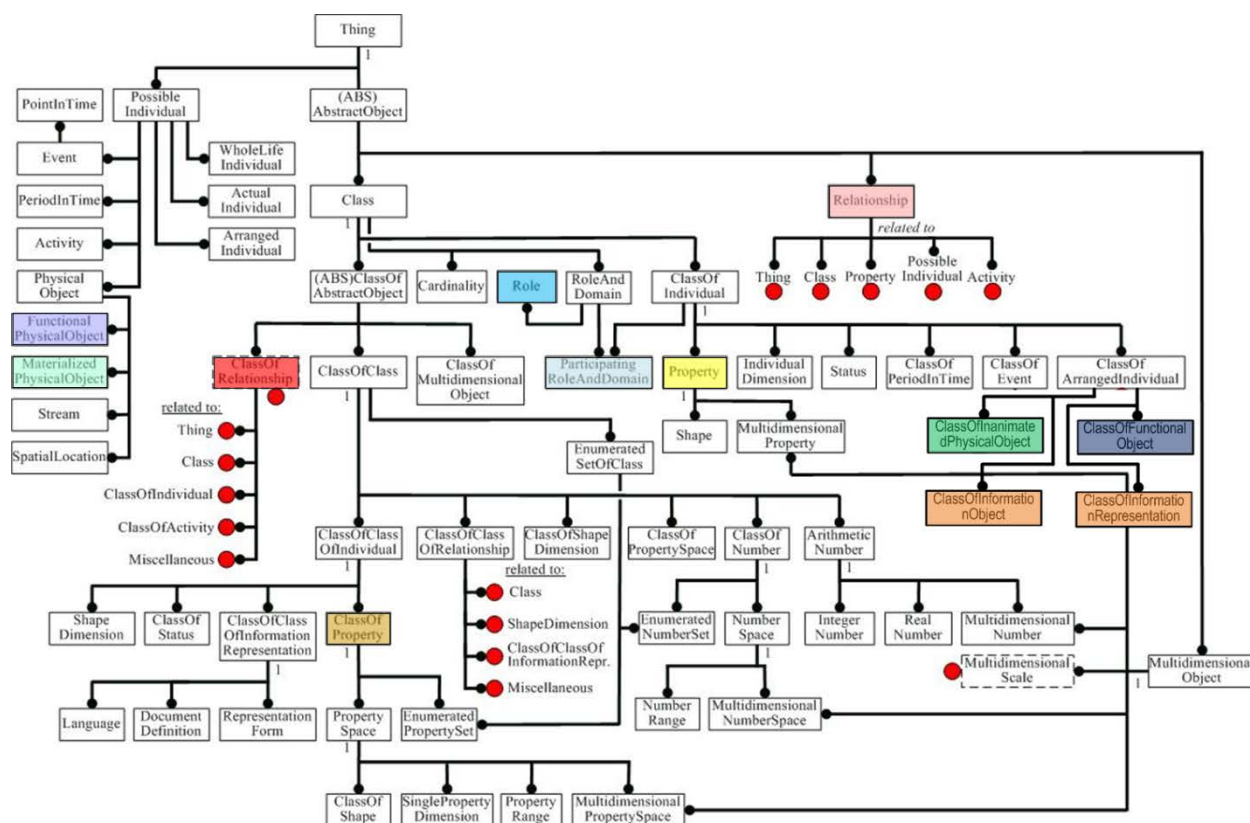


Figure 4 – ISO 15926-2 Data model (Top level)

6.4 Functional Class vs Physical Class

The MDM provided by Company segregates the data relating to functional objects from the one relating to physical objects.

This concept is supported by [ISO 15926-2](#) which makes the distinction between the functional role of an object and the object which physically performs that role. This concept is aligned with the General AEC Reference Model (Hamburger Model). In this approach represented in Figure 5, building information is defined in terms of Functional Units (FU) which describe objects “as required” and have “required characteristics” and Technical Solutions (TS) which describe objects “as designed” and have “expected characteristics”.

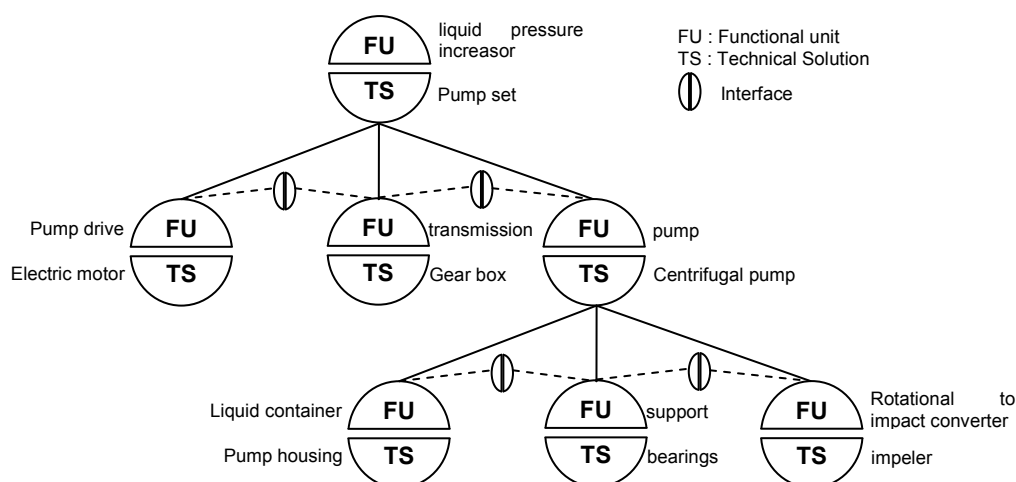


Figure 5 – GARM (General AEC Reference Model)

6.4.1 Functional vs Physical during project definition & execution phases

During a project definition & execution, the design of the asset is progressively decomposed into functional items until a sufficient level of granularity is achieved to enable procurement of equipment (Asset Breakdown Structure). These lowest level functions are allocated a unique identification number per Facility known as a Tag.

The requirements toward a tag will become more explicit as the project progress. This will result in a functional specification defining the design and operating conditions that will be mature enough to determine the physical items that most effectively meet the functional requirement for procurement. Once a physical component is identified to reside at the functional location, more specific physical data can be captured. These physical properties would change if the component was switched out for another but the functional properties would not.

OEM will then offer either a custom designed item or a standard Model that can meet or exceed the functional requirements. This allows the selection of the physical equipment that will be procured to be installed to satisfy the function. These physical items will typically have a serial number to uniquely identify them as a Model Item.

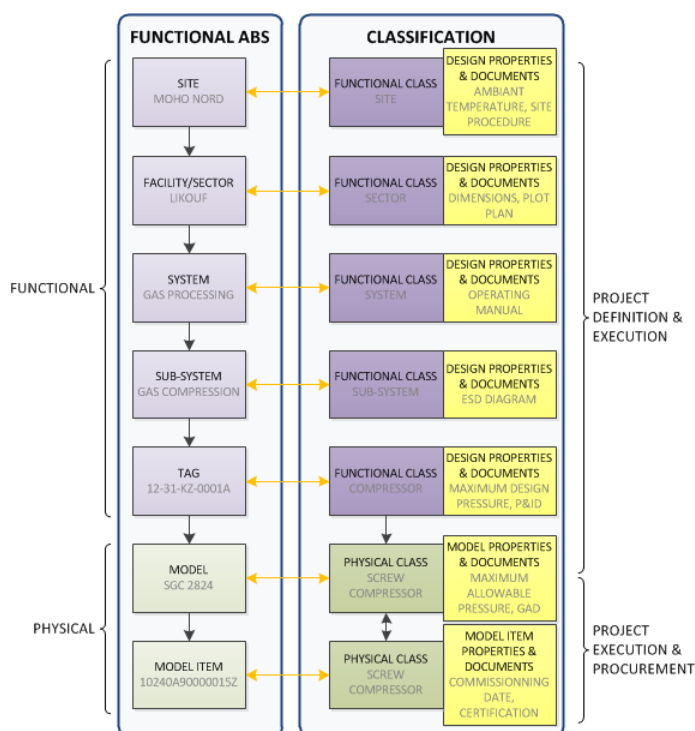


Figure 6 - Functional vs Physical during project phases

6.4.2 Functional vs Physical during field operation phase

During the field operation phase, the asset shall continue to function as designed independently of the material that makes up the object which are likely to be completely changed, provided the intended function of the individual remains the same.

The Figure 7, extracted from [ISO 15926-2](#), represents a lifecycle of a pump (functional object), known by the Tag “P101”, for which a succession of different pumping equipment items (physical object) are installed: Pump 1 is installed and removed from Tag P101 to be replaced later on by pump 2. There is no material continuity, but both pumps perform a similar function whilst installed.

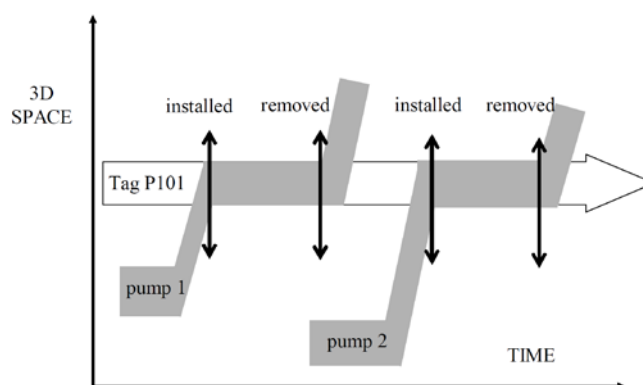


Figure 7 - Function physical object P101 space-time map (cf. ISO 15926-2 Figure 50)

6.5 RDL vs ISO 15926-4 & CFIHOS

The RDL provided by Company is specific to the type of assets managed by Company. In this respect the RDL is based on a subset of [ISO 15926-4](#) Initial Reference Data complemented as required with Reference Data defined by Company.

In order to ensure compliance with [CFIHOS](#) project, the Company RDL has been mapped, where applicable, with the [CFIHOS](#) RDL.

The definitions for classes and attributes used in the RDL are originating whenever possible from existing standards in accordance with the following order of precedence:

- When exact matching between Company and [ISO 15926-4](#) classes or attributes is achieved then [ISO 15926-4](#) definition is used;
- Otherwise, if exact matching between Company and [CFIHOS](#) classes or attributes is achieved then [CFIHOS](#) definition is used;
- Otherwise Company definition is provided.

The Figure 8 illustrates the inclusions relationship between the Company RDL and the available standard RDLs.

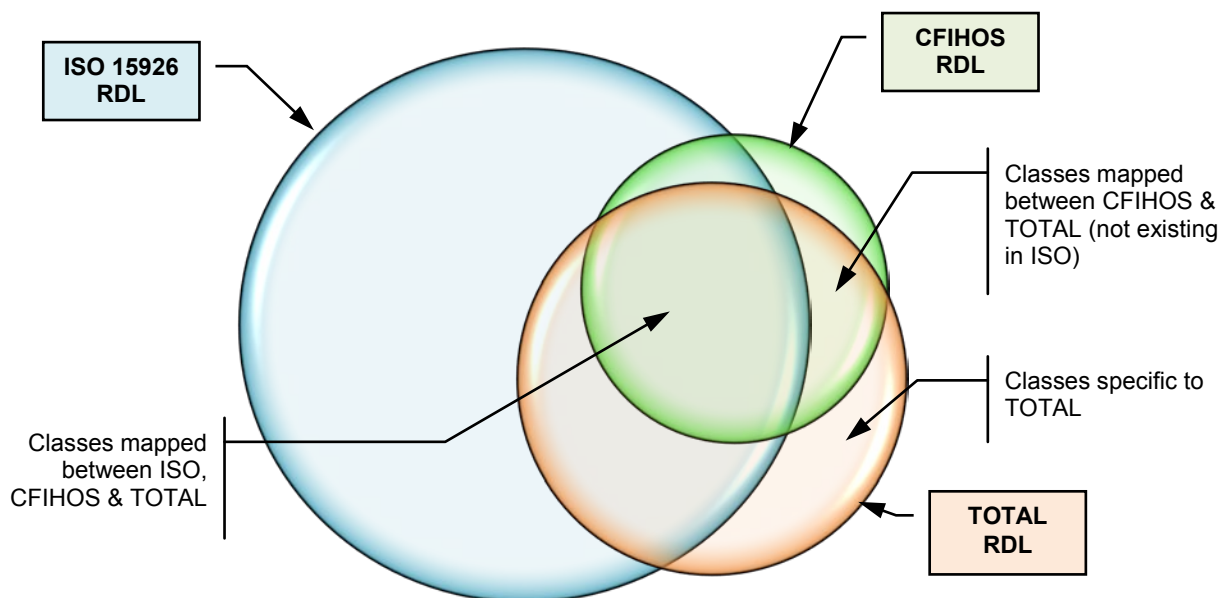


Figure 8 – RDL mapping between TOTAL, ISO 15926 & CFIHOS

Company objective through its active participation into [CFIHOS](#) project is to develop and promote the use of a RDL common to the Oil & gas industry. In order to do so, Company is willing to reduce/eliminate its specific classes by proposing them into [CFIHOS](#) RDL which will then propose them for inclusion into [ISO 15926-4](#).

6.6 Master RDL vs Asset RDL

The implementation of the MDM on an Asset may result to the creation of new classes or attributes, specific to the Asset, not existing in the Master RDL provided by Company. In that case a RDL specific to the Asset, the Asset Reference Data Library (ARDL), should be created.

It is the Contractor's responsibility to propose new classes or attributes to Company for approval. The addition of classes or attributes can only be granted through the official referential derogation processes in order to guarantee no duplication of classes or attributes in the ARDL and to allow proper capitalization of newly created classes in the RDL.

In no circumstance, the MDM structure, i.e. table name, content and relationship as defined in Figure 2 and **Appendix 1** can be modified for an Asset specific need.

The Figure 9 illustrates the main principles of ARDL creation for an Asset.

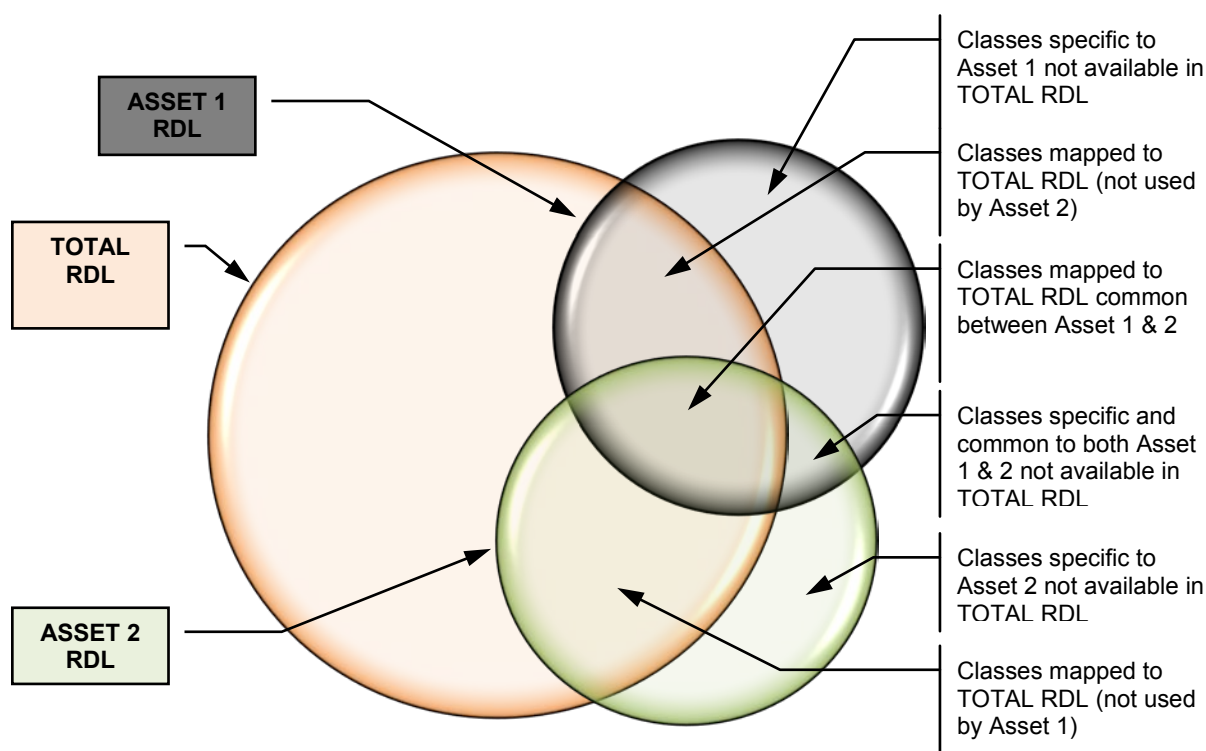


Figure 9 – Asset RDL management

Appendix 1 Master Data Model Structure

This Appendix display the MDM structure and correspondence with **Appendix 2** entities description.

