

DEXPI
ISO TC 184 SC 4 meeting Stavanger
Industry day, 2024-10-23

Gregor Tolksdorf, Evonik, Head of DEXPI Specifications
Heiner Temmen, DEXPI e.V., DEXPI Networking

We develop and promote a common data **exchange standard** for the **process industry**, covering all phases of the process-plant life cycle, from the specification of functional requirements to the assets in operation.

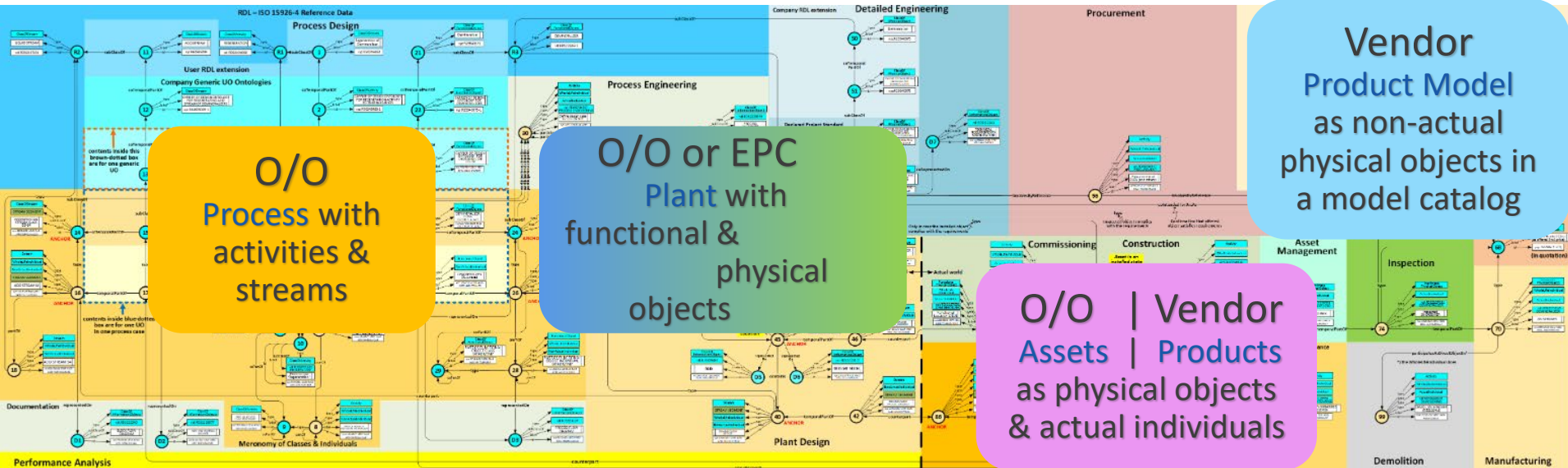
Our focus is the exchange of information for process and plants (data, models and structures). This comprises information contained in flow diagrams (BFDs/PFDs) and piping and instrumentation diagrams (P&IDs).

We work together with other organisations to get aligned specifications for the whole asset life cycle of the process industry.

Storyline of this presentation

- DEXPI Lifecycle View
- DEXPI Plant
- DEXPI Process
- DEXPI & IDO
- DEXPI & CFIHOS
- Summary / messages to ISO

DEXPI Process and Plant



DEXPI Process
(BFD&PFD)

DEXPI Plant
(P&I D)

P&I Ds are central information carrier

A P&I D connects different disciplines in one ,document‘

Piping

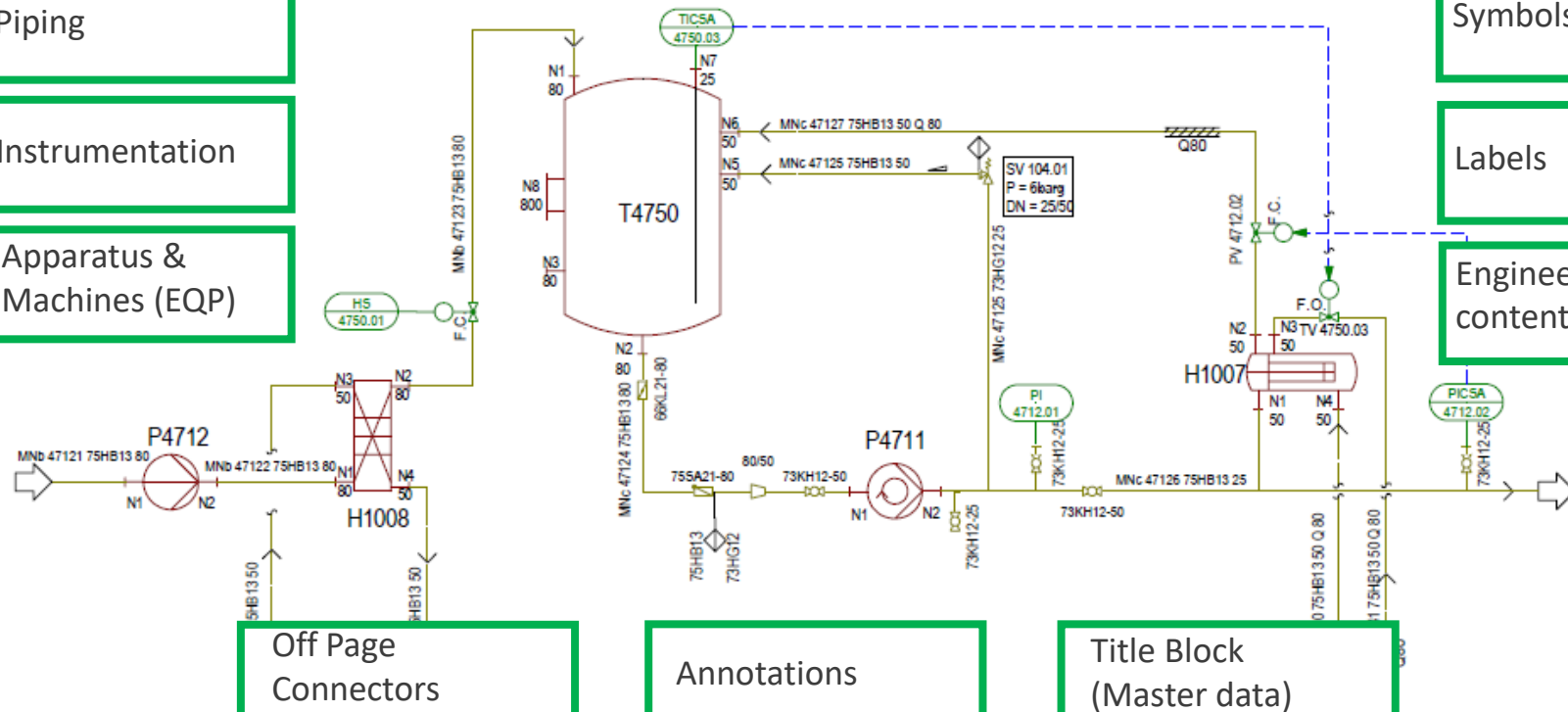
Instrumentation

Apparatus &
Machines (EQP)

Symbols

Labels

Engineering
content



Off Page
Connectors

Annotations

Title Block
(Master data)

International Standards

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 part 4
			IEC 61987	Proteus 4.0.1 (formerly XMpLant)

Deliverables DEXPI Plant

www.dexpi.org

1. DEXPI Specification for Exchange of PIDs (Version 1.3)

2. Extension for the Proteus Scheme (resulting in Version 4.0.1)

3. Tools & Test cases

4. CAE Interfaces of the leading PID software

first release 1.1 appears in 2016

Software & Technology

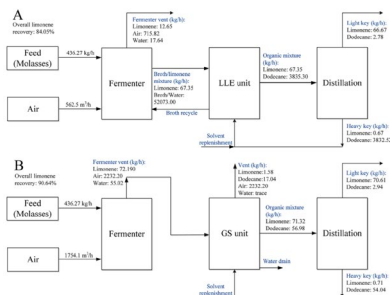
- Aucotec
- Autodesk
- Aveva
- Cadmatic
- CGC
- Hexagon
- IA
- ITandFactory
- PNB
- PTC
- Semantum
- Siemens
- Yokogawa



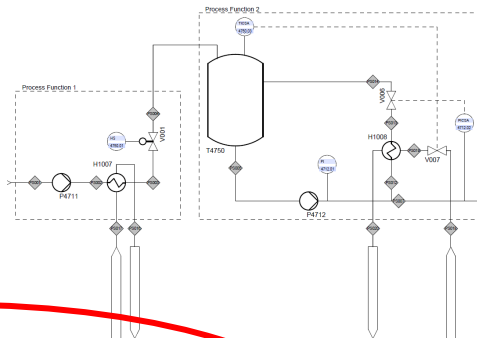
The goal of DEXPI Process is to be an information model for BFDs/PFDs

- In 2022, the project was started (see e.g. THTH autumn webinar November 2022).

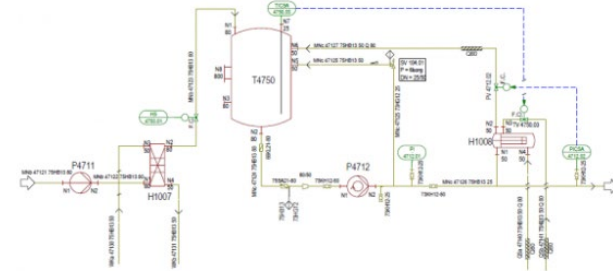
BFD Block Flow Diagram



PFD Process Flow Diagram



P&ID Piping & Instrumentation Diagram



Process Model

Plant Model

The outcome, DEXPI Process, was published in 2023

<https://dexpi.org/wp-content/uploads/2023/12/DEXPI-Process-1.0-Manual.pdf>

DEXPI Process Modelling of Process Systems and their Documentation

Authors: David Cameron, Wilhelm Otten, Heiner Temmen, Gregor Tolksdorf

DEXPI+ Project Team: David Cameron (University of Oslo), Andreas Schüller (NAMUR), Anselm Klose (TU Dresden), Behnam Ghahraman (Aucotec), Eric Carnet (Aveva), Iskandar Halim (ISCEE), Leon Hanke (Aucotec), Maged Selim (Aveva), Manfred Theißen (PNB), Martin te Lintelo (USPI), Monica Hole (Aibel), Idar Pe Ingebrigtsen (Equinor)

<https://dexpi.org/dexpi-process-specification-1-0-released/>

DEXPI Process Specification 1.0 released

2023-12-15

https://dexpi.org/static/process_model_1.0/index.html



PROCESSNET
EINE INITIATIVE VON DECHEMA UND VDI-ÖVC

DEXPI Process

Version 1.0

Released by the DEXPI Initiative on December 15, 2023

2024-10-23

<https://www.sciencedirect.com/science/article/pii/S0098135423004349>



Computers & Chemical Engineering

Volume 182, March 2024, 108564



DEXPI process: Standardizing interoperable information for process design and analysis

David B. Cameron^a, Wilhelm Otten^b, Heiner Temmen^c, Monica Hole^d, Gregor Tolksdorf^e

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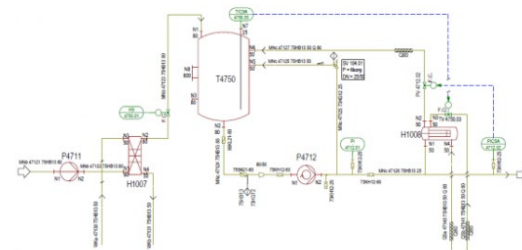
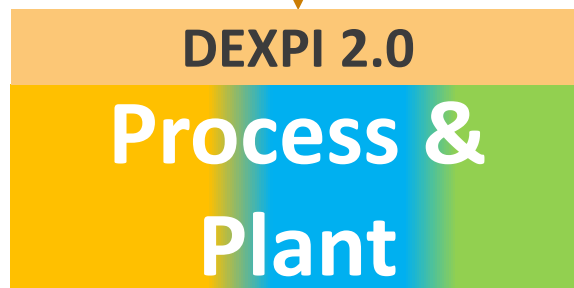
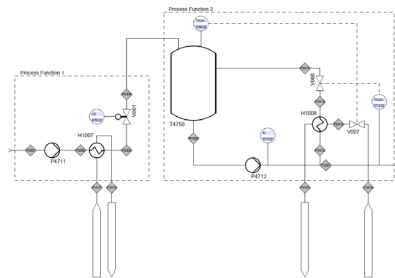
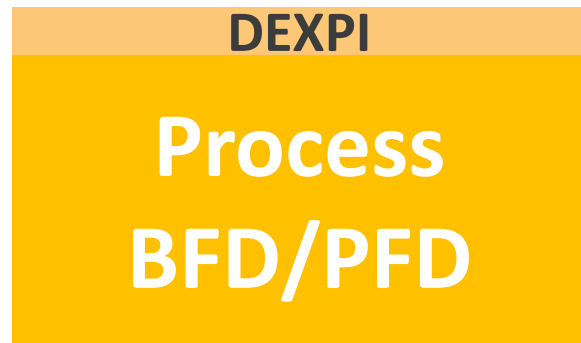
<https://doi.org/10.1016/j.compchemeng.2023.108564>

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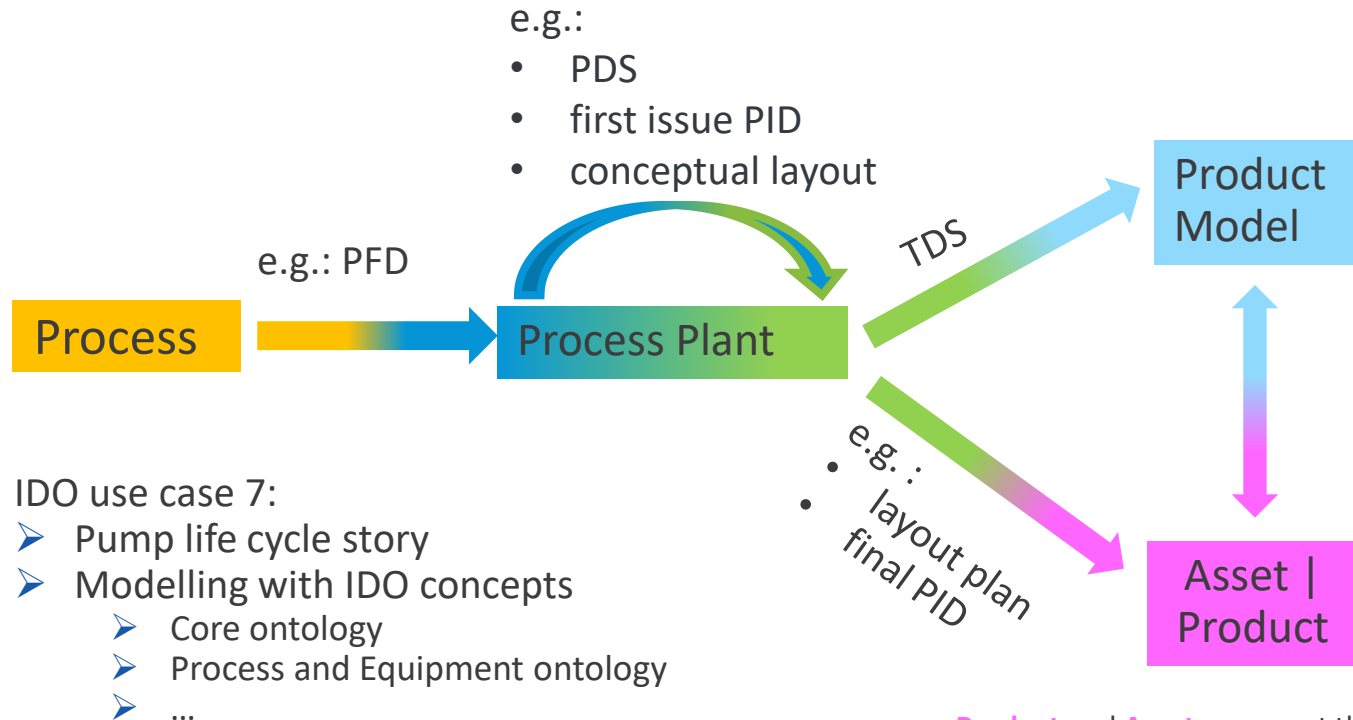
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DEXPI 2.0 will combine Process and Plant into one information model



Life cycle concept of the Process Industry as a requirement chain – view of an O/O

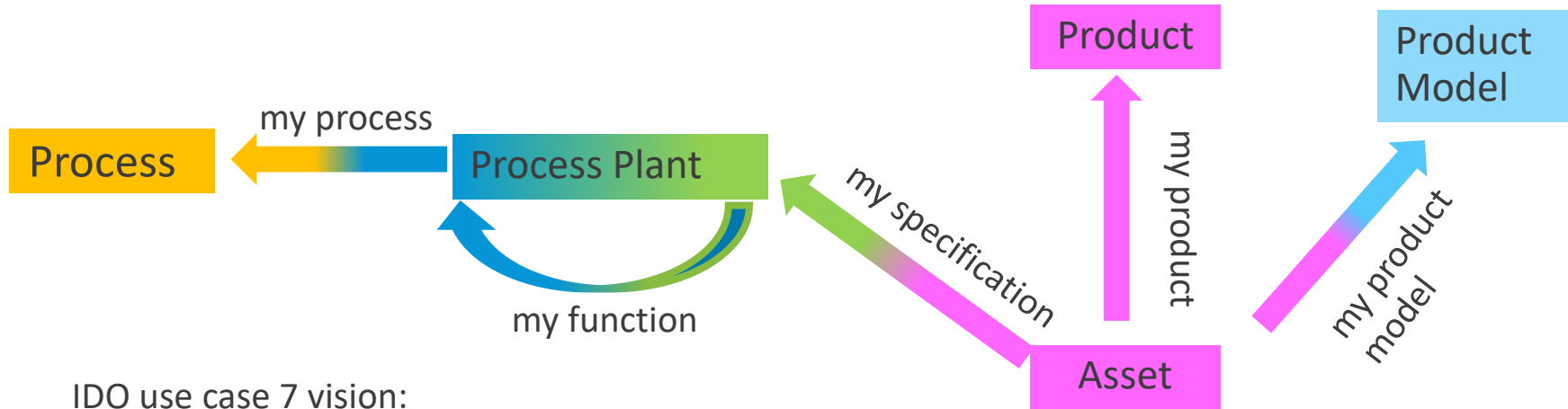


IDO use case 7:

- Pump life cycle story
- Modelling with IDO concepts
 - Core ontology
 - Process and Equipment ontology
 - ...

Product and **Asset** represent the same physical object as an actual individual. **Product** is the role for the manufacturer, **Asset** the role for the O/O. TDS are checked against **Product Models**!

Life cycle concept of the Process Industry as an analysing chain – view of an O/O

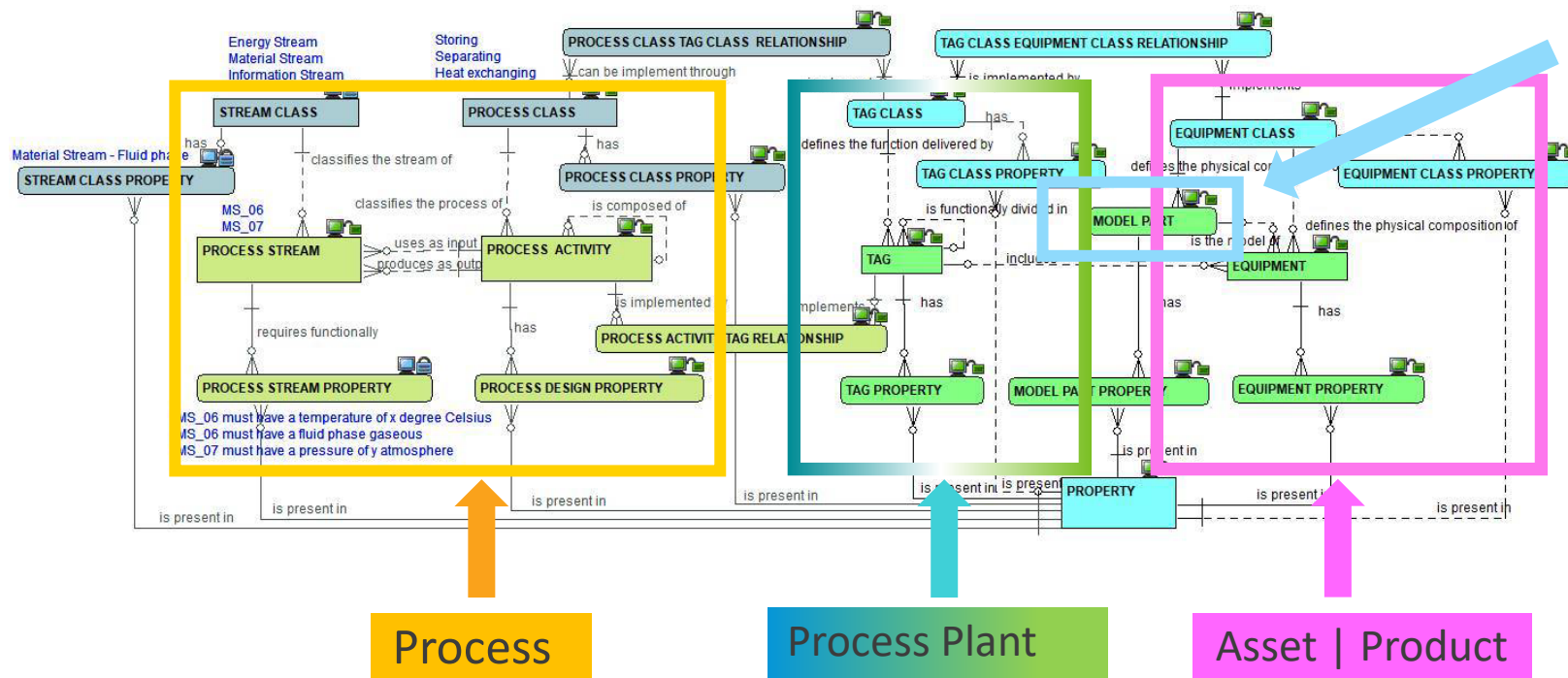


IDO use case 7 vision:

- Pump life cycle story
- enable reasoning during
 - engineering
 - construction
 - operation

Life cycle in CFIHOS data model

Product
Model



Common taxonomy:
DEXPI Plant and CFIHOS Tags

- ❖ DEXPI Process and DEXPI Plant are two structural models based on and using international standards
- ❖ DEXPI networking group tries to get alignment with other models and initiatives
 - ❖ Using ISO 15926 part 4 as primary RDL is fully accepted for classes
 - Renewed property approach is important
 - ❖ Alignment with CFIHOS ongoing and promising
 - IDO use case 7 is challenging – to cover the whole life cycle
 - The new ISO 15926 part 2 concepts should be checked by the pump life cycle story
 - ❖ ISO 15926 part 11 covers the pump life cycle story
 - There is no standard usage of central terms like Function, Product, Equipment, ... in standards like Step APs, ISO 15926, CFIHOS, DEXPI, ISO/IEC 81346, ...
 - Some concepts in some standards are in contradiction to each other, e.g. life cycle approach process industry versus ISO/IEC 81346
 - There are parallel not (fully) aligned activities in standardisation, e.g. IEC 61987, JIP 33, ISO 15926 part 4
 - The alignment with BIM / IFC is important – some first activities were started

Thank you for your attention!

time for questions and hopefully for
good answers later: Panel discussion

Plant Breakdown Structure

Based on ISO 10209

Elements of the identification system for a process plant

ISO 10209:2012		ISA 95	DIN 28000-3		DEXPI	
en	de		en	de	major	additional
works	Werk	Enterprise			Enterprise	
		Site	Site	Standort	Site	
		Area				Area
industrial complex	Anlagenkomplex		Industrial Complex	Anlagenkomplex, Betrieb	Industrial Complex	
process plant	verfahrenstechnische Anlage	Process Cell	Process Plant/Plant Unit	Verfahrenstechnische Anlage	Process Plant	System Train
plant	Anlage					
plant section	Teilanlage	Unit	Subprocess/Plant Component	Teilanlage	Plant Section	
Equipment	Anlagenteil		Technical Item	Technische Einrichtung	Plant Item	

DEXPI Plant specification internally UML (xmi), RDF(s)+JSON - converted to HTML and PDF

dexpi.plants-and-bytes.de/reference/Equipment/Pump.html

Pump

- ☒ Show Examples
- ☒ Show Proteus

DEXPI P&ID Specification 1.3

Overview and Concepts
DEXPI Information Model

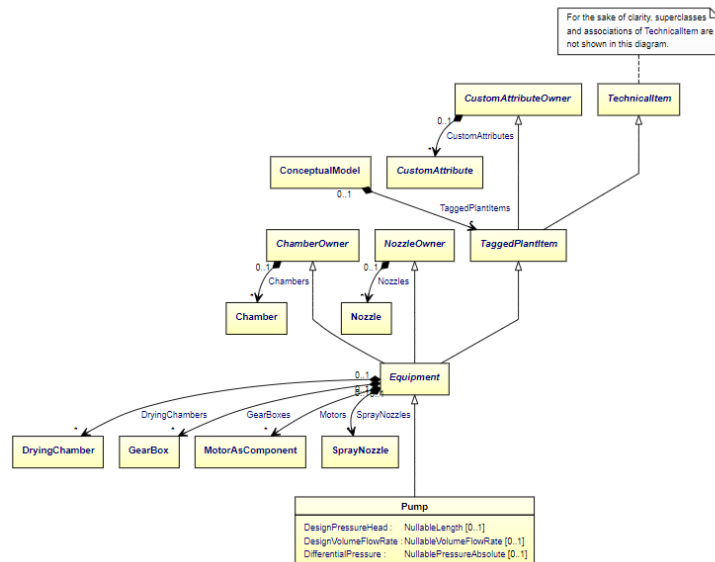
Package DexpiModel
Package MetaData
Package PlantStructure
Package Equipment

Agglomerator
Agitator
AgitatorRotor
AirCoolingSystem
AirEjector
AlternatingCurrentGenerator
AlternatingCurrentMotor
AlternatingCurrentMotorAs...
AxialBlower
AxialCompressor
AxialFan
BatchWeigher
Blower
Boiler
BriquettingRoller
Burner
CentrifugalBlower
CentrifugalCompressor
CentrifugalPump
Centrifuge
Chamber
ChamberOwner
Chimney

Overview

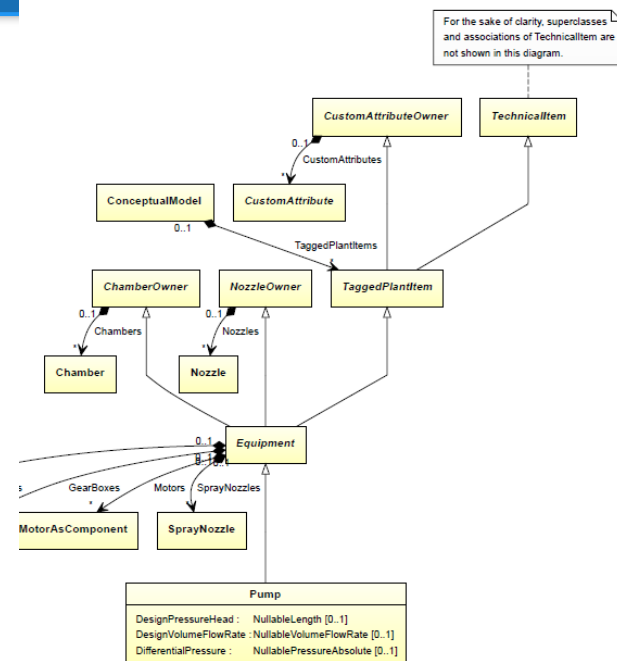
Class

A machine that is capable of pumping but may require parts and subsystems for that capability.



Pump

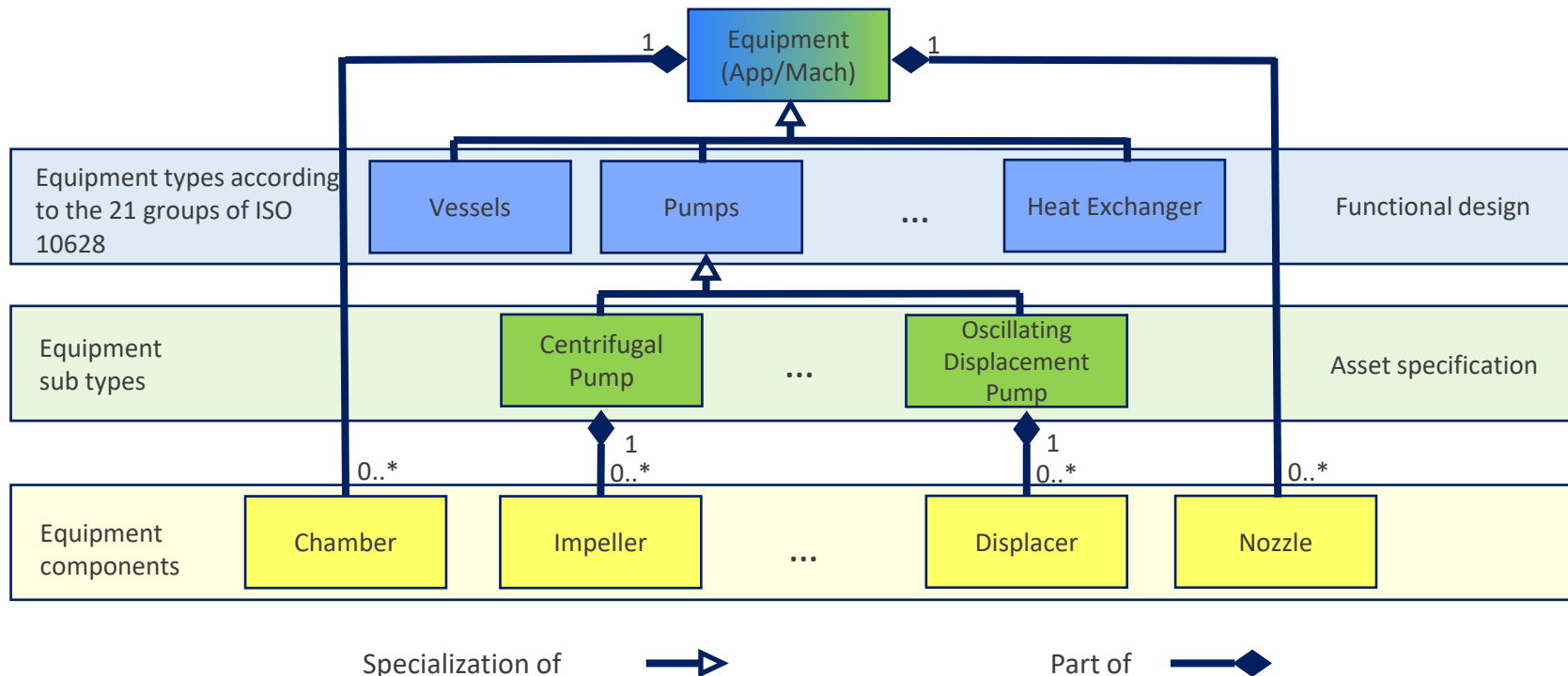
Overview
DesignPressureHead
DesignVolumeFlowRate
DifferentialPressure



DEXPI P&ID Specification 1.3

Equipment Taxonomy

Based on ISO 10628 and ISO 14224





DEXPI Viewer and Verificator

The tool is a viewer for P&IDs that allows access to all data and graphical details of an imported DEXPI-compliant Proteus XML file. A detailed verification report lists all issues detected during the import.

- Download [PID Verificator 1.0.1](#).



DEXPI Sandbox RDL

The DEXPI Sandbox RDL is an ISO 15926 compliant Reference Data Library (RDL). It provides definitions for classes used by the DEXPI P&ID Specification.

- Explore the [web version of the RDL](#).
- Access the underlying [SPARQL endpoint](#) (select the RDL dataset).



Code, data and specification repository

We use a Gitlab repository for code versioning, issue tracking and tool collection. More info: <https://gitlab.com/dexpi>



SVG Graphic Builder

The SVG Graphic Builder converts a [ProteusXML](#) file to into an [SVG](#) file. SVG files can be visualized by every modern browser.

- [GraphicBuilder Project on Gitlab](#)

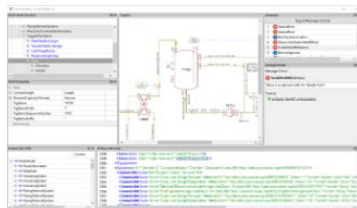
DEXPI Plants and Bytes support



P&ID and DEXPI

Piping and Instrumentation Diagrams (P&IDs) are pivotal documents for the planning and operation of chemical plants. In today's engineering tools, P&IDs are not just drawings – they are intelligent documents with valuable information for all stakeholders.

The downside is that P&IDs are often locked in some CAE tool, and data exchange with other tools is tedious. Thus, users from the chemical and petrochemical industry, software vendors and academic partners have founded the [DEXPI Initiative](#). DEXPI has defined an information model and exchange format for P&IDs. DEXPI covers both the graphical appearance of a P&ID and the underlying engineering information, including equipment types and properties, piping topology, and instrumentation. A growing number of software vendors support DEXPI in their tools.



PID Verificator 1.0.1 for DEXPI 1.3

The PID Verificator 1.0.1 for DEXPI 1.3 is a tool to check the compliance of DEXPI files (Proteus XML) with the [specification](#). It comes with a GUI that shows the P&ID graphics, the underlying conceptual model, a list of verification messages, and the Proteus XML source code in an integrated view.

By downloading the tool, you accept the [license agreement](#).

DEXPI sandbox



https://sandbox.dexpi.org/rdl/DesignRotationalSpeed



What is the DEXPI Sandbox?

☐ on-site navigation [?](#)



The URL (web address) shown by your browser starts with *https* because you visit this site using a secured connection. Note that the URI reference (identifier) of DESIGN ROTATIONAL SPEED (dexpi) to be used in DEXPI-compliant Proteus files starts with *http* - as shown below:

http://sandbox.dexpi.org/rdl/DesignRotationalSpeed

DESIGN ROTATIONAL SPEED (dexpi)

[SinglePropertyDimension](#)

The number of 360 degree revolutions per unit time by design.

Specialization

Superclass

[ROTATIONAL FREQUENCY \(pca\)](#)

(relationship)

Classification

Classifier

[DEXPI PROPERTY CLASS \(dexpi\)](#)

(relationship)

RDF Properties

[pca:hasDefinition](#)

[pca:hasDesignation](#)

[rdf:type](#)

[rdfs:label](#)

"The number of 360 degree revolutions per unit time by design."

"DESIGN ROTATIONAL SPEED"

[p2:SinglePropertyDimension](#)

"DESIGN ROTATIONAL SPEED"

ISO 15926 part 4 is the
primary RDL for DEXPI