TAXONOMY FOR INDUSTRIAL DATA BASE TO IMPROVE OPERATIONS MANAGEMENT INFORMATION SYSTEM

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ABSTRACT

To classify equipments regardless of their manufacturer, the KKS, a product classification system, provides the required features to develop Plant Data Management Information System (PDMIS). Equipment items have one status at any one time. Equipment installed in a plant is assigned to a group with the KKS nomenclature system. In process plant, products of the same type are employed several times. The KKS coding rule allows other data structures with the plant designation code to be created and linked. The system assigns successive ID code to each item of equipment. All types of technical data are managed in the PDMIS with respect to technical characteristics.

The plant data management information system (PDMIS) is a powerful plant configuration management tool that can be accessed from other applications and serves as common interface. Using plant documentation system and the PDMIS, detailed information of the respective plant can be developed to a range of requirements. This paper addresses the important features, attributes that are needed to develop the PDMIS using KKS taxonomy. The KKS plant database helps to develop quality assured services and administration of plant components.

Keywords: KKS, Information System, Power Plant, Operations Management, Industrial Data Base

PLANT DATA MANAGEMENT

Well-organized plant management requires fast access to consistent industrial database. It is the foundation of integrated plant operational management system. The unified plant database makes it possible to express the entire plant in the form of a single database using standard system for all domains of operation and in all engineering fields. The consistent plant data management information system (PDMIS) is a convenient plant configuration management tool and it can be accessed from other applications and serves as common interface. Using plant documentation system and the PDMIS, detailed information of the respective plants are developed to a range of requirements (2). The prerequisite of accommodating existing data is incorporated without any difficulty using appropriate plant taxonomy system. Numerous plausibility checks and data validation mechanisms guarantee the necessary quality and consistency of data.

Plant Identification System

Technical installations of equipments in process industry such as power plants are extremely complex. The installation of equipment is best described if it is subdivided into smaller units. To develop consistent PDMIS the plant is subdivided on a process-oriented designation system in accordance with functional and structural considerations into plant items such as plant areas, the systems it is composed of, the subsystems that are associated with, the machine sets, the valves, the drives and such other items (4). Also alongside, the plant items are classified on a process oriented designation system, and the objects are documented in accordance with a specific power plant identification system. The plant items are uniquely identified in the Plant Data Management using KKS nomenclature. It is possible to distinguish between plant items with the same identification code on the basis of their type by using an additional classification (3). A classification system that accommodates the special requirements of power plants provides greater flexibility in developing PDMIS. The KKS is a multi level identification system and is possible to tailor and extend by the user as required.

Location specification and Data Validation

The PDMIS allow the plant to be subdivided from a topographical standpoint. For example, the buildings, corridors, installation locations, rooms, mounting locations such as cabinets are accommodated in to the KKS nomenclature system. The plant items within the plant are thus described using this nomenclature system. Any type of design data in PDMIS can be described. The plant item is correlated to a data group with the plant item class. To describe the design of an electrical motor the technical data from the PDMIS are linked. The specification norm is applied to assure the quality of data during entry mode and administration with regard to the format specifications, consistency and integrity (8). These checks are adapted to the plant specific requirements. Once the data validity has been checked the data is updated in the system.

In PDMIS, the current status for the plant and the premeditated modifications are recorded. Information that is old and not used frequently is retained as historical data. The KKS coding structure carry status information such as installed capacity and planned capacity. The KKS designation system, when used as PDMIS allow the history of all changes to be logged. Amendments and additions of the data are documented and traced for reference purposes. With the KKS nomenclature system, it is easy to keep record of the all installation/removal events concerning the plant items.

The KKS nomenclature has special attributes; in particular it fulfills the following identification coding requirements:

- **i.)** Uniform coding for process plant and any connected processes
- **ii.)** Sufficient capacity and possible depth of detail for the identification of all systems, components and structures
- **iii.)** Sufficient capacity for extension to accommodate new technologies
- **iv.)** Consistent identification coding throughout planning, licensing, construction, operation, maintenance and decommissioning
- **v.)** Interdisciplinary applicability to mechanical engineering, civil engineering, electrical engineering and instrumentation and control
- **vi.)** Consideration of national and international standards

vii.) Non-language-based coding to ensure international usability
viii.) Global and trans-organizational application for designers, manufacturers and operators.

PDMIS derived from KKS is attachable with other database for the process pant management. The records concerning the equipment currently installed, the pressure and (or) temperature value pairs, the settings, position information, associated documentation, detection of faults, defects, maintenance orders to be performed; are all accessed through the unified KKS coding structure. The diversified nomenclature capability helps to develop integrated plant database.

The KKS classification system helps to develop quality assured services and administration of the plant components. The KKS classified database forms the basis for operational planning management. To describe complex technical systems, such as power plants, it is necessary to subdivide them into smaller units (1). This subdivision is based on process orientation according to the functional aspects, such as subsystems, systems, machine units, valves, actuators, etc. The plant components are identified according KKS process identification guidelines and norms. Also, when carrying out safety measures it is sensible to subdivide the plant according to topographic aspects, such as installation location in rooms, mounting location in cubicles, actuation locations to describe the position of the component in the plant. This is especially true for actuation locations that are sometimes different from the component's mounting location (5).

Maintaining Equipment Configuration

The process pant equipments linked to one another in accordance with the user specified rules. The rule allows other data structures with the plant designation code to be created and linked. A plant item is integrated into more than one structure and the structures incorporates position specific format. Apart from hierarchical structures, any other type of extremely complex relationship is possible to create between plant items (8). Such relationships are applied to plant configuration, functional configuration, and power supply structure such as electrical or hydraulic, topographic structure, pressure-testing unit and so on. The tasks are described in the form of plant items (e.g. code configuration for a plant item in a location PAC01 BA001) based on the location of the equipment. Any information applicable for maintenance for example status, failure, settings, etc. is related to the individual items of equipment. Each single component has its own service life history. This service life history of information forms the basis for better preventive maintenance management strategy. All data pertaining to the equipment is managed in the PDMIS to allow its service life to be easily traced later. In the PDMIS, the equipment together with its basic data are incorporated, classified and uniquely identified. The system assigns a successive ID code to each item of equipment. The equipment is referenced uniquely with the ID code in the system and throughout its entire service life. To classify equipments regardless of their manufacturer, the KKS product classification system provide the required features to develop the PDMIS. This classification also forms the basis for consistent assignment, whereby a product type is assigned to the equipment.

Any type of technical data is managed in the PDMIS for the equipment and items. The plant items are correlated to the KKS data group associated with the equipment type and the product class. Equipment items contain one status at any one time. If it is installed in the plant, it is assigned to a plant item with the KKS nomenclature system. The current status of each item of equipment allows the provision to keep record of the system, such as the equipment is installed

in the plant, in stock, returned to the manufacturer for repair or rented out. A document specific to an item of equipment (e.g. test certificates) is assigned to the equipment. They are then available with the integrated KKS style structured database. The service life of each item of equipment is traceable in the PDMIS for evaluation purpose. The service life data includes place of installation and duration of use with its status, detected faults/defects as well maintenance actions performed, results of inspections, log of operating values and settings, etc. In process plant, the products of the same equipment are employed several times. For overall plant management, it is useful to keep a catalog of the equipments used together with all relevant data. The advantage is that the data and documentation are maintained only once (no redundancy). Also, the components are easily found with reference to their special characteristics and the equipments from different manufacturers can be compared for performance. The PDMIS can build record for standardization in inventory control and procurement management functions.

Different Methods of Assignment

The KKS designation system implements code design by manufacturer on the basis of manufacturer's data, i.e. the type or product identification of the manufacturer. If neither of these data is available, *a category* can also be assigned on the basis of the product designation. Possible variations in product are allowed as different materials are described with the aid of additional data. The data groups are defined by the user and specify the information that is relevant for the associated product type. Relevant documents, for example, sectional drawings can be directly assigned to facilitate quick access to information. For each type, the equipment that exists in the plant or that is in stock may provide information along with its point of installation or storage location (8). In PDMIS, item lists of materials are created for all items of equipment and equipment types. *Category* can also be assigned to the item numbers in the parts lists. In the case of spare parts, the material number under which a part is managed in the stores can also be entered. The parts list is used to determine the materials required on planning work orders. Hence, the current stock levels can be determined.

KSS Break Down Level Structure

The field allocated in KKS system to a piece of equipment is broken down into a number of levels (Table 1). Within each level there is a field or set of fields and each field occupies a letter or a number according to a convention. Each letter or number has a field naming for example ***G*** is used for the plant, ***F*** for the function, ***A*** for the equipment and ***B*** for the system component.

a) A *level 0* code is specified to include two power plants on the same site. It can be coded as “A” or “B”. The system permits numeric characters to be used if required. If only one plant exists on the site the first character can be dropped altogether.
b) The first digit of *Level 1* code identifies the boiler/turbine unit on which the relevant piece of equipment is fitted. This is always numeric character and, for example, 1 can be used for boiler 1. When the equipment is common to all areas of the plant the number 0 is adopted.
c) The rest of the *Level 1* code defines the function of the equipment. For example it can be associated with feeder-water pump system, the pump itself, the motor and all the equipments. The components can be leak-off valve, starter and other parts. A unique sequential number for the system can be defined. It can be, for example, pump number 2. This group of digits, the first three alphabetic and the next two numeric digits is combined with the unit-identifying prefix. This is called the *function code*.

d) The *Level 2* codes comprise five or more digits. It defines a particular piece of equipment, such as pressure transmitter and can have unique sequential number as 101.
e) A device that generates some form of electrical signal is classified in *Level 3* code as the component itself. The nature of the signal is also classified in this breakdown level.

Incase there are 100 pressure gauges in a plant, the sequential numbers for these codes do not start at 001 and end with 100. The numbers relate to the functional area of the plant where they are used. The code changes when the position of the pumps changes with respect to the function for which it is used (6 and 7). For example, the first pressure gauge on the high pressure steam piping system of a plant, where the piping system is numbered LBA10 will be allocated a sequential number LBA10CP001, the next will be LBA10CP002, and so on. The numbering starts again on another system. The first pressure gauge on hot reheat steam piping system numbered LBB10 is allocated the sequential number LBB10CP001 and the next is LBB10CP002 and so on.

The KKS Coding with Breakdown Level 1 – Function Key

The coding example is shown Table 1 to illustrate how PDMIS can be developed with KKS taxonomy. This is just a simple illustrative guideline and detail is found in (3).

Table 1 KKS Fields

Break down Level	Plant Id	Unit No	Level 1 Function					Level 2 Equipment code					Level 3 Components or Signal			
Position code	G	F_0	F_1	F_2	F_3	F_n	F_n	A_1	A_2	A_n	A_n	A_3	B_1	B_2	B_n	B_n
Type of Character	A or N	N*	A	A	A	N	N	A	A	N	N	N	A	A	N	N

Where,

F0-(N): is used for the Prefix number
F0: is used for numbering of similar units and plants
F1-A: refers to the main group
F2-A: is reserved for group item
F3-A: is used for subgroup
FN-N: is the classification key is used for classification fixed as per KKS-Key for: systems, plants, points of installation, (switchboards), and structures
FN-N: is the index key is used for counting numbers: include redundant zeros, successive numbers or groups, start new if F1-A changes.

CONCLUSIONS

KKS is a function oriented advanced technical nomenclature system for equipments installed in nuclear, thermal and chemical industries among many other types. The advantage of a unified KKS coding structure in developing industrial database is to improve productivity of personnel, assure higher quality of work, avoid mistakes, and reduce unproductive search efforts. It reduces

costs with structured DSS and maintains common database for other modules. The PDMIS is an electronic form of documentation, and therefore is ideally complemented by document management information, which is required by many users and/or in different forms. Search functions are helpful in the document management system. The document management directly links the references as and when required for any functional purposes to be used in safety and operational planning. Since the KKS nomenclature can identify equipments based on its functions, it greatly helps in efficient operations planning and management. The function oriented classification system is helpful in devising efficient management information system.

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