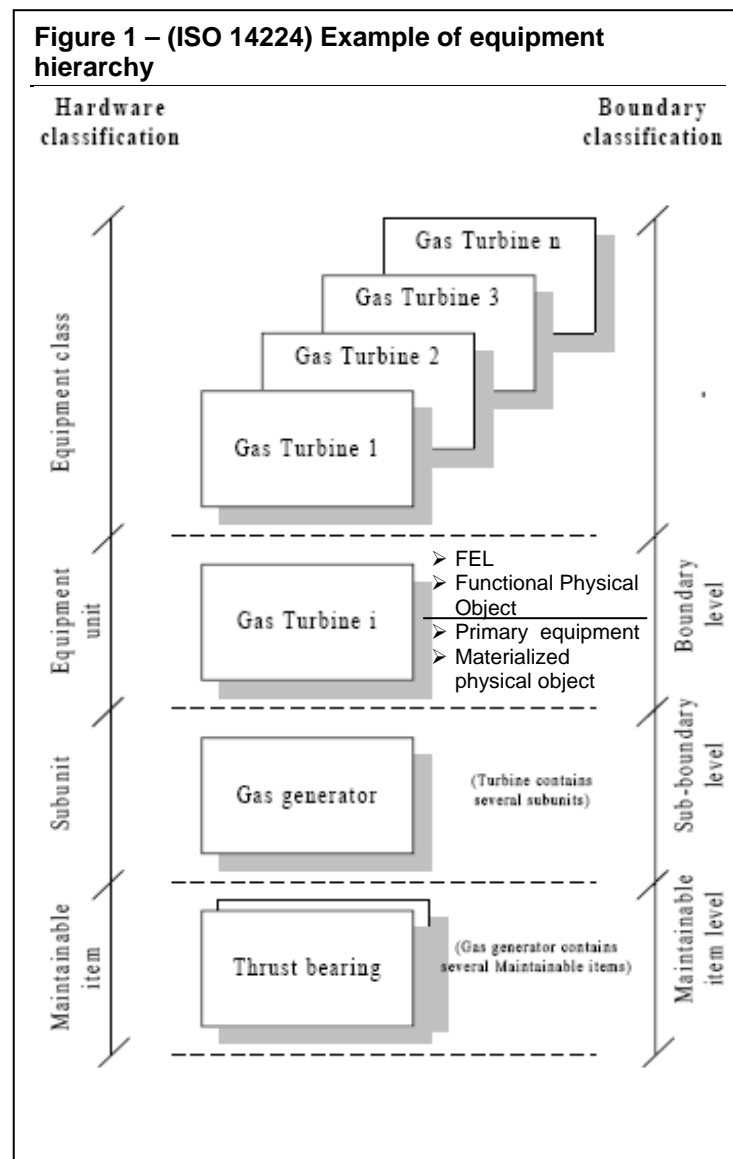


## Objectives

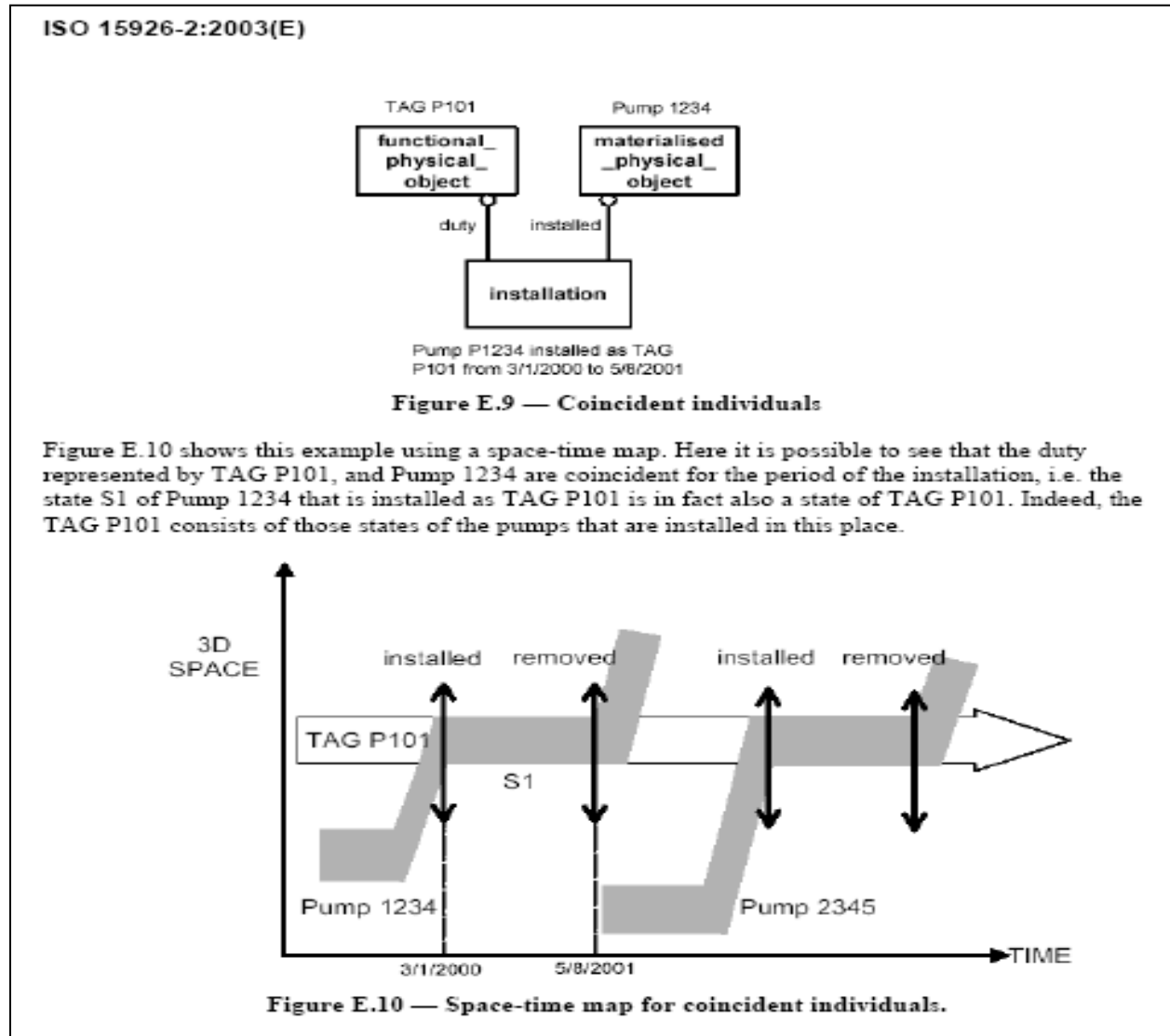
Establish a hierarchical framework for capturing quality equipment reliability data that can be applied consistently for all facility types in the oil and gas industries and that supports the data requirements of ISO 14224, Petroleum and natural gas industries – Collection and exchange of reliability and maintenance data for equipment. The framework should be a logically-organized structure that captures equipment-specific engineering specifications and characteristic data in a model that supports data flow from engineering design to procurement, installation, operation, and maintenance. This model should conform to industry standard ISO 15296, Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities. The framework should also differentiate between functional requirements of equipment versus equipment capabilities in a manner that allows automated confirmation that installed equipment items are correct for their applications.

## Functional Locations and Equipment



The SAP *functional location* structure is a hierarchical structure for identifying process functions as technical objects and cataloguing them in a logical manner. Top-level functional locations identify facility areas that can be referred to as functional area locations (FALs). Bottom-level functional locations (structure endpoints) identify individual equipment functions that can be referred to as functional equipment locations (FELs). FELs are equivalent to both ISO 14224 *Equipment Units* (Figure 1) and functional physical objects as defined by ISO 15926 (Figures E.9 and E.10). Materialized physical objects defined by ISO 15926 are equivalent to both ISO 14224 *Equipment Units* (Figure 1) and SAP *primary equipment* objects, have actual physical entities (serial numbers), are installed in FELs, and execute the respective process requirements as defined by those FELs (Figure E.9). SAP sub-equipment objects are differentiated from primary equipment objects in this context and are discussed below.

Both FELs and primary equipment are classified using the ISO 14224 taxonomy. Each taxonomy ID has a given set of characteristics associated with it that are specific to the FEL or primary equipment item it represents. SAP allows the use of the same taxonomy ID for FEL and equipment technical objects, which means that different sets of characteristics can be applied to one taxonomy ID for FEL versus primary equipment objects.



Each FEL is analogous to a tag number on a process and instrument diagram (P&ID) and is assigned applicable characteristic data fields based on its taxonomy ID that specify its process requirements and conditions. Each primary equipment item is assigned applicable characteristic data fields based on its taxonomy ID that specify its capabilities. Equipment items must have capabilities that meet or exceed the requirements specified by coincident FELs. The cardinality between FEL and coincident equipment at a given point in time should be one-to-one in order to simplify the comparison between FEL-to-equipment requirements versus capabilities and to facilitate the definition of equipment boundaries per ISO 14224.

FELs remain largely unchanged through the lifecycle of a facility, while equipment items frequently move from one FEL to another (Figure E.10). Therefore it makes sense to use FELs in the definitions of ISO 14224 equipment boundaries where possible to avoid having to change boundary definitions each time an equipment object is moved from one FEL to another. Historical records should be captured for both functional and materialized objects.

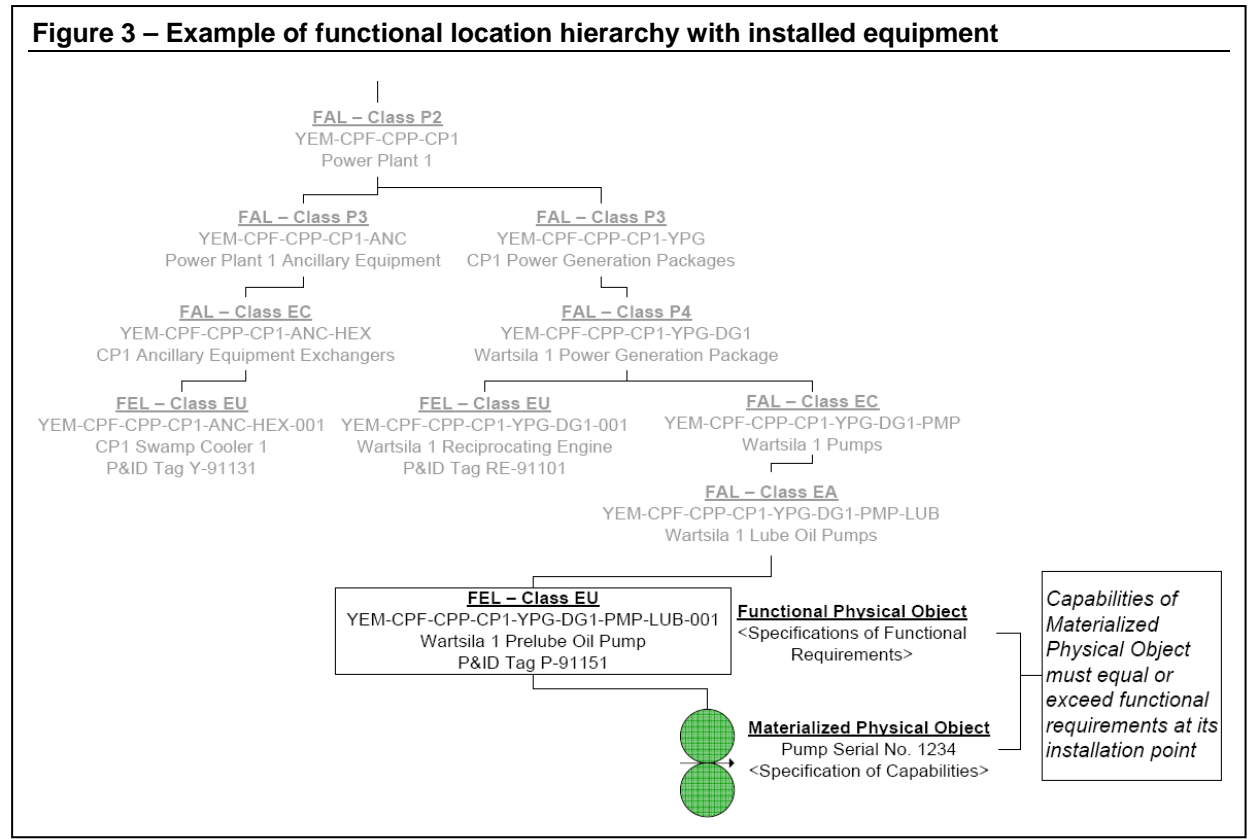
While FELs are clearly defined by the ISO standards specified above, FALs are left more to user discretion. This author recommends using a ten-tiered symmetrical structure with two components, the business/process hierarchy and ISO 14224 classifications, to create a logical structure for cataloguing assets, analogous to a filing system (Figure 2). The functional location hierarchy should allow flexibility in number of levels to accommodate both simple and complex facilities and processes. It should also

accommodate equipment additions without major structural changes. Instead of having a given position in the hierarchy define the functional level (e.g. facility, plant, etc.), each FAL is given a taxonomy ID that identifies its functional level. Three functional levels are mandatory per the recommended structure in Figure 2, but others are optional and would typically be used only in more complex facilities with greater equipment populations. The maximum number of functional levels is ten. The minimum number of functional levels with an equipment installation is three.

**Figure 2 – Functional Location Template (XXX-XXX-XXX-XXX-XXX-XXX-XXX-XXX-XXX-XXX)**

M/O <sup>1</sup>	Class <sup>2</sup>	Node	Example <sup>3</sup>	Node Type	
M	BU	Business Unit Entity	YEM	Business and process area	FAL
M	FC	Facility	CPF		
O	P1	Plant Level 1	CPP		
O	P2	Plant Level 2	CP1		
O	P3	Plant Level 3	YPG		
O	P4	Plant Level 4	DG1		
O	EC	Equipment Class	PMP		
O	ET	Equipment Type			
O	EA	Equipment Application			
M	EU	Equipment Unit	001	ISO 14224	FEL

1. M/O – Mandatory/Optional for equipment installation (ten levels maximum)
2. Additional plant levels are permissible
3. Abbreviations should be standardized

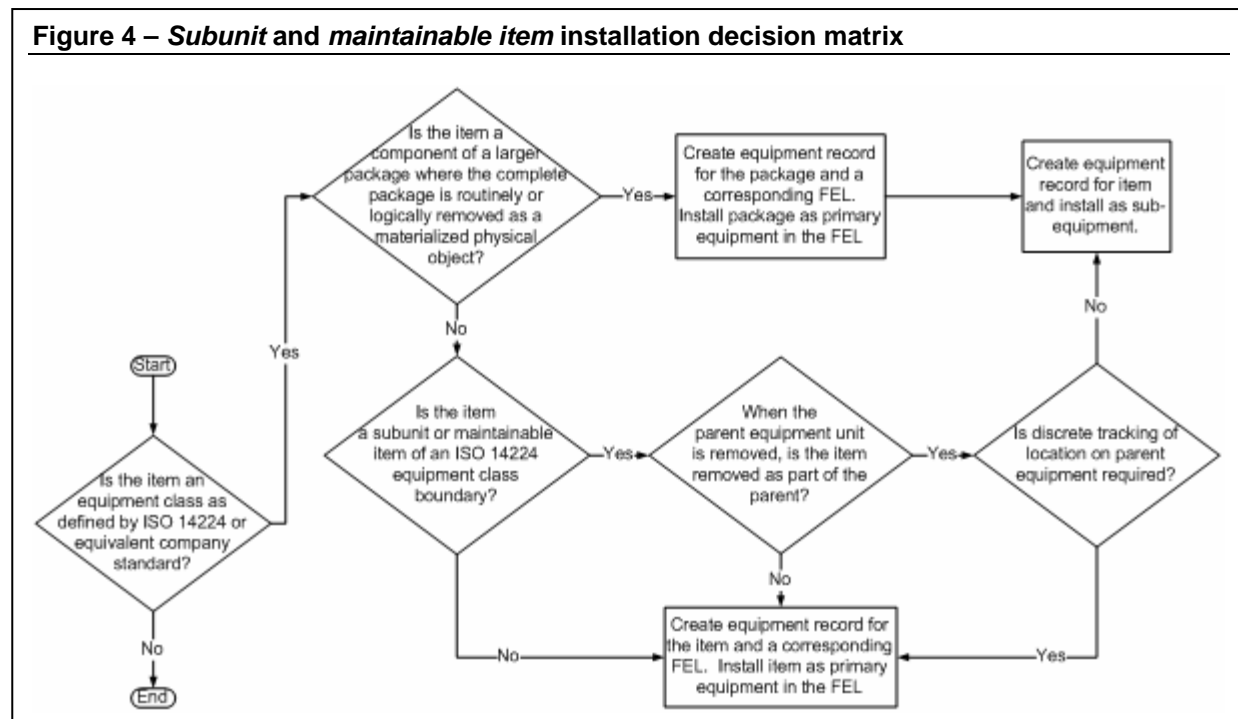


## Sub-equipment

Sub-equipment items are ISO *equipment class* that are also *maintainable items* belonging to a parent ISO equipment class. For a maintainable item to be installed as a SAP sub-equipment item, it must:

1. Be an ISO equipment class with an assigned SAP equipment number.
2. Physically be an integral part of the parent equipment. If removing the parent equipment also removes the subunit/maintainable item, then the subunit/maintainable item is sub-equipment. If it is not physically part of the parent item, then it should be installed as primary equipment into its own FEL.
3. An exception to Item 2 is when discrete tracking of the specific location of the maintainable item is required.

For an object to be assigned a SAP equipment number, it should be part of an equipment class per ISO 14224 or equivalent company standard. If an equipment class for an object does not exist but is required, a class should be defined for it along with applicable class information; failure modes, subunits and maintainable items, boundary definitions, classification and characteristics, key performance indicators, etc. When a SAP equipment number is assigned, the equipment should be installed either as sub-equipment or as primary equipment (unless available as spare equipment). Figure 4 gives details on when to assign the three types of SAP equipment objects (FEL, primary equipment, and sub-equipment).



## Bibliography

1. ISO 14224, Petroleum and natural gas industries — Collection and exchange of reliability and maintenance data for equipment
2. ISO 15296, Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities.