Designation of wind power plants with the Reference Designation System for Power Plants – RDS-PP®

Jörg Richnow, Clemens Rossi and Helmut Wank
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Introduction: Why should reference designation codes be used for wind power plants?

The designation system for industrial equipment like wind power plants has a long tradition. For just as long, however, there have been discussions about whether such a system is necessary or even beneficial.

The question: “What is the benefit of assigning standard reference codes to a wind power plant?” is answered by the following key points:

- A reference identification system is like a language of its own and forms the basis for consistent communication among all players involved throughout the entire lifecycle of a wind power plant. It applies cross-nationally and beyond all borders of technology. For example, the designation =G001 MDL10 MZ010 -MA001 is understood unambiguously across all wind power plants in every country: it is motor 1 of the 1st wind turbine’s yaw drive 1.

- This uniform classification system applies across the entire lifecycle of a wind power plant, from planning through construction and operation to demolition at the end of its lifespan. This means that all actors are always referring to the same component when they talk about =G001 MDL10 MZ010 -MA001.

- A clearly structured and precise system of identification is the basis for the systematic and accurate recording and evaluation of, for example, the operation, maintenance, and financial data of either a complete wind power plant or its individual elements. Such information can easily be included in a uniform hierarchy that extends beyond national and technology limits. This permits the comparison of these data by the owners or operators of completely diverse wind power plants.

- The assignment of information – for example, documents or technical plant data – to the individual components is also possible through the same procedure. This ensures a well-structured referencing of information – and RDS-PP® points the way to this information.

In conclusion, the still-widespread “chaos of information collection and assignment” will be avoided through the systematic, uniform, and clearly structured classification of the components of a wind power plant. The commercial “added value” of this information safety should not be underestimated!

However, in order to realise these advantages, the principles and rules of a “designation language” must be widely understood, and they must be applied in an identical way to every wind power project. In addition, internationally valid sector solutions are preferred to each individual’s identification language.

RDS-PP® is the identification language that is used worldwide within the wind power industry. The elements and rules of this language follow international standards and directives whose interrelationships are detailed in Figure 1. The VGB-S-823-32 mentioned in this Figure is the Application Guideline for the wind power sector.

The more precisely the individual elements of a wind power plant are classified, the lower is the degree of freedom for individual characteristics and “dialects” – but the probability of a common understanding even in the event of a change of ownership or operational responsibility increases significantly.

That’s why in the latest edition of the “RDS-PP® Application Guideline for Wind Power Plants”, considerable attention was paid to creating precise reference designations for as many types of components as possible. The resulting “designation dictionary” for wind power plants establishes the basis for a uniform coding for the entire wind industry.

To achieve the advantages listed above, it is highly recommended that this “dictionary” is stipulated as the basis for all wind-power plant project specifications in the future. Of course it is possible to assign reference codes to wind power plant components that have not yet been given a designation, which will help to lay the foundation for a uniform and systematic assignment of information in the future.

Principles of RDS-PP® designation

The application of RDS-PP® designations to a wind power plant is characterised, among other things, by the following key principles:

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Hierarchical designation: “From large to small”

The assignment of a designation code to a motor, for example, must indicate whether this motor is part of a fan or a pump; and in the former case, if this fan is installed in the brake system of a wind turbine or in the transformer of a substation. The codes according to RDS-PP® are compiled in a hierarchical structure starting from, for example, a complete wind power plant and ending with a single circuit breaker in a control cabinet. It is important to note that each hierarchical level (group of systems, system, group of elements, element) represents an independent object. It receives a code of its own, which is derived from the primary designation level. For example, the entire wind turbine is an object with its own RDS-PP® designation, just like the yaw system, its drives, and their drive motors. The code allows the object itself as well as its hierarchical level to be identified.

Figure 2 illustrates the designation concept for a wind power plant, while Table 1 shows the designation hierarchy of RDS-PP®.

The designation of systems or subsystems also follows the international standard IEC 81346-2, Table 2 and ISO/TS 16952-10. The Guideline VGB-B 101 shown in Figure 3 enriches the letter codes with additional synonyms for power plant applications.

The identification of basic functions and product classes follows the international standard IEC 81346-2, Table 2 and ISO/TS 16952-10. Each object has several aspects

Figure 4 shows that an object can be considered from different aspects. One possibility is the task- or function-related approach: What does the object do, what task does it perform? Another perspective is product-related: What components does the object consist of? A third perspective is location-related: What amount and type of space does it need, and is there space for other objects?

The designation code must clearly identify the specific aspect of the object. For this purpose, a prefix is allocated to each code in RDS-PP®, for example, an equal sign (=) for the functional aspect, a minus sign (-) for the product aspect, and plus sign (+) or plus plus (++) for the location aspect. Table 2 illustrates the classification of the various aspects of several objects.

**Table 2**

<table>
<thead>
<tr>
<th>Conjoint Designation</th>
<th>Main System</th>
<th>System</th>
<th>Subsystem</th>
<th>Basic Function</th>
<th>Product Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5154N0883E.DE_NW_ELI_1WN</td>
<td>Wind Turbine</td>
<td>Yaw System</td>
<td>MDL1</td>
<td>Yaw Drive System</td>
<td>MZ010 MZ2100</td>
</tr>
<tr>
<td></td>
<td>Wind Turbine</td>
<td>Yaw System</td>
<td>MDL1</td>
<td>Drive Subsystem</td>
<td>MZ010 MZ2100</td>
</tr>
<tr>
<td></td>
<td>Wind Turbine</td>
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<td>MDL1</td>
<td>Drive Subsystem</td>
<td>MZ010 MZ2100</td>
</tr>
</tbody>
</table>

**Objects with similar characteristics are bundled in classes**

Within RDS-PP®, objects with similar tasks (basic functions) are bundled into classes so that diverse technical disciplines can “speak the same language”. This approach supports the standardisation of detail engineering as well as operation and maintenance (O&M) tasks. This means that the maintenance activities for the gear boxes of all wind turbines will be assembled and consistently evaluated within the basic function “rotation conversion” irrespectively whether an automatic gearbox, a regulating transmission or a reduction gear is installed.
Designation of wind power plants with RDS-PP

In recent years, especially the development in the wind power industry has gained considerable momentum. This has led to a significant increase in the complexity of power plant technologies. To take this development into account, the first version of the VGB Application Explanation for Wind Power Plants from 2006 has been completely revised and considerably enlarged.

Naturally, there is a special focus on the wind turbine itself. But now the entire infrastructure, for example, the innerpark cabling and substation and communication networks for power plant management, has been comprehensively covered.

Figure 6 offers an overview of the scope of RDS-PP codes for wind power plants.

Comprehensive designation specifications were stipulated for each main system and linked to their respective systems, subsystems, and basic functions.

One of the main systems is called =G “energy conversion” (wind turbine), which is then broken down into systems as illustrated in Figure 7.

In addition to other systems, a wind turbine consists primarily of the wind turbine system (=MD). The wind turbine system is subdivided into other systems, which are listed in Table 3.

One part of the wind turbine system (=MD) is the drive train system (=MDK), which contains subsystems as illustrated in Figure 7.

The major tasks and system boundaries to adjacent (sub) systems of all systems and subsystems are defined in the VGB Application Guideline VGB-S-823-32.

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**Tab. 2. Prefixes for distinguishing the three aspects.**

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Designation task/aspect</th>
<th>Application</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>=</td>
<td>Function Designation</td>
<td>Main Systems, Systems, Subsystems, Basic Functions</td>
<td>=G001 MDA30 GP001 WTG 1, Tip Hydraulic Oil Pump Brake System Rotor</td>
</tr>
<tr>
<td>-</td>
<td>Product Designation</td>
<td>Product classes</td>
<td>=MA001 Electric Motor 1</td>
</tr>
<tr>
<td>+</td>
<td>Point of Installation</td>
<td>Cabinets, vessels</td>
<td>+G001 MDA30 GP001 MA001 WTG 1, Tip Hydraulic Oil Pump Brake System Rotor, Water Side</td>
</tr>
<tr>
<td>++</td>
<td>Site of Installation</td>
<td>Building, areas</td>
<td>++G001 MUD10 WTG 1, Nacelle</td>
</tr>
</tbody>
</table>

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**Tab. 3. Systems of the wind turbine system =MD.**

<table>
<thead>
<tr>
<th>F1</th>
<th>Denomination</th>
</tr>
</thead>
<tbody>
<tr>
<td>=MDA</td>
<td>Rotor System</td>
</tr>
<tr>
<td>=MDK</td>
<td>Drive Train System</td>
</tr>
<tr>
<td>=MDL</td>
<td>Yaw System</td>
</tr>
<tr>
<td>=MDV</td>
<td>Central Lubrication System</td>
</tr>
<tr>
<td>=MDX</td>
<td>Central Hydraulic System</td>
</tr>
<tr>
<td>=MDY</td>
<td>Control System</td>
</tr>
</tbody>
</table>

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Figure 7 offers an overview of the scope of RDS-PP codes for wind power plants.

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Fig. 4. The three RDS-PP® aspects.
The individual subsystems are further subdivided into basic functions and finally into classes of products that fulfill these functions. Figure 9 depicts a PID of the subsystem MDK56, the Cooling System Drive Train, with its basic functions.

Designation codes for product classes were also established wherever possible and appropriate, as shown in Table 4 for the subsystem =MDK56.

As already explained above, this far-reaching system of designation codes enables the extensive standardization of individual tasks, with associated cost advantages.

All designation codes within this application guideline have been summarized in a separate file, which is also available in an executable version. For the RDS-PP® Application Guideline that is sold as a print edition or as eBook, single-user or company licenses are available that permit the easy development of company-specific documents.

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**Fig. 5. Classification of the basic functions and product classes with RDS-PP®.**

**Fig. 6. Overview of the main wind power plant systems in RDS-PP®.**
Application of RDS-PP® in asset management systems

One of the main challenges for the operation of wind power plants is to obtain consistent information for the entire plant and to draw trustworthy conclusions about the plant condition, asset performance and reliability, as well as component failure rates. This information serves as the backbone of an efficient operating management in terms of budget planning, material and labour planning, history record managing, etc., in other words: a trustful basis in order to actively make decisions.

The basis to gain such information is a unified structure and unambiguous identification of individual systems and components across countries and machinery types. For various tasks of asset management different requirements may consist regarding the level of detail of the respective information. For controlling purposes, for example, information is needed which relates to the entire wind power plant, while for planning and procurement purposes information has to be provided down to the component level. Figure 10 schematically shows this distribution of information requirements with respect to its level of detail.

With RDS-PP® the different information hierarchies can be structured clearly and addressed uniquely as illustrated by means of the classical maintenance process (Figure 11).

This process starts with the determination of the maintenance requirements either as preventive measure \( (P) \), as reactive, unplanned measure \( (R) \) or as condition-based measure \( (CB) \).

Preventive measures are usually planned in advance and in detail with material usage and labour time in a maintenance management system (e.g. SAP-PM). RDS-PP® serves here as structuring element in order to link recurring work steps, so-called “Task Lists”, on component or system level.

Unplanned measures mostly lead to a corresponding alarm message in the SCADA system. The RDS-PP® coding in the SCADA system is used to uniquely address the relevant system or component in order to start the respective workflow in the maintenance management system.

The evaluation of system conditions can take place in different ways, e.g. through regular inspections, condition monitoring systems or by evaluating SCADA signals. These system conditions are assigned to the RDS-PP® designated object and enable the unambiguous allocation of the necessary maintenance measures.

The generation of work orders and the final resource planning typically takes place in the maintenance management system. The performance of these activities can be supported as well via RDS-PP®: e.g. the service team can retrieve additional detail documentation about the respective object as soon as the detail documentation identifier is linked to the RDS-PP® code.

In the last step, the information regarding the measures carried out are stored and assigned to the respective object by means of RDS-PP® coding.

The entire process and the assignment of information take place always in the same manner, independent of the type of plant or contractual conditions.

In order to gain the advantages of the three different RDS-PP® aspects in one single maintenance management system (e.g. SAP-PM) this system has to provide respective structural elements as shown exemplarily in Figure 12 where a wind turbine generator is structured in this manner:

Tab. 4. Basic functions and product classes of the Cooling System Drive Train MDK56.

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>P1</th>
<th>Denomination</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDK56</td>
<td>CM001</td>
<td>EQ001</td>
<td>Expansion Tank - Cooling System Drive Train</td>
</tr>
<tr>
<td>MDK56</td>
<td>CM001</td>
<td></td>
<td>Coolant - Cooling System Drive Train</td>
</tr>
<tr>
<td>MDK56</td>
<td>BI001</td>
<td></td>
<td>Level Coolant - Cooling System Drive Train</td>
</tr>
<tr>
<td>MDK56</td>
<td>GP001</td>
<td>MA001</td>
<td>Motor Coolant Pump - Cooling System Drive Train</td>
</tr>
<tr>
<td>MDK56</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 7. Overview of systems belonging to main system “G” (energy conversion).

Fig. 8. Structure of drive train system =MDK.
The function aspect of RDS-PP® is used as a “Functional Location”, therefore as an immobile object. This reflects the basic function without referring to an installed product. At this point mainly engineering data are handled, so that the subsequent selection of products can be based on these engineering parameters. Maintenance planning and storage of history is mainly managed with the help of the “Functional Location”.

The location aspect of RDS-PP®, i.e. point and site of installation is assigned as a property to the “Functional Location”. Thus, evaluations and gathering of information according to local considerations are possible.

The product aspect (not shown in Figure 12) is to be found in the SAP-PM structure elements “Equipment” or “Material”, respectively. If an individual object with serial number has to be tracked, an “Equipment”, a so-called mobile structure object, shall be used. This has also the advantage that the history of the individual object can be made available via the “Equipment” functionality.

With a consistent application of all three RDS-PP® aspects, work and inspection lists can be processed also according to local considerations (Figure 13). This results in an optimised sequence of individual work steps taking local conditions into account. It supports especially more extensive activities. Also, an on-site guidance of staff not being fully aware of the location, such as external experts, can thus be realised. The appropriate working steps with their necessary work procedures and safety rules can be assigned to each object which is structured in the RDS-PP® manner. Thus a consistent HSE concept can be implemented.

In addition to the process support for maintenance activities, another major application of RDS-PP® is used in SCADA systems for signal designation. Figure 14 shows an example of a commonly used list of signals with their RDS-PP® coding. Also, the 10min averages often used in wind industry are designated accordingly. This allows historical values being collected, aggregated and compared to each other across turbine type boundaries. Thus, branch wide condition evaluation of different wind power plants is enhanced.

From this consistent plant-overarching...
conclusions can be drawn, which considerably improve the performance and reliability management.

RDS-PP® is the master key to retrieve information which is processed in various systems and to get them connected to each other without redundancy and fault. This allows exchanging and processing large packages of information across affiliated systems, even on digital level using standardized information protocols.

The above-mentioned examples show clearly the high potential which can be earned by use of a uniform designation system. If the designation scheme used is not only company-wide, but also industry-unique, the benefit for everyone involved is high: cumbersome utilisation of translation and interpretation tables from one “language” into another is no longer necessary. The development of performance improvement strategies for individual components or larger systems based on branch-wide information is much more effective as if each industry participant can rely only on his own information.

Trademark registration for RDS-PP®: rationale and consequences

RDS-PP® is a registered trademark of VGB PowerTech. The brand has been registered so as to exclude divergent parallel designation concepts, as often has occurred in the past with the designation systems KKS (Power Plant Identification System) used in the conventional power plant sector, at least under the name of “RDS-PP”.

The brand registration for RDS-PP® therefore serves specifically to protect future quality assurance. Products based on RDS-PP® may only carry this “quality label” if they are developed in accordance with the rules of RDS-PP®, which are compiled in the VGB publications. Designation concepts that only partially comply with these rules are not allowed to use the RDS-PP® trademark.

Next steps

A maintenance team has been established at VGB PowerTech for the ongoing development of the RDS-PP® Application Guideline for Wind Power Plants. Lessons learned and updates to the guideline are provided as amendment sheets on the VGB homepage, where they can be downloaded at no charge. The maintenance team of this guideline can be approached via the VGB head office.

Summary

With the new edition of the RDS-PP® Application Guideline for Wind Power Plants, a practical guide for the complete designation of this type of power plant has been developed and is ready for use. The far-reaching and detailed designation requirements are a prerequisite for the standardisation of these tasks in order to reap the associated significant cost reductions.

Fig. 12. Display of a wind power plant structure in a maintenance management system [example].

Fig. 13. Maintenance plans within an operating system [example].

Fig. 14. Signal list for SCADA systems.