RDS-PP – Transition from the KKS to an international standard

Up-dated version of an article from VGB PowerTech 8/2007 concerning RDS-PP

By Dipl.-Ing. Harry Königstein, Ing. (grad.) Heinz Müller and Dipl.-Ing. Jörg Kaiser
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Abstract

New and withdrawn standards and the revised EU Directives relating to reference designation and plant documentation also have a significant impact also on the KKS power plants reference designation system run by VGB PowerTech.

To gain acceptance on the international markets, to ensure compliance with valid standards in conjunction with conformity evaluations and to satisfy safety provisions in plants, both manufacturers and operators needed to adopt the KKS to current rules and regulations.

The work was carried out in the VGB “Reference Designation and Plant Documentation” Working Panel and resulted in a technical standard for reference designation in power plants and a key for power plant systems – the “system key”. Experience and known potentials for improvement in the use of KKS complete the adoption and creation of the KKS replacement system. The new standardized reference designation system is called “Reference Designation System for Power Plants RDS-PP”.

The technical standard is based on the basic principles of international standards and takes into account nearly all the KKS structures. Around 90% of the code letters in the KKS function key were transferred to the new system key. KKS aggregate and equipment key will be replaced in the new reference designation system by a standard in which the code letters are standardized globally for specialist fields and sectors. These code letters do unfortunately always match the KKS specifications.

There are tools available for comparing RDS-PP to KKS and for performing the required conversion from KKS to RDS-PP. These tools support the transfer of the KKS function key to the RDS-PP system key and from the aggregate and equipment key to the code letters in the international standard.

The article depicts the development of the new reference designation system from the point of view of standardisation, describes the main features, mentions offers of support by the VGB “Reference designation and plant documentation” working panel and provides recommendations for future use.

General

The KKS Identification System for Power Plants has been successfully used worldwide since the early nineteen seventies for the designation of plants, technical equipment and components in power plants.

The issuing of international basic standards on reference designation in the year 1996 and the quoting of such standards in European directives and harmonized standards called for an adjustment of the KKS to such specifications.

The main motivation for this was for the manufacturers to assert themselves in the European and worldwide markets by ensuring conformity with the standards and for the power plant operators to avail themselves of a standardized equipment designation basis for their work.

The basic principles necessary for such adjustment and certain amendments of the KKS were developed in the VGB Technical Committee “Reference Designation and Plant Documentation” jointly by manufacturers and operators and contributed to the national and international standardizing activities. The main objective was to arrive at a sector-specific standard for power plants. The result is now available:


The KKS successor system is named: Reference Designation System for Power Plants – RDS-PP.

History

In March 1969, three manufacturing companies published in the technical journal “Elektrizitätswirtschaft”, an article entitled “System zur Kennzeichnung von Geräten und Anlagen in Wärmelektrowerken” (System for the designation of components and plant equipment in thermal power plants). The designation system referred to in this article was designed for the needs of planning, constructing and operating mechanical and electrical systems and was used by the name of “Anlagenkennzeichnungssystem” (Plant Designation System), in short “AKS” or “AKZ System”. The system used various code letters from other standards, e.g. the “device identifier” for electrical components from DIN 40719, supplementary sheet 1.

In the early nineteen seventies, the experience gained in the application of the AKZ System resulted in the further development of the system by the VGB Working Panel “Technical Classification Systems”, in which operators, experts, authorities and manufacturers were

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Figure 1. Development of the sector-specific standard for power plants.
equally represented. The result, the “KKS Identification System for Power Stations” was published by VGB as Guideline VGB-B 105e. The guideline was complemented by so-called “Key Parts” (function, equipment unit and component keys) and “Application Explanations”. Apart from electrical components, also equipment items of mechanical systems could be identified according to the KKS specifications. Furthermore, the KKS was used as a basis for the designation of signals, connections and documents (Figure 1).

The publication of IEC 61346-2 and DIN EN 61346-2 for the classification of technical objects across all technical disciplines and the associated withdrawal of DIN 40719-2 in the year 2000 resulted in a situation where KKS code letters were used which were not covered by a valid standard. International specifications and requirements were thus no longer reflected in the KKS.

This was an urgent reason to revise the KKS and adjust it to the new requirements resulting from the international codes. Taking into account DIN 6779-1, members of the VGB Working Panel “Reference Designation and Plant Documentation” (successor panel of the Technical Committee “Technical Classification Systems”) were instrumental in developing the sector-specific standard for power plants DIN 6779-10 entitled “Structuring principles for technical products and technical product documentation – Part 10: Power plants”.

This national standard was submitted as a proposal to the ISO and accepted. It has been published in the meantime as an international standard under the number ISO TS 16952-10 and DIN ISO/TS 16952-10. IEC and ISO have agreed to publish the various standards relating to reference designation resulting from the ongoing revision work under a common series of standards with the number 81346.

### Characteristic features

The Reference Designation System for Power Plants – in short RDS-PP – results from the consistent further development of the successful KKS Identification System for Power Plants. It has thus the characteristic features of a proven identification system:

- applicability to all power plant types,
- consistency throughout the entire life cycle,
- identity in sense for all technical disciplines,
- language independence.

The RDS-PP expands the KKS by the designation blocks:

- „Conjoint designation” for the designation of plant sites and plant complexes, and
- „Functional allocation” for the designation of dynamic processes.

The RDS-PP is based on structuring principles, designation rules and letter codes, specified in international standards published by IEC and ISO and fulfills the prerequisites for:

- finding worldwide acceptance, and
- application of the same, standardized code letters.

The RDS fulfills the requirements of European Directives in terms of

- operational safety,
- ergonomics,
- procurement, and
- declaration of conformity.

The RDS-PP is in full agreement with the national/international sector-specific standards for power plants ISO/TS 16952-10 and DIN ISO/TS 16952-10 and thus complies with the mentioned international standard for reference designation systems.

The RDS-PP can thus be considered to be a standard-conforming designation system.

### Sector-specific standard

The sector-specific standard ISO TS 16952-10 is based on the general basic standards (see Figure 2) and contains sector-specific specifications and rules relating to designation tasks, code structure and code representation as well as examples of use. The appendix (informative) offers a checklist for the definitions between the project-taken part as well as application examples.

The sector-specific standard is comparable with VGB guidelines VGB-B 105e for the KKS. Hereinafter, the main focuses of the sector-specific standard are described, pointing out differences from the KKS.

The general code structure consists of a maximum of three parts that can be combined according to defined rules (Figure 3):

- The sector-specific standard fully satisfies the basic principles of structuring which can be done under various aspects. The power plant is broken down according to the aspects “Function”, “Product” and “Location”. The Function aspect views an object by its functionality, the Product aspect by its physical composition. The Location aspect describes
which locations are made available by the same object for other objects. For each view/aspect, a tree structure can be developed in which the rules of partitive relation prevail (“consists of”/“is part of”), the relations between the trees are so-called role relations (dashed lines in Figure 3).

The designation for various aspects or tasks is done in designation blocks with a fixed structure. The general structure consists of a prefix followed by a designation code consisting of letters and numbers. Letters are used for the classification of technical objects, using letter codes VGB-B 101e and VGB-B 102, respectively; numbers are used to distinguish between objects designated by the same letter code.

Table 1 shows the prefixes and their meanings.

Hereinafter, the designation blocks according to RDS-PP are described.

Designation block „Conjoint designation“

This designation block can be used for identifying sites, plants, power plant units and has to be agreed between the parties involved in the project. It represents none of the three basic aspects.

Figure 4 shows several sites, hydroelectric power plants and control stations in the upper Danube area.

Designation Block „Function“

This designation block is used for function-oriented designation, from the view of task and purpose of the technical object. It corresponds to the breakdown levels 1 and 2 of the KKS process-oriented identification code, but without the prefix number of the system code and the additional equipment unit code.

A novelty compared to the KKS is the change of breakdown level 0. If necessary, several systems can be combined here.

Figure 5 illustrates this option, using the example of a gas and steam turbine combined cycle plant.

It is not possible to define universally valid letter coding for the breakdown level 0. For the specific application case, the coding letters have to be agreed between the parties involved in the project. The letters used in the Figure 5 were chosen arbitrarily.

Designation block „Functional allocation“

This designation block is used for function-oriented designation under the aspect of interaction of technical objects. It differentiates between group level and individual level.

<table>
<thead>
<tr>
<th>Conjoint designation</th>
<th>Reference designation under</th>
<th>Specific designation for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Function aspect</td>
<td>Signals</td>
</tr>
<tr>
<td>Factory complex</td>
<td>Product aspect</td>
<td>Terminals</td>
</tr>
<tr>
<td>Power plant unit</td>
<td>Location aspect</td>
<td>Documents</td>
</tr>
</tbody>
</table>

Table 1. Prefixes for designation tasks.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Designation</th>
<th>Designation tasks / aspects</th>
<th>Prefix origin, basic principles specified in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>Number</td>
<td>Conjoint designation</td>
<td>IEC 81346-1</td>
</tr>
<tr>
<td>=</td>
<td>Equals</td>
<td>Function-oriented designation</td>
<td>IEC 81346-1</td>
</tr>
<tr>
<td>+</td>
<td>Plus</td>
<td>Point of installation design</td>
<td>IS/TS 16952-1</td>
</tr>
<tr>
<td>−</td>
<td>Minus</td>
<td>Product-oriented designation</td>
<td>IEC 81346-1</td>
</tr>
<tr>
<td>:</td>
<td>Colon</td>
<td>Terminal designation</td>
<td>IEC 61666</td>
</tr>
<tr>
<td>:</td>
<td>Plus-Plus</td>
<td>Location designation</td>
<td>IS/TS 16952-1</td>
</tr>
<tr>
<td>&amp;</td>
<td>Ampersand</td>
<td>Document designation</td>
<td>IEC 61355</td>
</tr>
</tbody>
</table>

Figure 5. Example for breakdown level 0 in the designation block „Function“ for a CCP.
This designation block is new. It governs the uniform designation of processes and the allocation of control tasks, which used to be done differently in the KKS.

The basic flow diagram in Figure 6 shows the process of a thermal power plant, identifying the uppermost structural levels, the functional areas.

**Designation block „Product“**

This designation block is used for product-oriented designation of electrical and mechanical objects. Together with the designation block “Function” forms the unambiguous component designation code.

**Designation block „Equipment“**

This designation block is used for unambiguous identification of technical objects (see Table 2). It makes use of the possibility to consider objects following in succession according to different aspects and allocate different prefixes to them. For power plants, the transition from function to product aspect is used.

This designation block corresponds to the “process-oriented identification” used in the KKS.

Among other things, the component code is used as an identifier for plant data management systems and can be related to equipment items and/or product types and their data. Figure 7 shows the basic principle.

**Designation block „Point of installation“**

This designation block is used for designating the points of installation of technical objects. In addition to the hitherto existing possibil-
ity to identify electrical and I&C installation units, designation masks were created for the location-oriented designation of mechanical equipment. This permits, for instance, accurately locating the sampling point for a measured value on a pump set by using the component code under the location aspect.

**Designation block „Location”**

This designation block is used for designating locations, such as structures, areas etc.

**Signal designation**

The unambiguous designation of signals is achieved by combining the reference designations and the signal name according to the following structure:

<table>
<thead>
<tr>
<th>Reference designation</th>
<th>Signal name</th>
</tr>
</thead>
</table>

For power plants, the general provisions in IEC 61175/DIN EN 61175 were specified for the signal name. Structure and code letters of the signal name were transferred from the KKS to the standard without any change.

**Terminal designation**

The unambiguous designation of terminals on electrical or mechanical equipments is accomplished by combining reference designations and terminal designations according to the following structure:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Signal name</th>
</tr>
</thead>
</table>

Ranges of numbers were defined for the signal sections (2nd letter of the signal name) “B = single control”, “G = binary process signals” and “H = limit signals”, e.g. XB01 for check-back signal ON/OPEN, XB02 for check-back signal OFF/CLOSED.

**Document designation**

Non-manufacturer-specific, object-related designation of documents is achieved by combining the object designation with the document type class key according to the following structure:

<table>
<thead>
<tr>
<th>Object designation &amp; Document kind classification code, counting number</th>
<th>Sheet number</th>
</tr>
</thead>
</table>

As object designation, primarily the reference designation should be used, but other classification systems may also be used depending on the application case, e.g. type designation for the dimension drawing of a series product.

The structure of the document kind classification code DCC with counting number and the code letters are fully in accordance with IEC 61355-1/DIN EN 61355-1.

The power plant specific document kind classification codes are collected in the VGB Guideline VGB-B 103.

**Guideline and standard for letter codes**

The sector-specific standard allocates tables from two different codes of practice (VGB Guidelines) to alpha digits of the individual designation blocks.

**Guideline VGB-B 101e „Letter code for power plant systems (system key)”**

For breakdown level 1 of the designation block “Function” Guideline VGB-B 101e, “Letter code for power plant systems (system key)” is applicable. The system replaces the KKS function key.

Guideline VGB-B 101e was developed by the VGB Working Panel “Reference Designation and Plant Documentation” and is the binding letter code for power plant systems. Due to the reference contained in the sector-specific standard ISO/TS 16952-10, this guideline gets normative significance.

The guideline VGB-B 101e is based on the basic standard IEC 81346-2/DIN EN 81346-2 (Table 3) and provides a framework for a classification model for so-called infrastructure objects. In this table, the letters A, V to Z are generally specified, whereas the letter range from B to U is available for sector-specific specifications.

This free range from B to U was used to incorporate - almost without changes – the function key of the KKS. Systems of new technologies like CO₂ separation, air separation system, fermentation, central solar energy utilization etc., have been implemented.

The system key uses a three-digit letter code and defines the limits for certain systems. With regards to the designations, some ad-

**Table 3. Allocation of code letter sections to codes of practice.**

<table>
<thead>
<tr>
<th>Designation block</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakdown level</td>
<td>0 1 2</td>
</tr>
<tr>
<td>Section</td>
<td>0 1 2 3 4</td>
</tr>
<tr>
<td>Data digit/type</td>
<td>= AN(N) AA NN AA NNN</td>
</tr>
</tbody>
</table>

**Table 4. Excerpt from the “VGB System Key” VGB-B 101e.**

<table>
<thead>
<tr>
<th>MA</th>
<th>Systems for transformation in and transmission of electrical energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAA</td>
<td>High pressure turbine</td>
</tr>
<tr>
<td>MAB</td>
<td>Intermediate pressure turbine</td>
</tr>
<tr>
<td>MAC</td>
<td>Low pressure turbine</td>
</tr>
</tbody>
</table>

150

4.14.2 Data characters 1 (S₁), 2 (S₂) and 3 (S₃)

a M Systems for transformation in and transmission of electrical energy

<table>
<thead>
<tr>
<th>MA</th>
<th>Steam turbine system</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAA</td>
<td>High pressure turbine</td>
</tr>
<tr>
<td>MAB</td>
<td>Intermediate pressure turbine</td>
</tr>
<tr>
<td>MAC</td>
<td>Low pressure turbine</td>
</tr>
</tbody>
</table>

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Table 5. Examples according to VGB-B 102.

<table>
<thead>
<tr>
<th>KKS (Equipment unit key)</th>
<th>RDS/PP (VGB-B 102)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA Valves, dampers etc.</td>
<td>Can become</td>
</tr>
<tr>
<td>BB Storage equipment</td>
<td>becomes</td>
</tr>
<tr>
<td>CT Direct measuring</td>
<td>becomes</td>
</tr>
</tbody>
</table>

These specifications are generally applicable to all disciplines, such as civil, process, mechanical and electrical engineering, across all sectors of industries.

Table 5 shows some examples to illustrate the differences in letter codes and designations.

Table 6 shows an excerpt from the IEC 81346-2, including the subdivision by technical disciplines according to an example of main class “Storage of material and information”.

CA – CE
Storage of electric energy

CF – CK
Storage of information

CL – CY
Storage of materials, thermal and mechanical energy

Table 7 shows in an excerpt the conversion of table 2 of the basic standard DIN EN 81346-2 with amendments by power plant-specific terms in the Guideline VGB-B102.

Comparison of structure and content between KKS and RDS-PP

Based on the functional designation aspect, the difference between KKS and RDS-PP is depicted in the Figure 8.

Application explanations and instructions

Standards provide general rules and specifications. In order to facilitate efficient implementation in practice, application explanations and application instructions have been developed by the VGB Working Panel “Reference Designation and Plant Documentation”. They provide detailed guidance, starting with a cross-discipline Part A and then addressing the specific engineering disciplines of mechanical engineering, civil engineering, electrical and I&C engineering, and I&C functions in process systems (Parts B1 to B4). The application instructions are for particular types of power plants (Part D1 and D2).

The application explanations contain examples from practice and are also available for training.

Consequences

Frequently asked questions in connection with the introduction of the RDS-PP include:

What does this now mean for
- my existing plant,
- my plant which is currently in the pipeline, or
- a new plant I will set up in future?

- From which time you should make use of the RDS-PP?
- Is the KKS no longer valid?
- ... and so on.

Unfortunately no simple “Yes/No” answers or binding deadlines can be given to answer these very important and specific questions.

In general it has to be said that standards are not binding laws, their application has to be agreed between the parties to the contract. However an obligation to apply a standard can result from legal or administrative regulations or from contracts or other legal grounds.

Standards always become a matter of particular interest if no amicable solution between contracting parties is found or if man or equipment suffers damage. In these cases, the basic principle is applicable that the requirements can be deemed fulfilled if the state of the art (which is normally reflected in standards) has been adhered to. That may be the requirements of a specification in the bidding process, but that may also be the requirements for the safety of man and equip-
ment. If no valid standards are used, the party concerned will have to prove – if necessary with the assistance of third parties – that the solution chosen by such party likewise meets the requirements.

These explanations do certainly not provide a concrete answer to the questions asked above and do not nearly fully cover the complex of tendering procedures, product safety, industrial safety etc.; they are merely meant to outline the complexity of the issue.

Nevertheless the following facts can be summed up and should be considered in making a decision on the designation system to be used:

– The KKS is an (international) „house standard“ of VGB, which in absence of normative standards reflected the state of the art until international standards were published.

– The RDS-PP – as published ISO/TS 16952-10 – is a designation system which is supported by other international standards.

– The RDS-PP integrates systematic structures and letter codes which are applicable to all industries, which – in medium term – will result in an easier integration of „standard packages“ into the power plant business.

– Suppliers of „standard packages“ can not decline the request for designation according to RDS by just alluding to standards that are applicable in other industries or to their house standards. This makes it easier to make also such suppliers adhere to the RDS-PP; this will relieve planners and operators of time consuming and costly reworking.

– KKS and RDS-PP will coexist for many years and will also have to be supervised.

– Possible problems or additional expenses may result for the operator if different designation systems are used at the same site; these problems may concern the safety of plant and persons but also the operation and maintenance management systems.

– All users have to develop in-house know-how for RDS-PP; the VGB training centre for power plant operating staff Kraftwerkschule (KWS) support this process with suitable training courses.

– First experiences with the application of RDS-PP are available.

However, the authors do not want to get around concrete recommendations:

**Existing plants:**

Currently, there is no need for action, decisions should be made in the individual instance, on occasion of substantial plant modifications or retrofit projects.

**New plants**

For completely new plants which are not yet in the pipeline, RDS-PP should be used from 2008 on; the only arguments against such a decision could be safety-specific aspects at a common plant site with “KKS power plants” (Note: there are also various sites where KKS and the predecessor system AKZ coexist).

For plants already in the pipeline, the efforts necessary to change the plans need to be considered.

<table>
<thead>
<tr>
<th>Table 7. Excerpt from VGB-B 102.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kennbuchstabe</strong></td>
</tr>
<tr>
<td>BZ</td>
</tr>
<tr>
<td>C_</td>
</tr>
<tr>
<td>CA</td>
</tr>
<tr>
<td>CA</td>
</tr>
<tr>
<td>CA</td>
</tr>
<tr>
<td>CA</td>
</tr>
<tr>
<td>CB</td>
</tr>
</tbody>
</table>

**Figure 8. Designation structure and designation content KKS vs. RDS-PP.**

**KKS Technical procedure code**

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Overall plant</th>
<th>System designation (Function key)</th>
<th>Equipment unit designation (Equipment unit key)</th>
<th>Component designation (Component key)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V(Z)</td>
<td>=</td>
<td>A/N NAAANN AANNN AANN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RDS-PP Equipment code**

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Conjoint designation</th>
<th>Function aspect</th>
<th>Product aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1&gt;</td>
<td>Overall plant is partial mapped by new designation block &quot;Conjoint designation&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2&gt;</td>
<td>Function key is replaced by VGB-B 101e (System key)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3&gt;</td>
<td>Equipment unit key is replaced by VGB-B 102e</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;4&gt;</td>
<td>Component key is replaced by VGB-B 102e</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The RDS-PP

Maintenance of the RDS-PP and application support

The Working Panel “Reference Designation and Plant Documentation” as a collaborator in standardization and author of the VGB guidelines relating to RDS-PP is well aware that suitable assistance will be needed to support the introduction of the RDS-PP.

Questions should be addressed directly to the VGB office (ak-ad@vgb.org). The persons interested in RDS-PP will be registered and supplied with information about current developments. Current information will also be provided on the VGB website (www.vgb.org/db_rds.html).

There are thematic core teams from the VGB working panel for specific technical inquiries. The answers of the first level are free of charge. The core teams are furthermore available for engineer services or can arrange equivalent contacts. Basically, such effort needs to be charged.

The VGB training centre for power plant operating staff, which is likewise a member of the Working Panel “Reference Designation and Plant Documentation”, will provide training courses and seminars of RDS-PP on demand.

Literature

EU Directives


National laws/ordinances

BetrSichV


Ordinance on safety and health protection in the provision of equipment and its use at the workplace, on safety during the operation of plant subject to inspection and on the organisation of occupational health and safety (Betriebssicherheitsverordnung – BetrSichV)

GPSG


Standards

IEC 60204-1; DIN EN 60204-1
Safety of machinery - Electrical equipment of machines - Part 1: General requirements

IEC 61355-1; DIN EN 61355-1
Classification and designation of documents for plants, systems and equipment

IEC 61175; DIN EN 61175
Industrial systems, installations and equipment and industrial products – Designation of signals

IEC 61666; DIN EN 61666
Industrial systems, installations and equipment and industrial products - Identification of terminals within a system

IEC 81346-1; DIN EN 81346-1
Classification and designation of documents for plants, systems and equipment

ISO/IEC strukturalisering og planlægning af dokumentation – ISO/IEC 61175

ISO/TS 16952-1; DIN ISO/TS 16952-1
Designation codes for document kind classification code (DCC key) - 2010

VGB Guidelines

VGB-B 101e
Reference Designation System for Power Plants RDS-PP, Letter Codes for Power Plant Systems (System Key) – 2010

VGB-B 102
Reference Designation System for Power Plants, Letter Codes for Basic Functions and Product Classes - 2010

VGB-B 103
Designation codes for document kind classification code (DCC key) - 2010

VGB-R 171e
Provision of Technical Documentation (Technical Plant Data, Documents) for Power Plants – 2010

Technical articles


Hugo Popp: Die neue Vornorm DIN V 6779-1. VGB Kraftwerkstechnik 72 (1992), issue 7


