RDS for Foundations

(Guideline based on ISO/IEC 81346)

Industry Guideline for Structuring Principles and Reference Designation for Wind Power systems

Summary
This document is the Reference Guideline for Foundations based on ISO/IEC 81346. It is part of the Designation System for Power Systems (RDS-PS Wind). It has been developed in in collaboration between Work stream 2 Wind Turbine Generator (WTG) and Work stream 5 Foundations.

The Reference Guideline contains the TIM Wind functional, product and location break-down structures of the standard for land based, fixed offshore and floating offshore structures in all phases of their lifecycle.

RDS-PS for Foundations are based on, and adhere fully to, ISO 81346-1 Basic Rules, ISO 81346-2 Classification of objects and codes for classes and ISO 81346-10 Power supply systems.

The scope of the document is to list the designations in RDS-PS for Foundations that are complementary to the designations in RDS-PS for WTG, based upon ISO 81346-10 for Power supply systems and Technical systems, and ISO 81346-2 for Component systems.

The goal of the Guideline is to establish a reference source on how to use RDS-PS for Foundations to create standardized interoperable group system that can be used to structure technical documentation and share information between human and digital actors across the wind power lifecycle. It is intended to function as a guide that industry can follow. Floater designers, OEMs, engineers, manufacturers, and operators can use the baseline to define more detailed structures. The Transition Piece (TP) is included in this document as a part of the Foundation.

The document only describes the Technical systems that are most often part of the Sub-structure and/or Transition piece. For additional Technical systems that are normally only included in the WTG, definitions and descriptions can be found in RDS-PS for WTG.

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1. Foreword

This industry guideline has been created by a working group under the TIM Wind (Technical Information Management for Wind) initiative. The TIM Wind initiative is a collaboration between floater designers, wind turbine manufacturers (OEMs), energy companies (operators), classification and certification bodies and authorities (regulators) - with the purpose to agree on technical information management standards for the wind industry.

Participants and authors of the present document are:

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2. Introduction

This document provides guideline to the wind industry for the application of the IEC/ISO 81346 reference designation system (RDS), specifically part-10, Power Supply Systems (RDS-PS). It was developed in response to a demand for guidelines for the application of the ISO/IEC 81346 standard series following recent upgrades to part-1 [1], part-2 [2] and especially part-10, where the second edition, ISO 81346-10:2022 [3] introduced major changes by removing all reference to the previous VGB RDS-PP guidelines.

The basics of reference systems are not explained. It will be assumed that the reader already has a basic understanding of the major concepts. This includes the RDS aspects, the basic RDS semantics and basic RDS classification rules. These can all be found in the IEC 81346 part-1 and 2 of the standard series and further detailed in other available documentation.

3. Scope

This document provides a guideline for use of the IEC/ISO 81346 reference designation system (RDS) in the wind industry. In particular, the application of part 10 “RDS-PS” (i.e., ISO 81346-10). Guidelines and principles regarding the (future) combined use of part 10 and part 12 (RDS Construction Works, RDS-CW) [4] are introduced.

The guideline will assist the user both in the understanding of the standard, but also by proposing rules of thumb or best practice to practical application of the RDS for particular cases, situations, and users. By following the suggestions in ISO 81346-101 (Part 101), the application of the standard should be harmonized within and between the domains.

One of the characteristics of the RDS-PS is the “system within a system” approach and the capability of dividing into different aspects, such as function, product and location. Because of this, a consortium of wind industry participants (TIM-Wind) gathered to agree on a collective understanding of how they would apply RDS-PS.

The scope of this document is limited to the Sub-structure and Transition piece systems only. This will include the station keeping system, such as piles for fixed structures and mooring systems for floating structures. No inter-array cables, park controller or park communication system will be included. This will be defined in a separate Guideline Balance of Plant (B.O.P.).

Type Aspect is not addressed now but will be introduced in a later edition of the guideline. Refer to ISO 81346-10:2022 Chapter 5 Structuring Principles for greater explanation of aspects (Product, Functional, Location and Type).

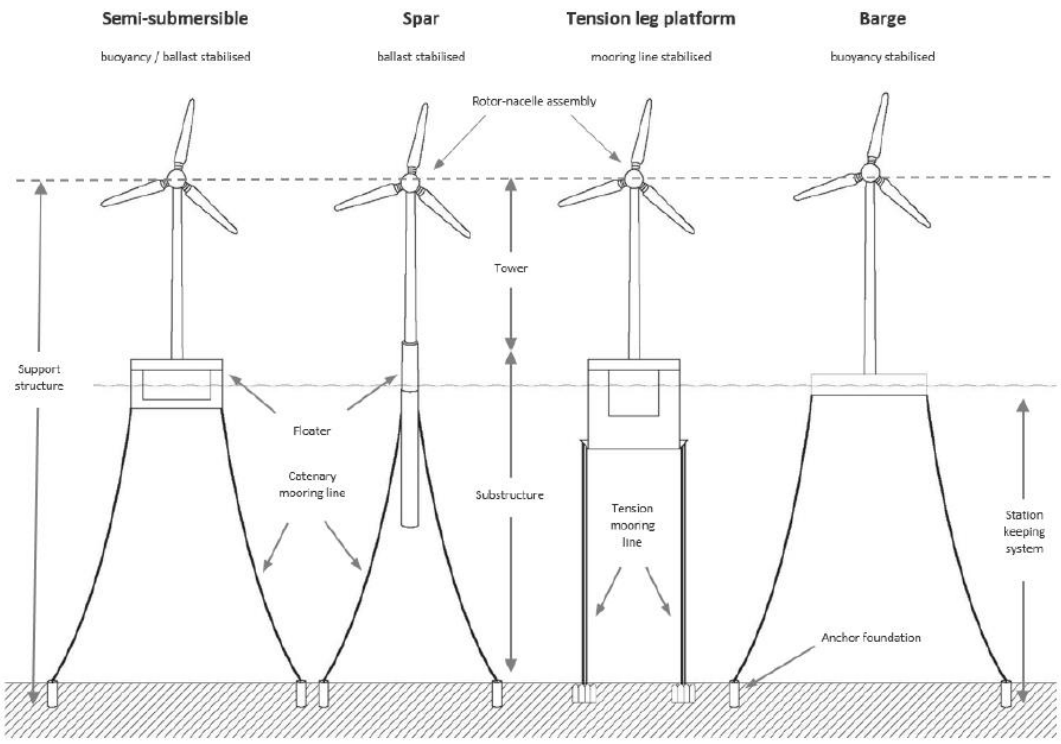

Figure 8.9.B Examples of floating wind turbine alternatives

(from DNV-SE 422 Certification of floating wind turbines)

9 Functional aspect for Wind turbine Foundations

This chapter gives an overview of the Technical systems defined in ISO 81346 that should be used to create RDS-PS for Foundations, Like TIM Wind RDS-PS for WTG it gives a general common structure meant to cover all types of fixed and floating Foundations. These common systems will normally be a subset of the systems used to describe the particulars and details of any specific structure of a given type. Examples of the common RDS can be used to model various sub-structure types in detail are given in the Application manual document (a set of used cases for the main sub-structure types).

RDS-PS FOR WTG defines the Functional breakdown structure and designations for energy transforming systems, supporting systems and controlling systems. Similarly, RDS-PS for Foundations defines breakdown a Functional breakdown structure and designations for the Sub-structure and the Transition piece The three sections below list the common Technical systems with (mandatory) designations and (suggested) names for the Functional, Product and Location aspect of the RDS.
Depending on the type of Sub-structure, the user may extend the RDS with additional Technical systems defined in RDS-PS FOR WTG and detail the RDS with Component systems defined in RDS 81346-2. For example, the Sub-structure system would typically be divided into sub-sections in different ways depending on the overall structure- since a floater would have different sub-sections than a monopile, different than a barge.

The Function aspect (FA) breakdown describes the systems (and components) in the asset from a perspective of what functions they perform (what they do) and provides a (common baseline for a) generic functional system breakdown for all types of Foundations.

Functionally, the wind turbine Foundation includes a structural system with primary and secondary structural parts, and various systems for energy routing, access support, containment, positioning and corrosion protection.

9.1 =AN>=D1 Sub-structure system

The Sub-structure system is the part of the Foundation of a wind turbine near and below the ground/sea level, and provides floatation, strength and stability for the WTG. Several alternative Sub-structure concepts/types exist for both fixed and floating units. This includes monopiles, jacket, gravity-based sub-structure, semi-submersible floater, tension-leg platform, barge, Spar and other types of buoys. Irrespective of variant, the Functional aspect for a Sub-structure system includes a small set of normative Technical sub-systems, as shown in figure 9.1 and briefly described below.

The intention of the Sub-structure function in RDS-PS is to have all relevant common functions represented together. To make the standard as flexible as possible, only top-level Technical systems that are common to all types of Sub-structures are included in the functional aspect.

In addition, there are a set of systems in the sub-structure and transition piece that are part of the overall function for the whole structure (turbine, nacelle, tower, transition piece and sub-structure) and are therefore (only) included in RDS-PS for WTG (for example Lighting and Warning systems). If there are separate functional systems used in the transition piece and/or sub-structure they should be placed also under the Sub-structure and Transition piece systems.

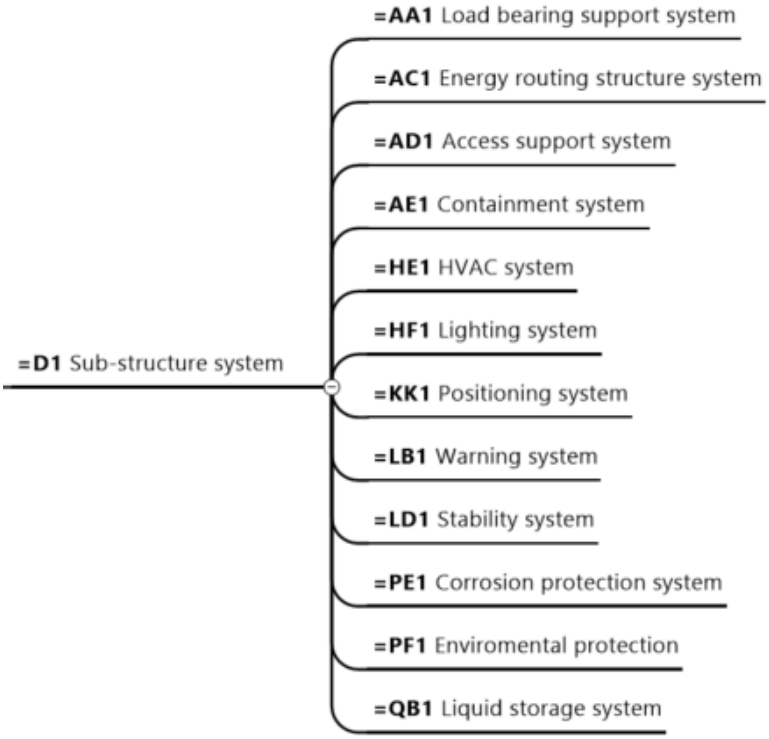

Figure 9.1 TIM Wind Functional aspect breakdown structure for Sub-structure systems

9.1.1 =AN>=D1=AA1 Load bearing support system

The Structural system is the overall system for load bearing support of the Turbine, Nacelle and Tower. It can be one of several types of fixed or floating structures. Different types of structures are constructed from different types of structural elements (columns, beams, braces, stiffeners, plates, slabs, etc.), and this, together with the level of detail (e.g., coarse beam-model or detailed plate-model) determines the RDS for a specific structure. For a steel structure the Structural system corresponds to the Primary steel.

IEC 81346-2:2019 Table 3 describes the various Component systems used to designate structural members (three-letter designation codes starting with U)- A forthcoming RDS Application examples manual

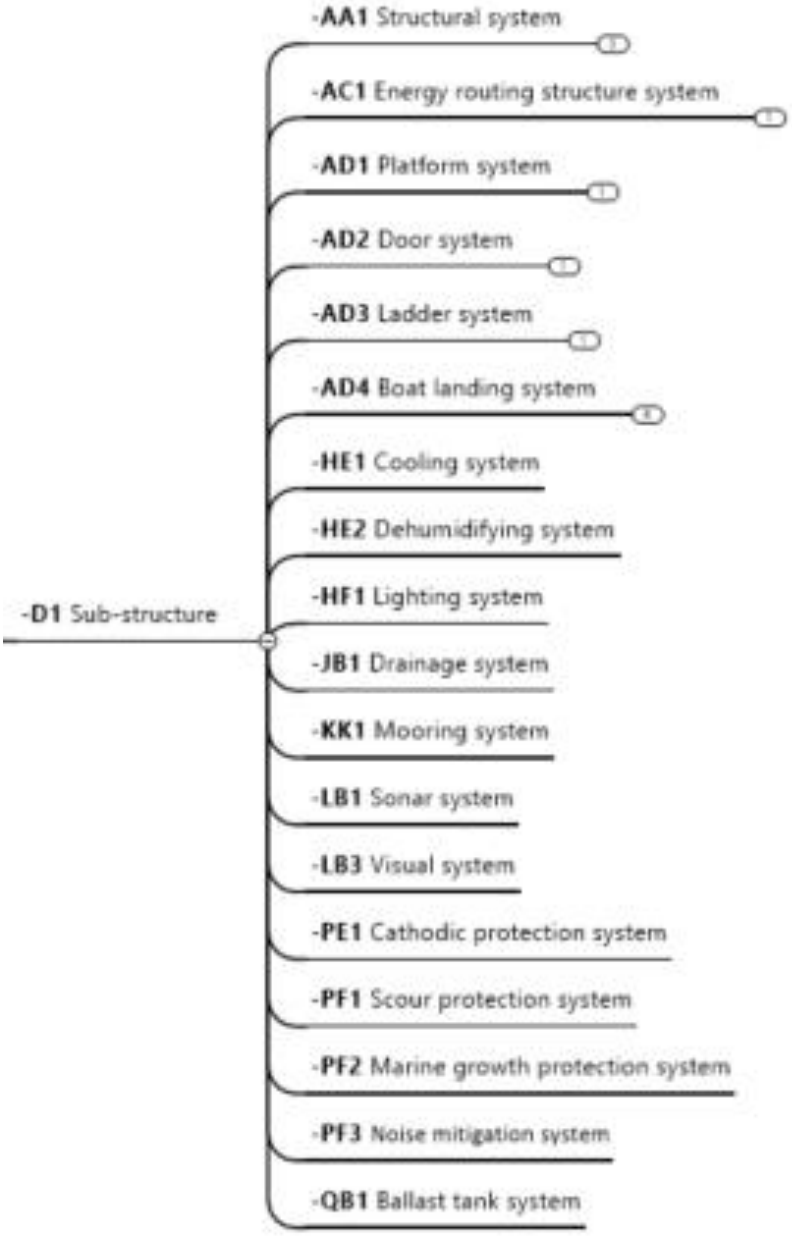

Figure 10.1.B TIM Wind Product aspect breakdown structure for the Sub-structure system

10.1.1 -An>-D1-AA1 Structural system

The Structural system is realized by a physical (fixed or floating) structure. When used in an actual design it will be specialized by the appropriate structural elements (columns, beams, braces, stiffeners, plates, slabs, etc.), with a chosen level of detail (coarse or detailed) in the Product aspect RDS for the specific structure. The Structural system can be divided into Technical systems for Columns, Braces, Panels, Flanges, Piles and Pontoons., each of which may be further detailed into Component systems such as Column, Frame stiffener, Beam, Plate, Tension Brace, Weld Seam, Flange coupler and Pile.

IEC 81346-2:2019 Table 3 describes the various Component systems used to designate structural members (three-letter designation codes starting with U). The RDS-PS for Foundations Application manual gives a series of example RDS breakdown structures for fixed (Monopiles, Jackets, and Gravity based structures), floating (Semisubmersible, Spar and Tension Leg Platforms) and land-based (Concrete) structures with RDS codes.

10.2.23 -An>-D2-PF1 Marine growth protection system

The Marine growth protection system is realized by a physical system for reducing and removing marine growth on the outside of the structure.

10.2.24 -An>-D2-QB1 Ballast tank system

The Ballast tank system is realized by a physical tank for holding. ballast water.

11. Location aspect for Wind turbine Foundations

The Location aspect describes systems (and components) in the asset from a perspective of their location or position (where they are). It shows the sub-division of the system into its parts with respect to their location (without considering other aspects of those objects). Two different location aspects are defined; the [+] Host installation aspect and the [++] Site of installation aspect are outlined in the subsections below.

Further details about the use of the Location aspect (both Host and Site of installation) can be found in RDS-PS FOR WTG. See also the RDS-PS Foundations application manual for examples of how use the Location aspect.

11.1 Location - host of installation [+]

Host of installation is used for location objects placed on/in other objects - as modelled in the Product aspect. This aspect is typically used to define positions in the product structure breakdown where many components with unambiguous designations are fitted into a defined structure. For example, the host may be Sections or Blocks and the installation could be inside or outside (or on the side of) the Section (or Block).

The hosting system is identified by using its *product* reference designation. To indicate that the reference designation is the host of installation aspect, the product aspect prefix "-", is replaced with the location aspect prefix "+". The physical labelling of the Components inside panels should only be marked with a component level from the product Aspect which will be the unambiguous designation of the object.

Figure 11.1.A Location aspect – host of installation breakdown structure

In figure 11.1.B we see an example of a Circuit breaker (-FCB1) on mounted on a DIN-rail (+UBA1) on the mounting plate (+B1) of the first Volume (+1) of the Switchgear (+UCA1).

Annex C
(informative)

Host of Installation breakdown structure [+]

+An Wind Turbine Generator no. n	**+An>**
+D1 Sub structure	**+An>+D1**
+AA1 Structural system	**+An>+D1+AA1**
+AC1 Energy routing structure system	**+An>+D1+AC1**
+AD1 Platform system	**+An>+D1+AD1**
+AD2 Door system	**+An>+D1+AD2**
+AD3 Ladder system	**+An>+D1+AD3**
+AD4 Boat landing system	**+An>+D1+AD4**
+AE1 Containment system	**+AN>+D1+AE1**
+HE1 Cooling system	**+An>+D1+HE1**
+HE2 Dehumidifying system	**+An>+D1+HE2**
+HF1 Lighting system	**+An>+D1+HF1**
+JB1 Drainage system	**+An>+D1+JB1**
+KK1 Mooring system	**+An>+D1+KK1**
+LB1 Sonar system	**+An>+D1+LB1**
+LB2 Visual system	**+An>+D1+LB2**
+PE1 Cathodic protection system	**+An>+D1+PE1**
+PF1 Scour protection system	**+An>+D1+PF1**
+PF2 Marine growth protection system	**+An>+D1+PF2**
+PF3 Noise mitigation system	**+An>+D1+PF3**
+QB1 Ballast tank system	**+An>+D1+QB1**
+D2 Transition Piece	**+An+D2**
+AA1 Structural system	**+An>+D2+AA1**
+AC1 Energy routing structure system	**+An>+D2+AC1**
+AD1 Platform system	**+An>+D2+AD1**
+AD2 Door system	**+An>+D2+AD2**
+AD3 Ladder system	**+An>+D2+AD3**
+AD4 Boat landing system	**+An>+D2+AD4**
+AE1 Containment system	**+AN>+D1+AE1**
+HD1 Electrical power supply system	**+An>+D2+HD1**
+HE1 Heating system	**+An>+D2+HE1**
+HE2 Cooling system	**+An>+D2+HE2**
+HE3 Dehumidifying system	**+An>+D2+HE3**
+HF1 Lighting system	**+An>+D2+HF1**
+JC1 Crane system	**+An>+D2+JC1**
+JE1 Electrical power transportation system	**+An>+D2+JE1**
+JH1 Data network system	**+An>+D2+JH1**
+KK1 Mooring system	**+An>+D2+KK1**
+LB1 Warning system	**+An>+D2+LB1**
+LB2 Foghorn warning system	**+An>+D2+LB2**
+LB3 Visual warning system	**+An>+D2+LB3**
+LC1 Surveillance system	**+An>+D2+LC1**
+LE1 Monitoring system	**+An>+D2+LE1**
+PC1 Earthing system	**+An>+D2+LE1**
+PE1 Cathodic protection system	**+An>+D2+PE1**
+PF1 Marine growth protection system	**+An>+D2+PF1**
+QB1 Ballast tank system	**+An>+D2+QB1**

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