Technical Guidelines

for Power Generating Units

Part 7:

**Operation and maintenance of
power plants
for renewable energy**

Category D3:

"Global Service Protocol (GSP)"

Standardised data format for the

electronic exchange of data in the maintenance process

Revision 0
01.01.2014

Operation and maintenance

of power plants for renewable energy

Category D3:

Global Service Protocol (GSP)

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The focus of the FGW Technical Guidelines for Wind Turbines part 7 (TG7) "Maintenance of renewable energy power plants" lies in the description of the processes and the necessary documents and data. Furthermore, a clear and standardised identification of components, standard description of states and events and classification of malfunctions are required for all participants to enable later evaluation and analysis.

The present Part 7 of the Technical Guidelines (TG7) was compiled jointly by operative management - companies, service providers, manufacturers, research institutes, specialist companies, certification bodies and insurance companies.

The objective of the Global Service Protocol (GSP) is the provision of a standardised electronic data format that facilitates communication between different parties involved in the maintenance of renewable wind turbines.

Part 1: Determination of Noise Emission Values

Part 2: Determination of Power Curves and Standardised Energy Yields

Part 3: Determination of Electrical Characteristics of Power Generating Units connected to MV, HV and EHV Grids

Part 4: Requirements for Modelling and Validating Simulation Models of Electrical Characteristics of Power Generating Units and Systems (starting from Rev. 3)

Part 5: Determination and Application of Reference Yield

Part 6: Determination of Wind Potential and Energy Yields

Part 7: Operation and maintenance of power plants for renewable energy

> **Category A:** Miscellaneous section
>
> **Category B3:** Specialist application notes for monitoring and testing foundations and supporting structures for wind turbines
>
> **Category D2:** State-Event-Cause code
>
> **Category D3:** Global Service Protocol (GSP)

Part 8: Certification of the Electrical Characteristics of Power Generating Units and Systems in the Medium-, High- and Highest-voltage Grids

Part 9: Electromagnetic Compatibility

Notes on TG7 category D3:

- *Existing energy industry standards were combined with experience from the renewable energy sector to produce these guidelines.*

- *Additional categories in TG7 are in preparation at the time of publication of Category D3 in TG7. References to other as yet unpublished categories are therefore provisional and purely for information.*

- *In revision 0 of these guidelines this particularly relates to*

    - *FGW TG 7 category C documentation*
    - *FGW TG 7 category D1*

- *Additional information and recommendations on practical implementation will in future include an application guide on the GSP for specific applications.*

Materials available from FGW e.V. on the GSP standard:

- **Guidelines as a free download (PDF) in German and English**
- **Application package TG 7 category D3**
  (available for token fee; free of charge for FGW members)
    - *Guidelines incl. Attachment A (schema documentation) as a print version in German*
    - *XSD schema file*

Contents

OPERATION AND MAINTENANCE
of power plants for renewable energy

Category D3: "Global Service Protocol (GSP)"

Revision 0, as at 01.01.2014

The focus of the FGW Technical Guidelines for Wind Turbines part 7 (TG7) "Maintenance of renewable energy power plants" lies in the description of the processes and the necessary documents and data. Furthermore, a clear and standardised identification of components, standard description of states and events and classification of malfunctions are required for all participants to enable later evaluation and analysis.

The present Part 7 of the Technical Guidelines (TG7) was compiled jointly by operative management - companies, service providers, manufacturers, research institutes, specialist companies, certification bodies and insurance companies. The aim is to define terms, describe necessary processes and documentation in the area of the maintenance of renewable energy power plants including the associated infrastructures as well as creating standardised communication interfaces for the exchange of maintenance-related data.

1   Introduction

In accordance with Section 6 of the Energy Industry Act (Energiewirtschaftsgesetz, EnWG), "Security and reliability of the energy supply", Para. 49 Requirements for Energy Plants, the following applies: "Energy systems must be set up and operated in such a way as to ensure the technical safety is guaranteed. Generally recognised rules of technology are to be taken into account subject to other relevant legal provisions."

In accordance with DIN EN 13306 and DIN 31051, the term maintenance comprises all technical and administrative measures, as well as the management of measures, required to establish the actual state, to maintain a functional state, to return to this state and to increase functional reliability during the life cycle of a unit. A proper approach to maintenance aims to secure the value of the invested capital and the required availability as well as protecting public safety.

Every operator of a system is responsible for its safe and economical operation. The operator is liable for any harm to the environment or to persons caused directly by the energy systems operated by him or the associated infrastructure. It is therefore necessary to seamlessly and adequately document operations for the authorities, insurance companies and banks, not only for economic considerations, as far as possible
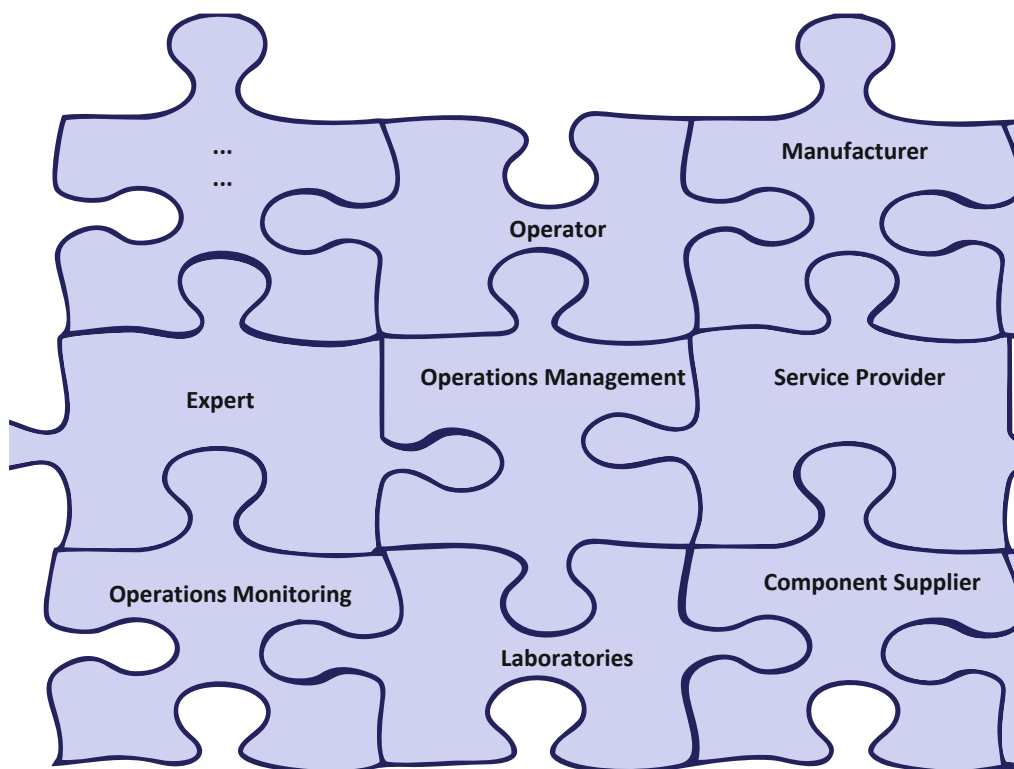
Figure 1: Parties involved in the process who generate or receive maintenance-relevant information using the example of wind energy

Figure 1 illustrates the complexity of communication between the participants in the maintenance processes and thereby indirectly the requirement for a standardisation of identification and descriptions for the purpose of simplification.

In addition to safety aspects, this documentation serves the purpose of prioritisation, planning and controlling maintenance measures as well as the analysis of operational and maintenance data

relating to the updating of ongoing maintenance planning, the optimisation of the named processes as well as improving the systems. The operator also needs all the required technical documents in accordance with DIN EN 13460. A standardised design of documentation and data interfaces facilitates co-operation of all the parties involved in the process.

1.1   Global Service Protocol (GSP)

In the maintenance of systems for the production of renewable energy, the provision of work order data and the provision of data from the work report is currently still often generated using printed paper templates. Although there are systems for the electronic recording and transmission of data in use, these systems use different data formats. This means that they are not compatible with one another or are only compatible to a limited extent.

The aim of the Global Service Protocol (GSP) is therefore to provide a standardised electronic data and document format that facilitates communication between different parties involved in the maintenance of renewable energy systems.

The definition of a standard format and unique identifiers ensures compatibility of the data from the various parties involved. This permits the exchange of relevant maintenance data, forming the basis for complete documentation (maintenance history file) of all maintenance activities.

When the IT systems of the individual parties involved support data exchange in accordance with the GSP document format, exchange with all other systems supporting the GSP is possible without further adaptation work. The complex conversion of files or the manual updating of maintenance information is therefore no longer required.

In the definition of the protocol contents, the GSP is based on FGW guideline TG7 as well as other standards and guidelines. In addition to the predefined protocol content, the parties involved can specify and exchange additional content via defined user-specific data fields.

2 General information

The application of the TG7 is available to everyone and is only binding when it is part of a contract or other publication.

2.1 Scope

The scope of the guidelines for power plants part 7 category A section 2.1.

In addition, users are also free to transfer data in GSP document and data format outside the scope of these guidelines.

In addition to the scope of the standard, the GSP described in these guidelines may also be suitable for the transfer of maintenance data for other systems which use a code system based on basic standards EN 81346 / IEC 81346 or ISO/TS ISO/TS 16952-1, such as RDS-PP®.

2.2 Legal regulations

Legal regulations of the respective country of the place of fulfilment take priority over these guidelines.

2.3 Normative references

The normative references given in the guidelines for power plants part 7 category A in section 2.3.

The following also apply:

Regulation/Guideline	Designation	Notes
ISO/IEC 26300:2006-12	Information technology - Open document format for office applications (OpenDocument) v1.0	
DIN 31051:2012-09	Fundamentals of maintenance	
ISO 639-1	Language codes	
ISO 3166-1	Country codes	

2.4   Reference to guidelines and requirements

The references to guidelines and regulations as well as the parts of TG7 categories A to E apply in addition to the guidelines for energy systems part 7 category A in section 2.4.

Regulation/Guideline	Description	Notes
VGB standard S-832-T32	RDS-PP® Application guideline part 32: Wind power plants	Draft: Formerly VGB-B 116 D2; Due for publication in 2014
DIN SPEC :2014-0291303:2014-02	Components and structure of a service life histories for renewable energy installations	Due for publication in 2014

3 General specifications

3.1 Definitions

As definitions from general case law and standards and guidelines given in the TG7 are not always harmonised, misunderstandings can occur. Separate specifications apply based on the TG7 in these cases. The application of the TG7 therefore also simplifies the contractual definition of terms.

To achieve a standardised terminology for the various bodies involved in the maintenance of wind power plants, the definition of terms and versions given in the guidelines for power plants part 7 category A applies.

In addition, the following terms are used in these guidelines:

Term	Definition
Energy system	In accordance with the German Energy Economy Law (Energiewirtschaftsgesetz; EnWG) energy systems are systems used for the production, storage, transport or distribution of energy, in so far as they are not simply used for the transmission of signals. This includes end consumer distribution systems, as well as the last shut-off device in front of the consumer system in the case of a gas supply. Within the scope of these guidelines, the evaluation unit is an energy system (= RDS-PP® classification level 0) such as a generating unit, a transformer or a substation.
Power plant	In these guidelines this describes a collection of 1-n energy systems as the overall system (energy system group) - in practice with the primary purpose of energy generation. Within the scope of these guidelines, this is in practice the wind farm as a system of energy systems. The scope of the GSP could also include other applications, in particular for renewable energy systems, such as solar parks or substations, etc. A power plant is identified by a RDS-PP® conjoint (=common assignment in accordance with VGB- VGB standard-S-823-T32; 2012-04-DE).
Global Service Protocol (GSP)	Structured collection of maintenance data from energy systems transmitted in a data and document format specified in these guidelines.

GSP data format	Structured collection of information units, specified in these guidelines, for the transmission of maintenance data on an energy system in an XML document complying with these guidelines. Attachment A to these guidelines documents the respective XSD schema file. Each Global Service Protocol (GSP) includes an XML document in the GSP data format.
GSP document format	Compilation of an XML document with GSP data and of these linked documents in a GSP document complying with these guidelines (see section 9.1). A GSP document is indicated by the file extension *.gsp.
Element	A subsection of the energy system as the evaluation unit under consideration, such as a subunit, a subsystem or a component (= RDS-PP® from classification level 1 and higher) is referred to as an element within the scope of these guidelines.
Assignable element	A clearly defined element included in the documented system structure of the plant, with a reference code record in accordance with the stipulations in these guidelines.

3.2 Abbreviations

Abbreviation	Description
.gsp	File extension for files in GSP document format
CT	Customer (ordering party)
CN	Contractor (implementing party)
DIN	German Institute for Standardisation
Docu	Documentation
EN	European norm
GSP	Global Service Protocol
M	Maintenance
ISO	International Organisation for Standardisation
IT	Information technology
M	Mandatory – required element (compulsory field)
O	Optional – permissible element (optional)
RDS-PP®	Reference code system for power plants RDS-PP®
Rel.	Relevance (application of the class or attribute recommended or compulsory).
Rev.	Revision (also version)
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
W3C	World Wide Web Consortium
WT	Wind turbine
XML	Extensible Markup Language
XSD	XML Schema Definition
ZEUS	Zustands-Ereignis-Ursachen-Schlüssel (status/event/cause code) in accordance with TG 7 category D2

3.3 Definition of the contents of the guidelines

The subject of this current guideline revision, and thus the position of the GSP, is defined as follows:

- These guidelines specify a document format summarising maintenance data and associated attachments for transmission. (GSP document format)

- These guidelines describe a data format for the electronic documentation of maintenance data. (GSP data format)

- These guidelines also define which data for the applications specified in section 3.6 are to be transmitted.

- These guidelines also specify how individually agreed data is to be incorporated between the parties.

- These guidelines regulate the assignments to be generated in the data gathering process to convert the data into the data format and to be able to compare the data later on in line with standardised criteria.

- For certain data, these guidelines regulate which categories are to be used for subsequent comparison and onward processing of the data recorded.
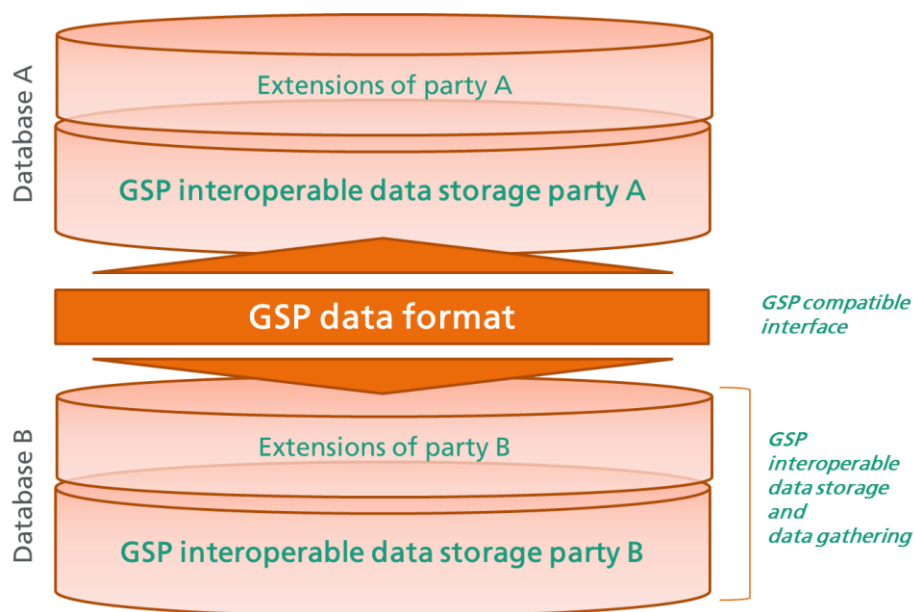
Figure 2: GSP data format and GSP interoperable data storage
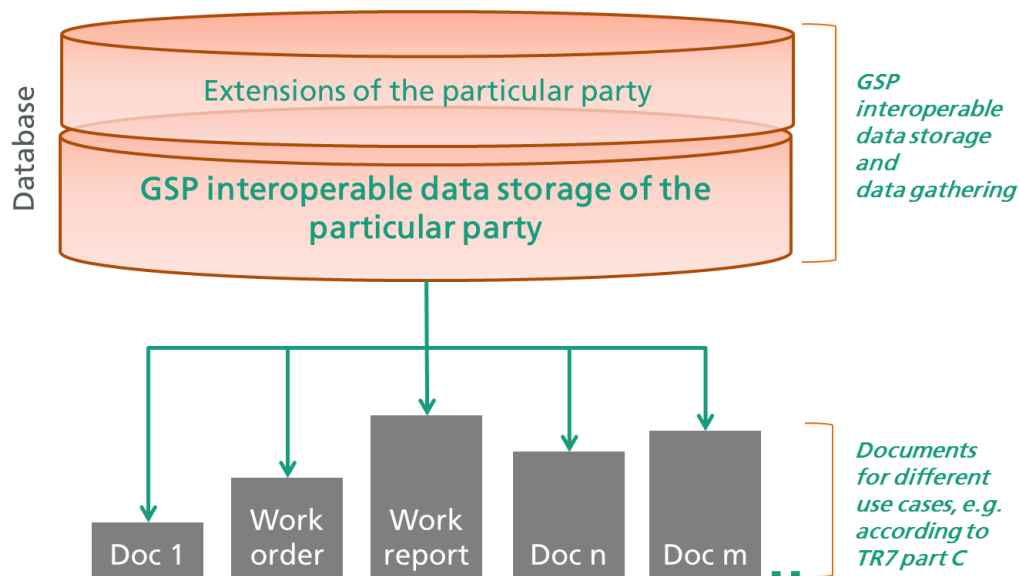
Figure 3: GSP data processing in the maintenance documentation

The following topics are involved in the implementation of the data exchange or data acquisition and are not therefore covered by these guidelines.

- Data acquisition process for individual applications.

- Backup and verification of data quality

- Conversion of existing data into GSP data format

- Specifications for software for the input, processing, compilation and analysis of the data transmitted in the GSP data format

- Documentation of the maintenance and format of the documents to be prepared for maintenance and the maintenance history file (covered in TG7 category C)

To achieve this, however, the provisions of other parts of TG 7 and the guidelines and standards given in the TG7 category may have overriding priority.

Higher priority documents, which may be compiled in accordance with the specifications from TG7 category C on the basis data transferred in the GSP data format, are given as follows:

- Work order (TG7 category A section 3.2.6)

- Work report (TG7 category A section 3.2.7)

- Maintenance report (M history)

- Documents for inspection (TG7 category A section 3.4.3.)

- Maintenance-related parts of the maintenance history files of WTs (DIN SPEC 91303)

To speed up the application of a standardised data format, this revision of the guidelines also contains provisional stipulations from the standards provided in the draft revisions of TG7 category D1 and TG7 category C.

This applies in particular to:

- The recommendation for the use of the ZEUS code in accordance with TG 7 category D2 as part of the maintenance documentation (to be covered in future by TG7 category C).

- The application of the VGB standard VGB-S823 T32 (RDS-PP® application guidelines part 32: wind energy) for the identification of assignable elements in the system structure (covered by TG7 category D1).

3.4 Functions of the GSP

The data format defined in these guidelines as the Global Service Protocol (GSP) fulfils the following functions:

- Exchange of data on maintenance measures between the parties as a prerequisite for the transmission and compilation of the maintenance documents given above

- Assignment of the information units on individual maintenance activities integrated in the GSP data format (orders)

- Assignment of the information units on relevant systems and system components integrated into the GSP data format

- Assurance of comparability for individual maintenance situations via the implementation of a standard data format and standardised assignment logic.

- Documentation option for the fault-finding process, i.e. the route from suspected fault to fault location.

The standardised assignment logic is achieved via:

- integration of the ZEUS code defined in TG7 category D2 for the standardised description of status conditions, events and causes.

- integration of a standardised code system within a function-oriented structure according to an industry-standard system (RDS-PP Reference Designation System for Power Plants according to the guidelines of the VGB).

- integration option of an object type definition into the GSP data format.

- In some cases, the requirements for standardised categories for the content of the information units, where this simplifies considerably the standardised processing and evaluation of the data. The specification of standardised categories is carried out if possible on the basis of existing guidelines and standards, see section 6.

With the acquisition and transmission of the information units defined in these guidelines, the user ensures the following:

- that the requirements of TG7 category A section 4.6 documentation of the maintenance measures can be fulfilled and

- in this respect, the information units specified in DIN EN 13460 on the work order can be transmitted.

3.5   Roles of the parties involved

Revision 0 of the guidelines has been designed primarily for the following parties as active participants in the maintenance of renewable energy systems. The parties involved in the marketplace can also have multiple roles in this process.

Description	Definition
Owner	The owner of an object is the person to whom the object belongs. The owner has comprehensive rights over the object, and unless the law or the rights of third parties would be contravened, the owner can proceed as desired and prevent actions on the object by others.
Operator	In accordance with DIN VDE 105 - 100, the system operator is a company or an individual or legal entity appointed by the operator who undertakes operator responsibilities for the safe operation and correct status condition of the plant.
Manager	The manager is responsible for the correct operation of the plant on behalf of the operator. The manager can determine plant responsibilities on behalf of the operator.
Expert	An expert is a person who, thanks to their specialist training and experience, has special expertise and an above-average level of expert knowledge in a specific field. He (or she) supports decision-making processes, but is not involved in the actual decision itself. The term "expert" is not protected in Germany. However, the following definitions are protected: • Accredited expert in accordance with DIN / ISO 17024, • State recognised expert (term legally protected), • Publicly appointed and sworn expert (term legally protected), • Recognised expert, • Independent expert, • Expert approval body
Inspector	The term "inspector" does not refer to a profession, but rather to a professional job function. An inspector is a person who has special expertise in a specific field and with an above-average level of expert knowledge issues an actual assessment of an event or status condition within their specialist area.
Manufacturer	The manufacturer produces an object and distributes it to owners directly or via third parties.
Service and	The service company, in line with the contractual regulations on behalf of

Description	Definition
maintenance companies	the owner or manager or of the manufacturer, undertakes maintenance or cleaning activities on equipment.
Service technician	As a skilled person, the service technician is charged with tasks relating to maintenance or cleaning on a system in accordance with their existing qualifications. The service technician can work for the operator, manager, manufacturer or maintenance company. The service technician completes maintenance and cleaning tasks on-site in line with the specified work order and documents these activities in the work report. The documentation in the work report can be completed in collaboration with other parties.

3.6   Applications

The content of this revision primarily cover the following applications.

Application (in accordance with DIN EN 13306)
Repair
Inspection
Condition monitoring
Compliance test (WPK)
Routine maintenance (servicing)
Overhaul
Fault diagnosis
Improvement
Modification
Rebuilding

The handling of other secondary applications such as

- Organising orders, approving work

- Customs & storage (or transport container/vehicle)

- Transport planning, transport equipment booking, transport approval

is not covered by this revision of the guidelines.

Recommendations for other applications may be covered by the application guide currently in preparation and by future revisions of these guidelines.

3.7   References between system components

The following terms are used in these guidelines to define plant components.
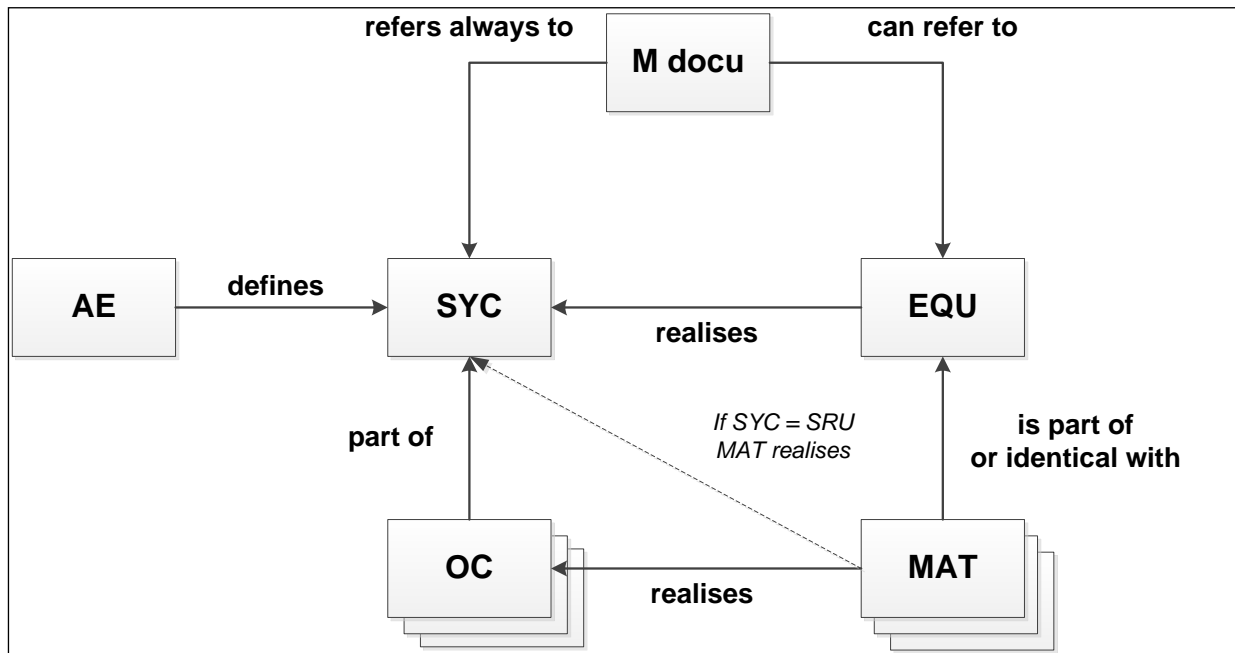
Abbreviation	Meaning
M docu	Maintenance documentation in accordance with TG7/A and DIN SPEC 91303
Design level	
SYC	System component
OC	Object component
AE	Assignable element (RDS-PP® or referenced structure)
Implementation level	
EQU	Equipment component (serial number/inventory number/type designation)
MAT	Material (replacement part for the equipment component)

Figure 4: Designations for maintenance objects in this guideline

The distinction between system component and equipment component for maintenance objects conforms to the principles given in VGB-S-823-T32.

The system component is an element of a system structure; the equipment component is a physical equipment component.

These guidelines take account of the fact that information on the maintenance documentation is to be systematically recorded on the system level as consistently as possible (object reference, see section 5.4) to permit evaluation on the same level.

- This also corresponds to the basic principles for the documentation of service history records for renewable energy systems in accordance with DIN SPEC 91303:2014-2

The system components that have been clearly defined in the system structure are therefore referred to as assignable elements because they can be assigned to a specific element of the system structure in advance. Components not defined in the system structure (below the defined system components) are referred to as object components.

An assignable element can be part of the system structure in RDS-PP® or a defined object with reference to RDS-PP® (user-specific system structure referenced on the same or a higher level of RDS-PP®).

Material used as a replacement part as part of the maintenance is then always identical to a system component if the system structure has been set up in accordance with the smallest logical replaceable elements. These elements are referred to in the guidelines as the smallest replaceable units (SRU).

In all other cases, the replacement part used is identical to an object component as part of a system component defined as an assignable element outside the system structure.

It should be noted that information on an equipment component does not always have to be transferred and documented, i.e. an equipment component stored in the inventory under inventory numbers or serial numbers is not always known for every plant component in practice.

3.8   Example process

3.8.1   Introduction

The definition and description of maintenance processes incl. the associated data acquisition and processing stages is not covered by these guidelines and is the responsibility of the parties at the company responsible for maintenance work. The maintenance contracts should be drafted accordingly to ensure a company-wide approach.

The GSP has been developed for the applications listed in section 3.6 of these guidelines. To determine the requirements relating to the content to transmitted to the parties given in section 3.5, an example process has been developed as a model in the working group.

This generic model process is intended to explain the basic usage options of the GSP and demonstrate the general workflow of maintenance and repair activities, inspections, regular tests, etc. that the GSP was primarily designed for. The process given does demonstrate the specific workflow of a maintenance/repair activity, but the workflows in an inspection or regular test can be formed from a subset of the process stages shown.

The stages shown in the process do not necessarily have to be implemented in all cases when using the GSP. The informational contents of the GSP given are information categories that are further differentiated in the GSP guideline. The contents of the information categories shown are also optional in some cases.

3.8.2   Process diagram
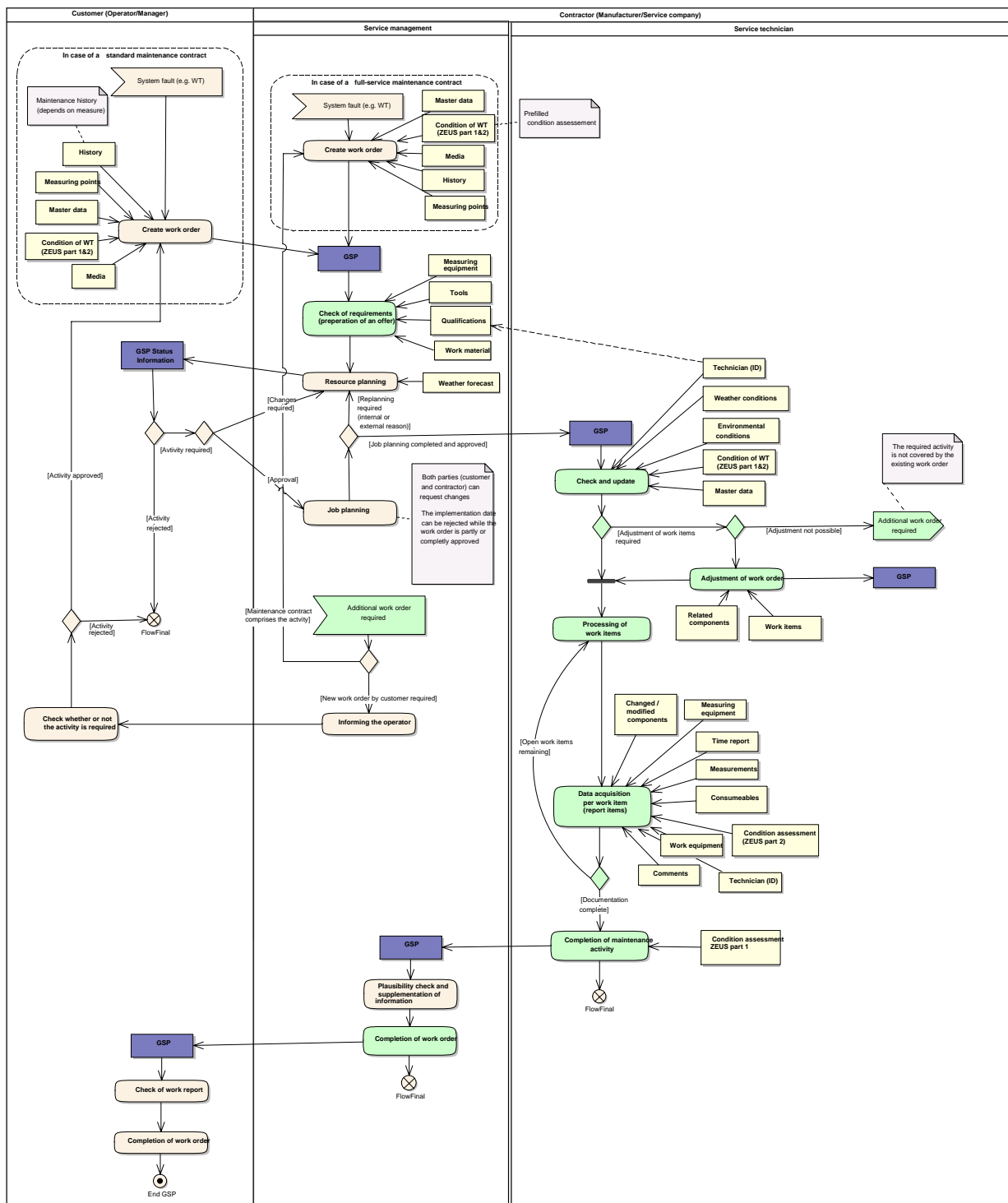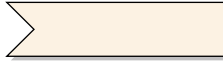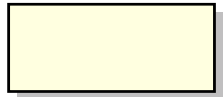
Figure 5: Example process for maintenance data acquisition

Key

	Information received from an external process (incoming event) Indicates the input of information from an external process. The information triggers stages of the process.
	Information Indicates information retrieved/defined by parties involved in the process and added to the GSP.
GSP	Global Service Protocol Symbolic display of the GSP to indicate the creation or transmission of the protocol.
	Process operation Operation carried out by a party involved in the process.
	Process operation with changes to the GSP Operation carried out by the party involved who can effect a change in the GSP data.
	Decision Decision between two or more potential process paths.
	Link within the process (outgoing event) Links the process workflow to the workflow of another party, for greater clarity.
	Link within the process (incoming event) Links the process workflow to the workflow of another party, for greater clarity.
FlowFinal	End of a process section Marks the end of the process implementation by a party involved in the process.
Ende GSP	Process end Marks the end of the processing of the GSP order and thus also the end of the process.
	Comments Includes comments for easier comprehension of individual process steps.

Table 1: Key to the description of the example process

3.8.3 Parties involved in the process

The parties described below are involved in this process. Depending on the configuration, the parties may belong to one or more companies.

Operator/manager (according to FGW TG 7)

The operator or manager is always the direct or indirect customer of every maintenance activity. Either a service company is appointed by the operator/manager directly with a specific maintenance/repair order, or a longer term maintenance contract is concluded (e.g. full-service maintenance contract). In the case of a direct appointment, details of the order can themselves be transmitted as a GSP order.

Various organisational units may be involved in the process implementation.

- Work planning

- Transport planning

- Engineering

- Manufacturer/ISP service management (according to FGW TG 7 category A)

The service management receives the order from the operator/manager, plans the staff deployments and evaluates these afterwards. Depending on the maintenance contract, the service management can also initiate internal orders. The implementation is also to be agreed with the operator/manager in this case. The service management prepares a corresponding GSP order for the service technician and adds to the order following processing. Depending on the contractual regulation, a report can be provided to the operator/manager via GSP protocol.

Manufacturer/ISP service technician

The service technician receives a GSP order from his service management, processes it and documents his work in the GSP protocol.

Other parties not shown in the process are

- independent technical experts and

- inspectors of the operator/manager.

3.8.4   Process workflow

1. Creation of the GSP order (operator/manager or service company)

The creation of the GSP order is carried out either by the operator/manger or internally by the service company depending on the situation (e.g. standard maintenance contract or full-service maintenance contract). The GSP is equipped with the basic information such as master data, required maintenance history and current condition assessment. This information is intended to be used as a decision-making aid in staff deployment planning as well as on-site. On creation by the operator/manager, the order is passed to the service company.

2. Order planning (service company)

The created order at the contractor (service company) enters into the order planning process, additional information is added such as the measuring equipment, tools, qualifications, etc. required and then scheduled in the resource planning process. The customer (operator/manager) is then informed for approval of the planned deployment, work content and the scheduled time slot and approves the planned activity.

If approval (see figure 5) is given on behalf of the customer and no changes are required, the staff deployment planning is carried out and the order is passed to the assigned service technicians following internal approval. If the customer requests changes to the planned order, the order is returned to order planning for alteration.

3. Order approval (operator/manager)

On the basis of the information on the work order, the operator/manager decides whether or not the planned activity is required and if any changes to the content or time slot of the order are required. The contractor receives the corresponding notification. The function of the GSP is particularly useful in the case of a full-service maintenance contract so that the customer is informed of all current activities and can coordinate the forthcoming activities with other system deadlines.

If the planned activity is not deemed necessary by the customer, the order is rejected and the process is ended.

4. Order processing (service technician)

After the service technician has received the GSP including the relevant information (master data, condition, work materials, etc.), he/she checks the data on-site, adds to the data if necessary, and begins the processing of work items. If other work items are required that are not covered by the order and that cannot be created by the service technician on his/her own account, the service management is informed and another work order is generated if necessary. Depending on the contract situation, this is created directly by the service management or by the customer once appropriately informed.

After/during the processing of each work item, this is documented specifying all necessary information (components, times, measurements, condition assessment, etc.). Following completion of all work items, the service technician can submit a condition assessment of the energy system if required.

5. *Order completion (operator/manager & service company)*

The GSP order completed by the service technician is checked by the service management and can then be passed to the customer with the contents agreed between the parties.

- The GSP data format does not contain any specific fields for order settlement. The transfer of data for order settlement can be carried out by users via user-specific content.

3.9   IT process workflow

The GSP has been developed for data exchange between IT systems (see sections 1.1 and 3.4). Based on phases 1 to 5 of the example process described in the section above, the subsequent IT process can be outlined for creating a Global Service Protocol. The numbers given on the diagram relate to the process phases in question.
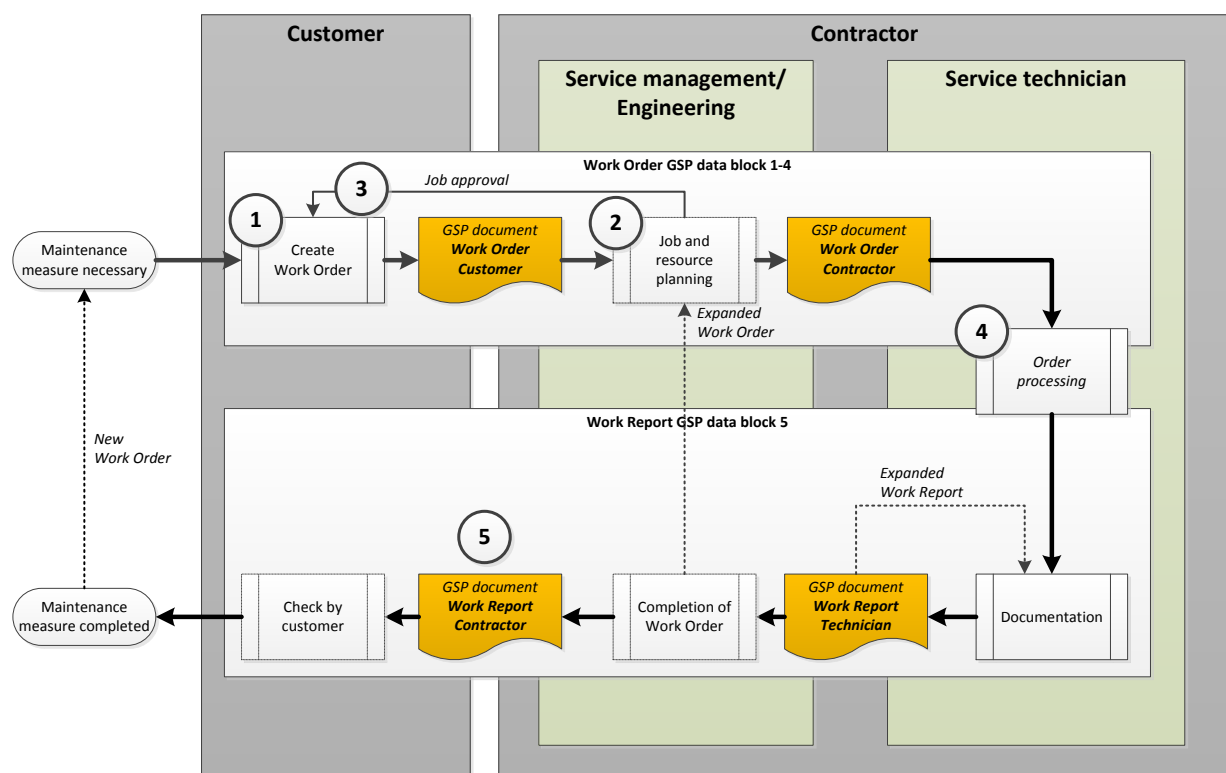
Figure 6: IT process workflow

As the illustration above shows, a GSP document (orange in the diagram) can exist in multiple revisions, which are completed gradually during the course of the maintenance process.

The compiled order data from the customer can, for example, be expanded as part of the order planning process to include specific data on deployment planning, instructed activities or material specifications for the service technician. In addition, a change in the status information can be used to indicate that an activity or the work order has been approved for implementation.

Within order processing it can occur that – depending on the appropriate approvals – new work on other components/subsystems is added (see also notes in section 7.2), whereby this is either only documented or where appropriate can be commissioned by the contractor/technician him/herself as necessary (additions/further details on the work order). The status of the activity should be given in order of priority with the activity status (see also section 6.4).

The GSP data format allows status information to be stored for every order and report item, as well as for the order and order processing and for activities.

Who can assign which status and when is covered by the agreements between the users, however.

As these guidelines specify a data format, but not IT and maintenance processes, this naturally does not exclude data being compiled for a GSP in other ways. More complex IT processes, through to parallel transmission of multiple GSP documents with partial content are also possible (see also section 5.9).

The information structure of the GSP has been developed based on the IT process and the example process given here,which is described in summary in the following part of the guidelines.

4   Information structure in the GSP

This section provides an overview of the structure of the information to be given in the GSP. More in-depth information and detailed descriptions of the individual information units can be found in sections 8 and 9 as well as Attachment A of these guidelines.

4.1   Overview

The GSP document on M data exchange consists of:

1. one or more XML files which each include the data on one M activity

2. a manifest describing the structure of the file in question, including the references to the attachments contained

3. files attached by the user (attachments)

The structure of the document format (XSD schema) is described in Attachment A. A key for reading the XML schema diagrams is included in section 7.6.

The permissible structures of the XML file and of the manifest are each described in an XSD schema.

Figure 7: GSP document structure

The aim of the GSP is to provide a common data exchange standard for maintenance operations with different levels of complexity, to meet the needs of different user groups that contribute data for the documentation of their maintenance operations in different levels of complexity.

To ensure standardised legibility and the proper onward processing of documents, the GSP document specifications include the following contents:

- compulsory information units,

   that need to be used by all participants

- permissible (optional) information units,

   which are (can) be added depending on the application in question

- a permissible structure for user-specific extensions,

   which can be specified on the basis of mutual agreements between the users

The actual scope and size of a GSP document can therefore be very different depending on the requirements of the users and of the M situations being handled.

The information units to be given in the GSP document as an XML file are categorised in accordance with the 5 data blocks (main types) given in the overview below. Information units can be present singly or x number of times in the data blocks.

The GSP data format permits the following for each data block and each information unit, where appropriate

- Links to file attachments, i.e. text, data, image, video and audio documents

- Comments as notes by editors

- User-specific information units

In the configuration of the information units, attention has principally been paid to ensuring that all information from the ordering party is assigned to the first four main categories. This is all information that can be transferred as a work order.

The documentation of the work ordered in the work report is carried out separately in the main category work Report.
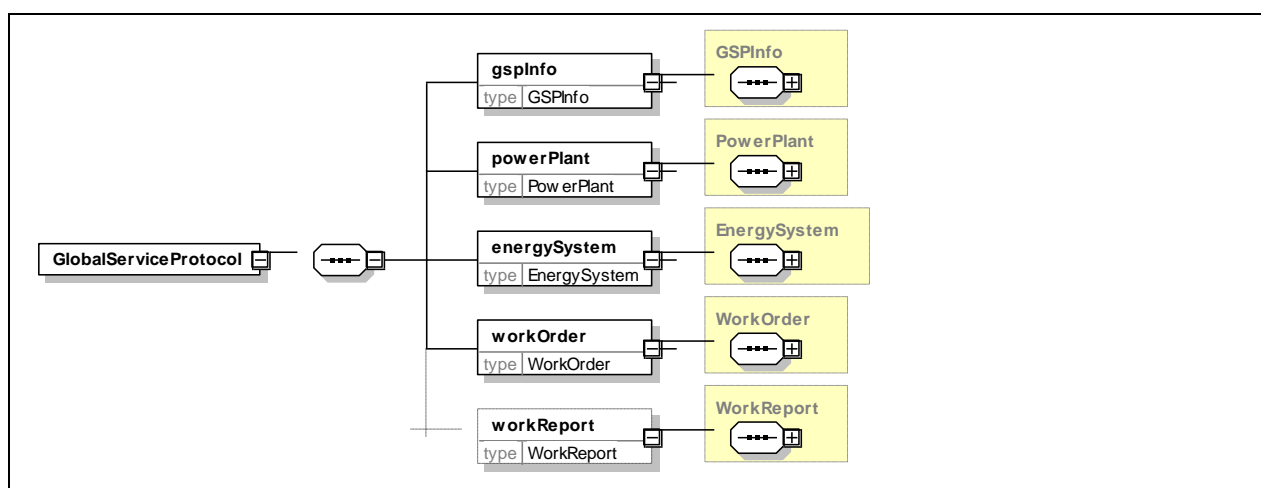
Figure 8: Main categories in the GSP

- The key for reading an XML schema diagram is given in section 7.6 of this guideline.

- The detailed specifications of the types and elements are given in Attachment A of these guidelines.

This means that in the GSP, separate documentation of content of the order and of the work implementation can be given. This creates a strict separation between order information (required) and report information (actual), see also section 5.5.

- The ordering party can be both a customer (manager, owner) as well as a service manager in the service company or in exceptional cases the technician him/herself (see example process in section 3.8).

4.2   GSP info data block (gspInfo)

The GSP-Info data block (element gspInfo in the XML schema) is used to identify the document and contains sub elements

- revision number of the revision of the GSP standard on which the GSP document is based (specified by the GSP working group)

- ID of the generated document

- Time stamp for the creation of the document

- Language used for the protocol contents in line with the language code specified by ISO 639-1.

In other words, this category provides all information that applies to the overall concept. Creation date and creation time in the createDate field can be used here as an option to distinguish between different revisions of a GSP document for the same order (versioning).
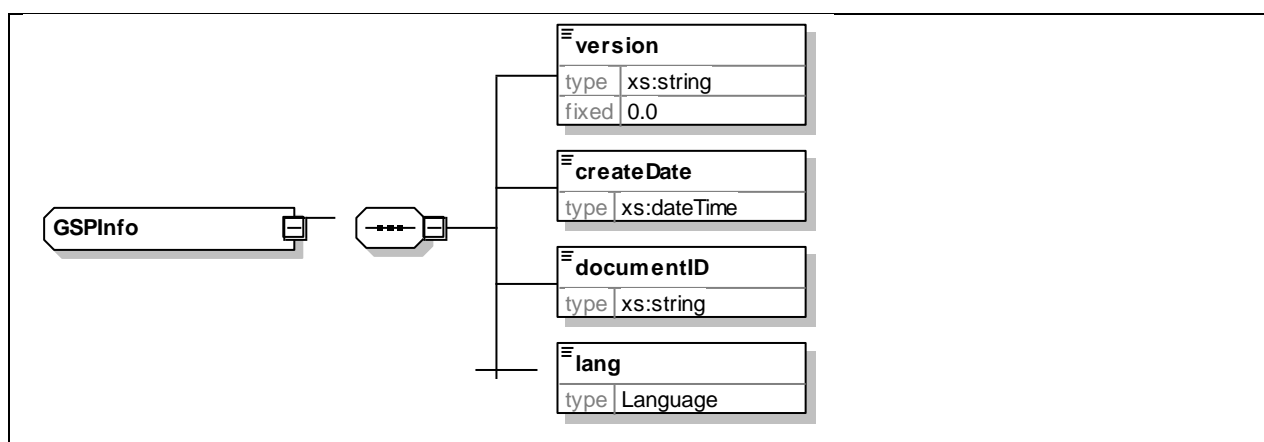
Figure 9: Structure of the GSP info data block

4.3   powerPlant data block

The powerPlant data block in the XML schema contains all information on the power plants relating to the individual energy system under consideration. Within the scope of TG7, this is normally the wind farm.

A power plant must always be assigned to the data of a GSP document. If this is an individual energy system, the information for the energy system should be used accordingly. This means that an appropriate RDS-PP® Conjoint should be defined for individual energy systems as well.
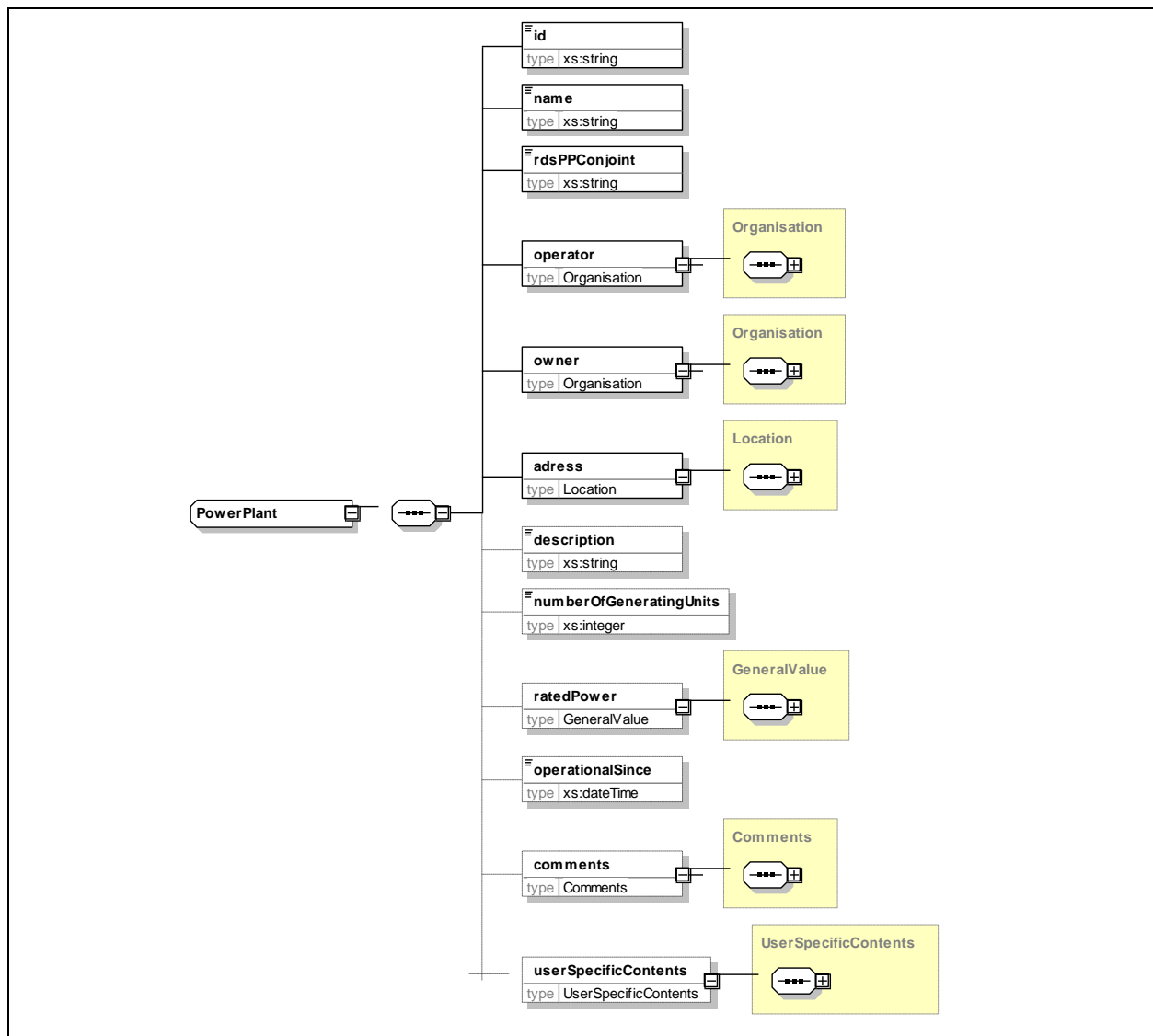
Figure 10: Structure of the powerPlant data block (wind farm)

The following minimum information on a power plant must be provided (system reference, see section 5.3):

- ID and name of the power plant (wind farm)

- RDS-PP® Conjoint for the wind farm or individual site in accordance with VGB S 832-T32

- Information on the owner and manager incl. electronic and postal address

- Information on the location of the power plant

- Optional, permissible information for wind farms is specified in revision 0 of these guidelines. Master data for all other types of plant can be transferred as user-specific content.

A long description, the nominal output (total) and the number of generating units (WTs) can also be transmitted on the power plant (wind farm).

As for every (large) data block with information units, comments and attachments as well as user-specific content are also permitted.

4.4   energySystem data block

The energySystem data block in the XML schema contains all information on the energy system (e.g. wind turbine) the GSP in question relates to. It has been designed primarily for wind turbines, but can also be used for other types of energy system.

A minimum of the following information must be provided on an energy system:

- ID of the energy system

- Information on the manufacturer, type, series and serial number

- Information on the owner and manager

In addition, the person responsible for the system appointed to the energy system in question for system operation can be stored using the contact data for the manager (see also section 5.14).

The following are also permitted as information on the energy system:

- Primary energy used (wind, biogas, water…)

- Commissioning date/date of manufacture

- Address of the WT (normally identical to the address of the wind farm)

- WT-NIS code of the system

- Selected technical values that may be relevant to the work planning process (hub height, rotor diameter, rated power…)

- End and, where applicable, the start of a warranty period in line with legal or individual contractual regulations

- List of equipment parts (directory of components) as well as RDS-PP system structure for the relevant energy system (see section 4.7.3).

Additional data on the energy system can be transferred as a user-specific parameter set or as attachments.

- The optional, permissible information for wind turbines is specified in revision 0 of these guidelines. Master data for all other types of system can be transferred as a user-specific parameter set.
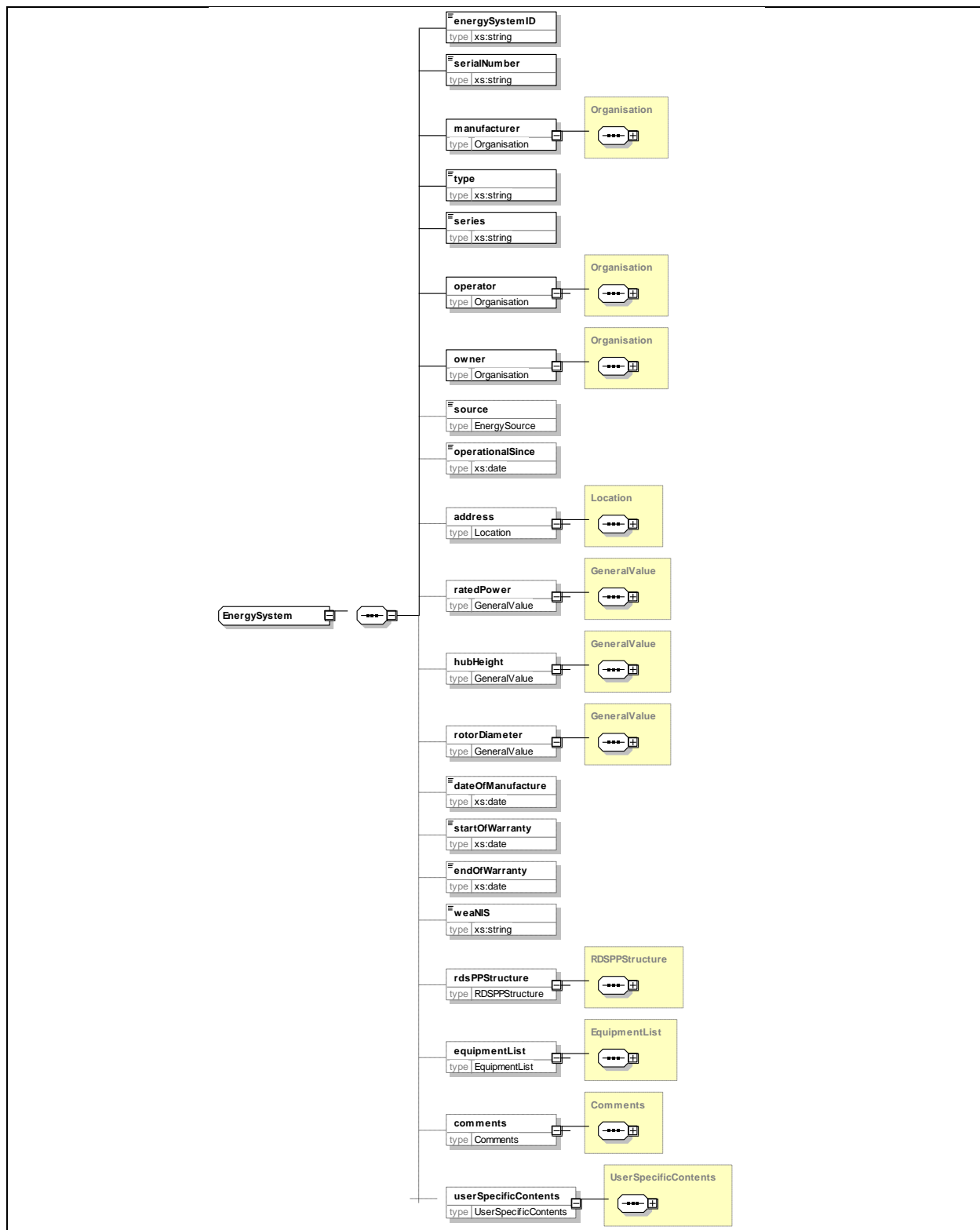
Figure 11: Structure of the energySystem data block (wind turbine)

4.5   workOrder data block

The workOrder data block in the XML schema contains all information on the work order and contains at least one order item. A work order relates to contracted work on various parts of an energy system which can be processed accordingly by a contractor as part of an activity type in line with DIN EN 13306. (see order reference usage rules, item and object reference and reference to the energy system, section 4.7.5).

The work order therefore defines the required work, materials, times, etc.

The data in a work order is initially compiled by the customer, and added to if required during the order planning stage, e.g. by the service management (see sections 3.8 and 3.9).

- Who is permitted to change which data in the order planning stage is not covered by these guidelines but is to be agreed between the users.

4.5.1   Contents of the work order

A work order contains a minimum of the following information for the contractor:

- Order ID and name

- Activity type in accordance with DIN EN 13306 Section 8

- Order priority and order status (log of the status changes)

- A minimum of data for an order item in accordance with section 4.5.2

- ZEUS condition assessment block 1 in accordance with TG 7 category D2 for the relevant energy system (history of the changes in condition at the time of order transmission)
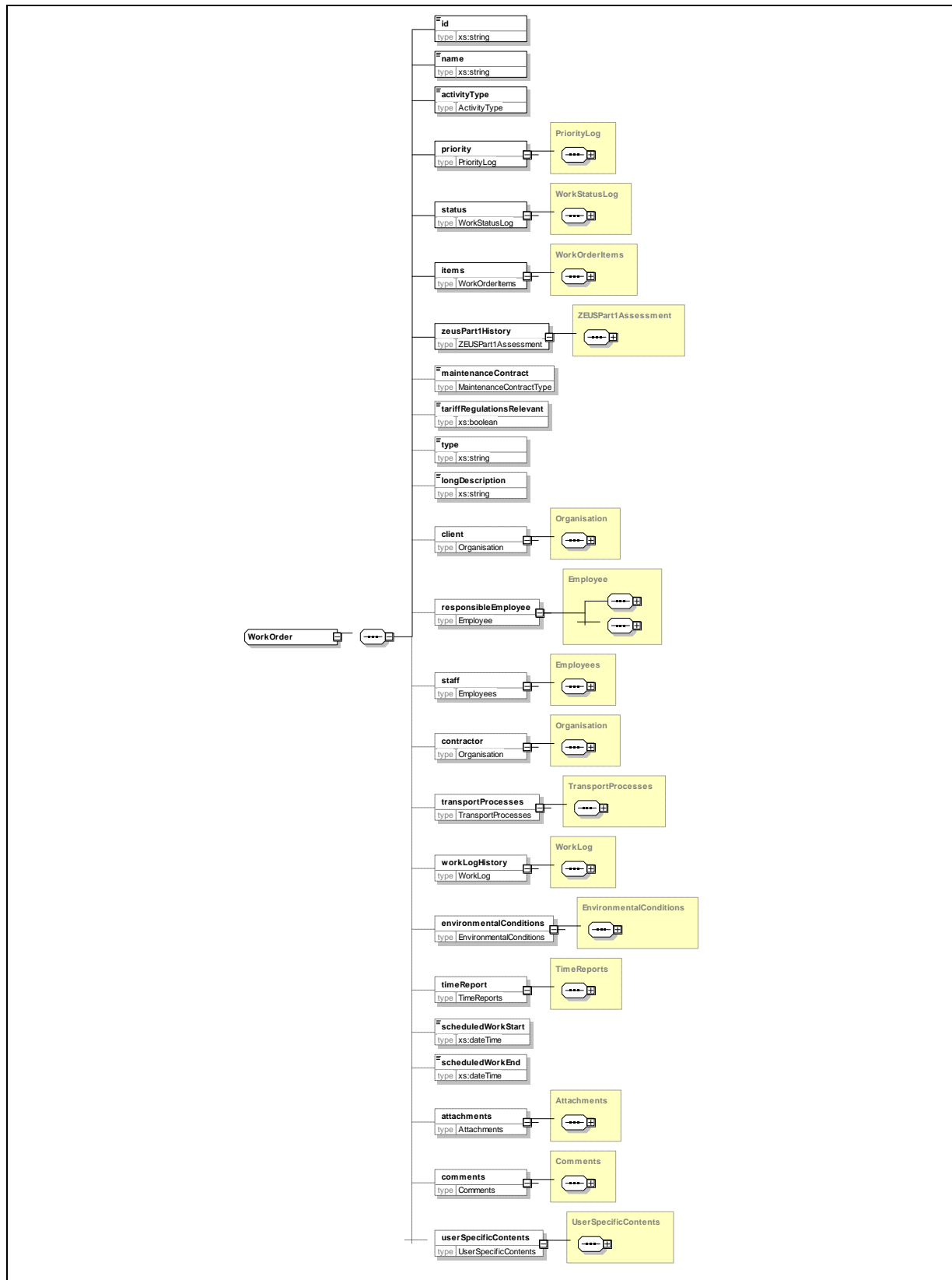
Figure 12: Structure of the workOrder data block

In addition, the following information is permitted as part of the order planning process by the customer or the contractor:

- Customer and contractor

- Person responsible for all work in the order

- User-specific order type

- Description of the order content (long text)

- Type of maintenance contract

- Requirement for customs processing (yes/no)

- Planned start of work/planned end of work

- Personnel requirements (qualifications and staff) from the order planning

- Planned transport processes (see section 4.7.5)

- History of the work completed on the energy system (WorkLogHistory)

- Environmental conditions

- Time-based specifications for the order

As well as comments, additional data on the work order can be transferred as a user-specific parameter set or as attachments.

4.5.2 Data on the order items

As well as the general specifications on the work order, it should be specified which maintenance activity (activities) is (are) to be carried out on which part(s) of the energy system.

The corresponding work for a system part (element in the system structure) should be recorded using order items, whereby every order item relates to an element of the system structure set up for the system (see object reference, section 5.4).

The previous set up of a system structure and the delimitation of the systems parts to be considered is required to this end to be able to assign the required maintenance activities (preventative and corrective maintenance) to the individual components (see also section 7.1).

The following must be specified for an order item on a component (item or orderItem information units):

- ID of the relevant order item

- ID of the corresponding work order

- Name of the order item

- Status of the order item (given as a history of status changes)

- Details on the relevant system part (assignable element in the system structure, incl. RDS-PP® equipment code)

- ZEUS condition assessment in accordance with TG 7 category D2 for the relevant part of the system (assignable element)

In addition, the following information is permitted in the GSP data format, which are typically compiled as part of the order planning process by the customer or by the contractor:

- Description of the work to be carried out and other information in long text

- Level (degree of complexity) of the maintenance task in accordance with DIN EN 13306

- Information on the equipment part representing the assignable element (removed, physical component)

- Details on the work to be carried out

- Qualifications required to carry out the activity

- Details on the equipment to be used (or scheduled)

- Staff (option for personnel planning)

- Measurements/measurement series

- Comments as processing notes

- User-specific content

Additional data on the work order can be transferred as user-specific contents or as attachments.
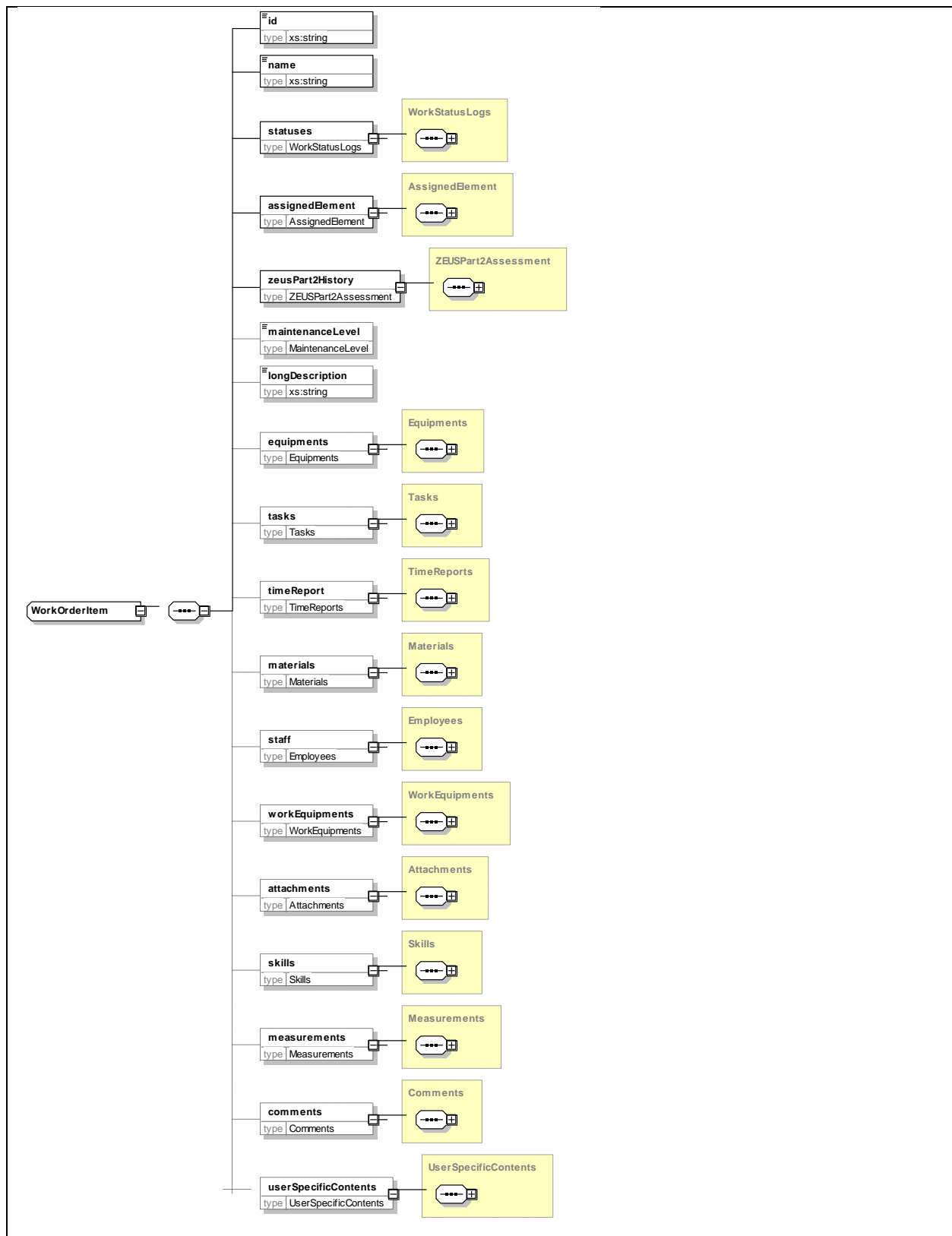
Figure 13: Structure for an order item for the work order

4.6   workReport data block

Data on the work report and data on the work order are compiled in a document. The information units contained in the workReport data block cover all data compiled by the service technician/assessor, etc. as part of the order processing on-site, primarily to document his/her work. The workReport data block in the XML schema contains all permitted information on the work report that relates to that work order (data blocks given above). At the time of commissioning (in other words, before starting work), this data block is not filled with content and is therefore an optional element.

This does not preclude the subsequent preparation and testing of the data recorded by the technician in a follow-on process (see section 3.9).

4.6.1   Contents of the work report

The workReport data block covers a minimum of the following information:

- Report ID and report name

- Work status (overall status of the order processing)

- At least one report item

- A minimum of the data for an associated report item (see section 4.6.2.)

- ZEUS condition assessment on-site for the energy system in accordance with TG 7 category D2

The specification of the following optional information is permitted:

- Long text to document the works carried out

- Staff involved (responsible employee as responsibleEmployee, involved staff as staff)

- Transport processes required for the work order (transportProcesses)

- Condition assessment in accordance with ZEUS Block 1

- Environmental conditions (e.g. weather on the day work is carried out)

- Work time recording for the entire order (timeReport - see also section 5.8)

- Attachments (e.g. appraisals, images, invoices and admin documents, measurement logs)

- Comments as processing notes

- User-specific content
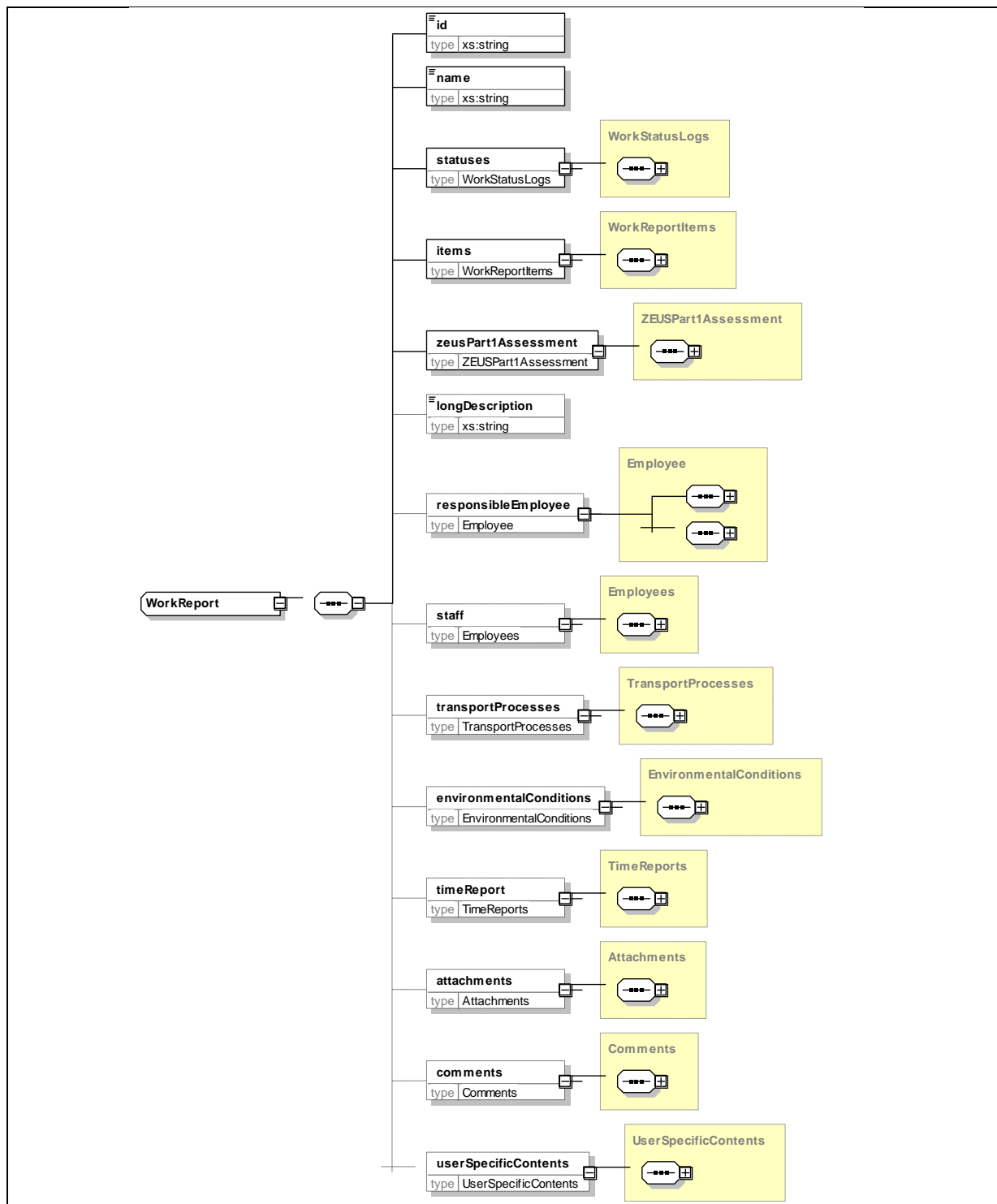
Figure 14: Structure of the workReport data block

As information recording takes place in different levels of detail in practice, individual pieces of information are permitted on the work report level and on the report item level, e.g. data on the working times.

4.6.2 Data on the report items

In addition to the general details on the work report, the maintenance activity (activities) carried out on which part(s) of the energy system should be detailed as part of the documentation on the works implemented.

The documentation of the works for a defined system part is provided via report items in the GSP, whereby each report item relates to precisely one element in the system structure of the system including its subelements (see object reference, section 5.4). A report item can relate to an order item, or be created as a new item as part of completing the work as an addition to the work order (see order reference sections 5.5 and 7.2).

Work on an element is documented in a report item.

The documentation covers a minimum of the following:

- ID

- Associated order item (if available)

- Name of the report item (can be taken from the order item)

- Editing status of the order item

- Relevant element (at least RDS-PP® equipment code, designation)

- ZEUS condition assessment for the relevant element incl. option for verbal fault description and details of a code classification
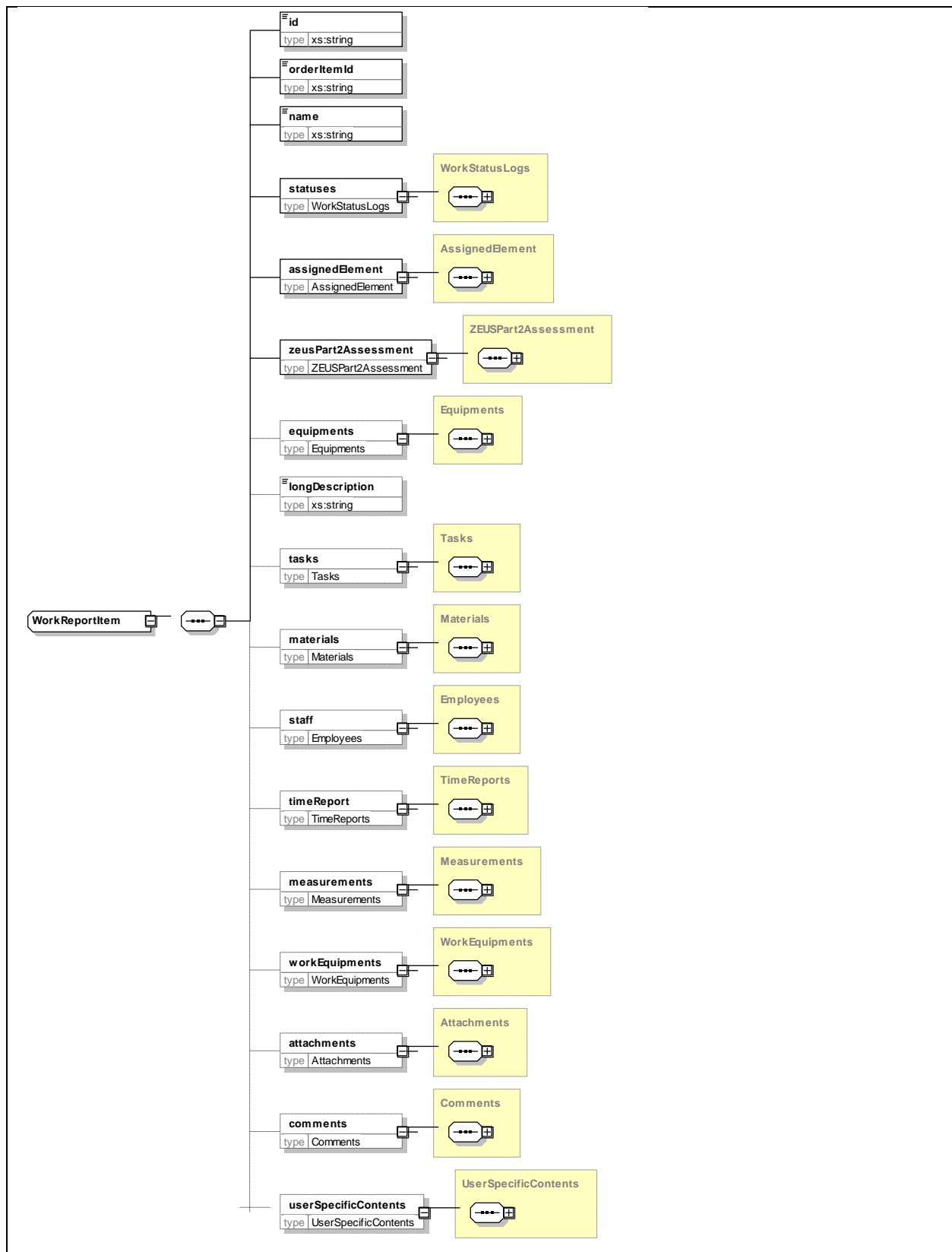
Figure 15: Structure for a report item for the work report

The following can also be transferred, depending on the user's needs:

- Information on the component installed at the installation site (equipment part = Equipment)

- Long text for the work description

- Documentation of activities (a minimum of the designation should be given: Status and type classification, times and work and measuring equipment required can also be transferred for an activity)

- Material used

- Personnel involved

- Work times (see also section 5.8)

- Measurements/measurement series (for the relevant system part)

- Work and measurement materials used (e.g. a calibrated measurement tool or lifting gear)

- Attachments (images, work instructions and type specifications for the component, measurement protocols, etc.)

- Comments

- User-specific content

4.7   Additional notes on the information structure

4.7.1   Formation of the system structure / RDS-PP®

The information units included in the GSP data format are structured so that a reference of all information to a standardised classification level can be produced in the defined structure of an energy system.

For this reason, the information on maintenance procedures should also relate to a system element defined in the system structure. As this element should be defined in advance, it is referred to in this guideline as what is known as an *assignable element*.

In accordance with the application rules on the object reference (see section 5.4), this means establishing a system structure with a reference code system standardised for the sector (RDS-PP®).

- The structure should ideally be defined down to the smallest logical unit for maintenance (smallest replaceable units (SRU)).

- As this requirement will not always be met in practice, the specification of information on object parts under the system structure is also possible and considered to a certain extent.

An order or report item contains exactly one system structure specification and relates to precisely one equipment part (removed and installed part where necessary).

The transfer of data to the system structure is carried out in the GSP data format in the assignedElement data block for the order and report item (see sections 4.5.2 and 4.6.2).

For details on removed components (equipment parts), see notes in section 7.4.

The information on system parts is included in the elements

- assignedElement

- Equipment.

If required, it is also possible to transfer entire system structures in the GSP data format (see section 4.7.3).
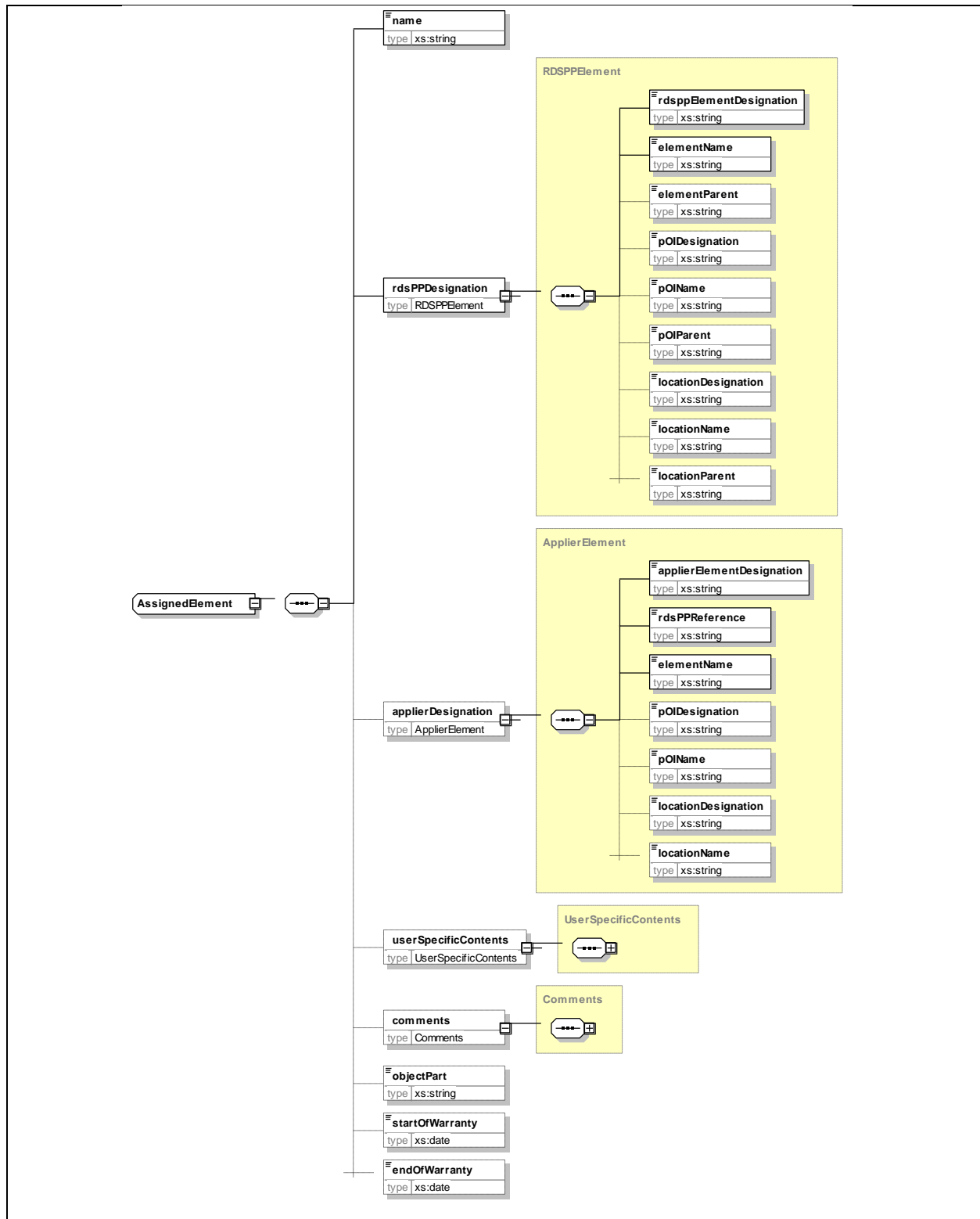
Figure 16: Structure of the assignedElement data block

The assignedElement data block contains the following as compulsory fields:

- The actual name of the element (e.g. designation from the manufacturer)

- The RDS-PP® code assigned to the element (equipment code and associated designation in RDS-PP®

In addition, information on the installation site (POI: point of installation)

- Name

- Installation site code

and on the location

- Name

- Site code

are permissible.

Where the system structure is not described in full in RDS-PP®, a user-specific system structure can be created referenced on the same level or a higher level RDS-PP® (applierDesignation).

The information units are identical to those of RDS-PP® here, but a reference to an RDS-PP® element should be given.

It is also possible to restrict all relevant information to a lower level object part (objectPart) which has not been defined in the system structure (for the relationships, see section 3.7).

4.7.2   Object types and object information in the GSP

Certain types of object are defined in the GSP data format.

These can be fixed (in other words permanently linked or inventoried) or mobile (brought across for the work order). For the designations of parts of the energy system, see section 3.7.

A distinction is drawn between the following:

1. The energy system itself as an evaluation unit.

2. Elements that have been defined in the system structure as system components of an energy system (assignable elements; e.g. motor, pitch gears)

3. Physically fitted components representing the defined system structure 1 to 1 (equipment parts/equipment with a type designation/serial number and installation date where applicable, e.g. specific motor for the pitch gears from a manufacturer).

4. On an element of the system structure as part of the material used as part of the maintenance work

5. Work and measuring equipment, i.e. the tools and equipment used to process an order (e.g. floating crane, calibrated measuring equipment)

6. Transport equipment used for order processing (e.g. service vehicle, helicopter)

Often a inventory may only be carried out for important/valuable equipment parts of an energy system. It should therefore be noted that the physical object (specific component) for the maintenance does not always have to be defined in more detail in the GSP assuming there is a unique reference to a specific element in the system structure.

Specific data required in the maintenance work is defined for objects as separate fields.
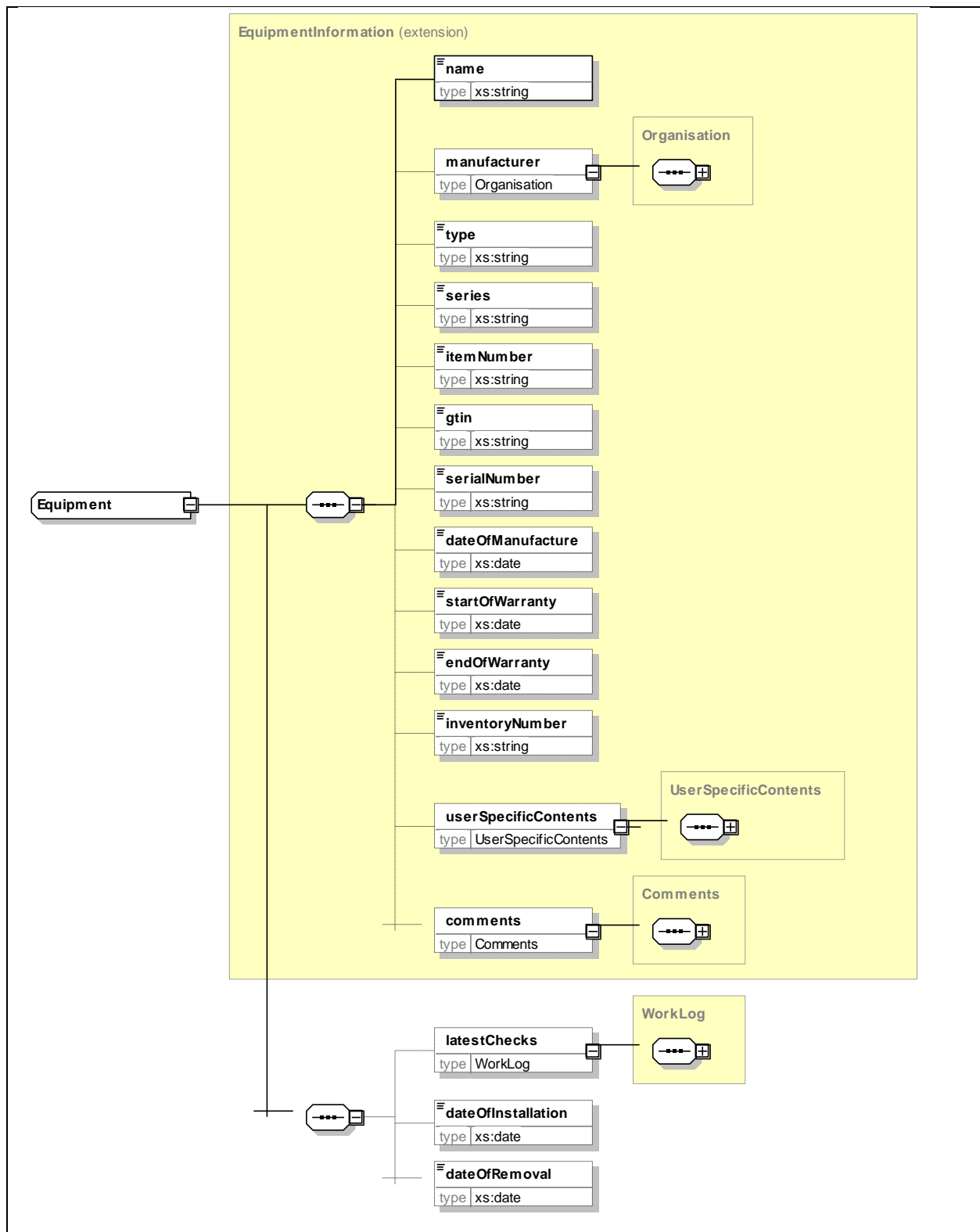
Figure 17: Object information using the example of an equipment part

The details of data on objects covers the specification of the object designation (compulsory field) and the following, depending on the needs of the user:

- for equipment parts, installation and expansion date, as well as

- History of the work carried out

For all of the object types given above:

- Manufacturer

- Type

- Series

- Inventory number

- Serial number

- Global Trade item number

- Production date

- Start and end of the warranty period

It is also possible to transfer the last work and inspections carried out (log of the maintenance activities/workLog).

If these details are not sufficient, the transfer of object parameters obtained from the IT systems is also possible via user-specific content.

In addition, files supplied are permissible for every object.

Examples of information assigned to an object as user-specific parameters or attachments include:

- Manuals, specifications (or links)

- Text modules from specifications and manuals

- Spare parts lists

- Work and safety instructions

- Technical data

- Hit list of faults, e.g. from ZEUS or typical patterns of damage obtained

- Lists with error codes from the software

- Hit list of spare parts replaced

- Lists with object parts (underneath/outside the system structure)

4.7.3   Transfer of system structures and parts list

The GSP includes relevant fields for the transfer of information on the structure of system.

The following can optionally be transferred in the main EnergySystem class:

- The system structure of the energy systems:
  A list of the RDS-PP® system structure for the corresponding energy system (see section 4.7.1.)

- The parts list for the energy system:
  A list of equipment parts used in the corresponding energy system (see section 4.7.2)

The option to represent the system structure and the parts list allows information belonging to the system in question to third parties. The information that varies from system type to system type or that is often different for each system can therefore be provided as required.
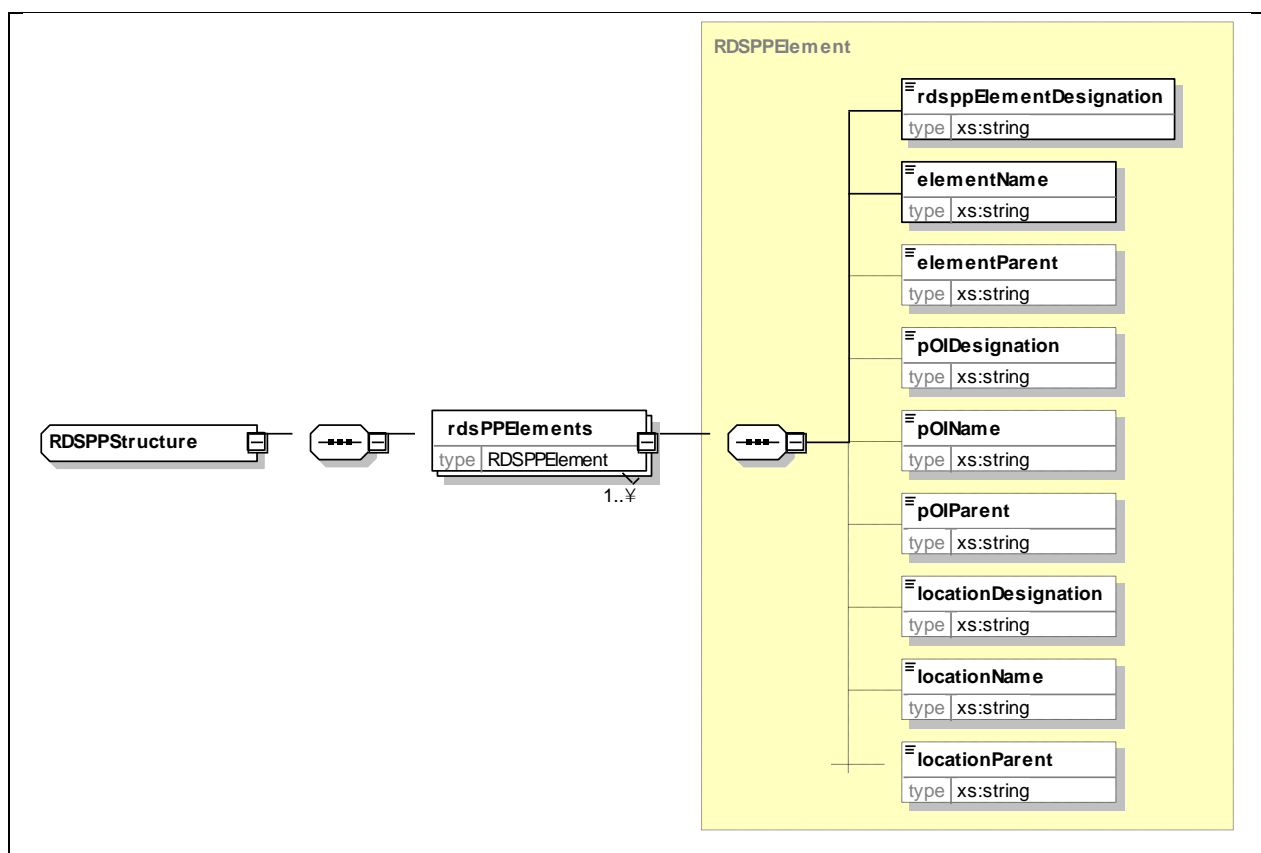
Figure 18: Structure for the representation of the corresponding system structure (according to RDS-PP®) in the GSP
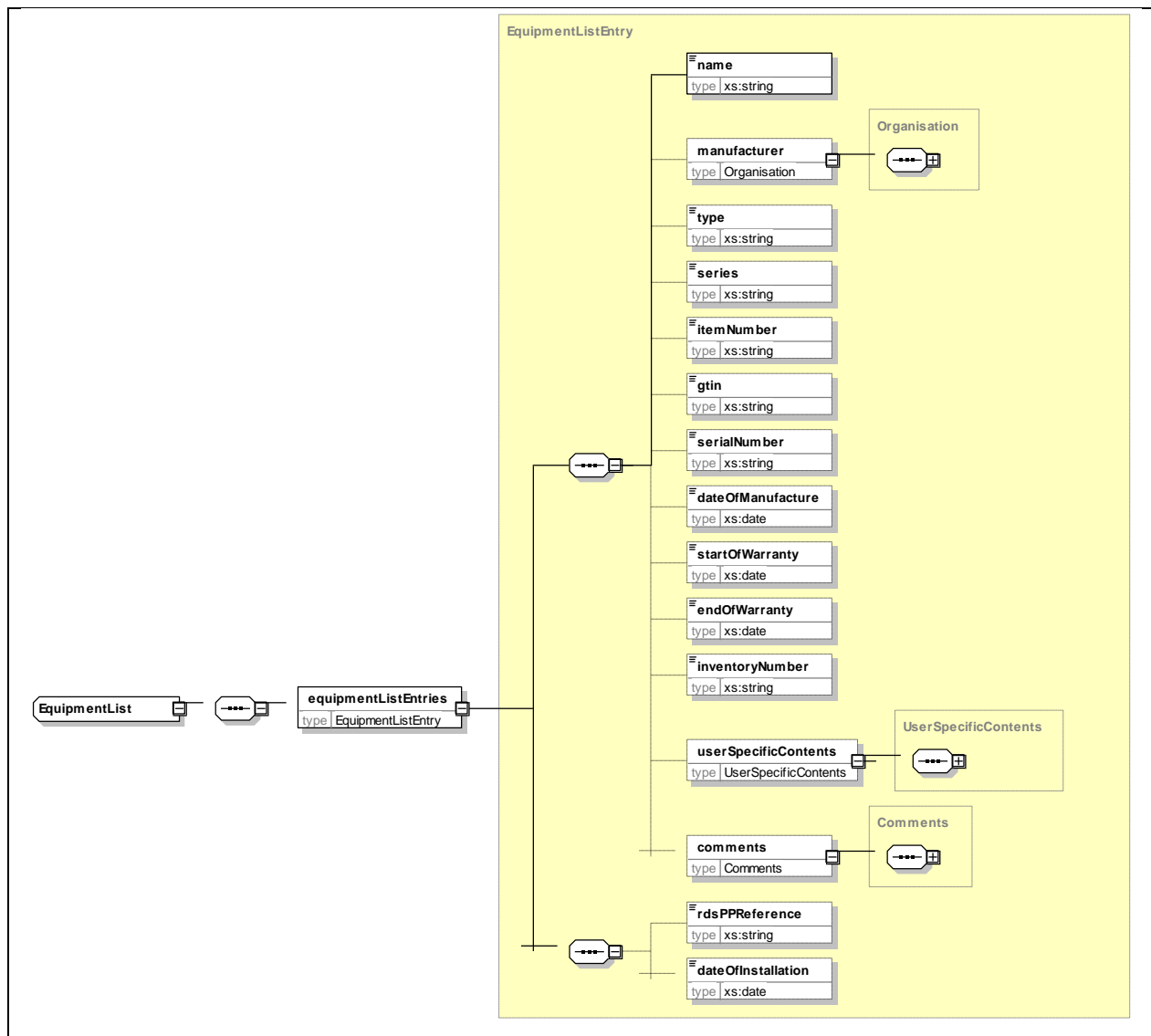
Figure 19: Structure for the representation of all equipment parts in the GSP

4.7.4   Details of organisations and persons

A distinction is made in the GSP between:

- Details of a person

- Of an organisation

- Of a contact in an organisation that can be accessed using a person element.

- Of an employee to whom organisations and qualifications can be assigned.

The Global Service Protocol designed for the anonymous transmission of information for persons involved, meaning that an ID, but not the name and other contact data, always need to be stored.

The details of names, etc. may be derived from other guidelines on maintenance (e.g. the person responsible for the system should be given, see section 5.14).

Which details on the person are stored in comments is determined by the design of the software systems and is not therefore covered by this guideline.

4.7.5   Details of transport processes

For settlement and documentation, data on the transport processes required can also be documented in GSP format. The recording of transport processes is integrated into the GSP and collected for a work order or a work report, whereby the necessary transport times can also be assigned as special activities (inward/outward journey) to a report item (and thus to a sub-order).

Planned transport operations (e.g. booked ship passages or material transports to the system) can be documented in the work order as required. The actual transport operations required are contained in the workReport data block.

Transport processes can be recorded in the GSP for the entire order, whereby the following must be stored:

- ID (consecutive number or journey/booking/transport order number…)
- Transport route (air, land, water)
- Carrier (transport company)

The other permissible information is based on the needs of the user.

- Carrier (transport company)
- Distance (incl. calculation method for the route)
- Type and description of the transport method (e.g. service vehicle 815)
- Shipping company (who is carrying out the operation)
- Parameters on the vehicle (e.g. load capacity, loading dimensions…)
- Type of transported goods (freight only or personnel, personnel and freight)
- Booked/paid transport capacity (weight, number of persons)
- Duration and/or start and end time of the transport process
- Start and end location of the transport process
- Comments

Both electronic travel documentation (log book) and transport order planning (e.g. booking with the transport company/shipper) can be documented in the GSP data format using these details.
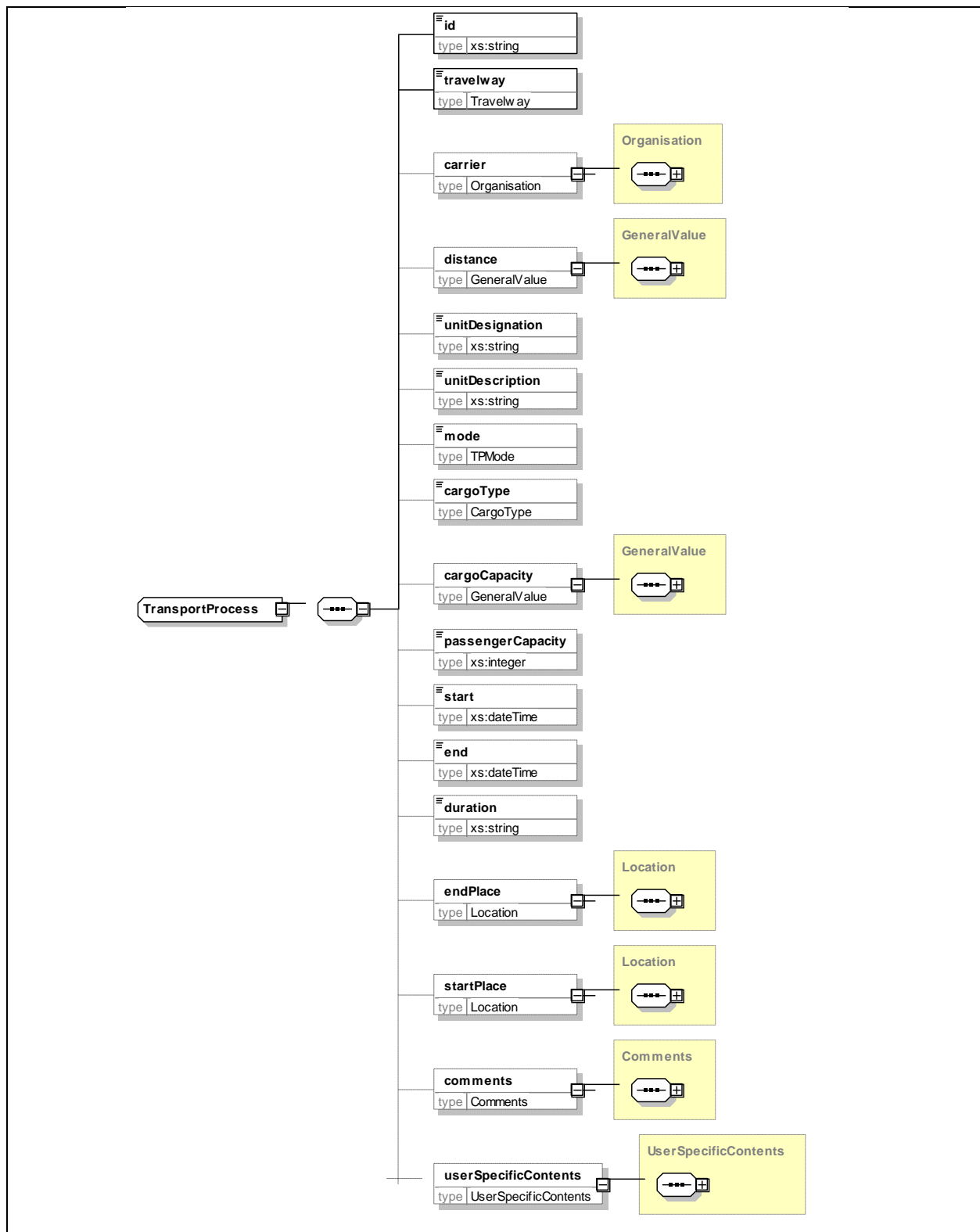
Figure 20: Data structure for transport processes in the GSP

4.7.6 Additional details of the ZEUS condition assessment

The GSP incorporates the use of ZEUS (TG7 category D2) for the evaluation of energy systems and the corresponding subsystem. The transmission of additional information on each ZEUS condition assessment (block 1 and block 2) is incorporated for the description of the ZEUS condition assessment.

The following information should be given to facilitate assignment and to provide information on the relevance of the condition assessment in question:

- Time stamp of the condition change/condition assessment
- Assessment status (see section 6.7)

It is also possible to specify the following optional information:

- Assessing person or organisation
- Additional condition/fault description as free text
- Error code
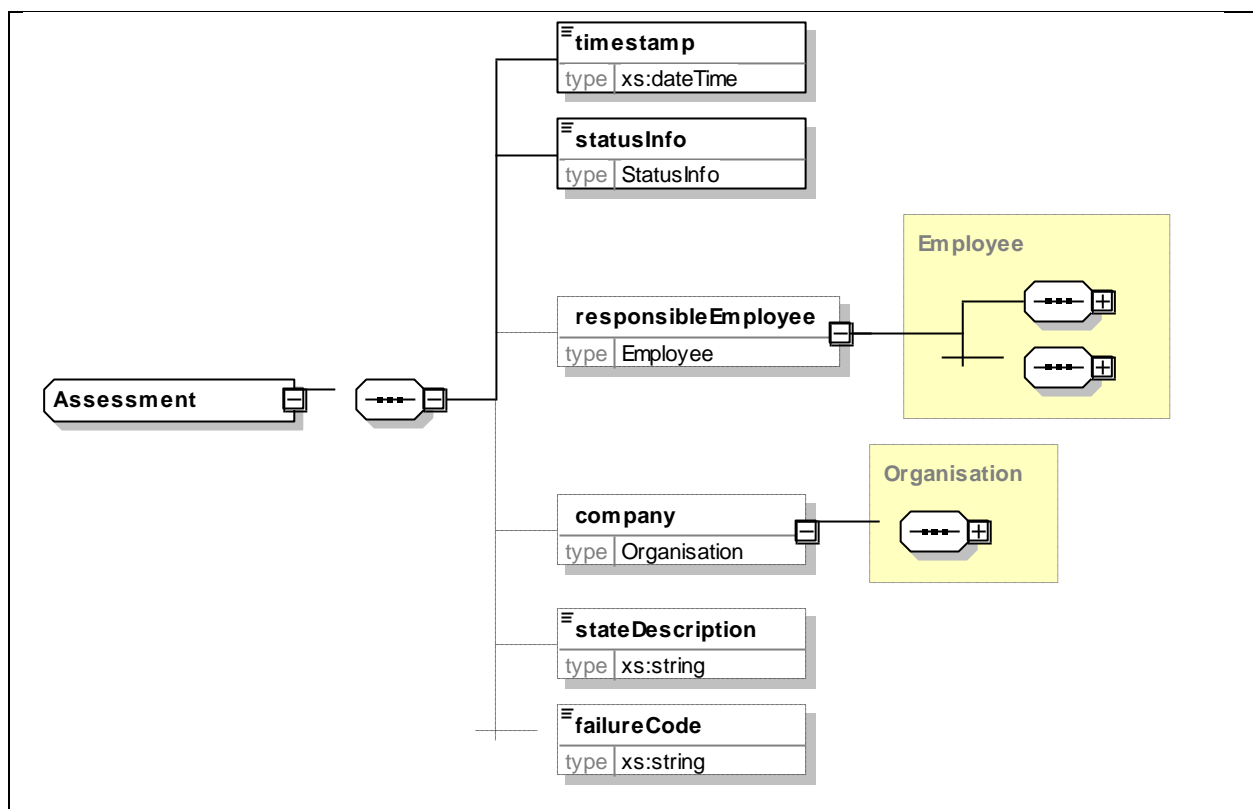
Figure 21: Structure of the additional information on the ZEUS condition assessment

4.7.7   User-specific content

User-specific content is used to provide

- the persons involved in the maintenance work for decisions and planning in the maintenance process

- with the software tools used for the structured preparation of information

to transfer additional information.

As the breadth of the usage options is significant, the possible user-specific content is not conclusively defined in these guidelines. These should therefore be agreed between the parties involved.

Potential examples for the use of user-specific information include:

- Object parameters (see section 4.7.2)

- Information on invoicing (e.g. prices and costs)

- User-specific criteria definitions (see section 6.1).

- Additional information for processing with specific software systems (e.g. SAP)

In addition, the GSP working group intends to submit recommendations for the format of parameters sets in future for specific areas of application to minimise the amount of modification required of software tools for typical applications.

- The application guide for these guidelines may contain more detailed specifications.

The recommendation is intended to be able to process the recommended parameter sets of all IT systems assuming this is appropriate for the application/user in question.

The following information can be provided for the software if required for processing user-specific content:

- ID of the parameter set (compulsory field)

- Category of the parameter (to be able to represent data content with multiple dimensions, e.g. table columns in value tables)

- Time stamp of the entry of a user-specific parameter

- Reference to a responsible employee

Multiple data types are permitted for parameters transmitted as user-specific content. In addition, links to files (attachments) can also be included in user-specific content.

User-specific content is structured as follows in the GSP data format:
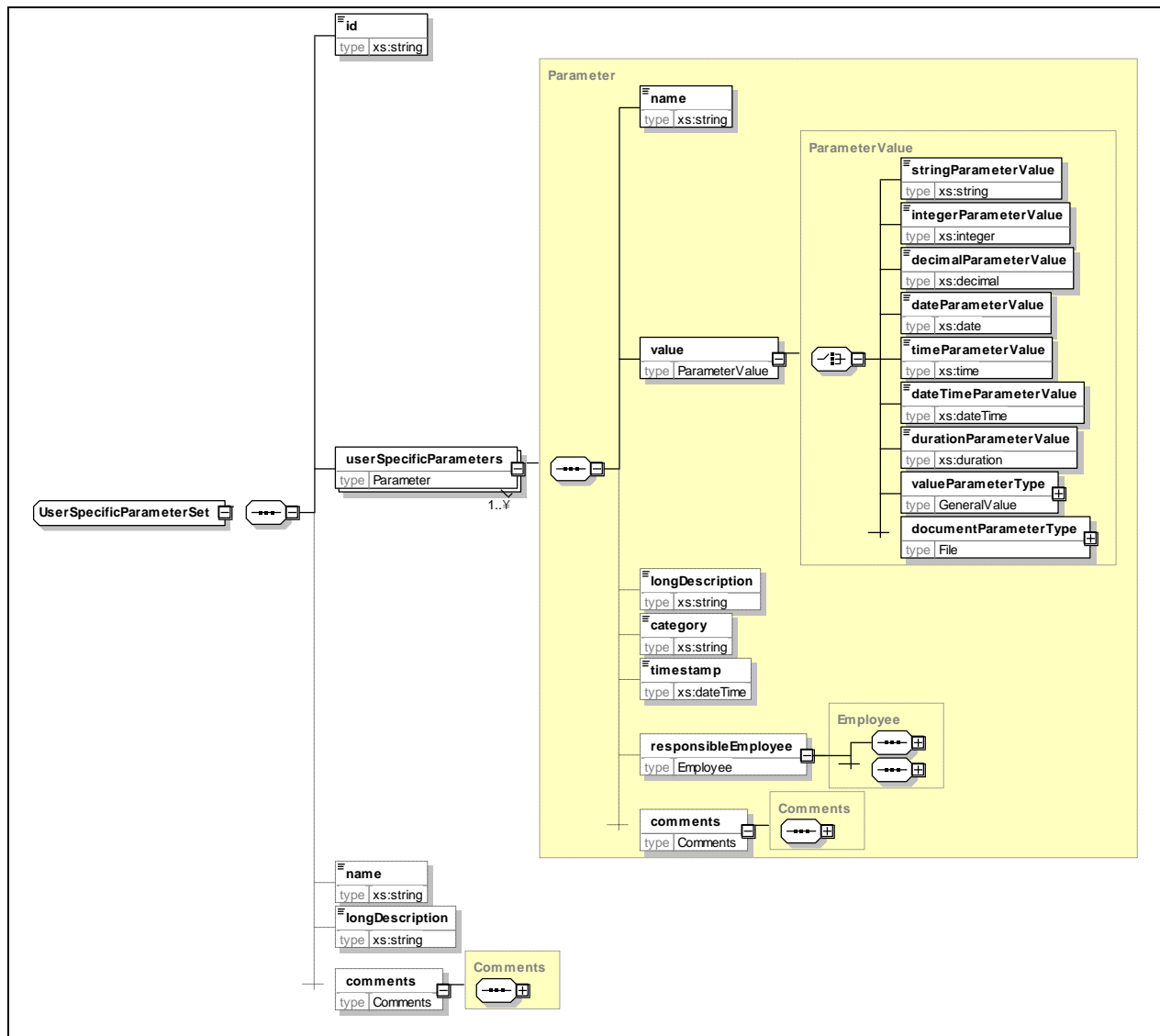
Figure 22: Structure of the user-specific content

5   GSP application rules

When maintenance data is transferred between different parties in a standardised format, agreement is required on the relevant usage rules.

This is the only way to ensure the following across the entire data processing chain:

- The information is recorded, compiled, assigned and interpreted in accordance with standardised aspects

- The information recorded and transferred in the GSP data format can be compiled effectively to create useful and consistent documents on the maintenance process

- Assessments are possible using the maintenance data transferred that apply to all situations, e.g. the assessment of the reliability of system components and system types.

5.1   Conformity rules

To ensure conformity of the data transferred in a GSP document, the following general rules for use must be observed.

All information units in the data blocks of the GSP data format must conform to the specifications of these guidelines (Attachment A).

Data in the GSP data format should be transferred in the GSP document format (see section 8).

The data transferred by the users must contain a minimum of the information units and contents identified as compulsory.

Recommended information units and recommended content should be used in a standardised way if appropriate for the use in question.

- Specifications for the essential information units to be provided are defined in section 4.

- The structure of the permissible information units (XML schema) is documented in Attachment A.

User-specific information units should only be defined and used where this has been (contractually) agreed between all users involved or if recommended by the GSP working group.

In line with the structure specified for the purpose, the users can agree the inclusion of additional information units in the data format as user-specific content (see section 4.7.2).

- For user-specific content, the GSP/FAIH working group at FGW e.V. can specify recommendations for specific applications.

- The GSP working group is pleased to accept suggestions and experiences from users of the guideline.

The requirement for the transfer of data in the GSP format is interoperable data acquisition and data management.

Data acquisition and data management of an IT system interoperable with GSP must follow the rules specified in sections 5.1.2 - 5.1.8.

- A database on an IT system is GSP-interoperable when it is possible to create a GSP from the database. This is the case when at least all information units (types, elements) in these guidelines that are identified as compulsory can be generated from the available data.

- The use of a separate assignment logic is permitted in this respect if it is possible to clearly reference the assignment logic required in these guidelines.

An interface compatible with the GSP data format between two IT systems interoperable with GSP must be able to process and generate the data in accordance with the data format defined in section 4 and the document format specified in section 8.

- The data exchange between two IT systems interoperable with GSP can also be ensured in ways other than data transmission in the defined format, such as via a direct database access with or without data synchronisation.

- In this case, the conformity rules given above apply for data acquisition and data management.

5.2   Time reference

The individual GSP documents must be comparable in terms of the processing status, and must permit conclusions to be drawn when status changes are implemented.

All information units containing a time stamp should be updated on each update of the associated element by the software.

- Example: Time stamp for status change, time stamp for comment editing, time stamp for a ZEUS condition assessment.

The creation date of a GSP (createDate) should be updated by the software on each document save operation.

- Document saving is referred to as the saving, exporting, creation, update/synchronisation time of the updated element.

5.3   Reference to the energy system

The maintenance data recorded must be assignable to the relevant evaluation unit. The following usage rules must therefore be observed.

Every work order must relate to precisely one energy system.

Every energy system must be assigned a power plant as a higher level system cluster.

The GSP data recorded structured in XML format in accordance with section 7.6.1 relates to precisely one work order with the corresponding order items in the scope of these guidelines.

- The energy system (generating unit) is normally referred to as the evaluation unit in the scope of the guideline (see also TG7 category A, section 3.5.).

- In the field of wind energy, the energy system or generating unit is normally the individual wind turbine.

- The documentation of the maintenance in the form of work orders relating to multiple energy systems or multiple power plants is not permitted when using these guidelines.

- In the field of wind energy, the power plant is the wind farm as a relevant cluster of energy systems.

- That a GSP data record relates to one work order takes into account the fact that most work on energy systems is carried out without consultation from the management. This means that a work order should be created for every activity on a system, including inspection, fault diagnosis, etc.

The use of the GSP document format described in these guidelines for other types of energy system (e.g. substation platforms, internal park cabling, etc.) is possible and is actively recommended.

The GSP document format can be used primarily for maintenance operations on energy systems that have a reference code system for the system structure comparable to the RDS-PP® ("object reference").

5.4   Object reference

The processing of maintenance orders is documented in the GSP principally for an assignable element that can be clearly identified and defined by a reference code in the system structure incl. any sub-elements it may have.

- The implementation of the data transfer in accordance with the GSP data format therefore requires the use of an adequately detailed system structure, see section 7.1.

Every order item should be assigned to exactly one assignable element in the system structure.

Every associated report item must relate to one order item and thus to the same or a different assignable element in the system structure.

Assignable element refers to the following, with reference to TG7 category A section 3.5:

- The assignment to a maintenance object in accordance with standardised criteria can only be carried out for the elements included in the system structure.

- The assignment can only be carried out in accordance with the information available at the time the documentation is produced (suspected damage or automatic error message triggered by the system monitoring).

- For more details, see section 7.2.

- For the assignment of order and report items, the order reference applies with the applications defined in section 5.5.

In the scope of the TG 7 category D3, a service protocol includes at least one report item.

Every report item should be assigned to exactly one assignable element in the system structure.

- The reference of multiple report items to one order item is permitted.

- For more information, see section 7.2.

In the scope of these guidelines, the RDS-PP® reference code set should be used for the maintenance documentation in accordance with the requirements of the VGB-Standard-S-823-T32 usage guidelines for the wind energy sector.

- The guidelines are currently in draft form and are expected to be released during 2014.

The reference code set to be used when setting up the system structure must include the equipment code.

It is also recommended to specify the reference code for the installation site:

- for the equipment code with function and product aspects, see VGB-Standard-S-823-T32; 2012-04 DE section 5.5.

- for the installation site, see VGB-Standard-S-823-T32; 2012-04 DE section 5.6.

- for the identification of energy systems, see VGB-Standard-S-823-T32; 2012-04 DE section 7.2.

It is also recommended to identify the installation site.

- The regulations of the guidelines TG7 category D1 should be observed here as necessary once published.

The additional use of an individual, user-specific reference code system is permissible assuming the logical item-based assignment to an RDS-PP® equipment code is guaranteed.

- The user-specific system structure can be more detailed than the classification according to the RDS-PP® system structure, assuming the assignment is created uniquely for every system element.

It should be ensured that all users of the GSP data format can carry out a logical, item-based assignment to one and the same system structure.

- This means that the IT systems must be able to access a standardised system structure for the relevant system.

- The GSP permits the transfer of the system structure belonging to the relevant energy system.

5.5 Order reference

For the continuous, traceable documentation and itemised processing of the maintenance activities, the maintenance data logged during the creation of the work report must be linked to the actual order data. The following therefore applies:

A maintenance activity is only logged within the protocol data block. The planned values of the order data block are retained permanently.

The maintenance documentation is completed by the addition of information in the protocol data block, whereby status entries in the order data block can be changed.

- This requirement relates to the data-based separation of the documentation for the work order and work report. Users are free to incorporate the dynamic modification of work order data, even during the processing of assigned order items.

A report item should relate to precisely one order item.

- For a new report item to be created without a reference to an existing work order (expansion of the work order), the user in question will need to have the relevant authorisations.

In addition, the contractor completing the works will need to be recorded for an accurate order reference and the work order will need to include the information units given in DIN EN 13460.

- See information units in the work order in accordance with DIN EN 13460.

5.6 Item reference

For the continuous, traceable documentation and itemised processing of the maintenance activities, items must be separated by activity type in the maintenance documentation.

The following therefore applies:

The maintenance documentation must be implemented separately for all maintenance activities in accordance with DIN EN 13306. Several activities of the same type are permitted to be combined in one work order. The relevant maintenance type should also be documented in line with DIN EN 13306.

- A work order, and thus a service protocol data record transmitted in the GSP data format, is therefore only permitted to contain data for one activity type.

- Activity types for maintenance are defined in DIN EN 13306, section 8 (part B).

- Maintenance types are defined in DIN EN 13306, section 7.

- When using an operator-specific code to describe status conditions, events and event causes, proceed as appropriate in line with these instructions.

- The relevant ZEUS codes for the categorisation of the maintenance are given in TG 7 category D2 revision 1 02-08-xx and 02-09-xx.

5.7 Condition assessment

If required, the condition assessment for each assignable object (element in the system structure) should be carried out consecutively for the entire monitoring period. In the context of the

maintenance documentation this should be implemented via a condition assessment criteria in accordance with criteria used in a standardised way.

In the scope of this guideline, a condition assessment and description should be carried out in accordance with the standardised status/event/cause code (ZEUS) according to TG 7 category D2.

- The application of the ZEUS code is a requirement of TG7 category A, see section 3.5.2 .

- The observation period should begin at the time of system acceptance.

- The responsibility for the ZEUS assessment (e.g. service technician, engineering, service management, etc.) is not covered by these guidelines.

- The condition assessment can be carried out directly in the process of data acquisition or on the basis of the data submitted downstream with the GSP.

- Other points are regulated in TG 7 category C.

5.8   Staff and time recording

Whether and how staff and working hours are to be transferred is based on the agreements of the individual parties involved in addition to the legal provisions.

For this reason, the GSP includes multiple options for staff and time recording including the specification of required qualifications. However, which level and what information is transmitted for staff and time recording is not covered by these guidelines.

To ensure the GSP interoperability of the IT systems and to meet the documentation requirements according to DIN EN 13460, at least the transmission in the GSP and the processing of the following information units is recommended on the level of the work report (WorkReport):

1.   List of the staff involved (if necessary, with anonymous ID only)

2.   working hours hours spent for the entire work order (incl. an indication of the working type time and the activity category).

- Corresponding provisions of the DIN EN 13460 and (when published) of the TG 7 category C must be observed.

- The transfer of the required activities of the staff involved may also be required (see also DIN EN 13460).

5.9   Scope and completeness of the data to be transferred

For data storage interoperable with the GSP, it is advisable to store all information units of a GSP data record included in the data format centrally in one place.

In addition, depending on the specific application to be implemented, the transmission of partial data is permitted if the assignment to a service protocol data record can be ensured on the IT side and the structure of the data format is observed for the parts transferred (valid GSP document).

The extent to which operator-specific parts in the transferred service protocol data record are displayed and processed is covered by the arrangements of the parties involved.

- The onward IT-based processing and testing and the adjustment of the service protocol data in the GSP data format are not covered by these guidelines.

5.10 Missing information in mandatory information units

In accordance with application rules defined in section 5.1, a GSP document must include details on all mandatory (compulsory) information units.

If a mandatory information unit in the *special* application is not required in exceptional cases, or if there is no data for it in an exceptional situation, the following applies to users of these guidelines:

A mandatory information unit for which there is no content, should be included in the GSP with all mandatory elements, but the content should be left blank.

If content is specified for the information units, in this case the specified categories should be used for unspecified or missing data.

- Specified content is defined in the XML schema for the GSP data format in accordance with section 7.6.1 of these guidelines using enumerations or specified content (fixed="…").

- for enumerations, see section 6

5.11 Uniformity of designations in the master data

To improve the interpretability of data, all parties involved in the maintenance should agree and use uniform descriptions.

A designation should be specified in the scope of these guidelines in a standardised way for all users of the GSP by the party to whom they primarily relate.

- Example: A WT type should be specified by the manufacturer.

- Example: A company name should be specified by the relevant company.

5.12 Units of measurement to be used in GSP data

In a GSP document, it is only permitted to use units corresponding to the international system SI of units for recording measurements and descriptions, in accordance with DIN 1301. The depiction of the units in the GSP corresponds to the CIM procedure (Common Information Model) and is carried out using a separate unit multiplier.

Individual deviations for the information units (elements) affected are identified in the element description. In these cases, the unit specified in the element description should be used.

- For the element description, see section 7.6.1 of these guidelines.

- Rev. 0 of the guidelines does not include any details on payments, and therefore does not cover units of currency.

5.13 Language of the Maintenance documentation in the GSP

The maintenance documentation (M documentation) should be given in a common language for the work order and work report in the scope of these guidelines.

The document language should therefore be stored in the protocol. The language codes according to ISO 639-1 should be used for the identification of the document language.

The language for the documentation of the GSP is to be recorded in the GSP info data block in the GSP data format (see section 6.18).

The language of other content linked in the GSP such as product and material specifications, manufacturer specifications, etc. may be different from the M documentation language in some circumstances.

Which procedure is correct here and whether or not links to language-specific documents or object parameters are to be included in the GSP, is not the subject of these guidelines.

5.14 Person responsible for a system

If a person responsible for a system is specified for the energy system in the current version of DIN VDE 0105-100, it must be noted in the GSP in the order data.

To do this, a corresponding contact should be transferred into the work order data in the operator information unit.

5.15 Use of comments

Comments are all the information which are used primarily as processing notes for the internal communication between the parties involved. The comment fields (comments) are intended for this purpose. In particular, it might not always be useful for the written M documentation to include all comments in the maintenance documents.

The following principle should be followed so that the use of comments in the GSP does not involve any information becoming lost or not clearly displayed.

Information to be included in the continuously archived M documentation is not permitted to be noted as comments.

- The scope of the M documentation is regulated by local work instructions and the regulations governing the M documentation, e.g. TG 7 category C.

- Long text fields or special fields are intended for all supplementary information in the protocol.

6 Standardised categories to be used

6.1 Structure of a standardised GSP category code

Given below is a description of the categories specified as the selection in the GSP for the assignment of individual information fields. The specification of the individual categories is based on existing standards where possible.

In the GSP data format, the application of standardised categories is obligatory for the areas given in this section.

This means:

All categories defined in the GSP should be language-independent, i.e. its structure corresponds to the code defined for it.

- The application guide may include other instructions.

- Coding of GSP specific categories

The code to be used in the GSP should be structured as follows without language dependence:

GSP-KKK-NNN

with:

GSP: Codes for tested category in accordance with the specifications of TG 7 category D3

KKK: ID group of the list (=enumeration list used)

NNN: Number code for the enumeration to be coded

The full text names of the German and English enumerations used are stored as annotations in the schema definition.

Example of an enumeration for the activity status (PossibleTaskStatuses):

```
<xs:enumeration value="GSP-STS-899">
        <xs:annotation>
                <xs:documentation source="description" xml:lang="en">user specific</xs:documentation>
                <xs:documentation source="description" xml:lang="de">Anwenderspezifisch</xs:documentation>
                <xs:documentation source="description" xml:lang="fr">spécifique à l'utilisateur</xs:documentation>
        </xs:annotation>
</xs:enumeration>
```

For (exceptionally) undefined or unassigned categorisations, the value GSP-KKK-999 is stored in the data record.

For the "other" categorisation, the value GSP-KKK-998 should be stored.

The value GSP-KKK-801 ("user-specific") is stored as a reference to a user-defined enumeration.

- It must be possible to interpret agreed user-specific enumerations and to transfer these as user-specific content.

- The application guide may include other instructions.

6.1.1   Codes for ZEUS categories

For the codes for ZEUS categories, the ZEUS code is used directly in line with TG 7 category D2 without a code letter. Details on the ZEUS categories can be found in section 6.6.

- Example:

  01-02-97
  = ZEUS block 1 - Functional condition status - undefined functional state

6.1.2   Codes for the document languages

For the codes for the document language, the language code is used directly in accordance with ISO 639-1. Details on the language codes can be found in section 6.18.

6.2   Classification of the energy system according to the type of energy used

The classification of the energy systems according to the energy type used is carried out in line with the categories defined in the Common Information Model (CIM).

- The possible energy types are defined as an enumeration in SimpleType EnergySource.

6.3   Categories to be used for work orders

Typically, the input and processing routines are adjusted in IT systems for order processing via order types.

For this reason, specified order types should be used uniformly in GSP-interoperable IT systems.

- The possible order types are defined in the SimpleType ActivityType as an enumeration.

- The possible order types are based on DIN EN 13306:2010-12, section 8 (part B).

- User-specific order types should be transferred as user-specific content, see section 4.7.7.

6.4 Categories to be used for the processing status of work orders and items

The processing status of maintenance (M) measures should be documented in the application area of the guideline with a schema compatible with the TG 7 category D2. This permits the assignment of the ZEUS code 02-11 to be linked automatically to the status of the order or of the protocol and its positions as part of processing M measures.

- The possible status messages are specified in the SimpleType WorkStatus as an enumeration.

- The corresponding provisions of the TG 7 category C should be observed accordingly following publication.

6.5 Categories for the status of activities

In cases where the user processes stipulate the documentation of the status of individually documented activities, an assessment should be carried out based on TG 7 category D2 but simplified.

As the "work" level in the work report documents consecutive activities or activities processed in parallel when processing a commissioned M measure on one and the same component (assignable element, see section 5.4), no reference to the ZEUS code is not permitted or required here.

- The possible status messages are specified in the SimpleType TaskStatus as an enumeration.

6.6 Condition assessment in accordance with TG7 category D2 (ZEUS)

The application of the ZEUS code for the status description in accordance with TG7 category D2 is compulsory in the scope of these guidelines, see section 5.7.

- The correct use of the ZEUS code is checked against the SimpleTypes ZEUS0101-ZEUS0212, ZEUSKA01-ZEUSKA05 as well as ZEUSKE01- ZEUSKE0103 via enumerations.

6.7 Categories to be used for the status of a ZEUS condition assessment

In the event of a division of tasks in the condition assessment - for example, between Service, Service Management, Operations Management and Engineering - it can be useful to make a preliminary condition assessment based on the information transferred in the GSP data format then evaluated after the work completed by the service engineer.

- The status of the condition assessment is specified in accordance with the enumeration specified in the SimpleType StatusInfo.

6.8 Classification of the M measures according to their complexity (maintenance level)

A classification of the M measures of a corresponding order or report position can be carried out based on DIN EN 13306:2010-12, section 7.13, depending on its complexity.

- The possible maintenance levels are specified as an enumeration in SimpleType MaintenanceLevel.

6.9 Description of file types in the attachment

For simplified assignment and processing, file attachments to the GSP protocol can be categorised in accordance with the upper level categories of the MIME types according to RFC 2045.

- The possible MIME types are stored as an enumeration in the SimpleType MIMEMediaType.

6.10 Units and unit symbols

In the specification of numerical values (e.g. measurements), an SI unit and the corresponding unit symbol must be specified in a standardised way to ensure comprehension.

6.10.1 Units

For the standardised designation of values, SI units should be used (in accordance with DIN 1301).

- The SI units are stored as enumerations in the SimpleType UnitSymbol.

6.10.2 Unit symbols

The unit symbols (SI prefixes) can be used to map the corresponding size to the values described, in accordance with DIN 1301.

- The possible unit symbols are stored in the SimpleType UnitMultiplier as an enumeration.

6.11 Recommendation for the assignment of order priorities

Different concepts have developed for the assignment of order priorities. No application rules have been defined here in the context of these guidelines.

The order priority can be indicated in the GSP by a ranking number from 1-99.

However, as IT systems involve the order priorities in the sorting and display, the following representation of the order priorities is proposed in this revision of these guidelines:

Attribute	Permitted content	Relevant designation
WorkOrderPriority	10	*Emergency (priority over all other measures)*
	20	*High priority (to be processed within 24 hours)*
	30	*Medium priority (to be processed within 36 hours)*
	40	*Low priority (to be processed within one month)*
	50	*Can be delayed to be processed during the next appropriate maintenance package)*
	11-19 … 21-29 … 51-98	*Space for user-specific priority categories* *< emergency* *<high priority* *etc.*
	99	*No prioritisation*

- The numbering of the user-defined order priorities should be carried out in such a way that the orders can be ordered in line with their priority together with the recommended order priorities in a ranking list.

6.12 Time types in the time recording

For example, to implement detailed time recording in the work report, the work time can be recorded in break time, working time, break and waiting time.

- The possible categories for times are stored in the SimpleType TimeType as an enumeration.

6.13 Remuneration surcharges

For detailed time recording, it is also possible to specify the time category according to which the work time is to be settled (shift surcharge, weekend and holiday surcharges, normal working hours, other surcharges).

- The possible categories for times are stored in the SimpleType TimePaymentType as an enumeration.

- For the time recording, calculation of the time types and remuneration categories are not specified in these guidelines. If necessary, a parameter record should be agreed as user-specific content, containing additional payment-related parameters.

6.14 Gender and salutation

In addition to the staff ID, the gender of a person should also always be given.

- The categories for genders are specified in the SimpleType Gender.

6.15 Traffic routes

With transport processes, the type of traffic route can be categorised.

- The possible categories for traffic routes are specified in the SimpleType Travelway as an enumeration.

6.16 Transport modes

To simplify the documentation of the transport processes (common recording of onward and inward journeys), defined categories can be stored for the type of the transport process.

To process the distances stored for the transport processes, the category description also specifies how the distance specification in question is to be calculated.

- The possible categories for traffic processes are specified in the SimpleType TPMode as an enumeration.

6.17 Description of the level of cloud cover

A description of the degree of cloud cover can also be included in the description of the environmental conditions (weather conditions). This is based on the standardised Okta unit used internationally.

- The categories for the description of the cloud cover are stored in the SimpleType CloudCover.

6.18 Description of the language of free texts in the GSP

The language information given in the GSP-Info data block includes an enumeration of the Language Codes in accordance with ISO 639-1.

- The possible categories of language codes are specified in the SimpleType Language as an enumeration.

6.19 Reference to countries

The possible reference to countries in addresses, for example, is carried out using the country codes according to ISO 3166-1.

- The possible categories of country codes are specified in the SimpleType Country as an enumeration.

6.20 Information on the type of maintenance contract

The possible storing of information on the type of maintenance contract in the workOrder under which the order has been granted, is carried out using standardised categories.

- The possible categories of maintenance types are specified in the SimpleType MaintenanceContract as an enumeration.

6.21 Loading type for transport operations

The general type of loading with a transport operation is distinguished at a high level as follows: Passenger, Cargo, Passenger + Cargo

- The possible categories of loading types are specified in the SimpleType MaintenanceContract as an enumeration.

7   Additional implementation notes and definitions

7.1   Required set up of system structure

As the energy system is normally the unit considered in the context of TG 7 section A paragraph 3.5, a system structure must be set up for the application of these guidelines for every energy system (wind turbine); this structure is maintained on an ongoing basis.

In practice, the system structure can change, e.g. due to conversions, and equally when completing maintenance work it may become clear that a redefinition of the system structure with new specifications or new assignments of elements in the system structure would be appropriate. The updating of the system structure is especially relevant for system types for which no complete system structure has been provided by the manufacturer.

The *smallest* object identifiable by a reference code and which is thus assignable should in the scope of these guidelines be the smallest replaceable unit (SRU) or the smallest unit regarded as relevant in the context of the M in practical terms.

The smallest assignable element (=SRU) thus also defines the lowest level of the system structure of the unit being considered (see DIN 60300-3-1).

7.2   Assignment of the system elements involved in the M process

The selection of assignable objects for which information on a report item is carried out in the context of the known information (e.g. suspected damage), so that in the course of a M process to be documented in the GSP it can be necessary to specify in more detail the documentation via the assignment of information to other assignable elements (recording of the actual work completed for another assignable element).

In other words to "extend" the condition assessment as part of the M to the specific "fault location". This means that the M documentation is restricted to the smallest or a smaller assignable element or "extended" to another element as part of the fault diagnosis process.

- Example:
  The fault diagnosis process showed that an adjacent unit has caused the fault. Only the fault diagnosis for the unit with suspected damage is logged in the service protocol initially. The fault diagnosis and repair for the faulty unit is then documented in a new report item. The condition assessments are then modified **both for the object with suspected damage, and for the actual damage**.

7.3   Application of the ZEUS code

The application of the ZEUS code for the status description in line with TG7 section D2 is specified in the application of these guidelines, see section 5.7. Accordingly, the transfer of all ZEUS codes is prescribed in the GSP data format. However, which ZEUS code is actually used and transferred in the respective application does not form part of these guidelines and should be specified by the user.

- Stipulations on this may be covered by other guidelines and standards such as TG7 section C or TG 7 section D2.

- The assessment can also be designed as a provisional assessment by the M personnel with downstream submission of a complete assessment according to ZEUS criteria catalogue.

7.4   Documentation of M on equipment parts when removed

For equipment parts in the removed status, the reference to the energy plant (see section 5.3) cannot always be produced. The special case where work is carried out on components in the removed status which are to be documented for the M history of the component can be given in the GSP, if the information units on the wind park or the energy system are modified accordingly in terms of content and also recorded as appropriate for the storage locations as well.

At points where equipment parts are also monitored in the removed status, the continuous M documentation can be ensured by the reference to the component details (equipment information), e.g. with a reference to the serial number and type.

- The RDS-PP® equipment code can be retained as these are normally large components which are not installed onto every subsystem

- For the location, a separate RDS-PP® conjoint or spare conjoint with site information would need to be defined in line with the power plant

- Further information on the warehouse and location can be recorded using the user-specific system structure, for example (applierDesignation).

- For smaller components where only the work is documented, the use of a standardised equipment code is not absolutely necessary as no M history is tracked here.

- It is recommended that the codes of warehouse locations are implemented in a standardised way for the user (standardised specification by the ordering instance).

- Even with an object code deviating from RDS-PP®, the GSP document is still valid as no stipulations on the format are made in the schema file.

- The component installation and removal (inward/outward from warehouse) can be removed via the information units dateOfInstallation and dateOfRemoval.

7.5   Temporary regulations

7.5.1   Sector-standard reference code system

Instead of a sector-standard reference code system, the use of a suitable user-specific code system is permitted for inventory systems.

Newly set up system structures must use a sector-standard reference code system (RDS-PP®) in line with the usage regulations in section 5.4 from the date of publication of these draft regulations in VGB-Standard-S-823-T32.

- The regulations in TG7 section D1 should be observed in this respect following publication.

7.5.2   Order types and editing status

The documentation of the editing status of orders, order items and activities takes priority over the processing and display of order data in IT systems interoperable with the GSP standard.

In addition, the GSP permits the use of a user-specific order type as free text which permits the partially more detailed categorisation required for IT systems.

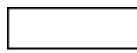## 7.6   Graphical display of the XML schema

7.6.1   Elements

The cardinal nature of an element (0…1, exactly 1, 0…n, 1…n) is identified by the boundary. Compulsory fields have a crossed-out boundary, whereas optional elements are indicated by a dotted edge line.
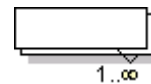
If the element can occur more than once, this is indicated by "stacked" element boxes.

Optional element	Compulsory field	Multiple compulsory field
Min. occurrence = 0,	Min. occurrence = 1,	Min. occurrence = 1,
Max. occurrence = 1	Max. occurrence = 1	Max. occurrence = unlimited

The content type of the element in question is displayed on the left and right-hand sides of the element.

The left-hand side indicates whether the element is a simple type, in other words contains only text, numbers, data and enumerations (lists), or if the element contains additional subelements (complex type). The right-hand side indicates whether or not there are subelements in a complex element.
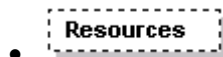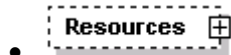
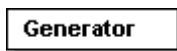| Simple content	Complex content	Complex content with additional subelements	No element content (simple type, only attributes or empty element)

Examples:

-

  Optional field, min. occurrence = 0, max. occurrence = 1, content = complex.

-

  As above, but with additional subelement(s) not shown.

-

  Individual compulsory field. Min. occurrence = 1, max. occurrence = 1, content =complex, no subelements (→ in other words in practice an empty field). The grey text contains the description stored in the XML schema annotation.

-

  Compulsory field occurring multiple times (content = complex) with subelements. This element must occur at least once (min. occurrence = 1) and can occur an unlimited number of times (max. occurrence = unlimited).

-

  Individual element as a compulsory field with simple content (e.g. text). Min. occurrence = 1, max. occurrence = 1, type = xsd:string (e.g.), content = simple.

7.6.2   Model symbols ("compositors")

 A sequence of elements: The elements must be stored in the sequence in which they are given in the schema diagram. This model is principally used in the GSP schema.
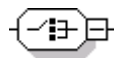
 A selection of elements: Precisely ONE element from the selection is permitted to be or must be contained in the XML.
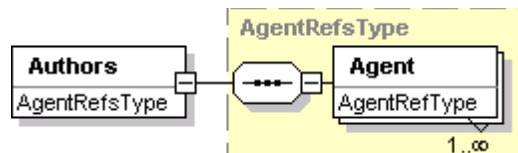
 The sequence of the elements in the content is not specified.

7.6.3   Element types

If an element belongs to a globally de-
fined complex type, the type is identi-
fied by a yellow square. All elements
shown in this square then belong to the
corresponding globally defined complex
type.
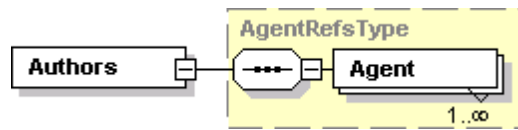
The second row specifies the element
type defined in the schema definition.

In this case, the data types of the simple
elements (simpleType) are also dis-
played.
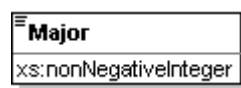
*Note: Where simple elements are as-
signed a data type deviating from the XML
standard, these will generally be enumer-
ations in the GSP schema.*

8   Specification of the GSP document format

8.1   Basics

The document format on the Global-Service-Protocol is based on the ZIP data format and contains additional meta-information in addition to the XML representation of the data in GSP data format. The GSP document format is described in the sections below.

The file extension .gsp is used for the GSP document format.

Designations in the GSP document format are normally given in English.

The GSP document format facilitates:

- the transfer of one or more GSP data records defined by the GSP XML schema in a common .gsp document

- the transfer of files (photos, graphics, PDF files, video files, audio files) included as attachments to every GSP data record

8.2   Structure of a GSP document file

A .gsp file may contain one or more GSP XML files. These XML files should be stored in the root of the .gsp file and named uniquely. In addition to the protocol files, a "manifest" folder should be created that contains a manifest for the .gsp file. In addition, a "media" folder should be created where the attachments linked in the XML files are stored. For every XML file, a sub-folder should be created with a unique name.

A GSP file is structured as follows:

```
Example.gsp
|
+ -- manifest
|        + -- manifest.xml
+ -- media
|        + -- GSPDemo20131121
|        |        + -- ….
|        + -- …
<GSPDemo20131121.xml>
```

Figure 23: Structure of a GSP file

8.3   Manifest

The manifest describes the structure of the .gsp file.

The manifest is required to

- be able to summarise multiple GSP documents in a .gsp file

- because certain meta-information on the documents is not to be included in the actual GSP XML.

The manifest should be defined in line with the following XML schema:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
               attributeFormDefault="unqualified" elementFormDefault="qualified">

  <!-- Manifest root element -->
  <xs:element name="gspManifest">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="documents" type="Documents"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <!-- A List of Global Service Protocol documents within in .gsp File -->
  <xs:complexType name="Documents">
    <xs:sequence>
      <xs:element name="document" type="Document" minOccurs="1"
               maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>

  <!-- A Global Service Protocol document -->
  <xs:complexType name="Document">
      <xs:sequence>
        <xs:element name="mediaFile" type="MediaFile" minOccurs="0
               " maxOccurs="unbounded" />
      </xs:sequence>
      <xs:attribute name="name" type="xs:string" use="required" />
      <!-- Empty path is valid if no attachments are defined -->
      <xs:attribute name="path" type="xs:string" use="optional"/>
  </xs:complexType>

  <!-- A digital attachment / media file -->
  <xs:complexType name="MediaFile">
      <xs:attribute name="name" type="xs:string" use="required"/>
      <xs:attribute name="mimeType" type="xs:string" use="required"/>
  </xs:complexType>
</xs:schema>
```

The manifest file can be created when the .gsp file is created by all file entries being evaluated.

The following example is intended to clarify the structure of the manifest file in the GSP document format:

```
<GspManifest>
      <Documents>
              <Document name="name1.xml" mediaPath="media/gsp1" >
                      <MediaFile name="logos/FGWLogo.jpg" mimeType="image/jpeg" />
              </Document>
              <Document name="name2.xml" />
      </Documents>
</GspManifest>
```

8.4   File references in the .gsp document format

In the XML structure of the GSP there is provision for various files to be linked within an order or a report. The type File should be used to do this.

Within this type, the fileLocation element can be used to specify the location of the file:

- as a Uniform Resource Locator (URL) in fileUrl or

- as a relative path specification within the .gsp file with fileName. This path relates to the folder media within the .gsp file.

The path should be specified in UNIX style.

The example below shows how a link to a file FGWLogo.jpg can be created within a GSP XML file. The absolute path is <Dateiname.gsp>/media/<GSPName>/logos/FGWLogo.jpg. The subpath media/<GSPName> is defined in the manifest file.

```
<file>
      <name>FGWLogo.jpg</Name>
      <mimeMediaType>image</mimeMediaType>
      <id>71263712</id>
      <creationDate>2013-09-10T16:12:00</creationDate>
      <lastModification>2013-09-10T16:12:00</lastModification>
      <description>The logo of ‚Fördergesellschaft Wind und andere Erneuerbare
              Energien e.V.' </description>
      <location>
              <path>logos/FGWLogo.jpg</path>
      <location>
</file>
```

Figure 24: Link to a document

9   XML schema documentation

9.1   Specification of the GSP document format schema definition

An XML Schema, XSD (XML Schema Definition) for short, is recommended by W3C to define structures in XML documents. An XML Schema, in accordance with the "W3C recommendation" of 28 October 2004, describes the structure of an XML document.

- The World Wide Web Consortium (W3C) is an international consortium where the member organisations, a permanently employed team, and the public work together to develop web standards.

- The recommendations for the XML standard are available on the Internet at http://www.w3.org/TR/xmlschema-0/

- Further information on the construction of an XML Schema e.g. http://www.w3schools.com/schema/

The purpose of an XML Schema is to define a class of XML documents.

- The term "Instance document" or "Instance" for short is also used for documents structured according to the XML Schema, in order to describe a document which corresponds to a certain schema.

The XML schema in accordance with the following specifications describes the structure of the GSP XML files with the GSP data contained, in accordance with these guidelines.

One or any number of these XML files may be parts of a GSP document specified in line with section 8 of these guidelines in accordance with the GSP document format.

9.2   XML schema documentation

A detailed description of the XML schema is contained in Attachment A to these guidelines.