DEXPI® Data Exchange in the Process Industry

International standards to support process industry digitalization – common view

THTH Spring webinar 2021

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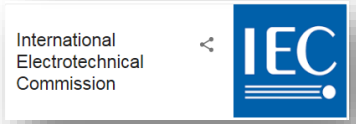
Agenda

DEXPI® Data Exchange in the Process Industry

International standards to support process industry digitalization – some examples

- ISO 15926
- DEXPI
- CFIHOS
- JIP 33
- IEC 61987
- IFC

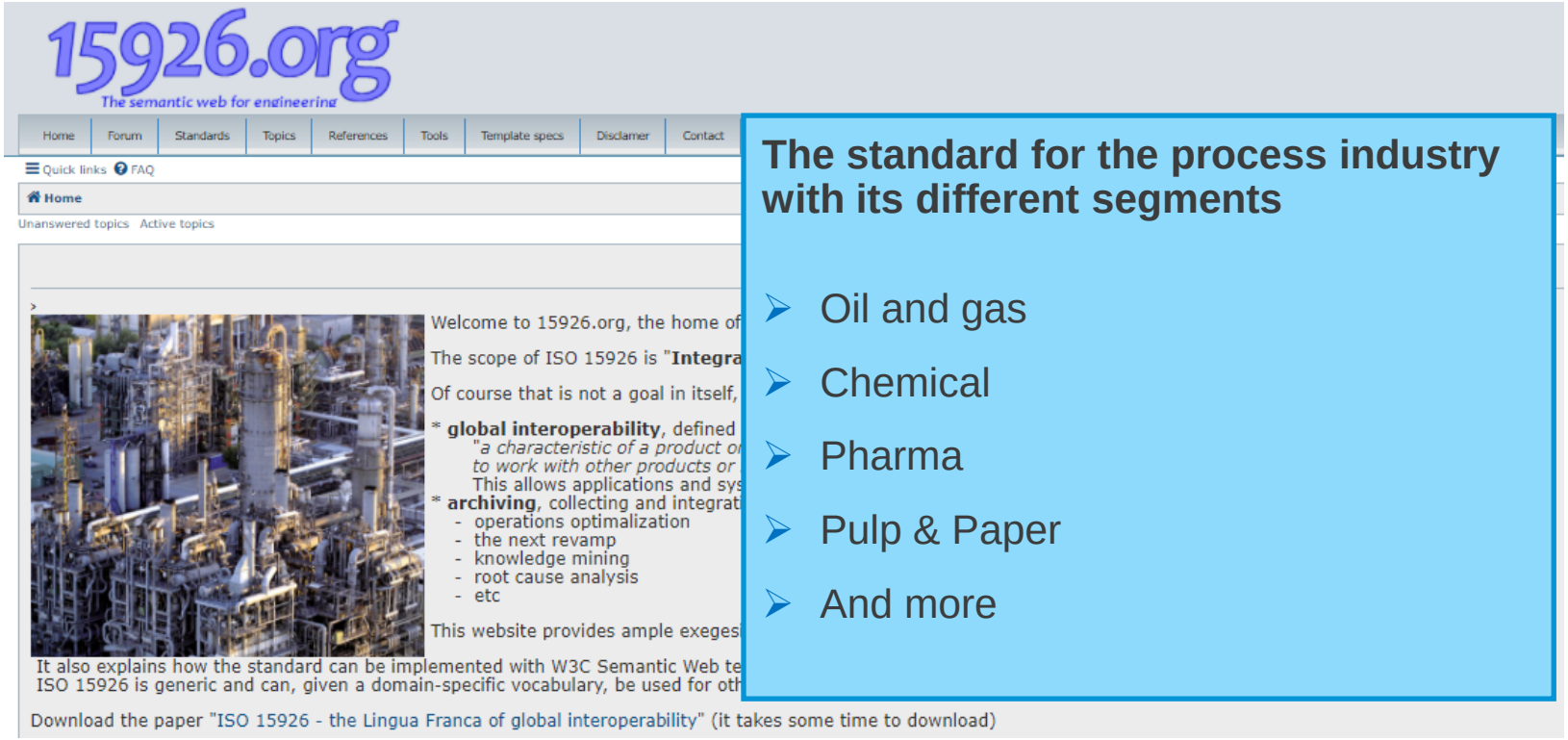
DEXPI eco system – our world view



ISO 15926

ISO 15926

DEXPI® Data Exchange in the Process Industry



The standard for the process industry with its different segments

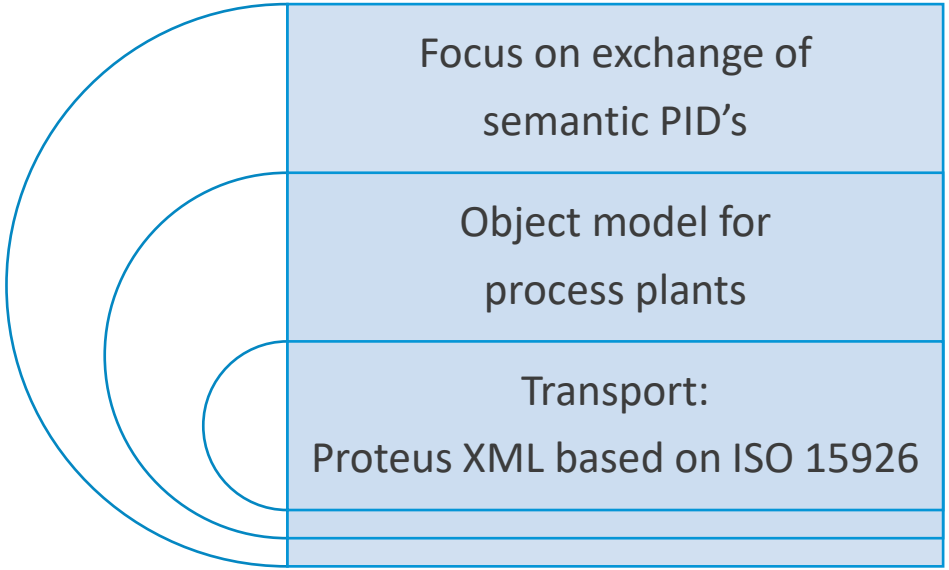
- Oil and gas
- Chemical
- Pharma
- Pulp & Paper
- And more

DEXPI (Data Exchange in the Process Industry)

DEXPI

DEXPI® Data Exchange in the Process Industry

DATA EXCHANGE IN THE PROCESS INDUSTRY



Specifications

The DEXPI Specification

DEXPI Specification 1.3

DEXPI Information model

Proteus XML schema

OPC-UA Companion Specifcation

P&ID main components

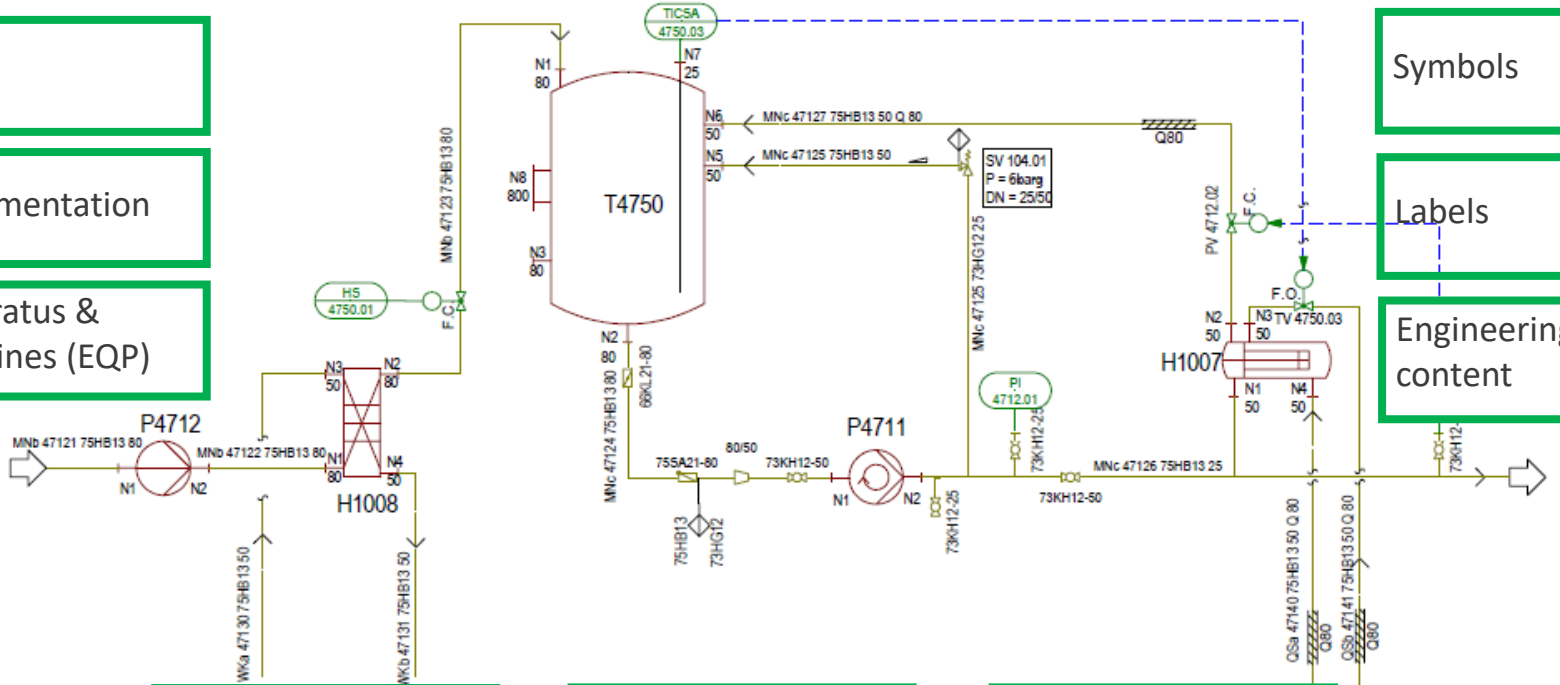
DEXPI® Data Exchange in the Process Industry

Data, graphics and topology

Piping

Instrumentation

Apparatus & Machines (EQP)



Symbols

Labels

Engineering content

Off Page Connectors

Annotations

Title Block

International Standards

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ISO and IEC

- **DEXPI specification based on international standards**
- **Applicable for IEC, ISA and DIN based P&IDs**

Plant Structure	Apparatus / Machines	Piping components	Instrumentation	Communication
ISO 10209	ISO 10628	ISO 10628	IEC 62424	ISO 15926
			IEC 61987	Proteus 4.0.1 (formerly XMPlant)

DEXPI 1.3 as the structural model for the Process Industry

DEXPI® Data Exchange in the Process Industry

- Support of all ISO 10628 groups
  - Including all solid handling apparatuses & machines
  - Including engines like motors, turbines and generators
- Support of electrical consumer (IEC 62424)
- All DEXPI classes a part of the new ISO 15926:2021 standard
- Released in 2021-05

Use of DEXPI

DEXPI® Data Exchange in the Process Industry

These (data exchange) workflows are supported through the DEXPI standard

Re-use PID information for other use cases

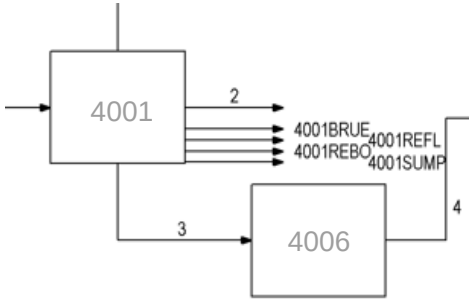
Instrumentation systems	Process simulation	AR/VR	IoT and control systems	3D piping systems	Mobile solutions	Safety and work permit systems	ERP, Data Management (Plant topology)
							

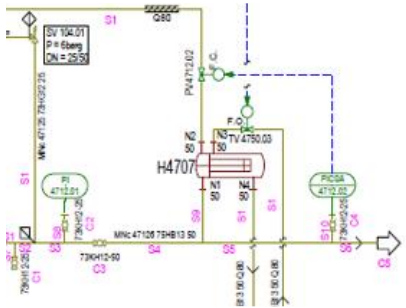
DEXPI and the ENPRO lifecycle model

DEXPI® Data Exchange in the Process Industry

The asset lifecycle is separated into four aspects with three underlying data structures

Functional Requirements → **Functional Design** → **Asset Specification** → **Asset in Operation**





Process Structure | **Plant Structure** | **Asset Structure**

Use of DEXPI

DEXPI® Data Exchange in the Process Industry

Opportunities

- The structural model for the process industry
- Based on ISO and IEC standards
- All DEXPI classes are ISO 15926 classes
- Many software implementations
- Aligned with CFIHOS and NAMUR specifications

Constraints

- Very small set of properties
- Covers not the whole lifecycle
- Perhaps some pulp & paper classes are missing

DEXPI‘s cooperation

CFIHOS (JIP36)

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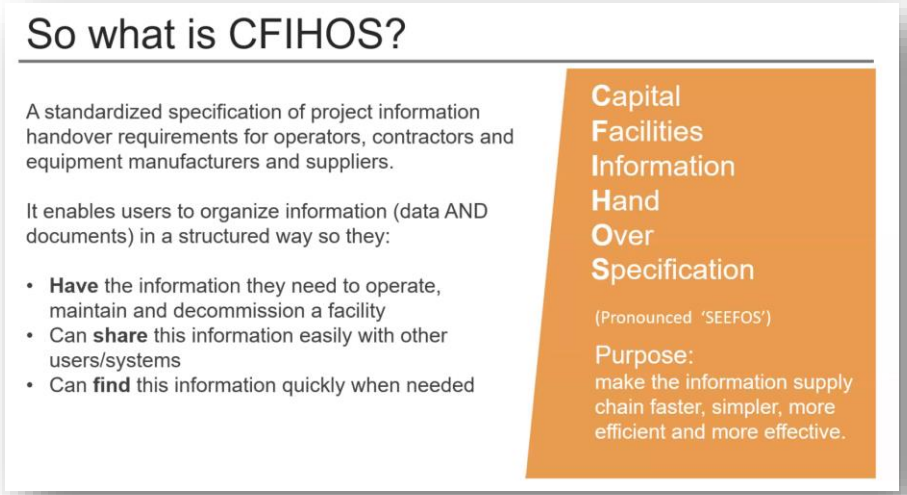
Managed by IOGP



Technical specification
Requirements, rules and principles for information handover.

Data model
For structuring data and documents about assets.

Implementation advice and guidance
Outlining implementation steps (and do's and don'ts).

Dictionary (Reference Data Library)
Consistent naming of equipment, properties and documents.

Implementation software requirements
Outlining functional system requirements for handover.

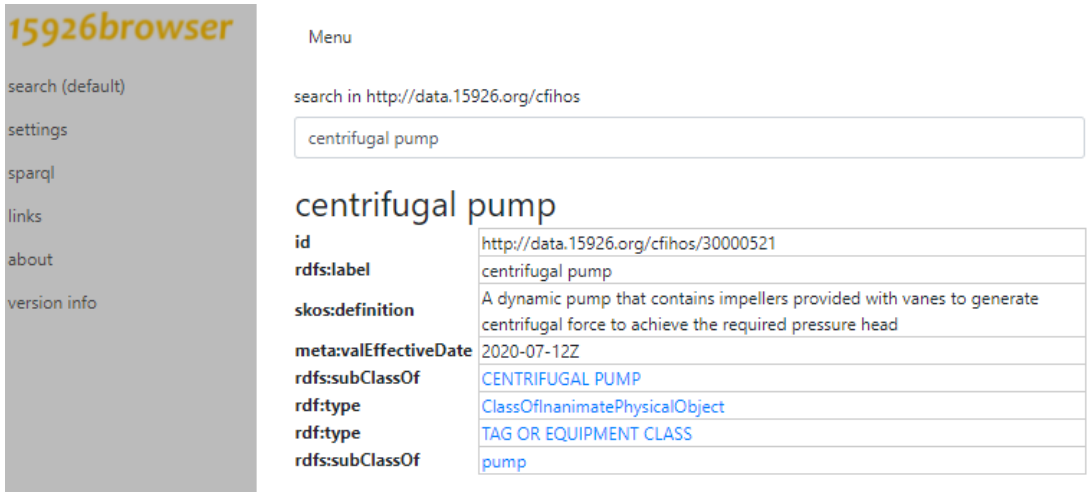
CFIHOS (JIP36)

Important results

CFIHOS Standard Documents

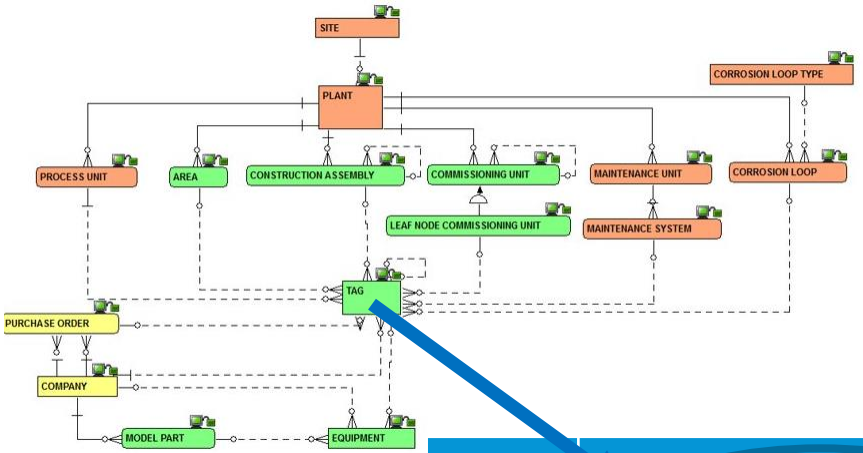
All documents are available to download and use FREE of charge.

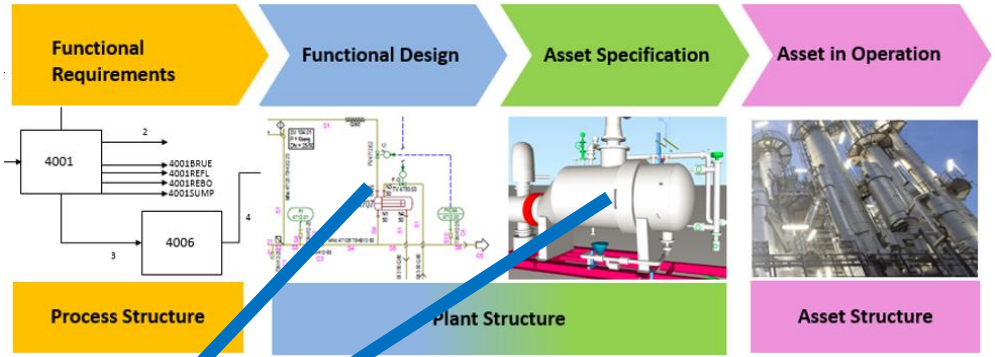
Narrative Documents
v.1.4.1 CFIHOS Scope and Procedures
v 1.4.1 CFIHOS Specification Document
v.1.4.1 CFIHOS Implementation Guide for Principal
v.1.4 CFIHOS Implementation Guide for Contractor
Reference Data Library
v.1.4 CFIHOS Reference Data Library (Excel)
v.1.4 CFIHOS Reference Data Library (CSV files)
Data Model
v.1.4.1 CFIHOS Data Model
v.1.4.1 CFIHOS Data Dictionary (Full version)
v.1.4.1 CFIHOS Data Dictionary (Light version)
Supporting Templates
v.1.4 CFIHOS Contract Scenario Templates



CHIFOS – DEXPI alignment concept

DEXPI® Data Exchange in the Process Industry





- Tags
- Equipments
- Model parts

	design objects	materialized objects
CFIHOS	Tag	Equipment
DEXPI	Plant items in Functional Structure	Plant items in Asset Structure / Assets in Operation
SAP	Functional location	Equipment

CFIHOS –DEXPI alignment concept

- 4 aspects
- 3 structures

DEXPI Alignment specification using ISO 15926:2021 RDL

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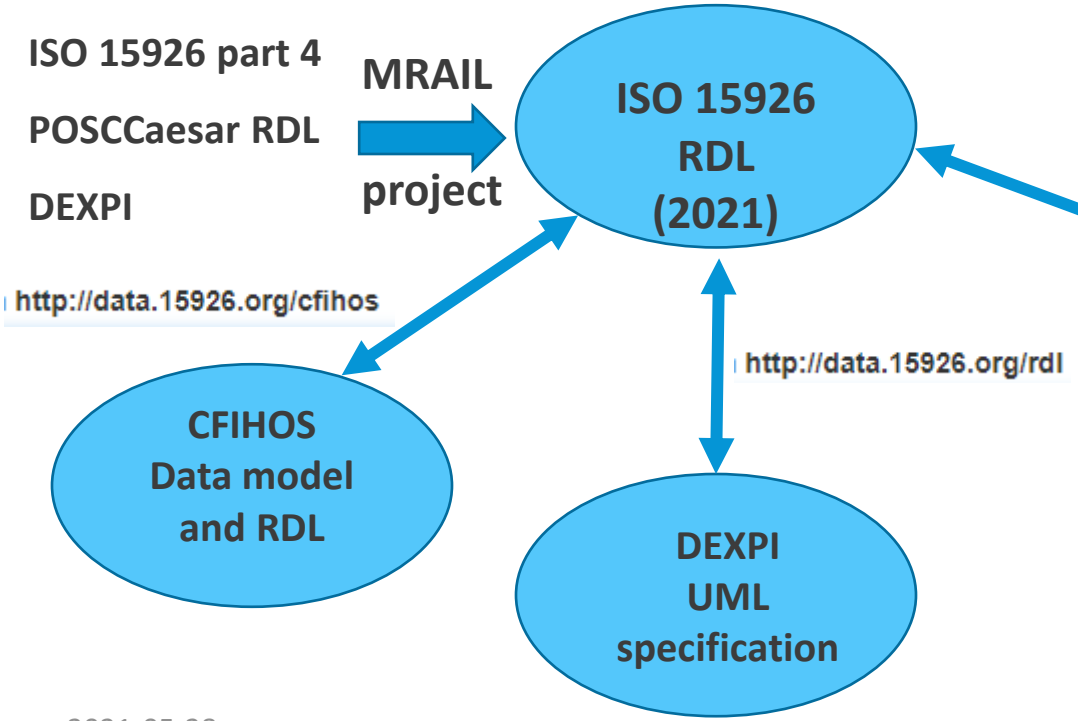
- ISO 15926 part 4
- POSCCaesar RDL
- DEXPI

MRAIL project



CFIHOS – DEXPI merge model

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Consists of

- All 228 DEXPI classes
- All CFIHOS tag classes, which were P&ID relevant: 321 of 600
  - A common taxonomy
    - Class and subclass model
    - Component model with cardinalities
- Plant break down structure
- Apparatus & machine model
- P&ID piping model
- Instrumentation model

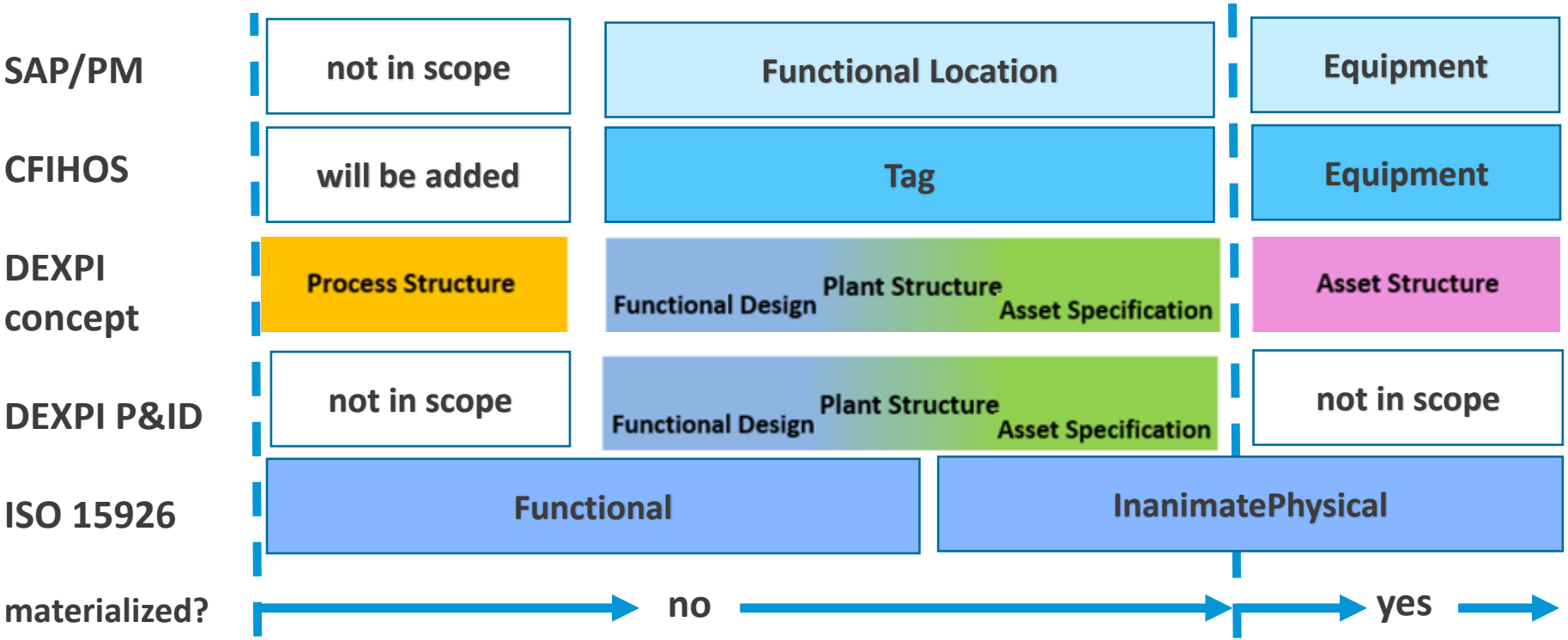
CFIHOS – DEXPI merge model

Pump example

DEXPI root class	ISO 10628-2:2012 group	DEXPI apparatus / machine type	DEXPI sub type (specialization)	DEXPI component (part of)	DEXPI RDL name	CFIHOS tag class name	CFIHOS unique id	RDL2 class
	15	Pump			PUMP	pump	CFIHOS-30000550	PUMP
			CentrifugalPump		CENTRIFUGAL PUMP	centrifugal pump	CFIHOS-30000521	CENTRIFUGAL PUMP
				Impeller (0..*)	IMPELLER			IMPELLER
			ReciprocatingPump		RECIPROCATING PUMP	reciprocating pump	CFIHOS-30000862	RECIPROCATING PUMP
				Displacer (0..*)	DISPLACER			DISPLACER
			RotaryPump		ROTARY PUMP	rotary pump	CFIHOS-30000864	ROTARY PUMP
				Displacer (0..*)	DISPLACER			DISPLACER
			EjectorPump		EJECTOR PUMP			EJECTOR PUMP
						eductor	CFIHOS-30000038	EDUCTOR
			CustomPump		CustomPump			
				Impeller (0..*)	IMPELLER			IMPELLER
				Displacer (0..*)	DISPLACER			DISPLACER

DEXPI's and CFIHOS 's lifecycle model for the Process Industry

DEXPI® Data Exchange in the Process Industry



Use of CFIHOS

DEXPI® Data Exchange in the Process Industry

Opportunities

- Available specifications as xls and as knowledge graph
- Integration with ISO 15926
- For process and energy sector
- Many participances

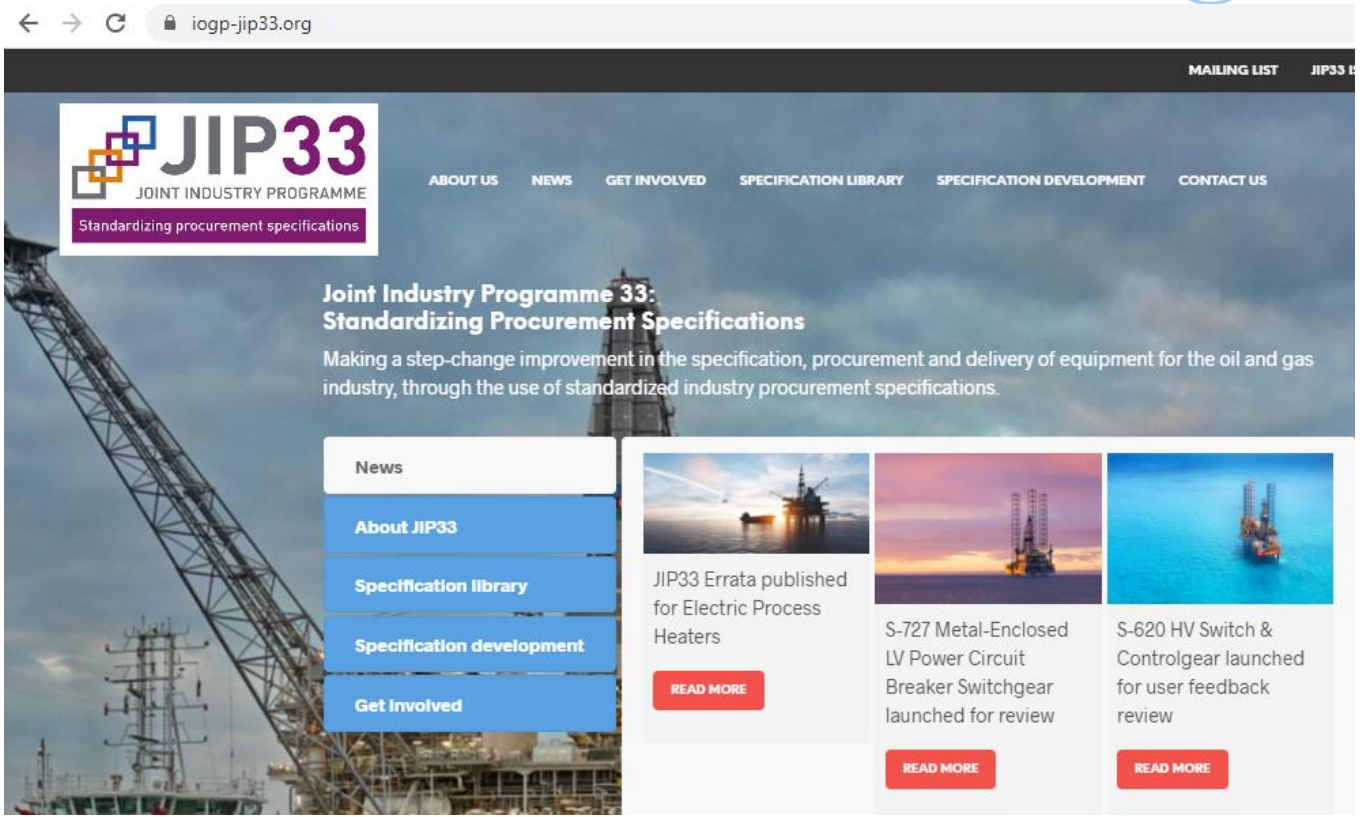
Constraints

- More document than data driven
- Oil and gas is sometimes the visible source
- To less properties for technical specifications
- Data part has to be improved

DEXPI‘s cooperation – not yet with JIP 33

IOGP JIP33

DEXPI® Data Exchange in the Process Industry



IOGP JIP33

DEXPI® Data Exchange in the Process Industry

Important results

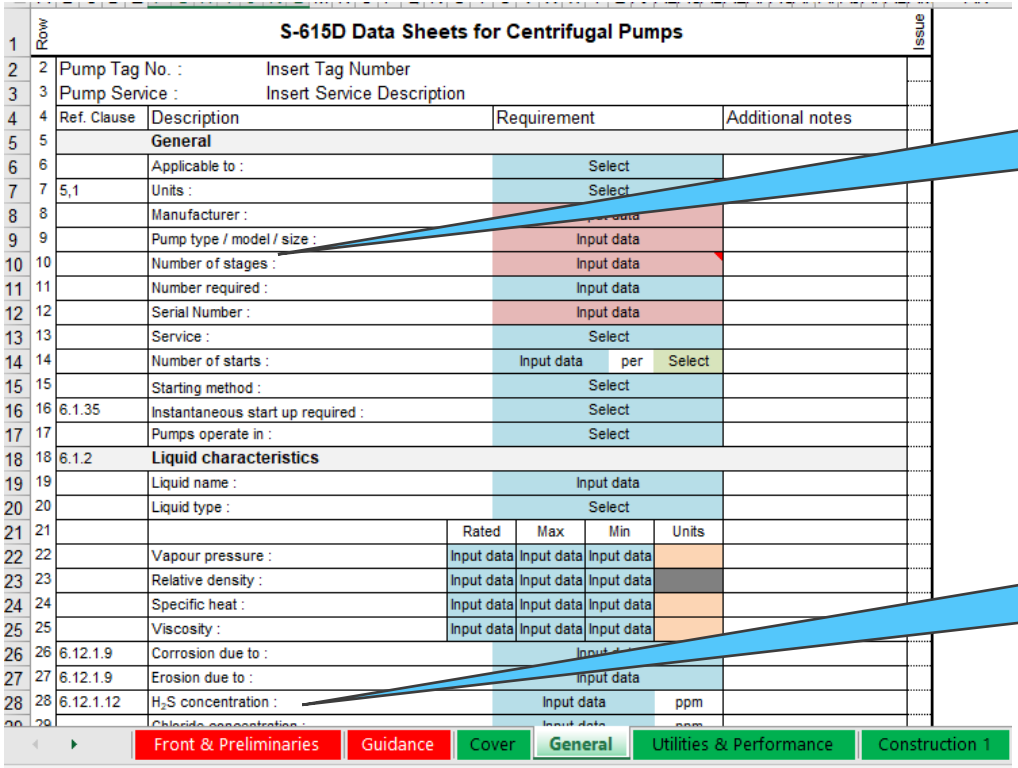
- Special Purpose Gear Units - S-713
- General Purpose Gear Units - S-712
- Valve – Gate to API Spec 600 and API Spec 603 - S-611
- Valve – Ball to API Spec 6D - S-562
- Pumps – Centrifugal to API Std 610 - S-615
- Cranes – Offshore Pedestal Mounted to API Spec 2C - S-618
- Cranes – Offshore General Purpose to EN 13852-1 - S-617

41 specifications are published

IOGP JIP33

DEXPI® Data Exchange in the Process Industry

Centrifugal pump example



S-615D Data Sheets for Centrifugal Pumps

Row	Ref. Clause	Description	Requirement	Additional notes
2		Pump Tag No. :	Insert Tag Number	
3		Pump Service :	Insert Service Description	
4	Ref. Clause	Description	Requirement	Additional notes
5		**General**		
6		Applicable to :	Select	
7	5,1	Units :	Select	
8		Manufacturer :		
9		Pump type / model / size :	Input data	
10		Number of stages :	Input data	
11		Number required :	Input data	
12		Serial Number :	Input data	
13		Service :	Select	
14		Number of starts :	Input data per Select	
15		Starting method :	Select	
16	6.1.35	Instantaneous start up required :	Select	
17		Pumps operate in :	Select	
18	6.1.2	**Liquid characteristics**		
19		Liquid name :	Input data	
20		Liquid type :	Select	
21			Rated / Max / Min / Units	
22		Vapour pressure :	Input data / Input data / Input data	
23		Relative density :	Input data / Input data / Input data	
24		Specific heat :	Input data / Input data / Input data	
25		Viscosity :	Input data / Input data / Input data	
26	6.12.1.9	Corrosion due to :		
27	6.12.1.9	Erosion due to :	Input data	
28	6.12.1.12	H_2S concentration :	Input data	ppm

Front & Preliminaries | Guidance | Cover | General | Utilities & Performance | Construction 1

extension to component concept

pulp & paper needs fiber concentration

Use of JIP 33

DEXPI® Data Exchange in the Process Industry

Opportunities

- Many properties
- Specifications complete for procurement
- Future integration with CFIHOS

Constraints

- Scope only oil and gas
- 41 technical specifications available
- Data models have to be improved for digital twin usage
- Up to now no reference to ISO 15926

DEXPI‘s cooperation - IEC 61987

DEXPI – Instrumentation Modell

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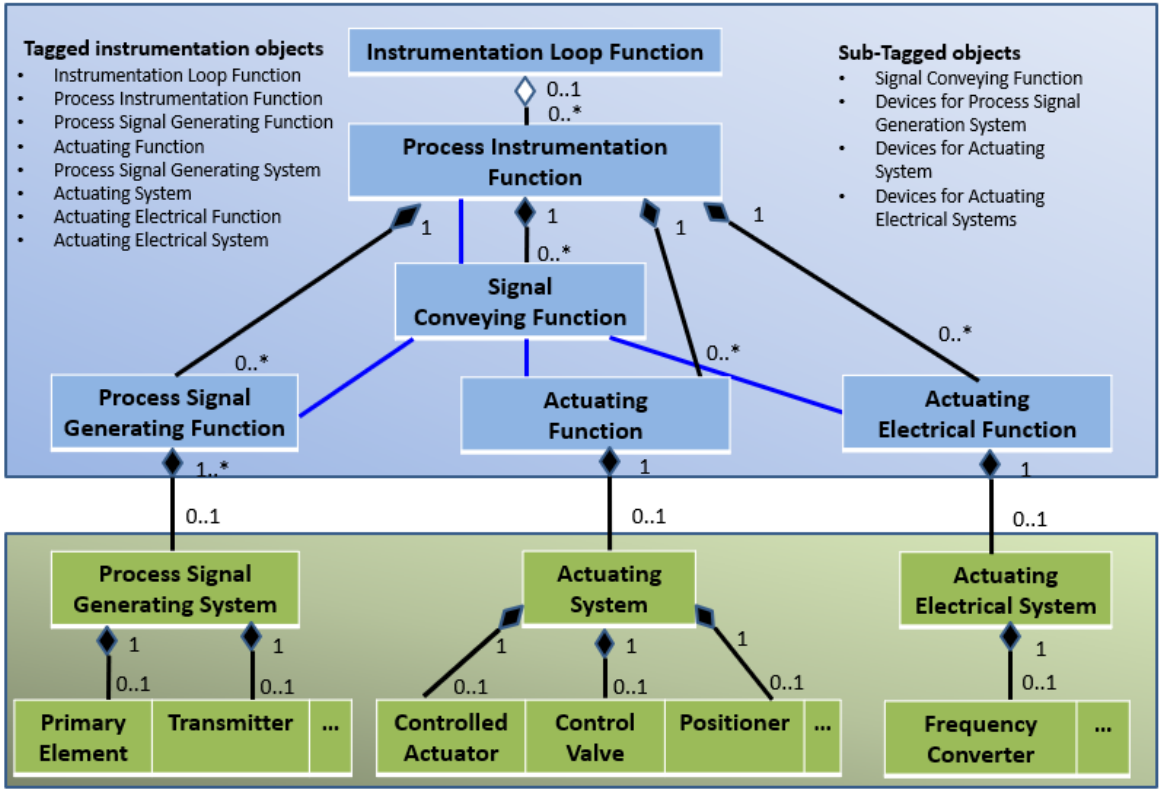
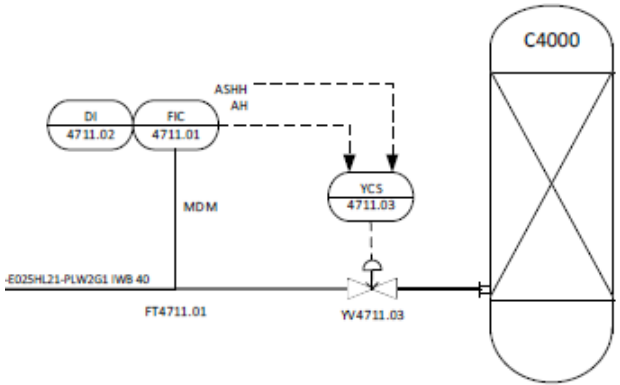


based on:
IEC 62424

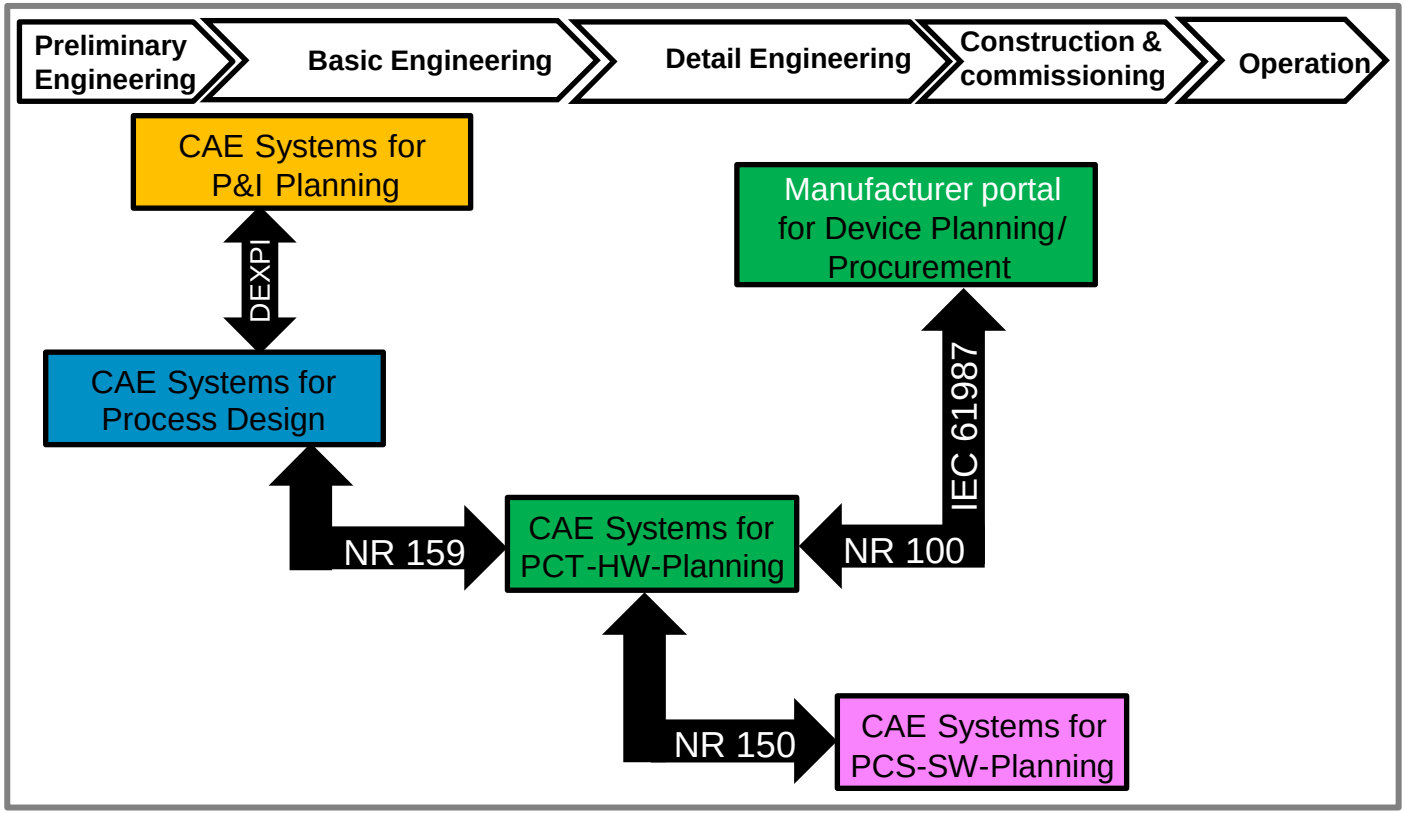


based on:
IEC 61987

NAMUR and DEXPI

DEXPI® Data Exchange in the Process Industry

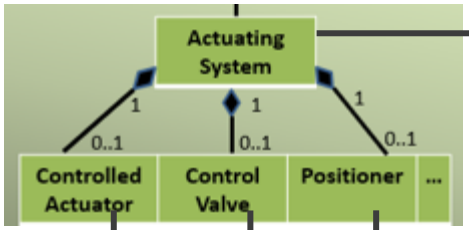
Instrumentation data models aligned with DEXPI

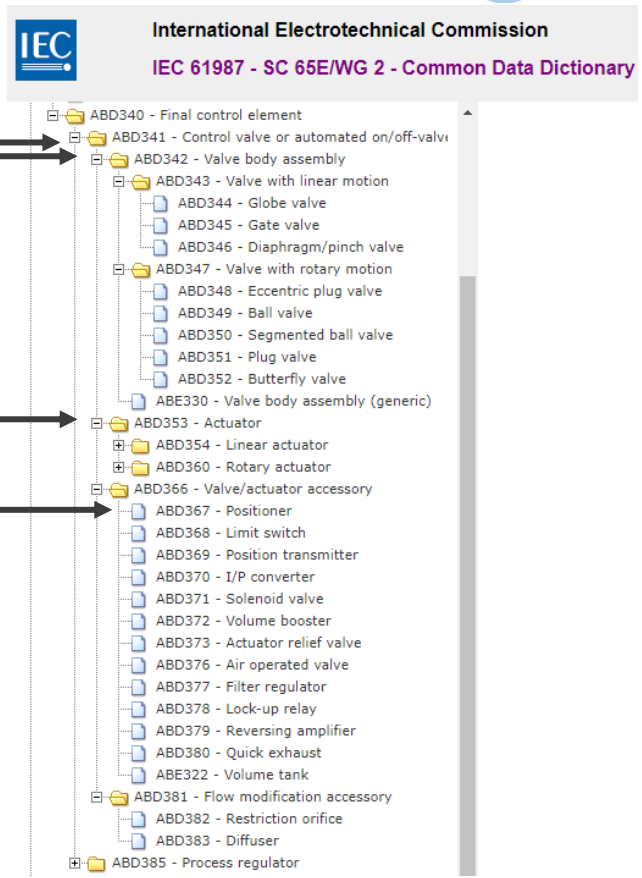


DEXPI and IEC 61987

DEXPI® Data Exchange in the Process Industry

CDD Common Data Dictionary





some properties from DEXPI and
more e.g. NAMUR Recommandation 159

DEXPI and IEC 61987 (CDD)

DEXPI® Data Exchange in the Process Industry

ABE307 - Operating LOP for valve body assem

- 0112/2///61987#ABE307 - Operating LOP for valve body assembly and process pressure regulator
  - 0112/2///61987#ABH439 - Measuring or control point (Ref: 0112/2///61987#ABH440 - reference to Measuring or control point)
  - 0112/2///61987#ABD808 - Base conditions [2] (Ref: 0112/2///61987#ABE064 - reference to Base conditions [2])
  - 0112/2///61987#ABB164 - number of process cases
  - 0112/2///61987#ABD987 - Process case [valves] (Ref: 0112/2///61987#ABE243 - reference to Process case [valves])
  - 0112/2///61987#ABD950 - Operating conditions for device design [2] (Ref: 0112/2///61987#ABE206 - reference to Operating conditions for device design [2])
  - 0112/2///61987#ABD994 - Process equipment [2] (Ref: 0112/2///61987#ABE250 - reference to Process equipment [2])
  - 0112/2///61987#ABB348 - number of physical locations
  - 0112/2///61987#ABD976 - Physical location [2] (Ref: 0112/2///61987#ABE232 - reference to Physical location [2])

ABE310 - Device LOP for valve body assembly

- 0112/2///61987#ABE310 - Device LOP for valve body assembly
  - 0112/2///61987#ABD885 - Identification [2] (Ref: 0112/2///61987#ABE129 - reference to Identification [2])
  - 0112/2///61987#ABC100 - Application (Ref: 0112/2///61987#ABC730 - reference to Application)
  - 0112/2///61987#ABD965 - Parameters of valve body assembly [1] (Ref: 0112/2///61987#ABE221 - reference to Parameters of valve body assembly [1])
  - 0112/2///61987#ABU557 - Function and system design [6] (Ref: 0112/2///61987#ABU551 - reference to Function and system design [6])
  - 0112/2///61987#ABD973 - Performance [10] (Ref: 0112/2///61987#ABE229 - reference to Performance [10])
  - 0112/2///61987#ABE000 - Rated Operating Conditions [11] (Ref: 0112/2///61987#ABE256 - reference to Rated Operating Conditions [11])
  - 0112/2///61987#ABD940 - Mechanical and electrical construction [valve body assembly] (Ref: 0112/2///61987#ABE196 - reference to Mechanical and electrical construction [valve body assembly])
  - 0112/2///61987#ABD817 - Certificates and approvals [2] (Ref: 0112/2///61987#ABE073 - reference to Certificates and approvals [2])
  - 0112/2///61987#ABC165 - Component part identifications (Ref: 0112/2///61987#ABC795 - reference to Component part identifications)
  - 0112/2///61987#ABA293 - number of additional components
  - 0112/2///61987#ABC080 - Additional component (Ref: 0112/2///61987#ABC710 - reference to Additional component)

DEXPI and IEC 61987 (CDD) - Procurement Process

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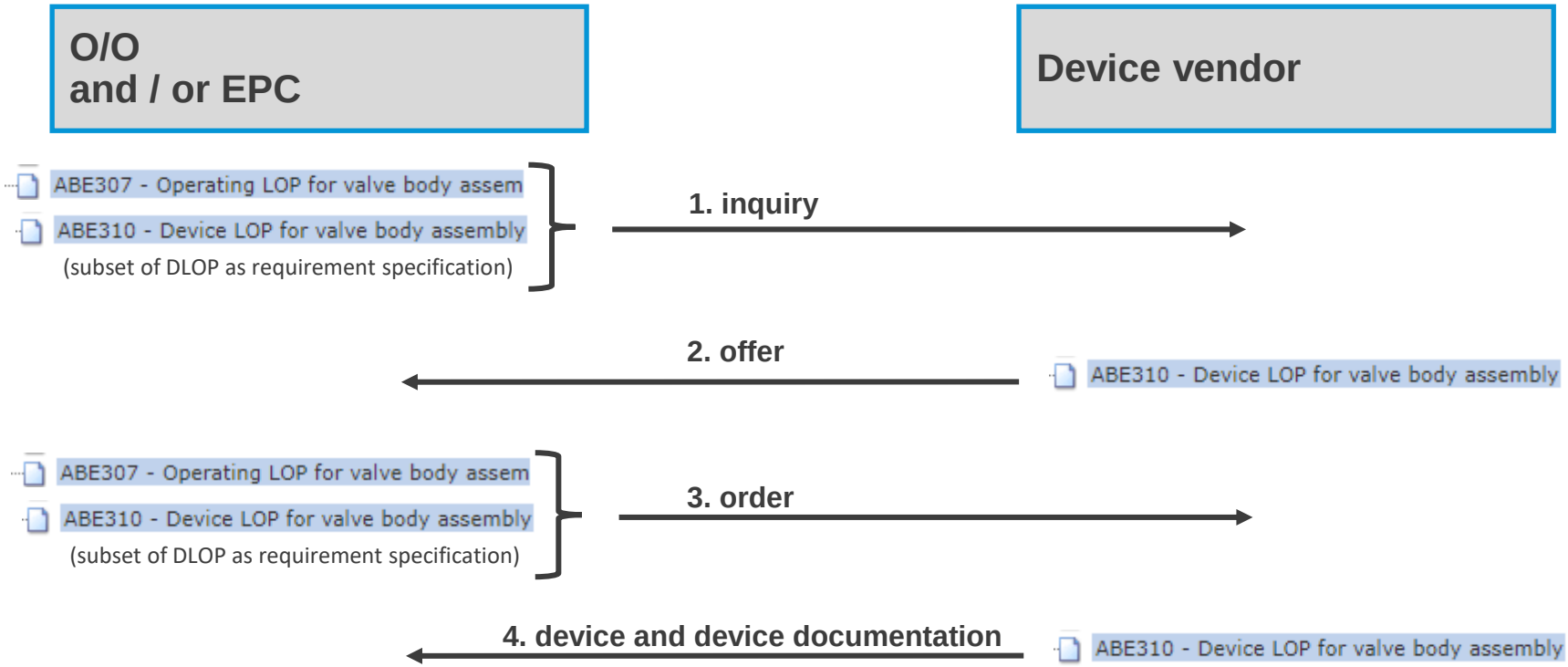


Use of IEC 61987 (CDD)

DEXPI® Data Exchange in the Process Industry

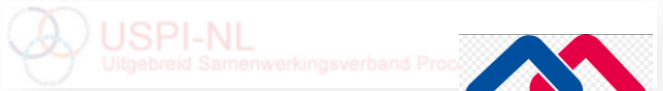
Opportunities

- Available specification as IEC
- Additional platform in eCl@ass
- Many field instruments
- First software implementations
- Aligned with DEXPI concept

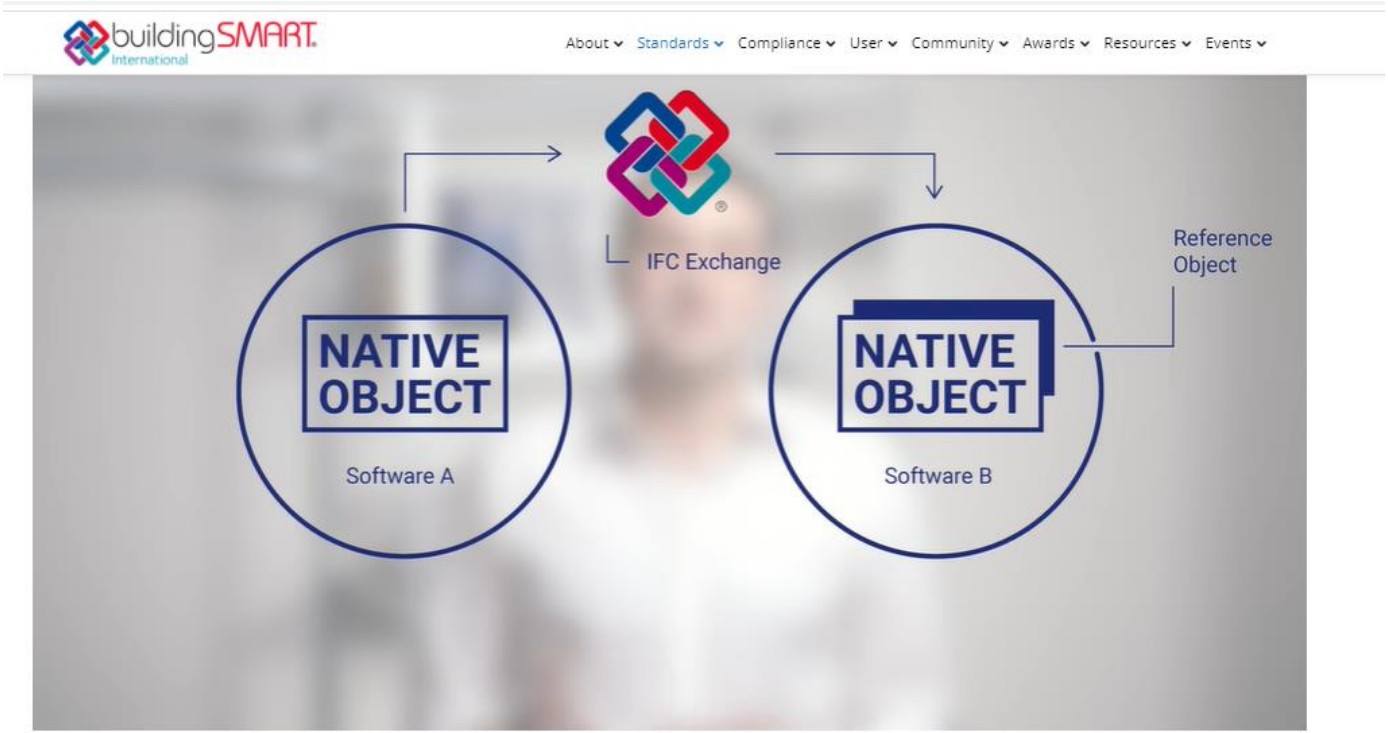
Constraints

- Not aligned with CFIHOS
- Parallel to ISO 15926

DEXPI‘s cooperation – not yet with IFC



IFC (Industry foundation classes)



Use of IFC

DEXPI® Data Exchange in the Process Industry

Opportunities

- Available specification as ISO 16739-1:2018
- Common use for BIM
- Covers 3D
- Software implementations
- Common roots with ISO 15926 (ISO 10303)

Constraints

- Not aligned with
  - ISO 15926
  - CFIHOS
  - IEC 61987
  - DEXPI

Conclusion

DEXPI® Data Exchange in the Process Industry

- There are several good standards for the process industry
- Some of them fit good together
- i.e. there is a good basis to start
- But all standards have to be improved
- Let us start

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