HEXAGON

Bust Through Barriers with HxGN SDx® Connector for Plant Maintenance

Digitally Transform Your Asset Lifecycle

Contents

1. Introduction

High-quality engineering data and plant documentation are essential for efficient, safe and reliable maintenance activities. Effective utilization of SAP® Plant Maintenance (SAP PM) requires consistent up-to-date master data for functional locations. As much as everyone in the industry agrees to the importance of this, surveys indicate that most companies struggle to make it a reality. The impact of poor-quality information in SAP PM includes equipment not being maintained or incorrectly maintained. This maintenance deficit may contribute to a high risk of equipment failure and potential incorrect purchase of replacement equipment and parts.

Incomplete, outdated and missing functional location (FLOC) structures and master data frequently linger within SAP PM systems because of non-integrated Management of Change (MoC) processes that fail to adequately address the information requirements and maintenance system administration that do not keep the information evergreen. Even in cases where the owner operator's engineering department has defined a clear handover specification or is using data-driven design tools, such as Hexagon's PPM division's Intergraph Smart® and SmartPlant® solutions, the maintenance systems are fully disconnected from this data.

Frequent causes of maintenance systems being disconnected from engineering data sources include:

- **Inadequate handover specification**
  When contracting with EPCs for CAPEX (greenfield) or OPEX projects, unclear handover specifications can result in the project data being handed over incompletely, incorrectly or inconsistently.

  - We recommend ensuring that for each project – regardless if small, big or mega – a proper data handover specification is part of the contract and enforced to all project participants.

- **Overarching protection of the SAP system**
  Many companies, for understandable reasons, protect their SAP system against data manipulation by completely blocking other systems to connect to SAP.

  - We recommend evaluating and comparing risks of opening SAP PM for trusted interfaces against continuation of risks that result from manual data manipulation for the plant, plant safety and plant effectiveness.

- **Aging plants**
  For decades, aging plants have operated without maintaining the data and documentation, resulting in information unsuited to feed the maintenance management system.

  - We recommend evaluating a brownfield data collection and clean-up program, which will improve your asset data health and build a digital twin of your plant.

Hexagon's Asset Lifecycle Information Management (ALIM) systems - HxGN SDx, SmartPlant Foundation, and SmartPlant for Enterprise Owner Operators - for more than 20 years have proven their ability to gather, maintain, keep up-to-date, and create an engineering design basis, or the asset's "digital twin."

The remainder of this document will describe how Hexagon's ALIM products, as they are shown on the left side of below figure, integrate tightly with SAP PM using HxGN SDx Connector for Plant Maintenance, therefore eliminating or reducing the pain of the challenges mentioned above.
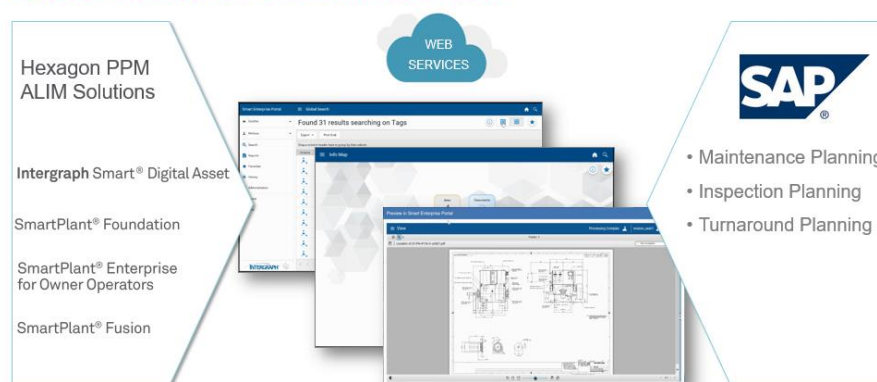
2. Integrating the Design Basis with SAP Plant Maintenance

There are four important work processes that need to be covered to ensure tight integration between an engineering design basis held in Hexagon ALIM products and any computerized maintenance management system, such as SAP PM:

1. Synchronizing Engineering Tags with Operational FLOCs
2. Asset Information Link for SAP
3. Synchronizing Operational Equipment with Hexagon ALIM Solutions
4. Synchronizing Engineering Changes with Operational Notifications in SAP PM

2.1. Synchronizing Engineering Tags with Operational FLOCs

This is the fundamental work process for integrating the engineering world with the operational world. While there is a debate in the industry concerning whether "tag" and "FLOC" are congruent, there is an agreement that those two objects are the binding elements when it comes to integration between these two information worlds.

In the engineering world, a tag represents a function at a location within a facility so that it can be designed. A tag is embedded into a plant hierarchy and has properties that describe the requirements for the technical object and the function within a process that should be fulfilled by this object. "Tag" is the commonly used term on all major deliverables such as P&ID, loop diagrams, 3D models and isometrics.

The current, most promising standard for handing over data, CFIHOS (Capital Facilities Information Handover Specification), sets the definition as follows:

Functional Specification: TAG

Physical Specification: Asset or Equipment[1]

Purchasing information: Model. Model is another object that can be used inside an engineering information management system that represents the typical material description such purchasing information

Similarly, the SAP wiki defines FLOC (functional location) as follows:

Definition
The functional location is an organizational unit within logistics that structures the maintenance objects of a company according to functional, process-related, or spatial criteria. A functional location represents the place at which a maintenance task is to be performed.

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[1] See chapter "Synchronizing Operational Equipment with Hexagon ALIM Asset"

To summarize the two, "tag" is used to represent the design that was created to fulfil the function and describes requirements for technical items that need to be engineered, purchased, installed, commissioned, and then taken over by the operations team for production and maintenance; FLOC is used to organize maintenance and reuses a subset of the data required for a tag. Note that SDx Connector for PM can combine information from Tag and Model into FLOC, if required.

As shown above, there are overlaps in the definitions, with maintenance being the most critical. Maintenance needs to know about the engineering specification and requirements of an item to ensure it performs as it should. Therefore, an engineering system can satisfy many, but not necessarily all, information requirements for a FLOC.

The following are use cases where an engineering system enriches knowledge required for operations and maintenance:

- **Existence of tag**
  Knowing which tags have been engineered is of substantial value for operations and maintenance. Looking back to the challenges discussed before, here we see companies that are missing this information.

- **Tag requirements and properties**
  When designing each process, engineering had a specific function in mind and a specific tag to correlate with that function. Keeping that information when the tag is in operation and under maintenance is important for selecting the correct equipment replacements or spare parts.

- **Tag documentation**
  Vendor and design documentation extends and completes the tag information.

Technically the integration works as follows:

Synchronizing Engineering Tags with Operational FLOCs
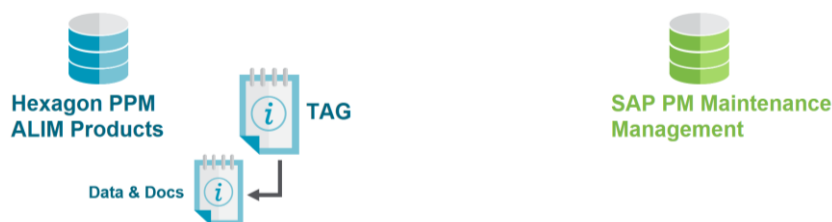
Tags that exist inside the engineering system (such as Hexagon products) hold lists of related data and documents. To identify which of these tags should and should be transferred to SAP PM depends on various factors, such as:

- **Tag is a maintained item**
  This is a definition that can be made based on the requirements given by maintenance, such as tag class and varies from customer to customer. For example, cables are not always seen as maintained items, though rotating equipment and vessels always need to be maintained. However, keeping a record of the cables related to the equipment and associated drawings is needed for proper maintenance. Only maintenance-relevant tags are sent to SAP, and this can be determined by configuration of the interface.

- **Tag has a status that allows transfer to SAP**
  A tag can have a status value to indicate that it currently only exists for engineering purposes, and there is nothing else to indicate if it ever will be physically implemented in the plant. The tag may be removed prior to physical implementation of the design. Other tags might be in an engineering status that will allow to transfer it to SAP because it is physically installed at the plant together with equipment that will be installed. The status at which a tag is transferred to SAP PM is configurable in the interface.

- **Tag transfer status**
  The interface will only transfer tags that are new, updated or deleted/terminated.

For tags meeting all the above requirements, the interface may execute a transfer.
Requirements may vary from case to case as well as when/how such a transfer should be started, such as the following options provided by the interface:

- **Automated periodically scheduled transfer jobs**
  In this case, a transfer is executed automatically based on a fixed schedule which might mean every hour, every night or weekends.

- **User manually triggers transfer**
  In this case, a transfer is only executed if a user initiates the transfer.

- **Tag change-based transfer**
  A transfer happens automatically when a defined number of tags have been created or updated.

Synchronizing Engineering Tags with Operational FLOCs

Once a transfer is kicked off, the integration mechanism executes the following:

1. Collect tag data to be transferred
2. Execute mapping: Engineering system properties need to be mapped against the transport mechanism
3. Transformation: Naming transformations are required if the tag naming convention and the FLOC naming convention are different e.g. adding a facility code prefix to the tag number to create the FLOC
4. Creation of a data container
5. Handover data container to SAP interface component

Synchronizing Engineering Tags with Operational FLOCs

The integration workflow is then continued on the SAP side by:

- Receiving the data container in SAP
- Map data to SAP system requirements
- Hand over data to the correct SAP Business Application Programming Interface (BAPI) for creation or update of FLOC data

Synchronizing Engineering Tags with Operational FLOCs

Finally, SAP collects response data for either success or error messages and sends back information about the created FLOC.

The end-to-end integration between the two systems:

- Enables SAP PM to receive detailed engineering information for all maintainable, engineered items via a direct data connection.
- Ensures that future engineering and maintenance data remain evergreen and synchronized through the fully automated integration.
- Verifies that only validated and therefore trustworthy data is sent to SAP without manual intervention, which is always error-prone.
- Allows both systems to know the relationship to the corresponding object (tag/FLOC) on the other side, meaning that downstream processes between the two systems can now be established. One example for such downstream processes is the Asset Information Link for SAP described below.
- Provides log and error messages for all transactions executed or failed so that an administrator can easily review what has changed in SDx Connector for PM.

2.2. Asset Information Link for SAP

Asset information link for SAP displays a list of relevant documents from Hexagon ALIM tools inside the SAP PM user interface for a FLOC. Due to the synchronization process described above, Hexagon ALIM tools already know about the relation between FLOC and tag that enables the relevant documents to be displayed.
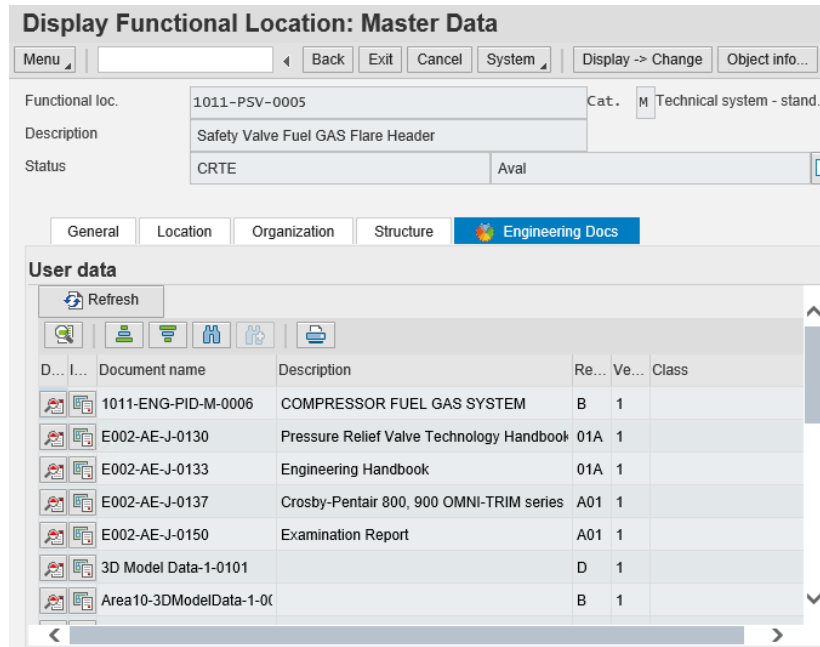
The figure above shows what the SAP PM user will see for a synchronized functional location object; "the SAP user interface displays an embedded list of documents from the Hexagon ALIM solution.

The user need not be aware this list is coming from a system external to SAP. The user can also view a document from this list, still without leaving SAP PM.
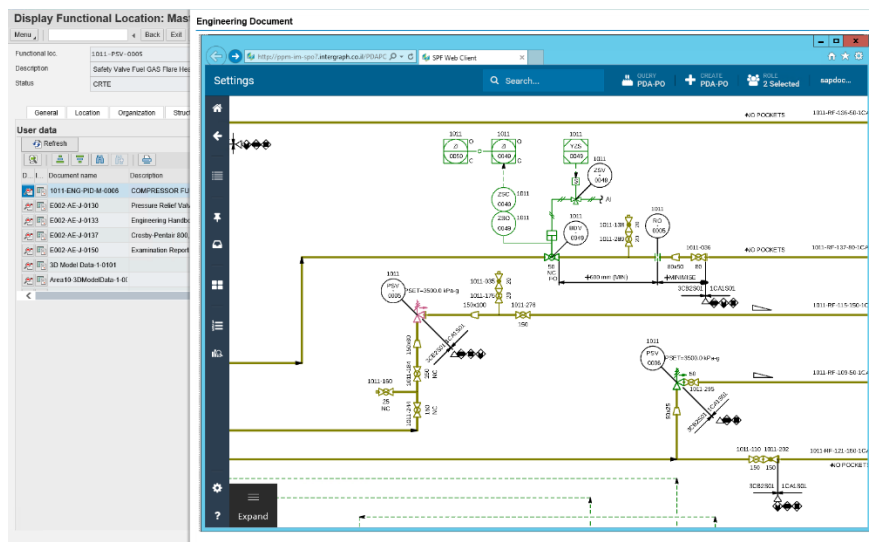
For more sophisticated users and for deeper analysis of a certain engineering data set, the user can also view an "Info Map" graphical representation of related data in a Hexagon ALIM system to see and browse related information as shown below.
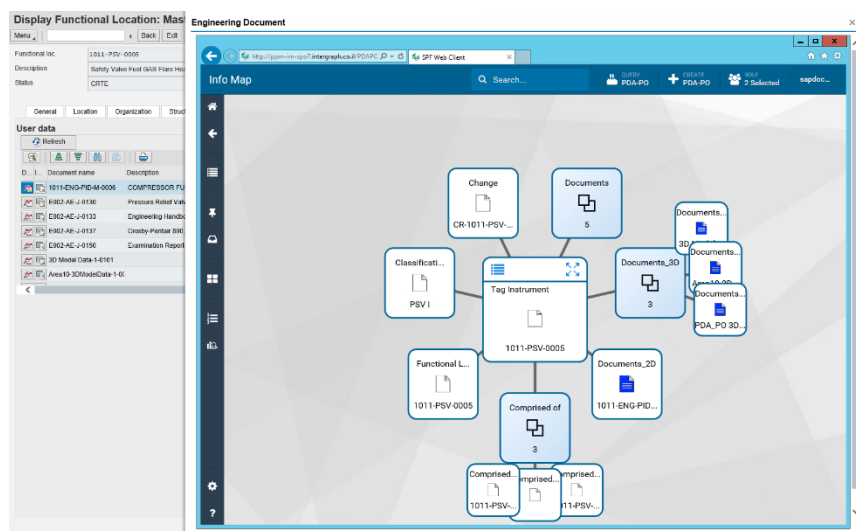
With this seamless end user integration between SAP and Hexagon ALIM tools, SAP PM users achieve the following advantages:

- Quick, integrated access to engineering documents with up to date engineering revisions
- Simple viewing options for documents stored outside SAP PM
- Info map
  - Requires minimum configuration and skill level to administer
  - Requires minimal end user training
  - Serves as a common search, view and simple navigation solution for engineering data and documents
  - Operates on thin client architecture with zero footprint in a web browser

2.3. Synchronizing Operational Equipment with Hexagon IM Solution

In this work process, the Hexagon ALIM tools that support asset integration are informed by the SAP PM integration about the installation and dismantling of equipment at a functional location; such equipment is stored in Hexagon as an "asset," which is the equivalent of an "equipment object" in SAP.

"Equipment" is a physical item that can be moved from one FLOC to another (rotable equipment, e.g., electric motors) or removed from service altogether. It may also be at the warehouse or under repair in a repair shop. Major equipment typically has a name plate that shows the manufacturer serial number and

production date, along with similar information; this nameplate might be missing for smaller equipment such as valves and compensators.

It is imperative to know which equipment has been installed on which functional location, since plant reliability, operations, safety, and maintenance require that the installed item satisfies the requirements defined at the functional location level. The maintenance history is stored against the equipment in SAP. For this work process, SAP PM is assumed as the master for equipment data. This assumption is based on the following:

- SAP has a procurement and logistics solution that, if fully used, enables a seamless supply chain from a requirement for new equipment through inquiry, purchasing, delivery, and commissioning/inserting the purchased item into equipment list of a plant.
- This should result in all information available for each purchased item being readily available inside SAP PM.
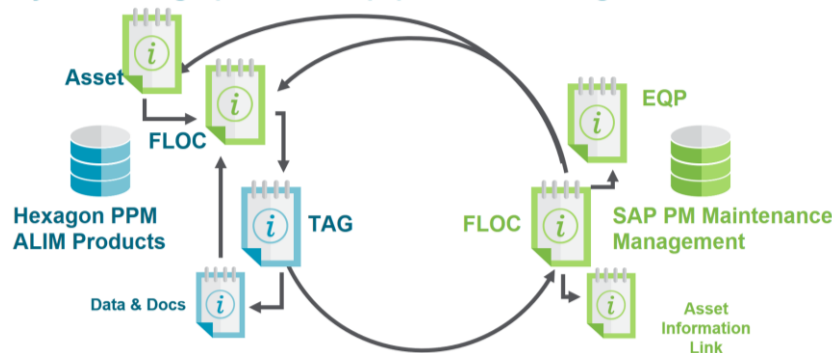
The graphic above illustrates the process.

Once the synchronization between tag and FLOC is established, installation of equipment related to a FLOC can happen at any time in SAP PM and subsequently dismantling of equipment from the FLOC. The SAP connector uses a "user exit" inside SAP PM that recognizes that such an activity happens. It calls a web service at the Hexagon IM tools that creates an asset object inside the respective Hexagon ALIM tool, along with the relation to the FLOC object. This establishes and maintains a triangle of information – Tag, FLOC, Asset – inside the Hexagon AIIM tools that will enable many further work process integrations in the future. For example, leveraging this triangle will allow many additional options for the asset information link for SAP.

## 2.4. Synchronizing Engineering Changes with Operational Notifications

Hexagon's SmartPlant Enterprise for Owners and Operators (SPO) supports an engineering management of change process for operations.

Maintaining the accuracy of essential plant engineering, maintenance, and operations information is vital to safe and efficient plant operations. Managing plant change is a safety-critical process.

Traceability of plant changes and auditability of the management of change process are essential to demonstrate compliance with regulatory requirements. Intergraph designed the Management of Change in Operations business package to provide rigorous management of change (MOC) of engineering information with full traceability and audit trail.[2]

SDx Connector for PM allows integration of SPO Management of Change process with SAP notifications, ensuring that engineering changes executed in SPO get implemented/installed in the plant by maintenance teams controlled via SAP.
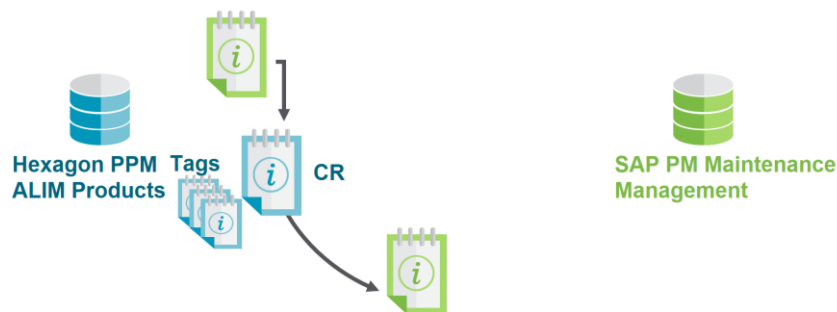

Once a change request (CR) in SPO has come to an approval stage, that allows SAP maintenance to start planning the execution. The SAP connector grabs the change object and transfers it to SAP PM. After a data transformation, the CR/tag pair creates one SAP maintenance notification with one related FLOC.
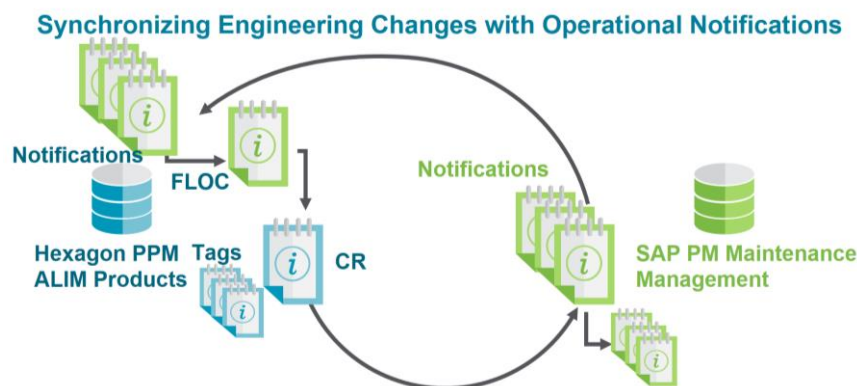
The same happens for each additional tag that is part of the SPO CR. In other words, a CR with relations to three tags will produce three notifications in SAP, each with its own relation to a FLOC.

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[2] Leverage the Engineering Design Basis Across the Life Cycle, 2015

Synchronizing Engineering Changes with Operational Notifications
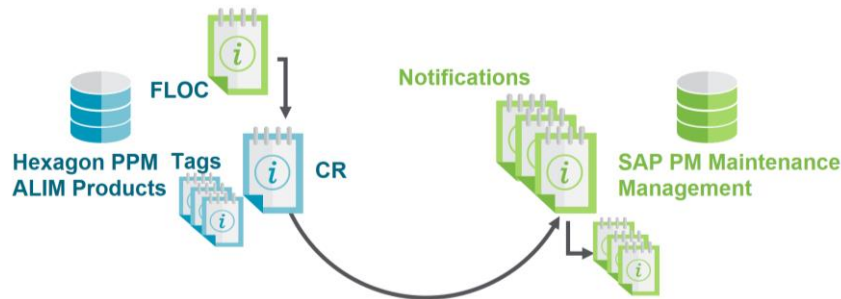
Finally, the SAP connector sends back to SPO the notification name and its relation to the tag so that SPO can generate an object for each notification.

3. Conclusion

SAP PM is the leading solution for Asset Maintenance in asset intensive industries such as oil, gas, chemicals and power; however, it is limited in its ability to manage engineering design information or manage all the information that is impacted during Management of Change. Hexagon offers several products specifically designed to manage engineering data and documents. Hexagon's HxGN SDx Connector for Plant Maintenance brings the best of both together, seamlessly. SAP users can now see all the information they need without leaving SAP and trust that it is current, complete, and consistent. The result is less time spent on non-productive tasks, such as finding and verifying information, and more time spent on the activities that are critical to safe, efficient operations.

About Hexagon

Hexagon is a global leader in sensor, software and autonomous solutions. We are putting data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications.

Our technologies are shaping urban and production ecosystems to become increasingly connected and autonomous — ensuring a scalable, sustainable future.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 21,000 employees in 50 countries and net sales of approximately 3.8bn EUR. Learn more at hexagon.com and follow us @HexagonAB.