Technical Specification

ISO/TS 81346-101

First edition
2025-01

Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations —

Part 101: Modelling concepts, guidelines and requirements for power supply systems

Systèmes industriels, installations et appareils et produits industriels — Principes de structuration et désignation de référence —

Partie 101: Concepts de modélisation, lignes directrices et exigences pour les systèmes d'alimentation électrique

Reference number
ISO/TS 81346-101:2025(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and https://patents.iec.ch. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared jointly by Technical Committee ISO/TC 10, *Technical product documentation*, Subcommittee SC 10, *Process plant documentation*, and Technical Committee IEC/TC 3, *Documentation, graphical symbols and representations of technical information*.

A list of all parts in the ISO/IEC 81346 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

This document provides guidelines for the understanding and application of the ISO 81346 and IEC 81346 reference designation system (RDS) for power supply systems (PS). It was developed in response to demands by the power supply sector for guidelines to the application of the ISO 81346 and IEC 81346 series, in particular ISO 81346-10.

PS, and the target industries of this document, include but are not limited to: wind, photovoltaic, thermal, nuclear and hydropower production.

The very basics of the RDS are not explained in this document. It is assumed that the user of this document already is familiar with the major concepts detailed in IEC 81346-1 and IEC 81346-2. These concepts include the four RDS aspects, the basic RDS semantics and basic RDS classification rules.

Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations —

Part 101: Modelling concepts, guidelines and requirements for power supply systems

1 Scope

This document gives guidelines to support the application of the ISO 81346 and IEC 81346 series to power supply systems. It also specifies best practice for its use and implementation depending on the user and situation. The application of this document supports harmonization within and between the power supply technical domains and industries.

Introductory examples of the use of reference designation systems (RDS) can be found in Annex A and Annex B. Annex C provides an example of a conversion table between an example structuring system and the classes specified in this document and other parts of the ISO 81346 and IEC 81346 series.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 81346-1:2022, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 1: Basic rules*

IEC 81346-2:2019, *Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations — Part 2: Classification of objects and codes for classes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 81346-1:2022, IEC 81346-2:2019 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
horizontal system
system which has an impact or supports one or more *vertical systems* (3.3) without being one

EXAMPLE Managing systems (e.g. =F1) or supporting systems (e.g. =D1)

Note 1 to entry: There can be supporting systems within core process (vertical) systems (e.g. the monitoring system of the generator =A1.RA1.LE1).

3.2
preferred reference designation
PRD
reference designation (RD) used as the main key to identify an object within a database

3.3
vertical system
system that is a part of the core process of the power production, distribution or transmission for power supply systems

EXAMPLE Production unit systems (e.g. =A1) or energy transport systems (e.g. =C1).

4 Abbreviated terms

For the purposes of this document, the abbreviated terms listed in Table 1 apply.

Table 1 — List of abbreviations

Abbreviation	Meaning
BIM	building information modelling
CB	circuit breaker
CDD	IEC common data dictionary
CID	construction identifier
CW	construction works
DOI	digital object identifier
GIS	geographic information system
HSE	health security and environment
IOD	individual object database
P&ID	piping and instrumentation diagram
PRD	preferred reference designation
PS	power supply systems
RD	reference designation
RDS	reference designation system
SCADA	supervisory control and data acquisition
SSOT	single source of truth

5 Modelling principles

5.1 Design for purpose

A system can be a constituent of a large and complex system. If so, it will often have a multi-levelled reference designation (RD). Or it can be such a simple overall system, and the constituents will be represented by a single level RD. It is the designer's responsibility to select the appropriate structure to reflect the complexity of the system in question.

The depth and complexity of a structured representation will be influenced by the innate complexity of the overall system in question. A nuclear power plant needs many levels to correctly represent and model all the functionality within it. Not all systems need that level of detail. The representation of highly complex systems can often benefit from simplifications. It would likely not make sense to include every single system down to individual bolts and screws when modelling a complete nuclear power plant.

The purpose of creation of the structure (also called model in this document) should also influence the complexity and granulation of the representation of the system. A model designed to provide an overview of a chemical park main processes, for example, does not need to include a detailed overview of the layers in the roof construction of the gardening equipment shed.

The framework set by the selection of aspect should be considered when designing a structure. When structuring a system based on the functional aspect, the system functional complexity and process criticality should be looked at, not physical size or cost. Large or costly objects, or both, are not always complex from a functional point of view. A transformer can be considered quite simple in the functional aspect, no matter what physical size, complexity of construction or costs it has. It usually has few functional sub-systems, and a simple functionality. With an RD-based model, depth and level of details should be influenced by its intended use. The structure should be a tool to benefit the user, not an absolute mirror of reality and all its details.

EXAMPLE 1 A component in the lower levels of a complex structure (e.g. a motor within a critical sub-system for the process, =A1.KA1.KK1.MAA1) can be of such importance to the process that a data collecting system can be required and of interest to the operating party (e.g. =A1.KA1.KK1.MAA1.KED1). Even the sensors connected can be of interest and can be represented (e.g. =A1.KA1.KK1.MAA1.KED1.BTA1) if useful.

EXAMPLE 2 A simple gate can be represented by a simple structure e.g. only two levels, all within the component system:

=C1.QQF1 – Gate system

    =C1.QQF1.MAA1 – Gate motor

or it can be a complex system with heating system, auxiliary power supply, monitoring systems and so on:

=C1.KA1 – Gate system

    =C1.KA1.LE1 – Gate system monitoring system

        =C1.KA1.LE1.BPA1 – Upstream pressure monitoring system

            =C1.KA1.LE1.BPA1.BPA1 – Upstream pressure monitoring 1

            = C1.KA1.LE1.BPA1.BPA2 – Upstream pressure monitoring 2

            = C1.KA1.LE1.BPA1.BPA3 – Upstream pressure monitoring 3

    =C1.KA1.HE1 – Gate heating system

    ...

The structure gives the proper representation of the system and lets the user of this document understand the system complexity through the model complexity.

Throughout this document, the basic semantics and classification rules for reference designation systems in accordance with IEC 81346-1 and IEC 81346-2 are used.

5.2 Receiver's ownership principle

According to the receiver's ownership principle shown in Figure 1 and the example in Figure 2, when a system is intended to link two other systems on the same hierarchical level, and when it is unclear to which system it belongs, the linking system should be part of the receiving system (in terms of information, matter or energy of any kind).

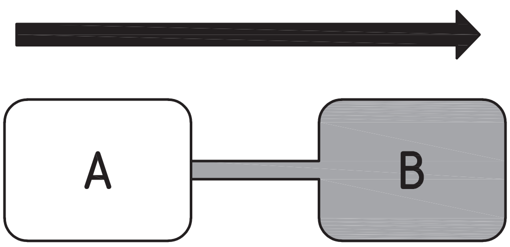
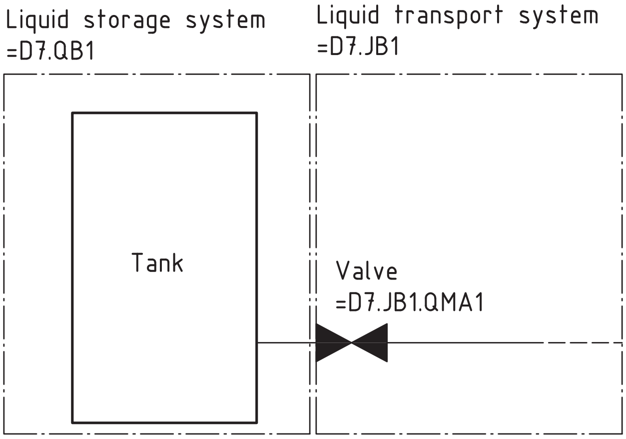


Figure 1 — Receiver's ownership principle



NOTE A valve is the separating agent between a liquid storage system (=D7.QB1) and a transport system (=D7.JB1). The valve is a sub-system of the transport system, not the storage system, because the transport system is the receiving system.

Figure 2 — Example of the receiver's ownership principle

The receiver's ownership principle is to be used in situations when doubt arises. Common sense and intuitive ownership should come first. The main goal is that systems should be where a future user expects them to be.

EXAMPLE The cord between a laptop and its charger constitutes the connecting agent between these two systems, with the laptop being the receiving system. The charger cord is however still a part of the charger, not the laptop.

The receiver's ownership principle can be used for all aspects.

5.3 Collector system principle

An exception to the receiver's ownership principle (see 5.2), in the functional aspect, is where multiple systems meet in a new system where energy, data or matter is collected. This is called the collector system principle. Examples are systems where a dominant feature is a busbar (i.e. collecting/distributing power to multiple other systems), or a liquid collection/distribution system.

For these systems the flow control system separating each supplying system to the collecting system should belong to the former. This is exemplified in Figure 3.

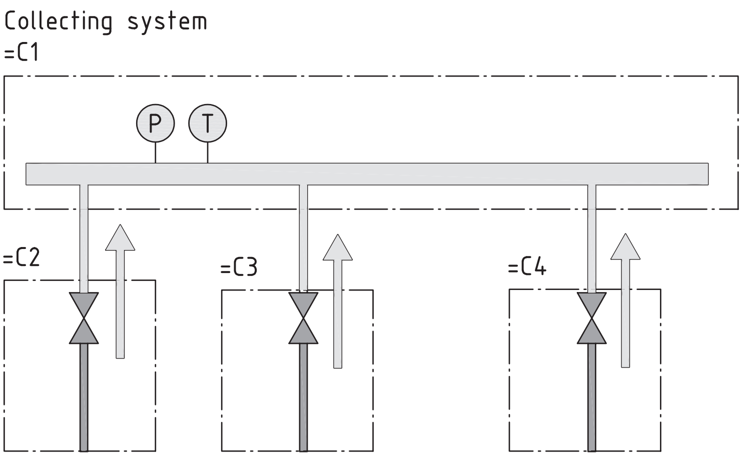


Figure 3 — Example of the collector system principle

It is useful from a process (or even safety) point of view to know which system is being isolated.

The collector system principle only applies to the functional aspect, not the product aspect, where an array of valves, such as the ones depicted in Figure 3 can be part of the collecting system -C1 (pointing to the same object individual as =C1).

This situation will often occur for switchgear systems, where breakers isolating a certain larger system are, in the product aspect, part of the switchgear system. However, in the functional aspect the breakers will be part of the systems to which the flow of electrical power is being controlled.

5.4 Classification according to inherent functionality

In accordance with the principles of IEC 81346-2, the object should always be classified according to what it was designed to do, not what it is being used for in a particular case.

EXAMPLE 1 Even if the overall function of the lubrification oil system is to reduce friction, the system supplying the lubrification oil does not see the final use of the oil, it just supplies it. It is a liquid matter supply system (JB), not a friction reduction system (KJ).

EXAMPLE 2 A valve opening the flow of the sprinkler system will have the effect of fighting fire. But the valve is a valve, it is a controlling device for flow, a QMA.

The overall use of a system will often be reflected by a parent system. In the case of Example 2 above, the valve (QMA) will most likely be a constituent of a firefighting system (PB).

5.5 Immaterial instantiation

In accordance with the principles of IEC 81346-1, instantiating the occurrences (object reference designations) should avoid situations where the numbering in itself carries meaning, including leading zeroes. Such information is considered metadata/properties of the object.

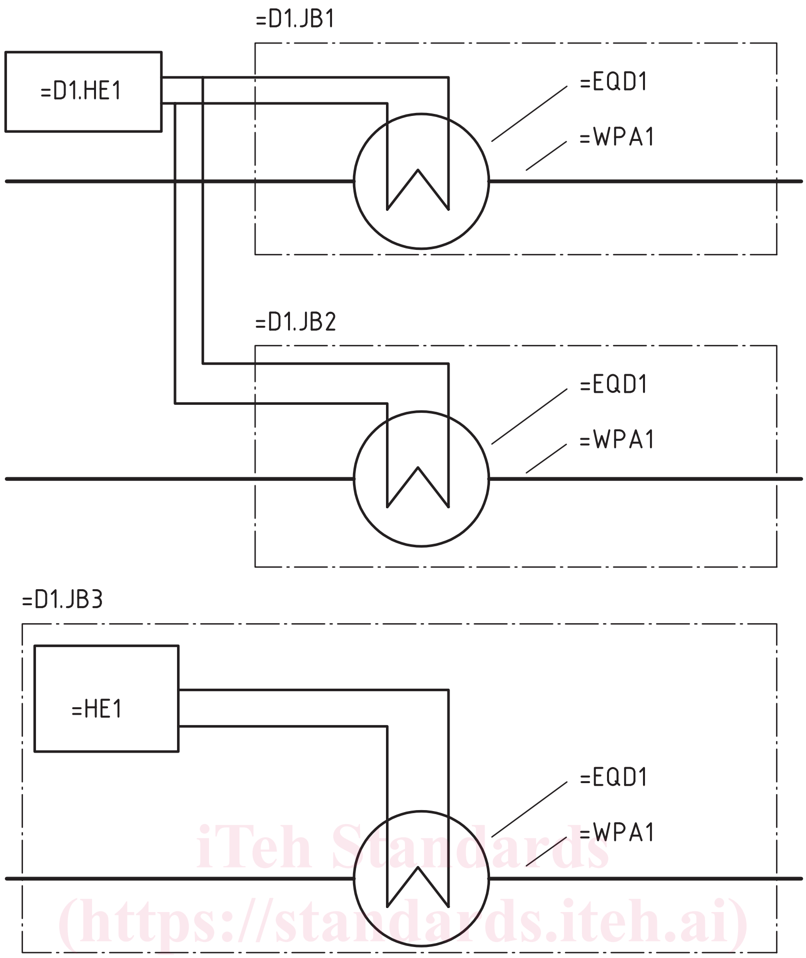
EXAMPLE =RA2, where "=RA2" is not necessarily the second generator (in any sense of the word).

The primary concern is to avoid situations where the instantiation carries technical information about the object in question that should be covered by the type aspect. Certain exceptions are acceptable for grouping/clustering purposes (see 5.7) and the type aspect (see 7.3). If a company selects to employ meaningful numbering, the rule should be well documented.

5.6 Parent system and sub-systems

If a system (e.g. HE) primarily affects a larger system (e.g. =D1.JB3), and only that, the former (HE) should be a sub-system of the latter (=D1.JB3). See "Distribution system 3", the lower system in Figure 4.

If a system (HE) affects multiple larger system (e.g. =D1.JB1 and =D1.JB2), that system should be considered lifted to the same level as the two latter systems (=D1.JB1 and D1.JB2). See "Distribution system 1 and 2", the two upper systems in Figure 4.

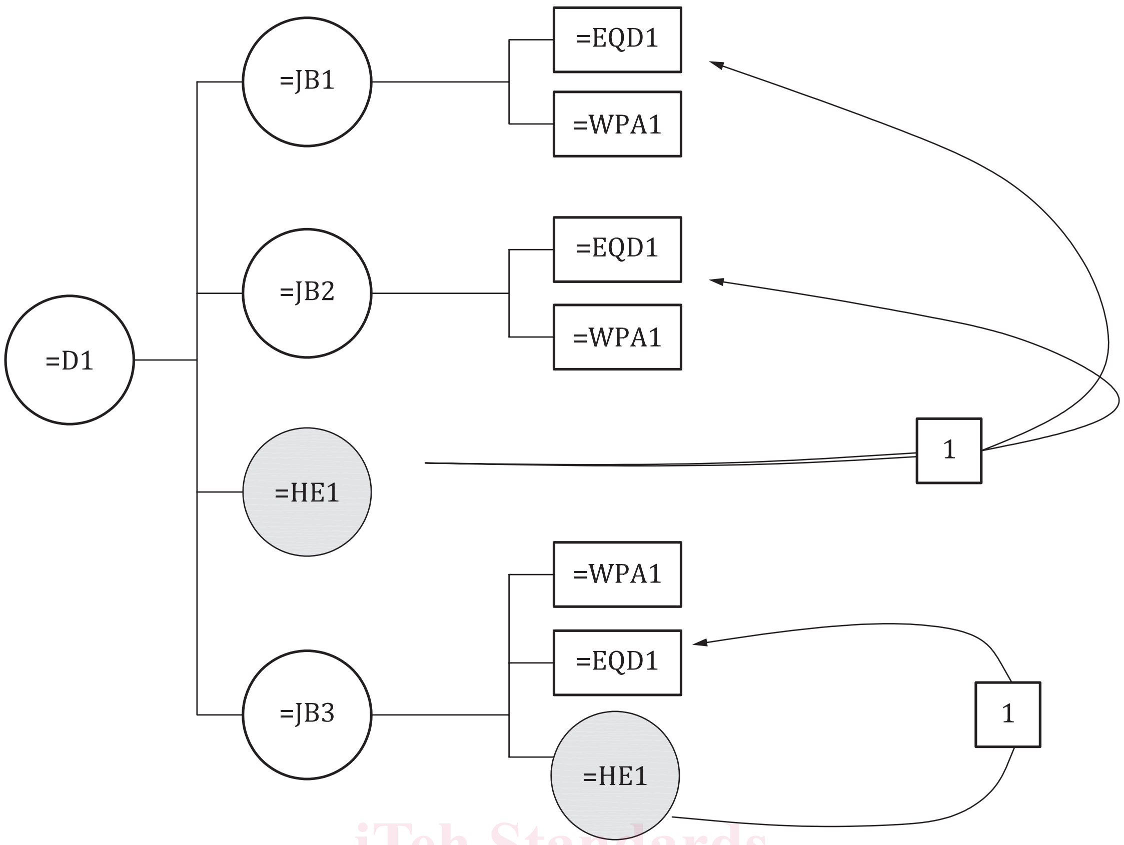


Key

=D1.JB1	cooling water distribution system 1
=D1.JB1.EQD1	cooling water distribution system 1, cooling system
=D1.JB1.WPA1	cooling water distribution system 1, distribution pipe
=D1.JB2	cooling water distribution system 2
=D1.JB2.EQD1	cooling water distribution system 2, cooling system
=D1.JB2.WPA1	cooling water distribution system 2, distribution pipe
=D1.HE1	cooling water supply (supplying distribution systems 1 and 2)
=D1.JB3	cooling water distribution system 3
=D1.JB3.EQD1	cooling water distribution system 3, cooling system
=D1.JB3.WPA1	cooling water distribution system 3, distribution pipe
=D1.JB3.HE1	cooling water distribution system 3, cooling water supply

Figure 4 — Example of structure showing cooling systems on different levels — P&ID

Figure 5 shows a model of an auxiliary water distribution system with its cooling system. Each of the major piping systems (=D1.JB1, =D1.JB2 and =D1.JB3) have their own cooling systems (=D1.JBn.EQD1). Each of the (EQD) cooling systems are sub-systems dedicated solely to their respective (JB) piping systems.



Key

1 supplying cooling water

Figure 5 — Example of structure showing cooling systems on different levels

Cooling water on the other hand is supplied to systems =D1.JB1 and D1.JB2 by a common cooling water supply system (=D1.HE1). Because this system is common to multiple systems on the second level of the structure it is also on the second level. The third distribution system (=D1.JB3) is particular in that it has a dedicated cooling water supply system (=D1.JB3.HE1). It is only supplying cooling water to this particular distribution system and is therefore a sub-system of it.

This proposed design guideline is not absolute. The second cooling water supply system (=D1.JB3.HE1) can already at this point be elevated to the second level of the structure (=D1.HE2) if, e.g.:

— it is expected (in the future) to feed a fourth piping system;

— it can be used as auxiliary supply systems to the other distribution systems;

— in similar situations, it is expected to feed multiple distribution systems.

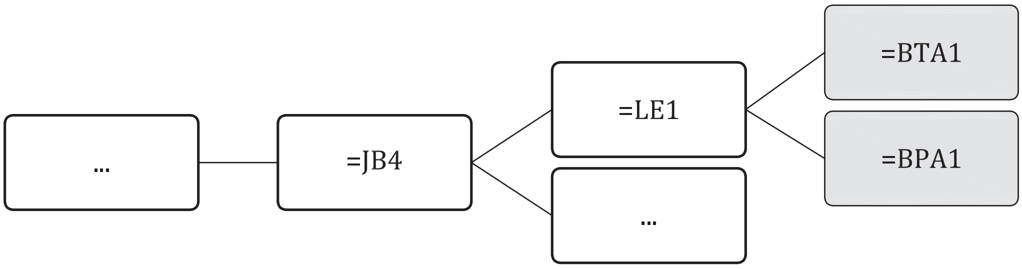
5.7 Limited constituent systems

5.7.1 General

The RDS-structures provide the users with a clear overview of the object/system of interest and its constituent sub-systems. To ensure readability and use friendliness, the system should contain between 5 and 25 sub-systems; a guideline to the lower and upper limits of that range is given in 5.7.2 and 5.7.3.

5.7.2 Lower limit

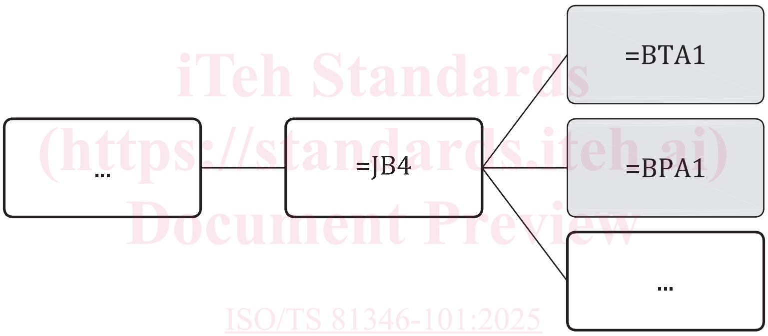
In cases with systems that contain less than five sub-systems, it is recommended to review the structure and consider lifting the few sub-systems up one level; such as illustrated in the examples in Figure 6 and Figure 7, where the monitoring system (=LE1) was superfluous.



Key

...=JB4	oil distribution system
...=JB4.LE1	oil distribution system, monitoring system
...=JB4.LE1.BTA1	oil distribution system, monitoring system, temperature measurement
...=JB4.LE1.BPA1	oil distribution system, monitoring system, pressure measurement

Figure 6 — Example of a potentially unnecessary system



Key

...=JB4	oil distribution system
...=JB4.LE1.BTA1	oil distribution system, temperature measurement
...=JB4.LE1.BPA1	oil distribution system, pressure measurement

Figure 7 — Example of a simplified and improved structure

This principle is a general recommendation. There are many situations where only a few, or even a single sub-system should figure in the structure.

EXAMPLE If the oil distribution system 4 (=JB4) only had the one single temperature sensor system (=BTA1) as a child system, it can still belong there. The placement would indicate that the temperature sensor system is a sub-system of that particular oil distribution system.

5.7.3 Upper limit

Many industrial systems include extreme numbers of similar systems, such as lithium battery racks, solar panel arrays, or individual pipes or poles in a large distribution line. In these cases, the proposed upper limit of 25 can be difficult to follow.

Handling of a potentially extreme number of sibling systems can be done by creating multiple instances of parent systems and distributing the siblings between them by clusters. This can be done either by using the existing parent classes, or by creating a new level in the structure.