**CFIHOS – Specification Document 规范**

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| --- | --- | --- |
| 版本 | Date 日期 | Comments/History 备注/记录 |
| 1.4 | April 2020  2020年4月 | IOGP republication of CFIHOS document first published in October 2019.  IOGP对首次于2019年10月发布的CFIHOS文档的再版。 |
| 1.4.1 | December 2020  2020年12月 | New sections added 增加新章：  2. ‘Purpose and Objectives’ (previously part of section 1. Scope) “2. 宗旨和目标”（之前属于“1. 范围”）  8. ‘Models’“8. 模型” |
| 1.5 | October 2021  2021年10月 | Broadened PDF requirements to include scans or renderings in section 7.4.5. Updated Annex A.2 Figure 3 to include process, streams and classes and section 6.2 to reference all figures in Annex A.2.  扩大了PDF要求，在7.4.5 中包括扫描或渲染呈现形式。更新了A.2图3，包括工艺、流和类，6.2引用了A.2中所有的图。 |
| 1.5.1 | 2022-11  2022年11月 | Minor text changes for bug fixes throughout the text of the document. Added ISO 8601 reference  在本文件的整个文本中更正错误的次要文本变更。增加引用了ISO 8601。 |

**Acknowledgements 致谢**

In 2012, Shell approached Netherlands-based process industry organization USPI to explore turning their corporate information standard into an industry-wide standard. The result was the CFIHOS (Capital Facilities Information Handover Specification) project.

壳牌于2012年与总部位于荷兰的流程工业组织USPI（荷兰流程工业协会）接洽，希望将其企业信息标准转化为行业标准，因而形成了CFIHOS（资产密集型设施信息移交规范）项目。

Its aim is to offer practical, standardized specifications for information handover that work across the supply chain – operators, contractors and suppliers. The most recent CFIHOS industry standard (Version 1.4) was published in October 2019 by USPI with support from the Engineering Advancement Association of Japan (ENAA). This document, describing the scope and procedures of CFIHOS, is part of this standard.

CFIHOS项目旨在为信息移交提供实用标准化规范，该规范适用于整个供应链——运行方、承包方和供应方。CFIHOS 1.4版是由USPI在ENAA（日本工程协会）支持下发布的最新版，于2019年10月发布。本文件描述CFIHOS的规范，是该标准的一部分。

Following a member vote in 2019, the future governance, development, and maintenance of the CFIHOS project and standard moved from USPI to IOGP in January 2020, becoming Joint Industry Project (JIP) 36.

2019年经成员投票表决，CFIHOS项目和标准的未来治理、编制和维护于2020年1月从USPI移至IOGP（国际油气生产方协会），成为JIP36（第36号联合工业项目）。

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Foreword 前言

The Capital Facilities Information Handover Specification (CFIHOS) is an industry standard developed to improve how technical information is exchanged between Principals, Contractors and Suppliers/Manufacturers for the process and energy sectors. Starting with a common engineering dictionary and supporting specifications, the CFIHOS goal is to become a common language for the exchange of technical information in these sectors.

CFIHOS（资产密集型设施信息移交规范）是一项为改进流程与能源行业委托方、承包方和供应方/制造方之间如何交换技术信息而制定的行业标准。CFIHOS始于公用工程字典和支持规范，目标是成为流程与能源行业信息交换的公用语言。

CFIHOS is being developed collaboratively by Principal (Owner/Operator) companies, EPC Contractors, software providers and equipment vendors/suppliers/manufacturers as a practical standard to ensure the systematic and reliable exchange of information among all companies involved in the data supply chain, thereby reducing cycle times and costs.

CFIHOS由委托方（业主/运行方）公司、EPC承包方、软件提供方及设备供方（供应方/制造方）作为实用标准协作编制，以确保数据供应链中涉及的所有参与公司之间系统及可靠的信息交换，从而缩短周期并降低成本。

The initial focus is on the information, as computer models, structured data and traditional document formats, are handed over when a project moves from its development to operations phase. Ultimately, the aim is for CFIHOS to become the de-facto standard for information exchange throughout the physical asset lifecycle, from vendor information through to decommissioning.

CFIHOS起初关注项目从开发阶段进入运行阶段时必须移交的信息，如计算机模型、结构化数据和传统文档格式信息。CFIHOS终极目标是成为从供方信息至退役的整个物理资产生命周期信息交换的事实标准。

Introduction 引言

This document provides the requirements for engineering information handover specification for capital facilities between Principals, Contractors and Suppliers/Manufacturers. It specifies the engineering information Principals require for future operation and maintenance of their facilities.

本文件提供资产密集型设施委托方、承包方和供应方/制造方之间工程信息移交规范的要求，规定委托方未来对其设施进行运维所需工程信息。

CFIHOS Implementation Guide for Principal [C-GD-001] and CFIHOS Implementation Guide for Contractor [C-GD-002] provide detailed guidance on how to use this specification.

CFIHOS委托方实施指南[C-GD-001]和CFIHOS承包方实施指南[C-GD-002]提供如何使用本文件的详细指导。

# Scope范围

This specification covers:

* Handover of information for production facilities
* Handover of information along the process industry plant engineering supply chain that consists of Principals, Contractors, and Suppliers/Manufacturers

Where:

* + The Principal is the end client company that owns the production facility and is responsible for operation and maintenance
  + The Contractor is responsible for design, detailed engineering, procurement, construction and commissioning of a facility
  + The Maintenance Contractor maintains and/or operates the facility
  + The Supplier/Manufacturer delivers the equipment used to construct a facility and is responsible for the design, manufacturing and assembly of a particular piece of equipment.
* That part of engineering information created by a Contractor and Supplier/Manufacturer required by the Principal to operate and maintain a facility and to support future design changes.

本文件涵盖：

* 生产设施信息移交；
* 流程工业工厂工程供应链（由委托方、承包方和供应方/制造方组成）信息移交；

其中：

* + 委托方是拥有并负责运维生产设施的最终客户公司；
  + 承包方负责设施的设计、详细工程设计、采购、施工和调试；
  + 维修承包方维护和/或运行设施；
  + 供应方/制造方交付用于建造设施的设备，并负责特定设备的设计、制造和组装。
* 由承包方和供应方/制造方创建，委托方设施运维及未来设计变更支持需要的那部分工程信息。

Out of scope for this specification:

* Engineering information created by a Contractor and Supplier/Manufacturer that is not required by a Principal to operate and maintain a facility or to support any future design changes
* Processes that govern how a Contractor or Supplier/Manufacturer creates and/or quality assures the engineering information
* Systems used to develop the information nor the systems in which the information will be quality assured and stored at handover.

以下不在本文件范围内：

* 由承包方和供应方/制造方创建，委托方设施运维或任何未来设计变更不需要的工程信息；
* 承包方或供应方/制造方如何创建工程信息和/或保证其质量的管控流程；
* 用于生成信息的系统，或移交时保证信息质量和存储信息的系统。

# Purpose and Objectives 宗旨和目标

Create a standard specification for Principals, Contractors and Suppliers/Manufacturers for the handover of engineering information in a facilities project, such that:

* This specification is an integral part of the full set of specifications which specifies the:
  + Physical plant
  + Information required.
* The information satisfies:
  + Information requirements from statutory authorities
  + Approval and acceptance of delivery by the involved stakeholders
  + Design for future changes to the plant
  + Operation and Maintenance during the lifetime of the plant.

为委托方、承包方和供应方/制造方创建标准的规范，以在设施项目中移交工程信息：

* 该规范是整套规范的组成部分。此套规范规定：
  + 物理工厂
  + 所需信息
* 该信息满足：
  + 法定机构的信息要求
  + 涉及的利益相关方对交付的批准和验收
  + 工厂未来变更设计
  + 工厂生命周期运维

The specification can be applied across the supply chain.

本文件能适用于整个供应链。

# Normative References 规范性引用文件

|  |  |
| --- | --- |
| C-TP-001 | CFIHOS Scope and Procedure  CFIHOS范围与程序 |
| C-GD-001 | CFIHOS Implementation Guide for Principal  CFIHOS委托方实施指南 |
| C-GD-002 | CFIHOS Implementation Guide for Contractor  CFIHOS承包方实施指南 |
| C-ST-001 | CFIHOS Reference Data Library (RDL)  CFIHOS参考数据类库（RDL） |
| C-DM-001 | CFIHOS Data Model  CFIHOS数据模型 |
| C-DM-002 | CFIHOS Data Dictionary  CFIHOS数据字典 |
| C-GD-003 | CFIHOS Knowledge Guide (Note: this document is not yet issued)  CFIHOS知识指南（注：此文件尚未发布） |

# Terms, Definitions, Acronyms and Abbreviations 术语、定义、首字母缩略词和缩略语

**Additional Files:** A logical collection of physical computer files that are associated to **one** document revision identification.

**附加文件：**与**一个**文档版本标识相关联的物理计算机文件的一个逻辑收集。

**Application**: A computer program designed to help people perform an activity.

**应用程序**：为帮助人们进行某项活动而设计的计算机程序。

**Approved For Construction**: Formal milestone indicating the start of construction/erection activities. Information assigned this status may be used to support construction activities.

**批准用于施工**：指明施工/安装活动开始的正式里程碑。赋以此状态的信息可用于支持施工活动。

**As-Built:** Describing documentation, data and models associated with the facility, system or component that represents the actual physical “as is” situation.

**竣工状态：**描述与设施、系统或部件相关联的文档、数据和模型，表示实际物理“现状”。

**As-Design:** Documentation, data and models associated with the facility, system or component that represents the initial design and subsequently incorporates all approved design changes.

**设计状态**：描述与设施、系统或部件相关联的文档、数据和模型，表示初步设计并在之后纳入所有批准的设计变更。

**Contract Information Management Scope of Work:** Document in which the Principal specifies the terms and conditions for information delivery by the Contractor. Where it is applicable and feasible, quality benchmarks and criteria to fulfil them may be included.

**合同信息管理工作范围**：委托方规定承包方交付信息的条款和条件的文档，可在适用且可行的情况下包括满足这些要求的质量基准和准则。

**Contract RDL:** Document in which the Principal specifies the requirements of the RDL specific for the scope of contract based on the CFIHOS RDL and may include deviations from or additions to the CFIHOS RDL.

**合同RDL（参考数据类库）**：委托方基于CFIHOS RDL规定合同范围特定RDL要求的文档，可包括对CFIHOS RDL的偏离或补充。

**Contractor:** The party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility.

**承包方**：执行项目或设施运行的全部或部分设计、工程设计、采购、施工、调试或管理的一方。

**Controlled Document:** Digital or hard-copy entity which is required by a company, a standards organization, or a regulatory agency to be managed within a tightly controlled process that maintains the integrity of its content through revision control.

**受控文档**：某公司、某标准组织或某监管机构要求在严格控制的流程中进行管理的数字或硬拷贝实体，其内容完整性通过版本控制保持。

**Discipline Document Type**: An association between Disciplines and Document Class names. In the CFIHOS context, this is a unique identifier for types of documents and has been developed for situations where a document class is common to more than one discipline. For example, a process engineering flow scheme should only be produced by the process discipline, whereas a data sheet could be produced by many disciplines depending on the equipment where each discipline is responsible for part of the content.

**专业文档类型**：专业和文档类名之间的一种关联。专业文档类型在CFIHOS中是文档类型的唯一标识符，针对一个以上专业公用一个文档类的情况而制定。例如，工艺流程图宜仅由工艺专业生成；而数据表取决于具体设备，可能由多个专业生成，每个专业负责部分内容。

**Export Control Classification Number (ECCN):** An alphanumeric code that identifies the level of export control for articles, technology and software (collectively, "Items") that are exported from member states of the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies, including the United States. The ECCN classification that applies to any specific item is determined by referring to a table such as that issued for the United States by the Bureau of Industry and Security and for Europe by Regulation 428/2009.

**ECCN（出口管制分类编码）**：一个字母数字代码，用于标识从《关于常规武器和两用物品及技术出口管制的瓦森纳安排》成员国（包括美国）出口的物品、技术和软件（统称为“物项”）的出口管制级别。适用于具体物项的ECCN分类通过引用一张表格确定，如对于美国由工业和安全局发布的表格，及对于欧洲的第428/2009条例表格。

**Handover of Information:** The formal process between Principal and Contractor for transfer of ownership and responsibility for the change management of information aligned with the official acceptance of a physical facility.

**信息移交**：委托方与承包方之间转移信息所有权和变更管理责任的正式过程，与物理设施正式验收对齐。

**Handover Plant Breakdown Structure**: The plant breakdown structure that structures the handover deliverables in relation to the physical assets.

**移交工厂分解结构**：用于构建与物理资产相关的移交交付物的工厂分解结构**。**

**Maintenance Contractor:** Party that maintains the plant on behalf of the Principal.

**维修承包方**：代表委托方维护工厂的一方。

**Original Equipment Manufacturer (OEM)** is the company that originally manufactured the equipment item and from which the equipment supplier purchased the equipment ultimately for the Principal’s use.

**OEM（原厂）**是最初制造设备项的公司，设备供应方从其购买设备以供委托方最终使用。

**Principal:** Party that initiates the project and ultimately pays for it. This includes any agent or consultant authorised to act for, and on behalf of, the Principal.

**委托方**：发起项目并最终为其出资的一方，包括任何被授权代表委托方并为其行事的代理方或顾问方。

**Reference Data Library (RDL):**  a standard and unified naming convention for equipment classification, its properties, disciplines and documents. It is a set of information requirement specifications for documents and tagged items.

**RDL（参考数据类库）**：设备分类、设备分类属性、专业和文档的标准及统一命名规范，是文档和位号项的信息要求规范集。

**Supplier/Manufacturer:** Party that manufactures or supplies equipment and services to perform the duties specified by the Contractor. The Supplier/Manufacturer may be the Contractor where the client is the end consumer of the equipment/service.

**供应方/制造方**：执行承包方规定的任务，制造或供应设备及服务的一方。如果客户是设备/服务的最终使用方，则供应方/制造方可是承包方。

**Master Tag Register (MTR):** List of tagged items the Principal would like to trace e.g. have technical data and documentation available, during the lifetime of an industrial plant. Note that:

**MTR（主位号清册）**：委托方要跟踪（例如，在工厂生命周期内有可用技术数据和文档）的位号项列表。

* **shall** is used to indicate that a provision is mandatory
* **should** is used to indicate that a provision is not mandatory, but recommended as good practice.

注：

* **应**用于指明一项规定是强制性的；
* **宜**用于指明一项规定不是强制性的，但推荐作为良好实践。

**Aliases**

The words “facility” and “plant” are used interchangeably throughout this document.

**别名**

本文件中互换使用“设施”和“工厂”。

# Applicable Standards and Documents 适用标准和文档

This section describes the applicable standards and practices relevant to this document in specifying what information is handed over to the Principal.

本章描述与本文件相关的适用标准和实践，规定移交给委托方什么信息。

## International Standards 国际标准

International standards relevant to this area of work include ISO 10303, ISO 14224, ISO 15926, and ISO 8601-1:

* ISO 10303 is titled “Industrial Automation Systems and Integration - Product Data Representation and Exchange”, also known as STEP or the “Standard for the Exchange of Product model data”. It is a standard for the computer-deciphered representation and exchange of industrial product data. The objective is to provide a mechanism capable of describing product data throughout the life cycle of a product, independent from a particular system.
* ISO 14224 is titled “Petroleum, petrochemical and natural gas industries -- Collection and exchange of reliability and maintenance data for equipment”. It provides a comprehensive basis for the collection of Reliability and Maintenance (RM) data in a standard format for equipment in all facilities and operations within the petroleum, natural gas and petrochemical industries during the operational life cycle of equipment.
* ISO 15926 is titled: "Industrial automation systems and integration—Integration of life-cycle data for process plants including oil and gas production facilities". It specifies a conceptual data model for computer representation of technical information about process plants.
* ISO 8601-1 2019 is titled: “Date and time — Representations for information interchange — Part 1: Basic rules “. It specifies a standard date format of YYYY-MM-DD.

与此工作领域相关的国际标准包括ISO 10303、ISO 14224、ISO 15926和ISO 8601-1：

* ISO 10303名称为“工业自动化系统与集成 产品数据表达与交换”，也称为STEP或“产品模型数据交换标准”，是工业产品数据的计算机解码表示与交换标准,旨在提供一种能够独立于特定系统来描述整个产品生命周期中的产品数据机制；
* ISO 14224名称为“石油、石化与天然气工业 设备可靠性和维修数据的采集与交换”，为在设备生命周期内，以标准格式采集石油、天然气和石化行业所有设施和运行中设备的RM（可靠性和维修）数据提供全面基准；
* ISO 15926名称为 “工业自动化系统与集成 流程工厂（包括石油和天然气生产设施）生命周期数据集成”，规定了一个流程工厂技术信息的计算机表示的概念数据模型；
* ISO 8601-1:2019名称为“日期和时间 信息交换表示 第1部分：基本规则”，规定了 YYYY-MM-DD 的标准日期格式。

## CFIHOS Reference Data Library (RDL) CFIHOS RDL（参考数据类库）

The CFIHOS RDL [C-ST-001] provides a standard and unified naming convention for equipment classification, its properties, disciplines and documents. It is a set of information requirement specifications for documents and tagged items. The CFIHOS RDL contains the following:

* List of classes for Tag and Equipment (what the equipment does and what it is)
* List of properties (attributes, measures, characteristics etc.)
* Lists of requirements by class (data and applicable document references)
* List of disciplines
* List of document types
* Relationships between data entities
* CFIHOS Unique ID codes.

CFIHOS RDL [C-ST-001]为设备分类、设备分类特性、专业和文档提供一个标准且统一的命名规范,是文档和位号的一组信息要求规范。CFIHOS RDL包含以下内容：

* 位号和设备的类列表（设备功能和设备定义）
* 特性列表（属性、计量、特征等）
* 按类的要求列表（数据和适用的文档引用）
* 专业列表
* 文档类型列表
* 数据实体间关系
* CFIHOS唯一标识符编码

Contractor shall deliver plant’s data and applicable document references in conformance with the Contract RDL based on the CFIHOS RDL [C-SP-001] and other Principal specific documents including, but not limited to, engineering tagging specification and document numbering specification.

承包方应交付符合基于CFIHOS RDL [C-ST-001]的合同RDL和其他委托方特定文档（包括但不限于工程标识规范和文档编码规范）的工厂数据和适用的文档引用。

By application of the CFIHOS RDL, Contractor is able to determine Principal’s information requirements, for example:

* If a Tag is classified as a temperature transmitter, the CFIHOS RDL defines which entity attribute and class-specific properties for that temperature transmitter need to be delivered by the Contractor. Except for the entity attributes common to all classes, the property requirements would be different if a different classification is used
* If a Document is classified as a Piping and Instrumentation Diagram, the CFIHOS RDL identifies the final status of the document to be handed over (e.g., As-Built), when a native file format is required (at handover, during project or not required) and a document’s representation type (e.g., structured data).

承包方能够应用CFIHOS RDL确定委托方信息要求，例如：

* 如果某位号分类为温度变送器，CFIHOS RDL定义承包方需要交付该温度变送器的哪些属性和类特定特性。除了所有类公用的实体属性，如果使用不同的分类，则特性要求将有所不同；
* 如果某文档分类为管道及仪表流程图，CFIHOS RDL确定要移交的文档的最终状态（例如竣工）、何时要求源文件格式（移交时、项目期间或不要求）和文档表示类型（例如结构化数据）。

# Data 数据

## General 总则

### Plant Breakdown Structure 工厂分解结构

The Plant Breakdown Structure (PBS) defines the hierarchy of engineering data Objects and the relationships between them. (Annex A.2.2. Figure 2) defines the PBS recognised by the Principal for data handover.

PBS（工厂分解结构）定义工程数据对象的层次结构及其之间的关系。委托方认可的用于数据移交的PBS的定义见A.2.2图2。

### Process, Streams and Cases 工艺、流和工况

At the earlier phase of plant lifecycle, that is preceding the “functional design of the plant and the specification of the assets (asset requirements)” phase, process activities (e.g. pumping, heating, distilling) and streams (e.g. flow of material, flow of heat/energy) data are generated to represent the functional requirements describing what conditions are necessary to convert (chemical) substances step-by-step into final products.

在工厂生命周期的前期阶段，即“工厂的功能设计和资产规格（资产要求）”阶段之前，生成工艺活动（例如泵送、加热、蒸馏）和流（例如材料流、热量/能量流）数据，以表示描述将（化学）物质逐步转化为最终产品所需条件的功能要求。

Processes and streams define the requirements for tags (e.g. ‘we need a tag to perform pumping’), tags define the specification for equipment (e.g. ‘we have to order a centrifugal pump with the following features to implement/fulfill this tag’). The scope of the information required for handover is not limited to the specifications for equipment, but also the requirements for tags.

工艺和流界定对位号的要求（例如“我们需要一个位号来执行泵送”），位号界定设备的规格（例如“我们必须订购有以下特征的离心泵来实施/实现这个位号”）。移交要求的信息范围不仅限于设备规格，还包括对位号的要求。

Streams and Process Activities also have cases which enables the Principal to follow the thoughts of the Contractor Process Engineer who uses cases to view the various what-if scenarios of the process streams.

流和工艺活动还有多个工况，以使能委托方跟随承包方工艺工程师的思路，使用工况查看工艺流各种假设场景。

The relationship between Processes, Streams and Cases is presented in Annex A.2.2. Figure 3.

工艺、流和工况之间的关系见A.2.2图3。

### Tag and Equipment Class Properties 位号和设备类特性

A facility’s information is concerned with the functional definition of the facility (its operating parameters), and how the facility then fulfils the functional requirements i.e. the physical definition of the facility.

设施信息涉及设施功能定义（其运行参数），以及设施如何满足功能要求，即设施物理定义。

The Classification of the tag, equipment or model part engineering data object is used to define functional and physical data properties requirements

位号、设备或型号部件工程数据对象分类用于定义功能和物理数据特性要求。

**Tag (functional) data properties** are the technical design requirements for a tagged item, for example the ‘Maximum Design Pressure’ of a pump. An example of functional data is contained in the datasheet of equipment developed by the design engineer for a piece of equipment.

**位号（功能的）数据特性**是对位号项的技术设计要求，例如泵的“最大设计压力”。设计工程师为一台设备制定的设备数据表包含部分功能数据。

**Equipment (physical) data properties** pertain to the characteristics of the device used to fulfil the design requirements, for example the type, weight and dimensions of a pump. Physical data is normally delivered to Contractor by the Supplier or original equipment manufacturer (OEM).

**设备（物理的）数据特性**与用于满足设计要求的装置特征有关，例如泵的类型、重量和尺寸。物理数据通常由供应方或OEM（原厂）交付给承包方。

## Data Specification 数据规范

The full dataset that shall be handed over by Contractor to Principal is defined in the Contract RDL and may be made up of the following:

* PBS data entities (Tag, Equipment) and their attributes
* Tag and Equipment class properties
* Process, Streams and Cases.

承包方应交付给委托方的完整数据集在 合同RDL中定义，可由以下组成：

* PBS数据实体（位号、设备）及其属性
* 位号和设备类特性
* 工艺、流和工况

Throughout project execution Contractor shall:

* Verify tag numbers on Contractor, Supplier and Subcontractor documents and drawings conform to the Principal’s tagging specification
* Deliver tag data in conformance with the Contract RDL
* Deliver tag data to Principal in a structured electronic format
* Submit intermediate and final handover tag data at Principal’s request
* Verify all tag numbers are separately identified in the master tag register
* Verify the format of engineering units of measure used for tag data are consistent with the Contract RDL
* Verify tag data is consistent with the corresponding information that appears in the latest approved revisions of issued documents, including manuals and dossiers
* Be responsible for the quality (completeness, correctness and consistency) of tag data delivered by Contractor, Contractor’s suppliers and Subcontractors
* Maintain Tag-to-Tag relationships electronically in accordance with the Contract RDL. Examples of Tag-to-Tag relationships include (but are not limited to):
  + - Parent-child associations (e.g. equipment item on a skid)
    - From/To connectivity (e.g. cables, piping lines)
    - Piping line number connectivity (e.g. valves)
    - Loop ID

(Note: Tags cross-referenced to other tags shall be validated against the MTR).

* Maintain Tag-to–Document Number cross-references in accordance with the Contract RDL. Document numbers that are cross-referenced to tags shall be validated by Contractor against the Master Document Register (MDR)
* Verify valid Original Equipment Manufacturer (OEM), model, and serial number are delivered to Principal in conformance with the Contract RDL
* Provide spares data in conformance with Principal’s spares tool
* Hand over complete “As-Built” tag data in conformance with the Contract RDL for the entire scope (including supplier/manufacturer tagged items).

承包方应在整个项目执行中：

* 验证承包方、供应方和分包方文档和图纸上的位号编码是否符合委托方标识规范；
* 交付符合合同RDL的位号数据；
* 以结构化的电子格式将位号数据交付给委托方；
* 应委托方要求提交中间和最终移交位号数据；
* 验证所有位号在主位号清册中单独标识；
* 验证用于位号数据的工程计量单位格式与合同RDL一致；
* 验证位号数据是否与发布的文档（包括手册和档案）的最新批准版本中对应信息一致；
* 负责承包方、承包方的供应方和分包方交付的位号数据质量（完整性、正确性和一致性）；
* 按合同RDL以电子方式维护位号至位号之间的关系。位号至位号关系的示例包括（但不限于）：
  + - 父子关联（例如橇装设备）
    - 从/至连接（例如电缆、管道）
    - 管线号连接（例如阀门）
    - 回路标识符

注：应依据MTR确认交叉引用其他位号的位号。

* 按符合合同RDL维护位号至文档编码的交叉引用。交叉引用位号的文档编码应由承包方依据MDR（主文档清册）进行确认；
* 按符合合同RDL验证向委托方交付的有效OEM（原厂）、型号和序列号；
* 提供符合委托方备件工具的备件数据；
* 按符合合同RDL移交整个工作范围内完整“竣工”位号数据（包括供应方/制造方位号）。

To support these requirements, reference the following in Annex A.2:

* High level overview of the data model (Annex A.2 Figure 1)
* Overview of the document management metadata (Annex A.2 Figure 4)
* Overview of metadata requirements during of procurement (Annex A.2 Figure 5).

参考A.2以下内容以支持这些要求：

* 数据模型高阶概览（A.2 图 1）
* 文档管理元数据概览（A.2 图 4）
* 采购元数据要求概览（A.2 图 5）

# Documents 文档

## General 总则

The specifications for document handover are as stated in this document and the accompanying Contract RDL.

文档移交规范由随附合同RDL和本文件明示。

Contractor shall verify that these requirements are applied to all documents created as part of its scope, including those originated by the Subcontractors and Suppliers/Manufacturers.

承包方应验证这些要求是否适用于其工作范围中创建的所有文档，包括由分包方和供应方/制造方发起的文档。

Contractor shall:

* Verify all documents are submitted to Principal in accordance with the process described in the CFIHOS Scope and Procedure [C-TP-001] or as may be further instructed by Principal.
* Verify document titles, numbers and revisions are identical on the document and the MDR.
* Verify that documents are complete with Annexes and attachments.
* Verify that document cross references within documents and drawings are current, correct and consistent.

承包方应：

* 验证所有文档是否按CFIHOS范围与程序[C-TP-001]所述流程或委托方可进一步指示的方式提交给委托方；
* 验证文档和MDR中文档标题、编码和版本是否相同；
* 验证文档包含附录和附件是否完整；
* 验证文档和图纸中的文档交叉引用是当前的、正确的和一致的。

## Document Specification 文档规范

Contractor shall deliver all documents to Principal in conformance with the Contract RDL which provides a specification for Principal’s requirements in line with each document’s Discipline and Document Type.

承包方应按符合合同RDL向委托方交付所有文档。合同RDL提供对应每份文档的专业和文档类型的委托方要求规范。

Contractor shall handle all deliverables as controlled documents and the following sections shall apply.

承包方应将所有交付物作为受控文档处理，且以下各条应适用。

### Document Numbering 文档编码

Contractor shall verify all documents issued by Contractor, Subcontractors and Suppliers/ Manufacturers are numbered in conformance with the Principal’s Document Numbering Specification. This document number shall be used consistently in the document content (electronic and hardcopy) and the document metadata provided to the Principal.

承包方应验证承包方、分包方和供应方/制造方发布的所有文件编码均符合委托方文档编码规范，并应在提供给委托方的文档内容（电子和硬拷贝）及文档元数据中始终一致使用此文档编码**。**

Contractor shall produce a new revision whenever an update of a document is issued to Principal. A new revision is raised in case information regarding form, fit, function or performance of a component or system is changed.

承包方应在向委托方发布文档更新时生成新版。如果有关部件或系统的形式、配合、功能或性能的信息发生变更，则发起新版。

Revision coding shall be in conformance with Principal’s Document Numbering Specification.

版本号应符合委托方文档编码规范。

### Discipline 专业

Discipline refers to a branch of knowledge of expertise which is responsible for the content of a deliverable. A unique identifier for Discipline shall be used to classify documents in conformance with the Contract RDL.

专业指负责交付物内容的专门知识分支。应按符合合同RDL使用专业唯一标识符分类文档。

### Document Type Classification 文档类型分类

A unique identifier for Document Classification shall be used to classify documents in conformance with the Contract RDL.

应按符合合同RDL使用文档分类唯一标识符分类文档。

### Discipline Document Type Classification 专业文档类型分类

Discipline Document Type Classification is an identification of the type of document required for each discipline, and its related delivery requirements in conformance with the Contract RDL. A Discipline Document Type unique identifier is used for instances where a document type is common to more than one discipline or to further classify documents of a particular type within a discipline.

专业文档类型分类是对每个专业要求的文档类型的标识，其相关交付要求符合合同RDL。专业文档类型唯一标识符用于例如某文档类型对一个以上专业公用，或用于进一步分类某专业的某特定类型文档。

Contractor shall verify all documents handed over to the Principal are assigned an appropriate Discipline Document Type code and that all handover requirements of the relevant Discipline Document Type code are satisfied in conformance with the Contract RDL.

承包方应验证所有移交给委托方的文档已赋以适当的专业文档类型编码，且相关专业文档类型编码的所有移交要求均符合合同RDL。

Documents shall only contain one Discipline Document Type Classification. Contractor shall not create documents containing the content of multiple Discipline Document Types (especially if the content may be updated independently) but should split such documents into individual documents per Discipline Document Type. If necessary, these may be formed into a book, as described in Section 7.4.1.

文档应仅包含一种专业文档类型分类。承包方不应创建包含多种专业文档类型内容的文档（尤其是如果此内容可单独更新），而宜根据专业文档类型将此类文档拆分为单独的文档，如有必要可成册，如7.4.1所述。

Contractor shall not create new discipline document type combinations without prior approval from Principal.

未经委托方事先批准，承包方不应创建新的专业文档类型组合。

## Document Properties (Metadata) 文档特性（元数据）

Each document revision submitted by Contractor to Principal shall be delivered along with the following metadata as structured data:

* Document number
* Document Title
* Document revision code
* Document revision date
* Originator company
* Document revision author
* Document revision approver
* Document revision file name
* Originator document number
* Originator document revision code
* Originator file name
* Document status code
* ISO language code
* Project code
* Document revision comment
* Plant code
* Export control classification
* Transmittal number
* Document revision recipient
* Actual review date
* Actual approval date
* Actual approved for design date
* Actual approved for construction date
* Actual as-built date
* Document revision physical storage location
* Storage media
* Project stage
* Regulatory required indicator.

承包方向委托方提交的每个文档版本应与以下元数据作为结构化数据一起交付：

* 文档编码
* 文档标题
* 文档版本号
* 文档版本日期
* 发起方公司
* 文档版本作者
* 文档版本批准人
* 文档版本文件名
* 发起方文档编码
* 发起方文档版本号
* 发起方文件名
* 文档状态编码
* ISO语言代码
* 项目编码
* 文档版本备注
* 工厂编码
* 出口管制分类
* 传送单号
* 文档版本收件人
* 实际复核日期
* 实际批准日期
* 实际批准用于设计日期
* 实际批准用于施工日期
* 实际竣工日期
* 文档版本物理存储位置
* 存储介质
* 项目阶段
* 法规要求指示符

## Document and File Structures 文档和文件结构

### Document Books (or binders) 文档卷册（或文档活页册）

A book, i.e., a logical collection of documents, may be used to retain a natural grouping of documents (e.g., to record the documents delivered in a Vendor Package, regardless of their discipline document type). The following rules shall apply to all books:

* Create a separate document that contains the index of the book and classify it as a document type appropriate for the book
* Assign a unique document number to each document in the book
* Create a document-to-document reference between the index document and the documents in the book.

卷册即文档的逻辑收集，可用于保留文档的自然分组（例如，不分专业文档类型记录供方供货包中交付的文档）。以下规则应适用于所有卷册：

* 创建一个包含卷册索引的单独文档，并将其分类为适合该卷册的文档类型；
* 为卷册中的每份文档赋以一个唯一文档编码；
* 在索引文档和卷册中的文档之间建立文档至文档的引用。

### File Requirements 文件要求

Contractor shall verify each document has at least one electronic file.

承包方应验证每份文档至少有一个电子文件。

The following shall apply to electronic files:

* Each document or its rendition is delivered in a single electronic file
* If drawings have multiple sheets (for example Piping and Instrumentation Diagrams), each sheet is a separate document number. Therefore, each sheet shall also be created as a single electronic file
* Any document that refers to a single object shall be delivered as a single file. For example, loop diagrams shall not be combined into a single document as this will make it harder to find and modify an individual loop diagram in the future
* Each electronic file is self-contained and does not require any other electronic files for viewing or updating purposes (e.g., X-Ref, shape files, non true-type fonts, templates, etc.)
* The maximum file size for a document is specified by Principal. Larger files may be allowed for files that are accessed rarely or for 3D Models that need to be handled as single document objects
* For large files (larger than the specified maximum size), split into smaller files:
  + - The document should be split at natural section breaks (indicated by section markers)
    - If the document has no natural section breaks but exceeds the allowable file size, the document should be broken at the file size limit.
* Verify that image formats within a document are legible when embedded in an A4 document
* Electronic files shall accurately represent the information on equivalent paper deliverables. The completeness of electronic files shall be the same as that of paper deliverables. Electronic native files need not contain the sign-off signatures for the current issue unless the native file is specified as the authenticated record format in the RDL.

以下应适用于电子文件：

* 每份文档或其呈现副本均以单一电子文件形式交付；
* 如果图纸有多张（例如管道及仪表流程图），则每张图纸都有单独的文档编码，因此每张图纸也应创建为单一电子文件；
* 任何引用单一对象的文档应作为单一文件交付。例如，多张回路图不应合并为单一文档，因为这将增加未来查找和修改单张回路图的难度；
* 每个电子文件都是自足的，其查看或更新无需任何其他电子文件（例如，X-Ref、形文件、非TTF字体（非全真字体）和模板等）；
* 文档的最大文件大小由委托方规定。对于很少访问的文件或需要作为单个文档对象处理的3D模型，可容许使用更大的文件；
* 大文件（超过规定的最大大小）拆分成较小的文件时：
  + - 文档宜在自然的分节处拆分（由分节符指明）；
    - 如果文档没有自然的分节但超过容许的文件大小，则宜以文件上限拆分文档。
* 验证嵌入A4文档中的图像格式易于辨识；
* 电子文件应准确表示等效纸质交付物信息。电子文件完整性应与纸质交付物完整性相同。电子源文件不必包含当前发布版的签发签名，除非源文件在RDL中被规定为经认证的记录格式。

File naming shall be in conformance with the Principal’s Document Numbering Specification. The following rules apply to file names:

* The file name should only contain alphabetic, numeric, and underscore characters (no special characters are allowed). Underscore should replace any slashes (/ or \)
* The file name should not imply any relevance. It shall be possible to rename the file without affecting the viewing or editing of that file or any other file.

文件命名应符合委托方文档编码规范。以下规则适用于文件名：

* 文件名宜只包含字母、数字和下划线字符（不容许使用特殊字符）。宜用下划线替换任何斜杠（/或\）；
* 文件名不宜隐含任何相关性。文件应能在不影响该文件或任何其他文件的查看或编辑的情况下重命名。

### Additional Files 附加文件

Contractor shall use additional files indication in the transmittal when multiple files are delivered against a single document number revision. Examples include:

* A document delivered in multiple renditions (e.g., a scanned PDF of the signed off document and a word processor native file of the same)
* A document with an unacceptably large file size that has been divided into multiple files of acceptable size
* A single document containing multiple file types (e.g., a specification document with an attached data sheet)
* A single document containing equivalent information in multiple languages.

以单一文档编码版本交付多个文件时，承包方应在传送单中使用附加文件指示。示例包括：

* 以多种呈现形式交付的文档（例如，已签发文档的扫描PDF和该文档的文字处理器源文件）；
* 超出文件大小限制已被分成多个可接受大小文件的文档；
* 包含多种文件类型的单一文档（例如，附数据表的规格书）；
* 包含多语言等效信息的单一文档。

Where additional files are indicated, Contractor shall:

* Nominate the primary document and treat it in the same way as any other document, giving it a Document Number and Revision Code
* Assign the same Document Number and Revision Code to all other (secondary) files in the set. Each Document Title and File Name reflects the sequence of the files as they appear in the complete document
* The primary file shall contain the front sheet and table of contents.

在指明附加文件的情况下，承包方应：

* 指定主文档，并以与其他任何文档相同的方式处理，给以文档编码和版本号；
* 为该文件集所有其他（次要）文件赋以相同的文档编码和版本号。每个文档标题和文件名反映文件在完整文档中出现的顺序；
* 主文件应包含首页和目录。

### Files to be delivered 要交付文件

The Contractor shall deliver all documentation (final and intermediate revisions) electronically.

承包方应以电子方式交付所有文档（最终和中间版本）。

A signed PDF rendition of all documents shall be delivered along with the native files unless the authenticated record format is otherwise specified by the Principal.

除非委托方另行规定认证记录格式，所有文档的签名PDF应与源文件一起交付。

Where the native format is paper, the Contractor shall scan the document and deliver a PDF file.

如果源格式为纸质，则承包方应扫描文档并交付PDF文件。

Where files require long time archiving, use the PDF/A format specified in ISO 19005-2:2011. The Principal and Contractor shall determine which categories of document that this applies to.

要求长期存档的文件使用ISO19005-2:2011规定的PDF/A格式。委托方和承包方应确定适用的文档类别。

If the native format cannot reasonably be converted to electronic media (for example radiographic films) the Contractor shall deliver the non-electronic native format only. See Section 7.6 for the Physical Record Handover requirements.

如果源格式不能适当地转换为电子介质（例如射线胶片），承包方应仅交付非电子源格式。物理记录移交要求见7.6。

### Image Quality 图片质量

Contractor shall verify PDF files are:

* Rendered directly from the authoring application as content searchable PDF format with commenting enabled, or
* Scanned directly from hardcopy documents containing a wet signature and/or official stamp(s).

承包方应验证PDF文件为：

* 直接从文档创建应用程序生成的，可搜索内容并启用批注的PDF格式，或；
* 直接扫描包含手写签名和/或官方印章的硬拷贝文档。

For all PDF files, Contractor shall verify:

* Documents are rendered or scanned at their original size directly from the original hard copy
* Images are rendered or scanned in an orientation that allows viewing without rotation
* The rendered or scanned image file is split into smaller files if it is too large. Refer to Section 7.4.2 for more detail
* All information in a rendered or scanned document is legible and fully text searchable
* Documents are rendered or scanned in colour at a resolution of 300-600dpi
* The quality of rendered or scanned documents containing characters are measured by running an OCR scan on a printed version of the document with all characters recognized.

承包方应对所有PDF文件进行以下验证：

* 文档直接从原始硬拷贝中以原始尺寸生成或扫描；
* 图像用无需旋转查看的方向呈现或扫描；
* 如果生成或扫描的图像文件太大，则将其拆分为较小的文件；更详细信息见7.4.2；
* 生成或扫描文件中的所有信息都易于辨识，并且可以全文搜索；
* 文档以300-600dpi分辨率彩色生成或扫描；
* 通过在文档打印版本上运行OCR（光学字符识别）扫描识别出所有字符，测量包含字符的生成或扫描文件质量。

### Hyperlinks 超链接

Contractor/Supplier may use links to reference information within the same file.

承包方/供应方可使用链接以引用同一文件中的信息。

Contractor/Supplier shall not use hyperlinks to the contractor’s intranet or shared drives.

承包方/供应方不应使用指向承包方内部网或共享盘的超链接。

Contractor/Supplier shall not use hyperlinks between documents.

承包方/供应方不应在文档之间使用超链接。

### Different Languages 不同语言

A document created in one language and translated to another language shall be managed as a single document generated by combining multiple documents (e.g., Chapter 1 – English, Chapter 2 – Russian). In this case, the document may exist as a single file, or a set of files in line with the agreed rules when multiple files are delivered against a single document number revision.

对于以一种语言创建并翻译成另一种语言的文档，应作为通过合并多份文档（例如，第1章 - 英文，第2章 - 俄语）而生成的单一文档进行管理。这种情况下，文档可作为单一文件存在，或在以单一文档编码版本交付多个文件时，作为符合商定规则的文件集存在。

The Principal shall define which language is regarded as the “master” language. In case of disputes or when something is unclear, refer to the text in the “master” language.

委托方应定义哪种语言被视为“主”语言。在有争议或某事不清楚时的情况下引用“主”语言文本。

Contractor shall ensure processes and procedures are in place to ensure the quality of the translations. The Principal may reject translations that do not meet Principal’s quality standards.

承包方应确保流程和程序到位，以确保翻译质量。委托方可拒绝未达到委托方质量标准的翻译。

Country code abbreviations used in file names or document titles should comply with ISO 3166-1.

文件名或文档标题中使用的国家/地区代码缩写宜遵守ISO 3166-1。

### Character Set 字符集

The Principal shall define the character set to be used for all information handovers with possible exceptions; Where none is defined by Principal, the Unicode/ISO 10646 character set shall be used.

委托方应定义用于所有信息移交的字符集，但可能存在例外情况； 如果委托方未定义，则应使用Unicode/ISO 10646字符集。

Special characters shall not be used in attribute or classification fields. Examples are:

* à, á, â, ä, è, é, ê, ë, ô, ö, ü, ç, etc.
* !, , #, $, -, \*, &, :, “, /,\, or carriage returns.

不应在属性或分类字段中使用特殊字符。例如：

* à、á、â、ä、è、é、ê、ë、ô、ö、ü、ç等；
* !、、#、$、-、\*、&、:、“、/、\或回车符。

In attribute or classification fields, words that contain these characters shall be converted to standard characters as follows:

* Replace à, á, â and ä with a
* Replace è, é, ê and ë with e.

在属性或分类字段中，包含这些字符的单词应按以下转换为标准字符：

* 替换à、á、â和 ä为a；
* 替换è、é、ê和ë为e。

A similar approach shall be followed for other special characters.

其他特殊字符应遵循类似方法。

### Document Size 文档尺寸

All drawing and document sizes shall comply with ISO 216 (i.e. A1, A2, A3 and A4). The following rules shall apply:

* Documents are A4 size
* Drawing sheets do not exceed A1 in size
* Drawings of a size greater than A3 should be produced so they are legible when printed at A3 size.

所有图纸和文档尺寸均应遵守ISO 216（即A1、A2、A3和A4）。以下规则应适用：

* 文档为A4尺寸；
* 图纸尺寸不超过A1；
* 宜以A3尺寸打印的情况下易于辨识绘制尺寸大于A3的图纸。

## Document References 文档引用

Document references are critical to quickly finding tag information during the commissioning and operation phases.

文档引用对于在调试和运行阶段快速找到位号信息极其重要。

Contractor shall cross reference all documents through document numbers to the asset hierarchy level in conformance with the Contract RDL and provide this data to the Principal in a document references file as structured data.

承包方应按符合合同RDL通过文档编码将所有文档交叉引用至资产层次结构级别，并在文档引用文件中将此数据作为结构化数据提供给委托方。

Contractor shall verify that Approved For Construction and later revisions of all documents are issued with a complete set of document references including document to tag number references defined in the Contract RDL.

承包方应验证所有批准用于施工及之后版本的文档发布时，均随附完整文档引用集（包括合同RDL定义的文档至位号引用）。

## Physical Record Requirements 物理记录要求

The Principal’s objective is to maximise electronic information exchange. However, to comply with local regulations and/or working practices, final delivery of both electronic and hardcopy (original signed) versions may be necessary. Paper or hardcopy is required for some legally binding agreements and for certificates carrying original signatures or marks that authenticate a document. In this case, hardcopy formats shall be deemed the original native format.

委托方目标是最大化电子信息交换。但为了遵守当地法规和/或工作实践，可最终既交付电子版本，也交付硬拷贝（原始签名）版本。一些具有法律约束力的协议和带有原始签名或文档认证标记的证书需要纸质或硬拷贝，这种情况下硬拷贝格式应视为原始源格式。

Contractor shall verify that hardcopy and electronic renditions of the same document are identical at the time of handover to the Principal.

承包方应验证同一文档的硬拷贝文件和电子呈现副本在移交给委托方时是否相同。

Contractor shall be responsible for maintaining and handing over all physical records (media files, X-rays, core samples, etc.) produced during the execution of the works as required by Principal.

承包方应负责维护和移交委托方要求的在工作执行期间产生的所有物理记录（介质文件、X射线、岩心样品等）。

# Models 模型

## General 总则

The term ‘model’ is used to describe the computerised representation of an aspect of the performance of the facility, usually requiring specific software to be used.

术语“模型”用于描述设施某方面性能的计算机化表示，通常需要使用特定软件。

Where the Principal has requested the handover of Models, Contractor shall:

* Handover those models outlined in Table 1, which is indicative with details defined in the Contract Scope of Work
* Submit models to Principal in native format such that Principal can open, edit and re-run the models in the application used to generate them
* Submit models which are restorable to the original native application used to create it and shall maintain the full functionality of the original model, ensuring Catalogues and Specifications used by Contractor to generate the original model, or thermodynamic property sets used to create the process simulations are made available to the Principal.

如果委托方要求移交模型，承包方应：

* 移交表1（指示性的表，详细信息在合同工作范围中定义）概括的模型；
* 将模型以源格式提交给委托方，以便委托方能在用于生成该模型的应用程序中打开、编辑和重新运行模型；
* 提交可在用于创建模型的原始源应用程序中恢复的模型，并应保持模型的完整功能，从而确保承包方用于生成原始模型的元件库和等级表，或用于创建工艺流程模拟的热力学特性集对委托方可用。

Table 1 - Handover Models  
表1 移交模型

| Model Description  **模型描述** | Handover Status  **移交状态** |
| --- | --- |
| Pipe stress analysis model.  管道应力分析模型 | As Design  设计状态 |
| Blast analysis model, Gas dispersion studies, risk analysis model for use in safety studies, Safety Case amendments.  用于安全研究、安全档案修正的爆炸分析模型、气体扩散研究、风险分析模型 | As Design  设计状态 |
| Steady State Process models for possible input to Production Optimisation, engineering modifications  可能作为生产优化、工程修改输入的稳态工艺模型。 | As Design  设计状态 |
| Dynamic process simulation models for use with Operator training simulator, Enhanced choke, possible input to Production Optimisation, engineering modifications  与操作员培训仿真机、增强型节流装置一起使用，可能作为生产优化、工程修改输入的动态工艺流程模拟模型 | As Design  设计状态 |
| Geospatial Information System  地理空间信息系统 | As Built  竣工状态 |
| Database system to generate ‘intelligent’ P&IDs and Line List deliverables  生成“智能”P＆ID（管道及仪表流程图）和管线表交付物的数据库系统 | As Built  竣工状态 |
| Database system used to generate Instrument Loop drawings Specification Sheets, termination drawings from an underlying Database  用于从下层数据库生成仪表回路图、规格表、端子图的数据库系统 | As Built  竣工状态 |
| A multi-discipline 3D model comprised of many components, which facilitate clash free design, produce 2D drawings from the 3D master, generate MTOs etc.  一个由多部件组成的多专业3D模型，以备无碰撞设计、从3D母体生成2D工程图、生成MTO（材料表）等 | As-built as far as possible from the individual 2D documents that will be available in as-built state after red/green lining and back-drafting.  竣工状态，尽可能基于红/绿批注和逆向绘图后获得的单独竣工状态2D文档 |
| Structural analysis models  结构分析模型 | As Design  设计状态 |
| Instrument & control systems model used to determine safety integrity requirements for instrumentation  用于确定仪表安全完整性要求的仪控系统模型 | As Built  竣工状态 |

## 3D Model 3D模型

A single as-designed native 3D model shall be handed over by Contractor to Principal covering 100% of the asset and includes all:

* Objects within the 3D model such that they can be maintained on an ongoing basis
* Applicable catalogues and specifications required to maintain the 3D model
* Contractors’ 3D models
* Tagged equipment items within supplier delivered equipment packages (clearly identified in accordance with Principal’s Tag Numbering Specification)
* Design changes made after the engineering deliverables produced from the 3D model issued for construction
* Responses to technical/engineering queries where these resulted in changes to information on design deliverables produced from the 3D model or impacted items within the 3D model
* Instructions issued to the fabrication or construction Contractor where these resulted in changes to information on design deliverables produced from the 3D model or impacted items within the 3D model
* As-built changes identified on mark-ups of drawings as part of the Construction and Commissioning work processes where these changes affected items within the 3D model.

承包方应向委托方移交单一的设计状态3D源模型，覆盖100%资产并包括以下所有：

* 能持续维护的3D模型中的对象；
* 维护3D模型所需适用元件库和等级表；
* 各承包方的3D模型；
* 供应方交付的设备包中带位号设备项（按委托方位号编码规范清楚标识）；
* 施工用3D模型生成的工程交付物发布后的设计变更；
* 导致了3D模型生成设计交付物或3D模型中受影响项产生信息变更的，对技术/工程问询的响应；
* 导致了3D模型生成设计交付物或3D模型中受影响项产生信息变更的，发给建造或施工承包方的指示；
* 在图纸标记上标识的影响3D模型中物项的竣工变更（作为施工和调试工作流程的一部分）。

For packaged or Subcontractor supplied equipment:

* Detailed 3D models of all Subcontractor designs or supplied equipment or packaged equipment shall be consolidated by Contractor into a single editable 3D model
* If these sub-models can only be imported as geometry (i.e. metadata cannot be imported), then separate 3D model files in their respective native formats shall be handed over to Principal.

对于成套或分包方提供设备：

* 承包方应将所有分包方设计或提供的设备或成套设备的详细3D模型合并为单一可编辑3D模型；
* 如果只能将这些子模型作为几何体导入（即不能导入元数据），则应将其各自源格式的单独3D模型文件移交给委托方。

The 3D model handed over to Principal shall include a common set of catalogues and specifications synchronized during the project execution and on project completion, or if the 3D system is not based on a system which uses catalogues and specifications, sufficient files and configuration information (including naming conventions) shall be supplied to enable editing in the native application used to create the 3D model.

移交给委托方的3D模型应包括在项目执行期间和项目完成时同步的一套公用元件库和等级表，或者如果3D系统不是基于使用元件库和等级表的系统，应提供足够的文件和配置信息（包括命名规范），以使能在用于创建3D模型的源应用程序中进行编辑。

When 3D modelling is carried out by more than one Contractor or Supplier, each Contractor and Supplier shall comply with a common set of modelling standards (including naming conventions). This facilitates the incorporation into the lead Contractor’s 3D model to verify that the model is wholly representative of what is delivered from both a visual and dimensional basis prior to handover.

当由一个以上承包方或供应方进行3D建模时，每个承包方和供应方应遵守一套公用的建模标准（包括命名规范），以备将模型纳入至主承包方3D模型中，从而在移交前根据视觉及尺寸基准验证该模型完全表示交付内容。

At handover the integrated model shall be free of unresolved clashes.

集成模型移交时应无未解决的碰撞。

At handover the 3D model shall not be dependent on internally developed or third-party software, i.e. the model shall be capable of accepting modifications to existing objects, and the addition of new objects.

3D模型移交时不应依赖于内部开发或第三方软件，即该模型应能够接受对现有对象的修改以及新对象的添加。

Unless otherwise agreed between Principal and Contractor, the 3D model shall be handed over fully compatible with the latest commercially available version of the native CAD application.

除非委托方与承包方之间另有约定，否则移交的3D模型应与CAD源应用程序的最新商业可用版本完全兼容。

General arrangements, plot plans and layout drawings shall be capable of being generated directly from the native 3D modelling application with no post processing required. e.g. drawing borders used by the contractor shall also be handed over with the 3D model.

总布置图、平面图和布置图应能够直接从3D建模源应用程序生成，无需后期处理，例如承包方使用的图框也应随3D模型移交。

Objects in models shall be identified with tag numbers in conformance with the facility’s tagging specification to facilitate linking to external tools and systems of record. The syntax of tag and document numbers shown on graphical reports and drawings generated from the model shall be identical to the syntax in the Principal systems of record. All tagged items in Supplier packages shall be clearly identified in Supplier delivered 3D model in conformance with Principal’s tagging specification.

模型中的对象应使用符合设施标识规范的位号编码进行标识，以备链接至外部工具和记录系统。从模型生成的图形报告和图纸上显示的位号和文档编码的规则应与委托方记录系统中的规则相同。供应方供货包中所有位号项均应在供应方交付的3D模型中清楚标识，并符合委托方标识规范。

Temporary facilities (e.g. hook-up areas and temporary objects) shall be removed from the 3D model prior to handover to Principal.

3D模型应在移交委托方前删除临时设施（例如连接区域和临时对象）。

A User Manual containing all information required to allow suitably trained and competent users to maintain the model in operations shall accompany the "as-designed" model.

“设计状态”模型应随附一本用户手册，该手册中应包含所需所有信息，以容许经适当培训及合格的用户在运行阶段维护模型。

A view only format of the complete model for the facility shall also be handed over to Principal as required, within 2 weeks of being requested incorporating all Supplier and Subcontractor 3D models.

还应在收到要求后2周内按要求将查看格式的设施完整模型移交给委托方，此完整模型合并所有供应方和分包方3D模型。

### Photogrammetry and LIDAR Survey Specification 摄影测量和LIDAR（激光探测及测距系统）测绘规范

Contractor shall carry out photogrammetry and laser scan surveys for the as-built asset:

* Covering 100% of process plant, structures and utility systems
* Scan density covers all visible surfaces within line of sight of walkways and access routes
* Scans are spatially aligned with 3D model and GIS model
* Tagged equipment items shall be identified and tagged within the photogrammetry and laser scans in accordance with Principal’s tagging specification
* Photogrammetry surveys shall be consolidated into a single photogrammetry model that reflects the as-built state of the asset
* Laser point cloud surveys shall be consolidated into a single point cloud model that reflects the as-built state of the asset.

承包方应对竣工资产执行摄影测量及激光扫描测绘：

* 覆盖100%的流程工厂、结构和公用系统；
* 扫描密度覆盖人行道和通道视线范围内的所有可见表面；
* 扫描在空间上对齐3D模型和GIS模型；
* 应按委托方标识规范，在摄影测量和激光扫描中识别并标记带位号的设备项；
* 摄影测量测绘应合并为反映资产竣工状态的单一摄影测量模型；
* 激光点云测绘应合并为反映资产竣工状态的单一点云模型。

Raw survey data for both photogrammetry and point cloud laser surveys shall be handed over to the Principal.

摄影测量及激光点云测绘的原始测绘数据应移交给委托方。

### Coordinate Alignment Specification 坐标对齐规范

Survey and 3D model data shall be aligned to a consistent facility coordinate system, which itself is aligned to a recognised geospatial coordinate system.

测绘及3D模型数据应与一致的设施坐标系对齐。该坐标系本身与公认的地理空间坐标系对齐。

# Bibliography 参考文献

* EPISTLE Process Industry Data Handover Guide Part 1 and Part 2 EPISTLE（欧洲流程工业STEP（产品模型数据交换标准）技术联络执行委员会）流程工业数据移交指南 第1部分和第2部分
* NIST Capital Facilities Information Handover Guide, Part 1 NIST（美国国家标准技术研究院）资产密集型设施信息移交指南 第1部分
* Shell EIS Hand Over Specification 壳牌 EIS（工程信息规范）移交规范
* CEN ORCHID Roadmap Standardising Information Across the Plant Engineering Supply Chain - Part 1: Direction and Framework CEN（欧洲标准委员会） ORCHID（工业数据统筹）工厂工程供应链信息标准化路线图 第1部分：方向和框架
* PISTEP Process Plant Engineering Activity Model PISTEP（流程工业产品模型数据交换标准） 流程工厂工程活动模型
* EPRI New Nuclear Power Plant Information Handover Guide. EPRI（美国电力研究院）新核电站信息移交指南

1. - Information Specification  
   附录A 信息规范
   1. General总则

This Annex contains a snapshot of the CFIHOS Entity Objects, Attributes and Relationships that form Principal’s Standard Information Specification both in terms of a data model and in terms of a data dictionary.

本附录包含CFIHOS实体对象、属性和关系的快照，这些对象、属性和关系从数据模型和数据字典方面构成委托方标准信息规范。

This Annex does not define the scope for the contractor but is included to provide Contractor with an overview of the information requirements to enable them to make decisions regarding how to support the Principal. If no Project Contract Information Specification is provided, then the contractor shall assume all fields are mandatory until advised by Principal.

本附录并未定义承包方工作范围，而是向承包方提供信息要求概述，以使能承包方决定如何支持委托方。如果未提供项目合同信息规范，承包方应假定所有字段必填，直至委托方通知为止。

* 1. Data Model 数据模型
     1. How to read the data model 如何解读数据模型

There are different types of object used in a data model:

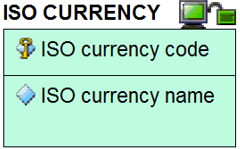
数据模型中使用不同类型对象：

The first type is an **entity**. It is represented by a rectangle either with its name in it or the name above it. An entity is like a table of data.

第一种类型是**实体**，由一个矩形表示，实体名称在矩形内或上方。一个实体就像一张数据表。

The second type is an **attribute**. An attribute above the line (here shown with a key symbol overlaid on the diamond) represents a primary key – i.e. an ISO 4217 Currency Code uniquely identifies the ISO currency. Each ISO currency will also have an ISO Currency Name, but the code is the key.

第二种类型是**属性**，线上方属性（此处显示为叠加在菱形上的钥匙符号）代表主键，即唯一标识如ISO货币的ISO 4217货币代码。每种ISO货币也有一个ISO货币名称，但ISO货币代码是主键。



The third type is a **relationship**, or ‘foreign key constraint’. The lines between entities with the different symbols represent the different variants there are to these relationships. The relationships include ‘one to one’, ‘one to many’ and ‘many to many’ but the exact relationship between the connected entities is described in words with a connecting phrase such as “qualifies the price of” or “is used by” or “contains allowed values for”. This connecting phrase will be contextual depending on the entities involved.

第三种类型是**关系**或“外键约束”，实体之间带有不同符号的线表示这些关系的不同变体。这些关系包括“一对一”、“一对多”和“多对多”。连接实体之间的确切关系是用带连接短语的词语描述的，如“限定……的价格”或“被……使用”或“包含……的容许值”。根据所涉及的实体，该连接短语将是语境相关的。

The variants of relationship differ from each other in other aspects:

关系的变体在其他方面彼此不同：

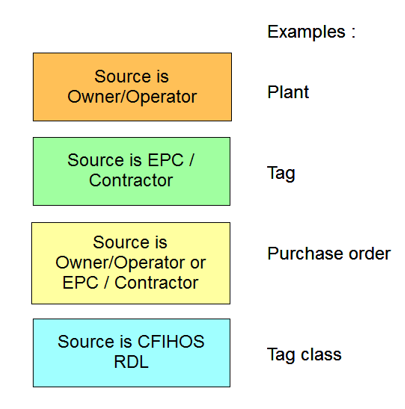
|  |  |
| --- | --- |
|  | **Variant one:** The identifier of the first entity is passed as a non-identifying element of the other entity.  **变体一**：第一个实体的标识符作为另一个实体的非标识元素传递。 |
|  | **Variant two:** The identifier of the first entity is passed as an identifying element of the other entity. The line between the two entities is a solid line.  **变体二**：第一个实体的标识符作为其他实体的标识元素传递。两个实体之间的线是实线。 |
|  | **Variant three:** Many-to-many relationships. These typically require an intermediate entity to clarify the constraints  **变体三**：多对多关系，通常需要一个中间实体以澄清约束。 |
|  | **Variant four:** Subtyping – where multiple entities have the same identifier, but the subtypes need distinguishing from each other because they have different attributes.  **变体四**：子类型化——多个实体有相同标识符，但子类型因为属性不同需要彼此区分。 |

For further instructional material on how to read the CFIHOS Data Model, refer to the Data modelling Training Material [C-DM-901] on the CFIHOS SharePoint site.

如何解读CFIHOS数据模型的进一步指导资料见CFIHOS SharePoint网站上的数据建模培训资料[C-DM-901]。

For reference within the figures below, the following colour coding represents the source of the information:

以下颜色编码表示图1至图5中信息来源：



* + 1. High-level views of the CFIHOS data model CFIHOS数据模型高阶视图

This section provides examples from the CFIHOS data model. In order to understand the context of the entities that make up a capital facility and all the elements that are required in the handover of information, the following four extracts from the overall data model cover the key areas.

本条提供CFIHOS数据模型示例。为理解构成资产密集型设施的实体内容及信息移交要求的所有元素，从整体数据模型中提取的涵盖关键领域的四个摘录如下。

It is important to appreciate that even extracts of specialist areas of the model – e.g. the part covering documents and document metadata – is always a part of a bigger picture and the entities covered in one picture with the same name as those covered in another picture are, by definition, the same.

重要的是要认识到，即使是模型的各专门领域的摘录——例如涵盖文档和文档元数据的部分——也始终是更大的图的一部分。一张图涵盖实体与另一张图涵盖的有相同名称的实体根据定义是相同的。

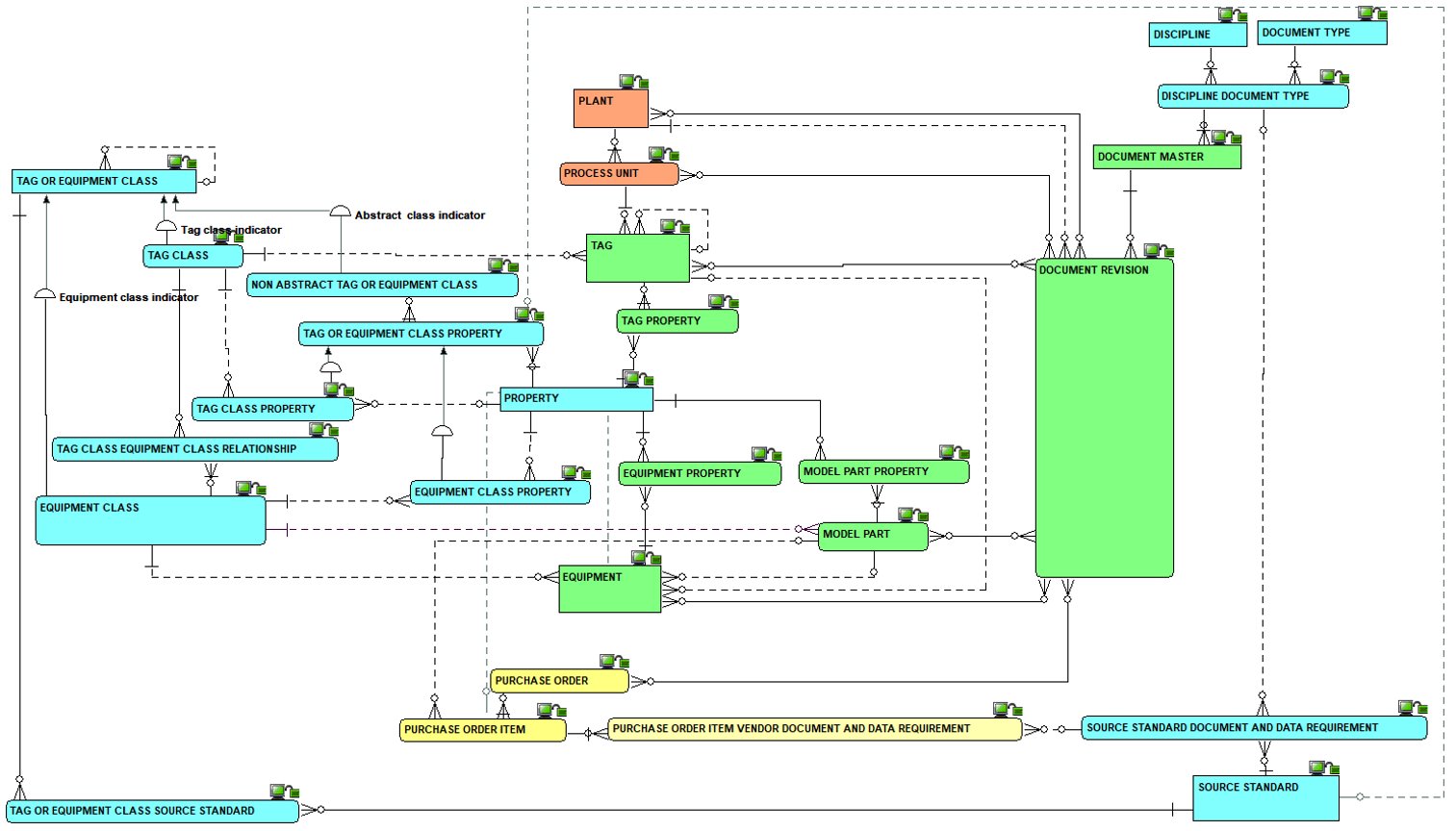


Figure 1 - High-level overview of the complete model   
图1 完整模型高阶概览

Diagram

Description automatically generated

Figure 2 - Overview of the Plant Breakdown Structure   
图2 工厂分解结构概览

Timeline

Description automatically generated

Figure 3 - Overview of the Classifications and Properties including Processes, Streams and Cases   
图3 分类和特性（包括工艺、流和工况）概览

Diagram

Description automatically generated with medium confidence

Figure 4 - Overview of the document management metadata   
图4 文档管理元数据概览

Diagram

Description automatically generated

Figure 5 – Overview of metadata requirements at time of procurement   
图5 采购时元数据要求概览

* + 1. Complete set of views of the CFIHOS data model CFIHOS数据模型完整视图集

The complete data model is available in the following formats:

* As a PowerPoint slide
* In its native format.

完整数据模型以如下格式提供：

* PowerPoint幻灯片
* 其源格式

Note – both of the versions come under the same document number [C-DM-001].

注：两个版本均使用同一文档编码[C-DM-001]。

* 1. Data Dictionary 数据字典
     1. How to understand the data dictionary 如何理解数据字典

For each CFIHOS Entity Object the data dictionary provides the list of attributes, with their definitions, examples, formats, optionality, constraints and sources.

数据字典提供每个CFIHOS实体对象属性列表，及其定义、示例、格式、可选项、约束和来源。

Table 2 describes the content of each column in the data dictionary.

表2描述数据字典每列内容。

Table 2 - Data Dictionary Descriptions  
表2 数据字典描述

| Column  列 | Field Name  字段名 | Definition  定义 |
| --- | --- | --- |
| A | Section  条 | Provides a unique reference to each entity, with some mapping to the section used in the previous edition. NOTE. This column is not shown in the light version of the data dictionary, as it is replaced by the name of the related Entity for filtering.  提供对每个实体的唯一引用，一部分映射至前一版本中使用的编号。  注：轻量版数据字典增加了用于过滤的相关实体名称。 |
| C | Name  名称 | The name of the entity (in the physical world: table) or attribute (in the physical world: column)  实体名称（物理世界中：表）或属性的名称（物理世界中：列）。 |
| D | Definition  定义 | What the entity or attribute is/means/represents  实体或属性是什么/意味什么/表示什么。 |
| E | Note/ comment  注释/备注 | Supplementary information about the entity or attribute, though not part of the definition  关于实体或属性的补充信息，并非定义的一部分。 |
| F | Example  示例 | An example to assist in understanding.  有助于理解的示例。 |
| G | Identifier/ Mandatory/ Optional  标识符/必填/选填 | An indication whether the attribute is (part of) what identifies one occurrence of the entity, or, if not (part of- the identifier, whether the attribute is mandatory or optional  指明该属性是否（部分）标识实体的一次出现。或如果不是（部分）标识符，则该属性为必填或选填。 |
| I | Format  格式 | An indication of attribute’s data type and its maximum size  指明属性数据类型及其最大大小。 |
| J | Constraint  约束 | An indication of restrictions on allowable values of the attribute  指明对属性容许值的限制。 |
| K | CFIHOS unique id  CFIHOS唯一标识符 | A code that, in CFIHOS, identifies uniquely an entity or an attribute. (Note: this column is not shown in the light version of the data dictionary)  CFIHOS中用于唯一标识实体或属性的编码。  注：轻量版数据字典未显示此列。 |
| L | Data source  数据源 | An indication of where the data is sourced from:   * Principal * Contractor/Supplier/manufacturer * A mix of both * Reference Data Library (RDL) * RDL as a pick list (note that the RDL pick list records are not shown in the light version of the data dictionary)   指明数据来源：   * 委托方 * 承包方/供应方/制造方 * 两者兼有 * RDL（参考数据类库） * RDL作为值列表   注：轻量版数据字典未显示RDL值列表记录。 |

* + 1. CFIHOS Data Dictionary excerpt CFIHOS数据字典摘录

Excerpt of the CFIHOS Data Dictionary provided below for reference:

以下提供CFIHOS数据字典摘录供参考：



* + 1. Access to the CFIHOS Data Dictionary 访问CFIHOS数据字典

The complete CFIHOS Data Dictionary can be found in document C-DM-002.

完整CFIHOS数据字典见C-DM-002。

A lighter version of the data dictionary, which omits columns K and L (see above) is also available.

还提供省略K和L列（见表2）的轻量版数据字典。