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Ships and marine technology — Offshore wind energy — Supply chain information flow

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National foreword

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*.

This International Standard is part of a series for offshore structures of the offshore wind industry. The full series consists of the following:

— ISO 29400, *Ships and marine technology — Offshore wind energy — Port and marine operations*

— ISO 29404, *Ships and marine technology — Offshore wind energy — Supply chain information flow*

Introduction

The complexity and the number of parties involved in the offshore wind farm (OWF) supply chains, both during the construction and the operational phase with their repair and maintenance requirements, depend on IT applications to facilitate planning and control of all physical processes.

In order to minimize frictions in data communication between different business parties, content and format of data need to be standardized.

INTERNATIONAL STANDARD ISO 29404:2015(E)

Ships and marine technology — Offshore wind energy — Supply chain information flow

1 Scope

This International Standard specifies content and format of the messages initiating and controlling the physical movement of wind turbine generator (WTG) components from suppliers to the construction site during the construction phase as well as for repair and maintenance purposes.

This International Standard is applicable to all organizations involved in the production, transportation, storage and installation of WTG parts and related components. This International Standard is not intended to be applied to substations.

Messages described in this International Standard covers only the operational aspects of logistics and therefore this International Standard will represent only one aspect of the entire information flow.

This International Standard does not specify the technical implementation of appropriate IT products. It rather provides an approach based on the EPC Information System (EPCIS) standard and describes the usage of extension mechanisms provided by the EPCIS standard for the exchange of information in the offshore wind supply chain. It aims at standardizing the exchange of essential logistic information. This International Standard specifies elementary informational needs of involved parties in the offshore supply chain and defines mechanisms for the exchange of this information via the EPCIS. Due to the high degree of specialization along different offshore supply chains, partners exchanging information might require mechanisms for personalizing according to their individual demands. The underlying extendable EPCIS concept allows end users and industry consortiums to extend and to refine the information exchange. These extensions might go far beyond the basic information exchange described in this International Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 29400, *Ships and marine technology — Offshore wind energy — Port and marine operations*

EPC Information Services (EPCIS) Version 1.1 Specification

Core Business Vocabulary (CBV) GS1 Standard Version 1.1

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 29400 and the following apply.

3.1
automatic identification data capturing
AIDC
methods of automatically identifying objects, collecting data about them, and entering that data directly into computer systems

3.2
bar code
linear array of rectangular marks of (possibly) varying width, height and vertical alignment, separated by spaces of (possibly) varying width, in which the positioning and size of marks and spaces are used to encode information

Note 1 to entry: Bar code may be 1D bar code or 2D bar code, also called Aztec code.

3.3
component
arbitrarily parts of a WTG, comprising foundations and all parts of a wind turbine generator as well as elements of a wind turbine generator tower

EXAMPLE Tripods, jackets, monopoles and other foundation types and blades and hubs.

3.4
container owner code
BIC code
coding scheme used for coding, identification and marking of containers used within containerized intermodal freight transport

Note 1 to entry: For detailed information, see Reference [1].

3.5
coordinate
one of a sequence of *n* numbers designating the position of a point in *n*-dimensional space

Note 1 to entry: In a coordinate reference system, the coordinate numbers are qualified by units.

[SOURCE: ISO 19111:2007, 4.5]

3.6
coordinate tuple
tuple composed of a sequence of coordinates

Note 1 to entry: The number of coordinate tuple equals the dimension of the coordinate system; the order of coordinates in the coordinate tuple is identical to the order of axes of the coordinate system.

[SOURCE: ISO 19111:2007, 4.12 — modified]

3.7
IMO number
unique identifiers for ships governed by IMO

Note 1 to entry: For more information, see IMO Resolution A.600(15).

Note 2 to entry: The issuing agency for IMO numbers is IHS Fairplay.

3.8
installation site
offshore location where WTGs are installed in an offshore wind farm

3.9
inland transport
transport of components which does not operate in offshore or coastal areas

EXAMPLE Via roads, via rail, via inland vessel and via plane.

3.10
issuing agency
agency that defines and governs unique numbering schemes

Note 1 to entry: For more information, see ISO/IEC 15459-2.

3.11
location
uniquely identifiable physical point or area

Note 1 to entry: The location can be characterized by coordinates.

3.12
logistics hub
location where flows of components are consolidated, stored or transhipped

Note 1 to entry: Logistic hubs are usually located in the inland or the coastal area.

Note 2 to entry: Supply chains may comprise multiple logistics hubs.

3.13
logistic service provider
role in the offshore supply chain which is responsible for the organization of parts or of the entire logistics chain

3.14
manufacturer
organization that produces one or more components for offshore wind turbines

3.15
n-tier
organization that supplies one or more manufacturer with raw material and semi-finished products

3.16
nearshore transport
water-based transport operated next to the coast or in mouths of rivers

3.17
offshore transport
transportation of components from designated marshalling port or another fabrication yard to the offshore installation site in the offshore wind farm

3.18
sea fastening
temporary fastening items which keep movable items in position during sea and waterways transport

3.19
sending party
legal entity that sends components to a receiving party

3.20
storage frames
structure to support storing of the WTG components

3.21
supplier
company which produces semi-finished products for the assembly of components of a WTG

3.22
radio-frequency identification
RFID
wireless non-contact use of radio-frequency electromagnetic fields to transfer data

3.23
telemetry
automated collection of operational data and its transfer via an information and communication infrastructure

3.24
trailer
system of steerable wheels, connected to a central spine beam by hydraulic suspension that can be raised or lowered

3.25
transport media
all kinds of vehicle that may be used to transport components, bundles of component, load carriers, lifting equipment and other related objects

3.26
unique identifier
identifier which is guaranteed to be unique among all identifiers used for those objects and for a specific purpose

Note 1 to entry: For more information, see ISO/IEC 15459-1.

3.27
process state
state of a process that describes the disposition and the current business step of a process

3.28
extensible markup language
XML
schema that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable

3.29
xml scheme
abstract collection of metadata, consisting of a set of schema components with element and attribute declarations and complex and simple type definitions

Note 1 to entry: For more information, see References [18] and [21].

4 Abbreviated terms

AIS	Automatic Identification System
CBV	Core Business Vocabulary
EPC	Electronic Product Code
EPCIS	EPC Information Services
IMO	International Maritime Organization
GIAI	Global Individual Asset Identifier
GLN	Global Location Number
GTIN	Global Trade Item Number
GPS	Global Positioning System
GRAI	Global Returnable Asset Identifier
OWF	Offshore Wind Farm
SGLN	Global Location Number With or Without Extensions
SGTIN	Serialised Global Trade Item Number
SSCC	Serial Shipping Container Code
SPMT	Self-Propelled Modular Transporter
URIs	Uniform Resource Identifiers
URL	Uniform Resource Locator

5 Supply chain processes: Planning, ordering and monitoring

5.1 General

This Clause describes the data communications needs arising through the different stages of production, transport and maintenance. Planning and control of activities along the offshore supply chain requires reliable information about states of processes, locations of components, availability of resources. Especially, the exchange of planning information and order information, such as estimated arrival times of components or vessels, allows harmonizing the material flow along the whole offshore logistics supply chain. Due to the different roles in the offshore supply chain, the involved parties have different information needs. In particular, this International Standard addresses the different stages of the offshore logistic supply chain and the following informational needs:

— production of parts and components by manufacturers;

— transport to marshalling ports;

— intermediate storage;

— transport to installation site;

— installation of WTG components;

— maintenance and repair;

— decommissioning.

The information flow, which is necessary to initiate the physical material flow, is organized by the exchange of information between the participants of the supply chain. In general, three different types of information have to be exchanged between involved parties. These messages are characterized as follows:

— Planning data — contains information about initial plans for component or for transport media. It comprises information about planned arrival dates of transport units at the transport origin and at the transport destination.

— Order data — contains information about short-term planning data (e.g. the estimated time of arrival of a vessel in a port). The physical information flow is initiated by this information. This order message comprises announcements for any kind of transport initiation or other related actions.

— Material flow event data — events that occur after the completion of planning or ordering processes. Events represent the actual status of particular processes in the supply chain (e.g. the arrival of a component at a marshalling port or another logistics hub).

The basic information requirements of each step of the offshore supply chain mentioned above are described hereafter. Figure 1 depicts a general supply chain for the installation of offshore wind turbines. The description of tasks, processes and related informational demands are based on Figure 1.

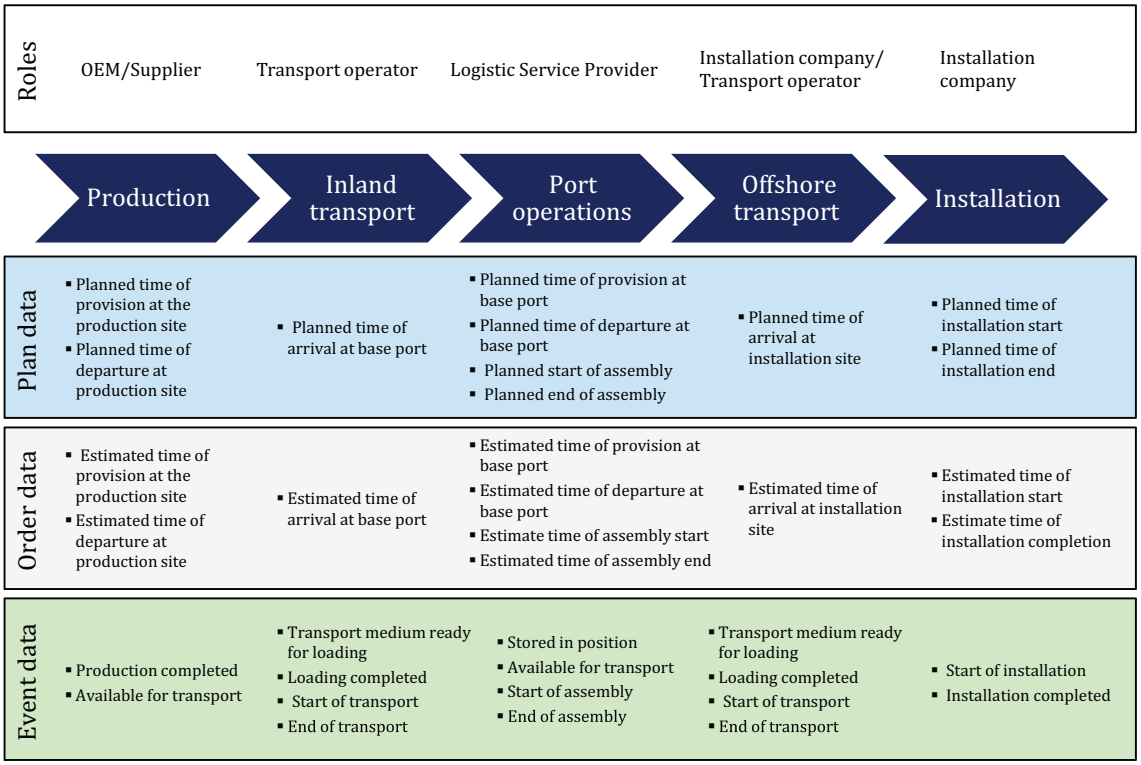

Figure 1 — General offshore wind energy installation supply chain

Relevant data for maintenance and repair operations as well as relevant data for the decommissioning is not depicted in Figure 1. Informational needs therefore are described in 5.6 and 5.8. The process-related tasks shown in Figure 1 are as follows.

a) Production of parts and components: production of WTG components.

b) Inland and nearshore transport: transport of WTG components from manufacturers or logistic hubs to the marshalling port. Inland transport can be organized via roads, via railways, via aircraft, via inland and nearshore waterways.

c) Port operations: Port operations cover all activities from receiving, storing, handling, assembling and providing components.

d) Offshore transport: This process covers the pick-up of components and the transport of components by an installation or other vessel.

e) Installation: This process covers all activities for the physical installation of a component at the installation site at the OWF.

Maintenance operations, as indicated in Figure 1, are also included in this generic scheme. Maintenance in the context of this International Standard covers the removal of parts from a WTG, the transport of components and the installation of new components to a WTG.

5.2 Production of parts and components

The production of components is triggered by orders of customers (e.g. general contractor). The contracting phase as well as the production planning of manufacturers is not in the scope of this International Standard. However, ordering of components is the starting point of the offshore logistic supply chain. The completion of a production order is a relevant event in the offshore supply chain. This event triggers all transport activities concerning the particular component. At least the following basic information has to be exchanged between transportation operators and manufacturers:

— unique identification attribute of component;

— planned time of provision at the manufactures site;

— estimated time of provision at the manufacturer's site;

— location of the component (e.g. location ID);

— destination of the component (e.g. location ID);

— required transport medium (e.g. transportation by ship or barge, ground-based transport via roads or transport by air).

This information is relevant for different parties of the supply chain. Transport operators and logistic service providers use this information for their operative planning processes. On this basis, the transport operator gives a reply to this request comprising information about

— planned time of arrival of the transport unit at the manufacturer's site,

— estimated time of arrival of the transport unit at the manufacturer's site,

— planned time of arrival at the destination, and

— estimated time of arrival at the destination

For other actors, these data are of informative character.

The status of a component should be sent to different parties in the supply chain after the production of a particular component has been finished. This event data confirms that components are potentially available for transport. Relevant information in this context are the following:

— unique identification attribute of component;

— current status of component (i.e. production completed);

— location of provision for transport (e.g. location ID).

5.3 Inland and nearshore transport

5.3.1 Transport by ground

Ground-based transports are triggered by the sending party (e.g. manufacturer). The sending party has to provide basic information about the transport to the transport operator or the logistic service provider. Transports are triggered as described for the production of components. The ground-based transport starts after the completion of loading of WTG components onto the transport unit. In this context, transport unit is a ground-based vehicle, for example low-loader trailer or SPMT. The sending party has to provide at least the following information to the manufacturer, base-port operator and the installation company:

— unique identification attribute of the component;

— unique identification attribute of the transport unit (e.g. license plate);

— starting time of the transport;

— destination of the component (e.g. location ID);

— planned time of arrival at the destination;

— estimated time of arrival at the destination;

— location of the transport vehicle (e.g. geo-information).

For the purpose of a precise process monitoring, the location data of the transport vehicle should be updated continuously. If telemetric devices are installed, location data can be processed and transmitted by this device.

5.3.2 Transport by ship

Transportation by ships or barges is used to transport components from the manufacturer or other logistic hubs to a defined destination via waterways. The destination could be another logistic hub, a marshalling port or an installation vessel (e.g. in the case of feeder ships). Transports by ships or barges are triggered by the sending party. Basic informational requirements are given in 5.1. The actual status of the components has to be updated after loading onto a ship. In order to inform relevant parties of the supply chain, the transport operator has to provide at least the following relevant information:

— unique identification attribute of the component;

— unique identification attribute of the transport unit (e.g. IMO number);

— starting time of the transport;

— destination of the component (e.g. location ID);

— planned time of arrival at the destination;

— estimated time of arrival at the destination;

— location of the transport vehicle (e.g. geo-information).

For the purpose of an exact process monitoring, the location data of the vessel should be updated continuously. Relevant location data can be obtained by installed GPS, AIS or other telemetric devices.

5.3.3 Transport by rail

Transportation via rail is used to transport components from the manufacturer or other logistic hubs to a defined destination. The destination can be another logistic hub or a marshalling port.

Transports via railways are triggered by the sending party. The sending party has to provide basic information about the transports to the transport operator or the logistic service provider.

In order to inform relevant parties of the supply chain, the transport operator has to provide at least the following relevant information about the status of the transport:

— unique identification attribute of the component;

— unique identification attribute of the transport unit (e.g. UIC wagon number);

— starting time of the transport;

— destination of the component (e.g. location ID);

— planned time of arrival at the destination;

— estimated time of arrival at the destination;

— location of the transport vehicle (e.g. geo-information).

5.3.4 Transport by aircraft

Transportation by aircraft is used to transport components from the manufacturer or other logistic hubs to a defined destination. This destination is consequently an airport or adequate landing site. Further transports will be performed to transport components to a logistic hub or to a marshalling port.

Transports via aircraft are triggered by the sending party. The sending party has to provide basic information about the transport to the transport operator or the logistic service provider, as required in in 5.1.

In order to inform relevant parties of the supply chain, the transport operator has to provide at least the following relevant information:

— unique identification attribute of the component;

— unique identification attribute of the transport unit (e.g. aircraft registration);

— starting time of the transport;

— destination of the component (e.g. location ID);

— planned time of arrival at the destination;

— estimated time of arrival at the destination;

— location of the transport vehicle (e.g. geo-information).

5.4 Storage

Storage processes occur between transport operations at the manufacturer's site, at logistic hubs (e.g. waiting period until next transport step) or at the marshalling port (e.g. waiting period until the availability of components for the installation vessel). Storage processes start after the completion of production, at the arrival of components at storage site, at a logistic hub or at the marshalling port. For the organization of the storage process, the storage operator has to receive at least the following information:

— unique identification attribute of the component;

— planned arrival time of the component at the storage site;

— estimated arrival time of the component at the storage site;

— planned time of arrival of a component at the marshalling port or a logistics hub (e.g. arrival of components for installation vessels);

— estimated time of arrival of component at the marshalling port or a logistics hub (e.g. arrival of components for installation vessels).

After placing the component in stock, the storage operator has to inform other relevant parties (e.g. the manufacturer or the installation operator) about the current state of the component:

— unique identification attribute of the component, and

— location of the component (e.g. geo-information or location ID).

The port operator shall receive at least the following information about the date of provision at the quayside:

— unique identification attribute of the component;

— planned time of provision of the component at the quayside;

— estimated time of provision of the component at the quayside.

Other processes which are often performed during the intermediate storage phase of components are assembly activities. The start date and the duration of assembly activities in ports or other logistic hubs are relevant information in the supply chain. The operator of assembly activities shall provide at least the following information about assembly processes:

— unique identification attributes of the involved components;

— planned start of the assembly activities;

— estimated start of the assembly activities;

— planned completion time of assembly activities;

— estimated completion time of assembly activities;

— location of the assembly activities (e.g. geo-information or location ID).

5.5 Installation

During the installation phase, installation vessels transport WTG components from the marshalling port to the installation site at the offshore wind farm. Alternatively, a supply of installation vessels with feeder ships is possible. In both cases, a provision of components at the marshalling port has to be triggered. Loading of WTG components starts after the arrival of an installation or feeder vessel at the marshalling port. At least the following information shall be given to other supply chain participants;

— unique identification attribute of the involved components;

— planned time of loading start;

— estimated time of loading start;

— planned time of loading completion;

— estimated time of loading completion;

— location (e.g. location ID).

After the completion of loading, the vessel will cast off. This event is relevant for different parties of the supply chain. Accordingly, at least the following information has to be provided:

— unique identification attribute of the vessel (e.g. IMO number);

— planned time vessel casts off;

— estimated time vessel casts off;

— planned time of arrival at installation site;

— estimated time of arrival at installation site;

— location of the vessel;

— destination of the vessel.

After arriving at the installation site, the installation vessel starts installing WTG components. Hence, at least the following information has to be submitted for other actors of the supply chain:

— unique identification attribute of the vessel;

— unique identification attribute of the component;

— planned time of the installation start;

— estimated time of the installation start;

— planned time of the installation end;

— estimated time of the installation end;

— location of the vessel (e.g. geo-information).

5.6 Maintenance and repair

During the maintenance and repair phase, components of WTGs are replaced in terms of preventive or reactive maintenance operations. It may occur that a component may be repaired on site or on-board vessels. Otherwise this process can be described by a decommissioning process and by an installation process which runs sequentially. The first step is the decommissioning of the component which has to be replaced. For this step, the informational requirements of 5.8 apply. After the decommissioning, the replacement process is similar to an installation process from the informational perspective. The requirements of 5.5 apply for this step. All related steps of the supply chain (e.g. transportation of defect components to a port or a manufacturer and transport of new components to the respective WTG) have similar informational requirements as described above. The following lists summarize these requirements.

Decommissioning of components and transport to a port or manufacturer:

— decommissioning process (as described in 5.8);

— transport of decommissioned component (as described in 5.3);

— storage of components (as described in 5.4).

Logistic steps and requirements for the installation of new components:

— production of components (as described in 5.2);

— transport of component (as described in 5.3);

— storage of components (as described in 5.4);

— installation of components (as described in 5.5).

5.7 Return of load carriers and equipment

There are several specialized assets such as load carriers or lifting equipment which are used at different stages of the supply chain. Owners of these assets may have an interest in identifying and locating these assets. In general, the informational needs are similar to the informational needs regarding the material flow of components. The usage of these assets in the supply chain can be described by a sequence of

transport and storing processes. For identifying and locating this equipment, all objects of this type have to be equipped with a unique identification attribute. All related steps of the supply chain have similar informational requirements compared with the components.

Thus, the following informational requirements apply for load carriers and other equipment:

— transport of load carriers and equipment (as described in 5.3);

— storage of load carriers and equipment (as described in 5.4).

5.8 Decommissioning

During the decommissioning phase, components are removed from WTGs and transferred to ports, manufacturing sites or other disassembly sites for further activities. The operator of the decommissioning process shall receive at least the following information:

— unique identification attribute of component to be removed;

— planned starting time of the decommissioning activity;

— estimated starting time of the decommissioning activity,

— planned completion time of the decommissioning activity;

— estimated completion time of the decommissioning activity;

— location of the component (e.g. geo-information);

— destination of the component (e.g. location ID).

After the decommissioning process, the decommissioning operator transfers the respective component to a port or directly to a manufacturer. At this stage, at least the following information shall be provided:

— transport of decommissioned component (as described in 5.3);

— storage of components (as described in 5.4).

6 Exchange of logistics information via EPCIS

This International Standard does not describe the technical implementation of a particular system for the information exchange. It rather defines basic informational demands and suggests an approach for using the EPCIS for the information exchange. It shows how these demands can be realized by using extension mechanisms of the EPCIS in a standardized way. In particular, this International Standard addresses extension mechanisms for EPCIS events and of the core business vocabulary. Other elements of the EPCIS standard are not affected by this International Standard. Thus, these aspects of the respective specifications remain valid. Regarding a particular implementation of EPCIS system using this International Standard for the exchange of relevant information, end users are able to refine and extend the implementation according to their own needs. Parties using such an implementation have to multilaterally agree on further extension, which are not addressed by this International Standard.

For a better understanding, the major elements of the EPCIS are described as follows. For the definition of messages and the exchange of messages, this International Standard refers to the EPCIS standard which is governed by EPCglobal. EPCIS offers extensible mechanisms for the event-driven exchange of logistical information in supply chains. The concept of EPCIS contains extension mechanisms, which allow adjusting the EPCIS concept to particular demands of organizations, groups of organizations and industries. This International Standard refers to the EPCIS standard entirely. It defines the extensions of the EPCIS in a unified way in order to provide a harmonized information exchange concept for the offshore wind energy supply chain. Applications using this International Standard may use further customized extensions according to their own needs. This International Standard defines only basic extensions to the EPCIS in order to make it applicable in a unified and harmonized way for the exchange of basic information.

The EPCIS specification provides a layered approach, providing an abstract data model layer, a data definition layer, a service layer and xml bindings. A detailed description of all layers can be found in the EPCIS standard. The Abstract Data Model Layer specifies the general requirements for creating data definitions within the Data Definition Layer. The abstract data model introduces two kinds of data: event data and master data. Event data arises in the course of carrying out business processes and is captured through the EPCIS Capture Interface and made available for query through the EPCIS Query Interfaces. Master data are additional data that provide the necessary context for interpreting the event data. The data definition layer defines data to be exchanged via EPCIS messages. The Service Layer defines service interfaces through which EPCIS clients interact. In the EPCIS standard, two service layer modules are defined. The Core Capture Operations Module defines a service interface (the EPCIS Capture Interface) through which EPCIS Capturing Applications receives event data. The Core Query Operations Module defines two service interfaces (the EPCIS Query Control Interface and the EPCIS Query Callback Interface). Bindings specify specific realizations of the Data Definition Layer and the Service Layer.

This International Standard uses extension mechanisms of the EPCIS in order to define new event fields and vocabulary elements for the exchange of information in the offshore supply chain. These extensions focus on the data definition layer.

The exchange of relevant information according to EPCIS is done by the exchange of event-related data in terms of xml documents. It describes the following four main event types and one generic base class for all events (namely the EPCIS event):

— EPCIS event: generic base type event;

— Object event: subclass of the EPCIS event. It refers to events of single objects;

— Aggregation event: describes the aggregation or disaggregation of different objects (e.g. assembly processes);

— Transaction event: assigns a business transaction to a material flow event (e.g. assignment of a purchase order to a specific object);

— Transformation event: provides for the description of events in which inputs are consumed and outputs are produced.

Generally, these events are able to cover logistics information in four dimensions.

— The first dimension is the object-related dimension. It contains information about involved objects (e.g. a nacelle which has been shipped to a partner).

— The second dimension contains information about date and time of an event (e.g. when did the nacelle arrive at the site of a partner).

— The third dimension contains information about the location (where did the event take place, e.g. marshalling port).

— The fourth dimension describes the business context of the event (why did the event take place, e.g. specific ordering information).

This International Standard specifies extensions for these event types in order to make them applicable for the offshore supply chain. It maps the requirements for the offshore wind energy logistics to the events defined in the EPCIS standard. This International Standard does not define new event types. It defines field and vocabulary extensions which are applicable in the context of the offshore wind supply chain.

7 Identification of relevant parties, objects and elements

7.1 General

To avoid ambiguity and the resulting error potential, all logistics objects constituting the physical supply chain serving the construction and maintenance of OWFs and all involved parties shall be identified with unique identifiers.

7.2 Roles and parties

7.2.1 General

Within the offshore installation, supply chain involved actors usually act in different roles. These roles are linked to the following specific tasks:

— manufacturer;

— supplier;

— transport operator;

— logistic service provider;

— port operators;

— installation operators;

— project owner;

— others.

Different legally entities (parties) perform one or more of these tasks. In an extreme case, one entity carries out all tasks. However, usually these roles are performed by different legally independent parties within the offshore installation supply chain. These different roles and parties should be enabled to exchange standardized information along the supply chain during all phases (i.e. installation, operation, maintenance and repair and decommissioning). Consequently, each party shall be uniquely identifiable as well as the business locations of these parties. In the following, a generic description of these parties is given. As mentioned, it is possible that one legal entity performs multiple tasks.

7.2.2 Manufacturer

Manufacturers produce, assemble and equip the main components of WTGs (e.g. foundations, nacelles, hubs, blades, tower segments). Manufacturers store components after the production process and provide them for further transportation processes. The manufacturing processes of one manufacturer may be geographically dispersed. Accordingly, manufactures and their production and storage locations have to be uniquely identifiable.

7.2.3 Supplier

Suppliers supply manufactures with subassembly or semi-fined components (e.g. general raw material, electric cabinets, gears, bearings, steel sheets, etc.). During the installation phase, products of suppliers normally are assembled in components of the manufactures.

However, during the maintenance and repair phase, parts produced by suppliers may be replaced directly (e.g. in terms of preventive maintenance activities or after unforeseen break downs). Thus, other parties of the supply chain have to be able to identify suppliers and to exchange logistic relevant information similar to manufacturers.

7.2.4 Transport operator

The transport operator is responsible for the operation of the transport of components. This role is independent of the transport medium used (e.g. trucks, SPMTs, trains, pontoons, etc.). The transport operator may have different business locations (e.g. depots). Consequently, these different locations have to be individually identifiable.

7.2.5 Logistic service provider

Logistic service providers organize the transport and storage of parts or the entire supply chain. This party plans and prepares transport and storage operations. In the case that a logistic service provider is involved in the supply chain, this party contacts transport and port operators in order to fulfil the planned activities. This party often acts simultaneously as transport operator and as port operator. Locations of logistic service providers have to be individually identifiable.

7.2.6 Port operator

Components are consolidated in marshalling ports. These ports receive and store WTG components. After storing, the components are provided for installation vessels. Activities related to these processes are organized and operated by the port operator. All port locations of port operators have to be uniquely identifiable.

7.2.7 Installation operator

The installation operator is responsible for installation of WTGs at the offshore wind farm. The operator uses specialized offshore installation vessels. These vessels transport components from marshalling ports to the installation site at the offshore wind farm. Installation operators may have one or more installation vessels. Accordingly, these vessels have to be uniquely identifiable.

7.2.8 Project owner

Project owner owns a wind farm project in parts or as a whole. Usually, the project owner is responsible for planning and contracting of the project. The party of project owners shall be uniquely identifiable.

7.2.9 Others

Beside the described typical roles and parties, there is the possibility of the involvement of other parties (e.g. legal authorities). Any other kind of involved parties shall be uniquely identifiable.

7.3 Identifying parties and business locations

7.3.1 General

For an efficient exchange of information along the supply chain, all parties and their business locations should be uniquely identifiable. This refers for the installation phase as well as for the subsequent phase of operation and maintenance.

7.3.2 Unique identifier for involved parties

Each party in the offshore installation supply chain should be uniquely identifiable by a unique identifier (ID). All parties of a particular supply chain should agree on a certain identification scheme for the identification of parties.

The global location number (GLN) is an identification scheme that allows a unique identification of legal entities and may be used for this purpose. The GLN is a 13-digit number comprising a country prefix, a location reference and a check digit. It is a coding scheme for coding location information, governed by the issuing agency GS1. The GLN is defined in Reference [23].

If nothing else is agreed between all involved parties, the GLN should be used for this purpose.

7.3.3 Unique identifier for locations

Each location of a party should be uniquely identifiable by a unique identifier (ID). This avoids the possibility of confusing origins and destinations of the material flow. All parties of a supply chain should agree on a certain identification scheme for the identification of locations.

The Global Location Number With or Without Extension (SGLN) is an identification scheme that allows a unique identification of legal entities and their locations. The SGLN EPC scheme is used to assign a unique identity to a physical location, such as a specific building or a specific unit of shelving within a warehouse. Different SGLNs can be assigned to geographically dispersed locations of one party. The SGLN is defined in Reference [23].

If nothing else is agreed between all involved parties, the SGLN should be used for this purpose.

7.4 Parts and components

7.4.1 General

For an efficient exchange of information along the supply chain, all relevant parts and components should be uniquely identifiable. This refers for the installation phase as well as for the subsequent phase of operation and maintenance. Smaller components or spare parts may be shipped as a bundle of components (e.g. components on a pallet, or pallets in a container). In this case, it may be useful not to identify single items, but the respective bundle of items.

Specialized lifting equipment and load carriers are often used in the offshore supply chain. In order to provide transparent information about the location and the usage of this equipment to its owners, this International Standard includes these objects as well.

Parties exchanging information in an offshore wind supply chain according to this International Standard should multilaterally define the granularity of the identification of components, load carriers and other equipment.

7.4.2 Components

Usually, big components should be uniquely identifiable. Smaller components may be identified as a bundle (e.g. pallet). All parties involved should define the desired degree of granularity.

For the purpose of identifying single items, all involved parties should agree on commonly used identifiers. The identifier used shall meet the requirements as follows.

— The identifier is unique: there is no other object carrying this identifier. Usually, these kinds of identifiers are serialized.

— There are mechanisms preventing that one identifier refers to more than one object, and

— there are mechanisms preventing that one object refers to more than one identifier.

A coding scheme meeting these requirements is the serialized global trade item number (SGTIN). The SGTIN can be used by a company to uniquely identify all of its trade items. Once a company has assigned a SGTIN to a trade item, it provides a common language for all of its entities and trading partners worldwide to uniquely identify the item and easily communicate information about the item. The SGTIN is governed by the issuing agency GS1. It is a serialized version of the GTIN. The Serialized Global Trade Item Number EPC scheme is used to assign a unique identity to an instance of a trade item, such as a specific instance of a product. The SGTIN is defined in Reference [23].

If nothing else is agreed between all involved parties, the SGTIN should be used for this purpose.

7.4.3 Bundles of components

In the case of multiple components aggregated in a shipping unit, the identification of the shipping unit may be more applicable than identifying single components. However, the identification scheme used for identifying bundles of components should meet the same requirements as mentioned in 7.4.2.

All involved parties should agree on common identifiers for bundles of components. The serial shipping container code (SSCC) meets the requirements mentioned. The SSCC is governed by the issuing agency GS1. If nothing else is agreed between all involved parties, the SSCC should be used for this purpose.

7.4.4 Load carriers and lifting equipment

Both lifting equipment and load carriers are usually designed for repetitive usages in the offshore supply chain. The identification of these objects is of interest for their owners. The identifiers of these objects shall meet the identification requirements mentioned in 7.4.2.

All parties involved shall agree on a common scheme for the identification of load carriers and of lifting equipment. The global returnable asset identifier (GRAI) meets all requirements. The GRAI EPC scheme is used to assign a unique identity to a specific returnable asset, such as a reusable shipping container or a pallet skid. The GRAI is governed by the issuing agency GS1. The GRAI is defined in Reference [23].

If nothing else is agreed between all involved parties, the GRAI should be used for this purpose.

7.5 Transport media and machinery

7.5.1 General

In order to provide reliable information about the status of transports, the identification of transport media should be possible.

7.5.2 Trucks

Trucks and other wheeled vehicle which carry components should be uniquely identifiable. The requirements for identifying this type of vehicle are the same as mentioned under 7.4.2.

For the purpose of identifying trucks and other wheeled vehicles, all involved parties should agree on common identifiers.

Trucks and other wheeled vehicles may be identified by license plates.

Another identifier, which might be used for truck and other wheeled vehicles, is the GIAI. The GIAI EPC scheme is used to assign a unique identity to a specific asset, such as a forklift or a container. The GIAI is governed by the issuing agency GS1. The GIAI is defined in Reference [23].

If nothing else is agreed between all involved parties, the licence plate should be used for this purpose.

7.5.3 Trains and wagons

Trains and wagons which carry components should be uniquely identifiable. The requirements for identifying this type of vehicle are the same as mentioned under 7.4.2.

For the purpose of identifying trains and wagons, all involved parties should agree on common identifiers.

Trains and wagons may be identified by the UIC wagon code. Another identifier which might be used for trains and wagons is the GIAI. The GIAI is defined in Reference [23].

If nothing else is agreed between all involved parties, the UIC wagon code should be used for this purpose.

7.5.4 Vessels

Vessels which carry and transport components should be uniquely identifiable. The requirements for identifying this type of vehicle are the same as mentioned under 7.4.2.

For the purpose of identifying vessels, all involved parties should agree on common identifiers.

Seagoing vessels may be identified by their unique IMO number.[22] Another identifier which might be used for vessels is the GIAI. The GIAI is defined in Reference [23].

If nothing else is agreed between all involved parties, the IMO number should be used for this purpose.

7.5.5 Aircraft

Aircraft which carry components should be uniquely identifiable. The requirements for identifying this type of vehicle are the same as mentioned under 7.4.2.

For the purpose of identifying aircraft, all involved parties should define common identifiers.

Aircraft may be identified by the flight number or the aircraft registration. Another identifier which might be used for identifying aircraft is the GIAI. The GIAI is defined in Reference [23].

7.5.6 Other

Other specialized machinery, which is not explicitly mentioned in this International Standard, may be used for the transport of components. If the involved parties agreed on identifying these transport media, they have to define a common identifier for the respective object type. However, the requirements of 7.4.2 apply for this identifier.

7.6 Container

Container used for the transport in the offshore wind energy supply chain should be uniquely identifiable. For the purpose of identifying containers, all involved parties should define common identifiers.

Container might be identified by ISO 6346[1] reporting mark, consisting of four characters long followed by six numbers and a check digit. The ownership code for intermodal container is issued by the Bureau International des Containers (BIC).

Alternatively, the GIAI might be used for the identification of container.

If nothing else is agreed between all involved parties, the containers' ISO number should be used for this purpose.

7.7 Unique identification numbers

7.7.1 General

Components, transport media and machinery shall be uniquely identifiable. Thus, redundant usage of unique identification numbers shall be avoided (e.g. usage of the same ID for different components).

7.7.2 Representation of unique identifiers

In order to create EPCIS compliant or compatible documents, identifiers shall be represented as defined in the actual CBV standard. According to the CBV standard, there are three different ways for representing identifiers:

— EPC URI: an Electronic Product Code "pure identity" URI may be used.

— private or industry-wide URN: a Uniform Resource Name (URN)[20] may be used for representing identifiers. This requires an authorized URN namespace.

— HTTP URL: a URL[14] may be used for representing identifiers. This requires an authorized internet domain name.

In general, all rules of the actual CBV standard apply. The representation of identifiers for physical objects and locations shall conform to the CBV standard.

7.7.3 Usage of existing unique numbering systems

Whenever existing numbering systems are used for the identification of objects (e.g. returnable assets), which do not conform to EPC-Tag-Data standards, these numbers shall be represented via HTTP URL in the following way:

http://my.unique.namespace/obj/type.id

— /my.unique.namespace: is a domain name governed by the respective party (e.g. example.org);

— /obj: qualifier - the characters o, b, j and / (slash);

— /type: type code of numbering system (five digits);

— .id: ID according to the corresponding numbering system.

Whenever existing identifiers are used, the corresponding HTTP URL representations should meet all syntax requirements of CBV and Reference [16].

Table 1 — Codes different types

id types	Usage
00001	Freight container (U)
00002	Detachable freight container-related equipment
00003	Trailers and chassis (Z)
00100	Licence plate
00200	IMO number
00300	Flight number
00400	Trains and wagons (UIC numbers)
00500	Container Code (BIC)
00600	Others: open for other numbering systems

8 Master data

Generally, there are two kinds of data: event data and master data. Event data arises in the course of carrying out business processes. Master data are additional data that provides the necessary context for interpreting the event data. Master data are a set of vocabularies, together with master data attributes associated with elements of those vocabularies.

The identifiers within a vocabulary are called Vocabulary Elements. A vocabulary represents a set of alternative values that may appear as the values of specific event fields. Vocabularies in EPCIS are used to model sets such as the set of available location names and the set of available business process step names. The value of an event field may be a Vocabulary Element. Vocabulary Elements are represented as URIs.[15] Each Vocabulary Element may have associated master data attributes. Master data attributes are an unordered set of name/value pairs associated with an individual Vocabulary Element. The value part of a pair may be a value of arbitrary type. A special attribute is a (possibly empty) list of children, each child being another vocabulary element from the same vocabulary.

The EPCIS contains an xml schema for representing the necessary master data. This schema allows managing master data regarding vocabularies and other related data (e.g. location information).

Regarding the locations master data, the general structure defined in the EPCIS should be used. It defines master data attributes for locations according to their structural granularity.

Site location: This attribute indicates the site which contains a particular location. In the case of the definition of a sub-site, this site location indicates the parent location of the sub-site.

— Sub-site type: This attribute indicates the function of a particular sub-site (e.g. storage area);

— Sub-site attributes: This may be used to specify further business functions of a particular sub-site (e.g. exit gate);

— Sub-site detail: This attribute may be used for further proprietary descriptions of a particular sub-site.

Parties have to agree on exchange mechanisms which satisfy their informational demands regarding the exchange of master data.

Master data in the context of EPCIS defines attributes of physical objects and locations. Object-related master data can be exchanged via EPCIS events by using the instance level master data. Due to the highly individualized representation of product-related data, parties exchanging information have to ensure a sufficient exchange of product-related master data as well. The exchange of product-related master data is not in the scope of this International Standard.

9 Event data

9.1 General

The exchange of information recommended by this International Standard is based on the mechanisms of EPCIS. EPCIS is a standard for the exchange of logistics information in terms of events (i.e. object event, aggregation event, transformation event and transaction event). This International Standard uses the principles of the extensibility of the EPCIS data definitions layer for adapting its usage in the context of offshore wind energy logistics.

In order to address the basic informational needs depicted in Clauses 5 and its subclauses, three different types of information shall be exchanged. These messages address the different time horizons shown in Figure 1.

— Planning information contains basic information about the logistics planning in an early stage phase. Planning information may be generated before components physically exist.

— Order information contains information about the next planned operative steps (e.g. estimated time of provision of component). Order information refers usually to physical existing objects.

— Material flow event information contains information about actual states of objects in the supply chain (i.e. components, transport media, etc.). Material flow information refers to actual events in the processes.

This International Standard does not define a specific sequence of events and it does not assign the usage of particular event types to specific physical events in the offshore supply chain. Due to the high degree of individualized processes, the specific modelling and assignment of event types remain as tasks of parties in a supply chain, willing to exchange information.

All extensions mentioned in this International Standard allow exchanging basic information. Thus, parties of a supply chain are able to use the same extension mechanisms in order to align and to refine this International Standard according to their particular needs. They may use all extension mechanisms defined in the EPCIS standard. However, the rules for using theses mechanisms (mentioned in the EPCIS standard and the CBV standard) shall be met at any time.

9.2 General extensions of event fields

As depicted in Figure 1, the steps of the physical material flow can be described by a series of events. The exchange of information about these events allows the tracking and tracing of the material flow. This series of events can be described by using and exchanging particular EPCIS events.

In order to be able to exchange relevant logistics information in the offshore supply chain, these basic EPCIS events have to be extended. Therefore, Table 2 shows field extension for all EPCIS events. The usage of all defined event field extensions is optional. From a technical point of view, this simplifies the extensions. It can be handled as a kind of vendor extension in terms of the EPCIS standard. Furthermore, this supports the compatibility to existing EPCIS implementations.

Table 2 — General EPCIS field extensions

Field name	Description	Usage
eventID	A universally unique identifier (UUID) as defined by RFC 4122 that uniquely identifies this event, using the URN syntax also defined in RFC 4122.[19]	Optional
eventOrigin	This field contains information about the ID of the legal party which is responsible for the observation of a current event.	Optional
locationOfProduction	This field contains the ID of the production location of a component.	Optional
locationOfPort	This field contains the ID of the marshalling port of a component.	Optional
locationOfIntermediateStorrage	This field contains the ID of the intermediate storage area of a component.	Optional
WindFarm	This field contains the ID of the wind farm of a component.	Optional
geoLocation	This field contains the actual geo position of an object at the moment of its observation. This location is formatted as geo coordinate with longitude and latitude information. The representation of coordinate should be according to the CBV (Geographic Location URIs for Location Identifiers).	Optional
sendFrom	This field contains information about the ID of the original sender (e.g. manufacturer).	Optional
sendTo	This field contains information about the ID of the final recipient (e.g. installation operator).	Optional
requiredTransportmedium	This field contains information about the ID of a particular transport medium.	Optional

In order to indicate sources and destinations of single transfer events, the source and destination attributes offered by EPC Information Services (EPCIS) Version 1.1 Specification and Core Business Vocabulary (CBV) GS1 Standard Version 1.1 should be used.

An xml scheme containing definitions on data types is provided in Annex A. The implementation of this scheme has to be done by a particular party. A unique namespace, which is controlled by one party, shall be used. All further rules of the EPCIS standard have to be met.

9.3 Plan data

Planning messages (event) announce the date and time of a specific event that is intended to take place. The planning message can be used to exchange information about scheduled dates for operations. The date and time given for order execution will not necessarily be identical with the date and time

of the estimated execution of an operation (i.e. order message). This kind of information refers mainly to components. These messages can be generated repeatedly, updating the information. Sender and receiver of planning messages shall agree on intervals for actualization or for the size of deviations triggering an actualization of a planning message. Table 3 shows the extensions for the EPCIS events.

Table 3 — EPCIS field extensions for plan data

Field name	Description	Usage	Corresponding object
PTProvisionProduction	This field contains information about the planned time of provision at the production site. This means that at this moment the production process ends and the corresponding component is planned to be ready for the next transport step in the supply chain.	Optional	Manufacturer
PTDepatureProduction	This field contains information about the planned departure of a component. Departure means in this context is the initial movement of the corresponding transport medium.	Optional	Transport operator/ Logistic service provider
PTArrivalPort	This field contains information about the planned time of arrival at a marshalling port.	Optional	Transport operator/ Logistic service provider
PTProvisionPort	This field contains information about the planned time of provision at the marshalling port for installation vessels.	Optional	Port operator/ Logistic service provider
PTDepaturePort	This field contains information about the planned time of the departure of a component or an installation vessel at the marshalling port.	Optional	Installation operator/ Logistic service provider
PTAssemblyStart	This field contains information about the planned time of the start of pre-assembly processes at a marshalling port or at other logistic hub.	Optional	Manufacturer/ Port operator/ Logistic service provider
PTAssemblyEnd	This field contains information about the planned time of the end of pre-assembly processes at a marshalling port or at other logistic hub.	Optional	Manufacturer/ Port operator/ Logistic service provider
PTArrivalInstallationSite	This field contains information about the planned time of arrival at the installation site.	Optional	Installation operator
PTStartingInstallation	This field contains information about the planned time of the start of installation operations for components.	Optional	Installation operator
PTEndingInstallation	This field contains information about the planned end of installation operations for components.	Optional	Installation operator

The column “Corresponding object” in Table 3 shows which party usually announces this planning data. However, implementations may vary according to the specific configuration.

An xml scheme containing definitions and data types is provided in Annex A. The implementation of this scheme has to be done by a particular party. A unique namespace, which is controlled by one party, shall be used. All further rules of the EPCIS standard have to be met.

The use of the extensions mentioned in this International Standard is optional. Accordingly, the usage of these fields can be omitted if they are not relevant for a particular event.

9.4 Order data

Order data are necessary for the exchange of short-term operational data (e.g. the estimated time of the provision of a component or the estimated time of arrival of vessel). In the following, extensions for all EPCIS event types are introduced, which allow an exchange of this kind of information. These event messages can be generated repeatedly to update the containing information. The field extensions for representing order data may be used for both (components and transport media). This also includes the usage of these event fields for equipment or load carriers. Table 4 shows the extensions for the EPCIS events.

Table 4 — EPCIS field extensions for order data

Field name	Description	Usage	Corresponding object
ETProvisionProduction	This field contains information about the estimated time of provision at the production site. This means that at this moment the production process ends and the corresponding component is expected to be ready for the next transport step in the supply chain.	Optional	Manufacturer
ETDepatureProduction	This field contains information about the estimated time of departure of a component. Departure means in this context is the initial movement of the corresponding transport medium.	Optional	Transport operator/ Logistic service provider
ETArrivalPort	This field contains information about the estimated time of arrival at a marshalling port.	Optional	Transport operator/ Logistic service provider
ETProvisionPort	This field contains information about the estimated time of provision at the marshalling port for installation vessels.	Optional	Port operator/ Logistic service provider
ETDepaturePort	This field contains information about the estimated time of the departure of a component or an installation vessel at the marshalling port.	Optional	Installation operator/ Logistic service provider
ETAssemblyStart	This field contains information about the estimated time of the start of pre-assembly processes at a marshalling port or at other logistic hub.	Optional	Manufacturer/ Port operator/ Logistic service provider
ETAssemblyEnd	This field contains information about the estimated time of the end of pre-assembly processes at a marshalling port or at other logistic hub.	Optional	Manufacturer/ Port operator/ Logistic service provider
ETArrivalInstallationSite	This field contains information about the estimated time of arrival at the installation site.	Optional	Installation operator
ETStartingInstallation	This field contains information about the estimated time of the start of installation operations for components.	Optional	Installation operator
ETEndingInstallation	This field contains information about the estimated end of installation operations for components.	Optional	Installation operator

The column “Corresponding object” in Table 4 shows which party usually announces this order data. However, implementations may vary according to the specific configuration of the particular supply chain.

An xml scheme containing definitions and data types is provided in Annex A. The implementation of this scheme has to be done by a particular party. A unique namespace, which is controlled by one party, shall be used. All further rules of the EPCIS standard have to be met.

The use of the extensions mentioned in this International Standard is optional. Accordingly, the usage of these fields can be omitted if they are not relevant for a particular event.

9.5 Material flow event messages

Material flow event messages help to check on relevant logistic events in the supply chain at the moment of the occurrence of the event. Material flow events give information about actual state of components, transport media and other equipment (e.g. the arrival of a transport medium or component at the marshalling port). Generally, all material flow events in the offshore supply chain can be modelled by standard EPCIS events (e.g. object event or aggregation event). However, to meet the particular informational demands, the core business vocabulary has to be extended. This refers to the dispositions and the business steps. In 9.5, additional vocabulary to the vocabulary defined in the CBV is given. Event messages notify status changes occurring to elements of the supply chain. Components affected by a material flow event are characterized by their disposition and the corresponding business step. This International Standard does not define the usage of these events on a detailed level (i.e. assignment of event types to particular instances of supply chain events). It rather introduces additional vocabulary elements for a better characterization of offshore supply chain-related material flow events.

Figure 1 indicates different informational demands regarding the corresponding events at the material flow level. These demands are characterized by specific dispositions and corresponding business steps.

The dispositions for the material flow events are described in the following.

— Planned: The disposition “planned” indicates that a physical object with the respective ID is currently in the logistics planning phase. The object needs not to exist physically during the planning phase.

— Production completed: The production of a component or a subcomponent at the manufactures site has been completed.

— Available for transport: A component intended to be transported to the next step of the supply chain is prepared for the transport. This means that all activities, which have to be performed for preparing the transport of the component, are done. The component is stored at the outbound storage area (e.g. at the quayside for transports by vessels or barges or manufactures site).

— Transport medium arrived at location: A transport medium arrived at a certain location (e.g. at the quayside for transports by vessels or barges or manufactures site) for the purpose of loading one or more components.

— Transport medium ready for loading: All activities for preparing a transport medium for loading one or more components have been completed. All operations for preparing the transport medium (e.g. mooring) have been completed and the handling process can start.

— Loading completed: The process of loading a specific component onto a specific transport medium has been completed. This event comprises activities for lashing and sea fastening, where applicable.

— Start of transport: Start of the physical movement of a transport medium. This can be represented by the core business vocabulary “in_transit”.

— End of transport: A loaded transport medium arrived at its destination. This can be represented by the core business vocabulary “in_transit”.

— Unloading completed: The unloading procedure of a component from the respective transport medium has been completed.

— Start of assembly: This event refers to assembly activities. Two or more components are assembled to one component. This can be represented by the core business vocabulary “assembly”.

— End of assembly: This event refers to assembly activities. Two or more components have been assembled to one component. This can be represented by the core business vocabulary “assembly”.

— Stored in position: A component has been stored at a specified location (e.g. storage area in a marshalling port).

— Start of installation: This event indicates the start of the installation process at the offshore location.

— End of the installation: The component has been installed at the offshore location.

— Start of removal: Start of the removal of defect components during the maintenance and operation phase at the offshore location.

— End of removal: End of the removal of defect components during the maintenance and operation phase at the offshore location.

— Start of decommissioning: Start of a decommission operation.

— End of decommissioning: End of a decommissioning operation.

For these dispositions, additional vocabulary elements are defined in the following. These vocabulary elements should be defined as a part of the master data. These elements should be represented as URL in the following form:

http://my.unique.namespace/disp/element

The namespace “my.unique.namespace” is a namespace governed by the respective organization. The string /disp indicates that a vocabulary element for a disposition is defined. The string /element is a placeholder for the additional disposition values depicted in Table 5.

Table 5 — Additional vocabulary elements for dispositions

Additional vocabulary element (value) - disposition	Description	Corresponding object
planned	No physical object existent. Event message contains planning information.	component
production_completed	Production of a component has been completed.	component
available_for_transport	Component has been prepared for the transport.	component
ready_for_loading	Loading procedure may start immediately.	transport medium
loading_completed	Loading procedure has been completed.	component/transport medium
unloading_completed	Unloading procedure has been completed.	component/transport medium
stored_in_position	Handling and storing of component has been completed.	component
installation_completed	The installation of a component at the installation site has been finished.	component
removal _completed	The removal of a component at the installation site has been finished.	component
waiting_on_weather	This deposition occurs whenever processes in the supply chain are delayed or interrupted by critical weather conditions.	component/transport medium

For describing the material flow process steps, the dispositions and business steps indicated in Table 6 should be used.

Table 6 — Combinations of dispositions and business steps

Material flow	Disposition	bizStep	Corresponding object
Planned	planned	-	component/transport medium
Production completed	production_completed	-	component
Available for transport	available_for_transport	staging_outbound	component
Transport medium arrived at location	in_progress	arriving	transport medium
Transport medium ready for loading	ready_for_loading	loading	transport medium
Start of loading	in_progress	loading	component
Loading completed	loading_completed	loading	component
Start of transport	in_transit	departing	component/transport medium
End of transport	in_progress	arriving	transport medium
Start of unloading	in_progress	unloading	component
Unloading completed	unloading_completed	unloading	component
Stored in position	-	storing	component
Start of assembly	in_progress	assembling	component
End of assembly	assembly _completed	assembling	component
Start of installation	in_progress	assembling	component
End of the installation	installation_completed	assembling	component
Start of removal	in_progress	disassembling	component
End of removal	removal _completed	disassembling	component
Start of decommissioning	in_progress	disassembling	component
End of decommissioning	removal _completed	disassembling	component

The standard EPCIS event types should be used to describe a specific event referring to material flow events. All additional dispositions and business steps allow specifying material flow events in the offshore supply chain and should be used to provide additional information.

Annex B provides illustrative examples for the usage of EPCIS events for the information exchange. Table B.1 shows basic material flow events in the offshore supply chain and assigns a specific EPCIS event for this operation.

In order to characterize material flow events more detailed, involved parties may define further material flow events. These events should be described by suitable dispositions and business steps according to the CBV or by user group defined vocabulary.

9.6 Extensibility and specific implementation design

9.6.1 General

Extensibility mechanisms are inherent elements of the EPCIS concept. It allows specifying and refining a particular implementation according to the end users' needs. This International Standard depicts

basic specifications for using EPCIS for the information exchange in offshore wind logistics. However, end users are able to refine the specifications of this International Standard by the following:

— defining further field extensions for the EPCIS events;

— adding the business vocabulary (e.g. introduction of additional depositions);

— adding and defining additional master data elements.

Parties applying to this International Standard have to set up their own user vocabulary, which has to contain the extensions mentioned in this International Standard. For all implementations and extensions, the requirements of the EPCIS and the core business vocabulary standards have to be met. Extensions should be used as few as possible.

Supply chain partners willing to exchange logistics information according to this International Standard have to agree on a particular software implementation. They have to define and agree at least on the following:

— granularity of data to be exchanged;

— mapping of process steps to EPCIS events (including the usage of dispositions, business steps, etc.);

— mechanisms of master data and event data exchange;

— mechanisms for exchanging product-related information;

— usage of data carriers and coding of data;

— requirements for data security and privacy;

— design of capturing and query services;

— adding and defining additional master data elements;

— design of further extensions.

9.6.2 Vocabulary extensions

Parties setting up a specific user vocabulary containing the elements mentioned in this International Standard shall use the CBV compatible URL scheme for representing the vocabulary. The following shows this type of representation in a general and exemplary way:

https://my.unique.namespace/type/element

The name space, in this example “my.unique.namespace”, is an URL governed by one party. The type describes the type of additional vocabulary element (e.g. disp for disposition). The term element indicates the particular user vocabulary element (e.g. start_of_installation). For extensions of vocabulary elements, the following types (/type) shall be used:

— /disp indicates a disposition type;

— /bizStep indicates a bizStep type;

— /btt indicates a bizTransactiontype;

— /bt indicates a bizTransactionIdentifier.

EXAMPLE <disposition>http://my.unique.namespace/disp/available_for_transport</disposition>

9.6.3 Event field extensions

In order to be able to exchange order and plan data via EPCIS according to this International Standard, a definition of the additional fields has to be provided in terms of a suitable xml scheme. This also refers

to new field extensions defined by parties for a particular implementation. Implementations of all extensions should be compatible with the EPCIS and the CBV standards.

Annex A provides an xml scheme for the field extensions mentioned in this International Standard. All extensions have to use a suitable unique namespace. This namespace shall be governed by the implementing party. The string "my.unique.namespace" in this International Standard represents such a namespace in an exemplary way. This placeholder shall be replaced in a particular implementation by a valid and unique namespace.

10 Data formats

The EPCIS standard provides standardized xml schemes for the exchange of event-related information along the supply chain. The use of EPCIS messages shall meet the requirements of the EPCIS standard, the CBV and this International Standard. This refers also to possible extensions of particular implementations. Data formats (in terms of an xml scheme for field extensions) are provided in Annex A for the field extensions defined in this International Standard.

The exchange of other data (e.g. master data or product-related data), except from material flow, order and plan data, is not in the scope of this International Standard. Parties have to define and agree on appropriate exchange techniques.

11 Data carriers

11.1 General

All relevant objects of the material flow (e.g. components, transport media, load carriers or lifting equipment) should be uniquely identifiable. In order to recognize these unique identifiers and to capture them in an information system, different technologies may be used. Involved parties have to agree on the use of data carriers for identifying objects in the supply chain. In general, auto identification and data capturing (AIDC) techniques may be used as well as manual techniques.

In order to provide stable processes that are less error-prone, AIDC techniques are preferable. AIDC techniques refer to the methods of automatically identifying objects, collecting data about them and entering that data directly into computer systems. The following AIDC data carriers are recommended:

— Bar code symbology specification - EAN/UPC (ISO/IEC 15420);

— Bar code symbology specification - Code 128 (ISO/IEC 15417);

— PDF417 bar code symbology specification (ISO/IEC 15438);

— Data Matrix bar code symbology specification (ISO/IEC 16022);

— Bar code symbology specifications - Interleaved 2 of 5 (ISO/IEC 16390);

— EAN.UCC Composite bar code symbology specification (ISO/IEC 24723);

— Space Symbology (RSS) bar code symbology specification (ISO/IEC 24724);

— MicroPDF417 bar code symbology specification (ISO/IEC 24728);

— Radio frequency identification (ISO/IEC 18000-6).

11.2 Barcodes

If bar code data carriers are used, they shall be able to represent the complete unique identification numbers arranged by the parties of the supply chain. The respective bar code reader has to be able to perform as EPCIS data capturing application or it has to pass the coding information to an external

EPCIS data capturing application, which provides the EPCIS data capture interfaces with the respective event message.

11.3 RFID

If RFID technology is used, it shall be able to represent the complete unique identification numbers arranged by the parties of the supply chain. The respective RFID reader has to be able to perform as EPCIS data capturing application or it has to pass the coding information to an external EPCIS data capturing application, which provides the EPCIS data capture interfaces with the respective event message.

11.4 Others

Other types of data capturing techniques may be used (e.g. optical character recognition or manual data capturing). The data carriers used shall be able to represent the complete unique identification numbers arranged by the parties of the supply chain. Furthermore, they have provided mechanisms for handing the identification number to an EPCIS data capturing application (e.g. included data capturing application in a manual hand-held).

Annex A
(normative)

XML scheme for field extensions

For applying the extensions described in this International Standard, end users have to create a specific XML scheme, which is compatible with the EPCIS standard. Parties willing to exchange logistics information in the offshore supply chain have to agree on a namespace for the XML scheme. In the following, the namespace is represented as URL namespace (i.e. my.unique.namespace). The namespace shall be governed by one of the involved parties.

```
<?xml version="1.0"?>
<xsd:schema xmlns:ISO29404="http://my.unique.namespace"
xmlns:xsd=http://www.w3.org/2001/XMLSchema
xmlns:epcis="urn:epcglobal:epcis:xsd:1" targetnamespace="http://my.unique.namespace">
<xsd:element name="eventID" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="eventOrigin" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="locationOfProduction" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="locationOfPort" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="locationOfIntermediateStorrage" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="WindFarm" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="requiredTransportmedium" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="geoLocation" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="sendFrom" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="sendTo" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="shippedFrom" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="shippedTo" type="xsd:anyURI" minOccurs="0"/>
<xsd:element name="ETProvisionProduction" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETDepatureProduction" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETArrivalPort" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETProvisionPort" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETDepaturePort" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETAssemblyStart" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETAssemblyEnd" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETArrivalInstallationSite" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETStartingInstallation" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETStartingInstallation" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETEndingInsatallation" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="ETEndingInsatallation" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTProvisionProduction" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTDepatureProduction " type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTArrivalPort" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTProvisionPort" type="xsd:dateTime " minOccurs="0"/>
<xsd:element name="PTDepaturePort" type="xsd:dateTime " minOccurs="0"/>
<xsd:element name="PTDepaturePort" type="xsd:dateTime " minOccurs="0"/>
<xsd:element name="PTAssemblyStart" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTAssemblyEnd" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTArrivalInstallationSite" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTStartingInstallation" type="xsd:dateTime" minOccurs="0"/>
<xsd:element name="PTEndingInstallation" type="xsd:dateTime" minOccurs="0"/>
<xsd:any processContents="lax" minOccurs="0" maxOccurs="unbounded" namespace="##other"/>
</xsd:schema>
```

Annex B
(informative)

Example messages in the offshore supply chain

B.1 General

In this Annex, different exemplarily EPCIS messages will be provided. The messages provided in this Annex do not represent the entire information flow in the chosen supply chain example. They rather illustrate possible EPCIS messages in the context of this International Standard at certain points of this supply chain example.

The EPCIS standard provides other examples explaining the basic principles of EPCIS.

Table B.1 gives information about the steps in the logistics chain and a verbal description.

Table B.1 — Example steps for an offshore supply chain

Example	Logistic step	Verbal description of the example
1	Planning for a component/ Generation of planning messages for a particular component	This example shows an EPCIS message according to this International Standard for the planning information for a component. Situation: The production of a component has not started yet. Planning information for this component (i.e. planned arrival times at the port, etc.) should be generated in this example. Accordingly, this example provides information about planned locations in the supply chain. Furthermore, it gives information about planned dates.
2	Setting and updating estimated time of production completion	This example shows an EPCIS message according to this International Standard for setting an updating of the estimated time of the production completion of a component. Situation: The production of a component has already started. The estimated time of production completion should be set/updated.
3	Loading of component(s) on pontoon	This example shows an EPCIS message according to this International Standard for the loading of a component on a pontoon. Situation: The pontoon arrived at the site of the manufacturer and is ready for loading. This information should be exchange.
4	Completion of unloading of components in the marshalling port	This example shows an EPCIS message according to this International Standard for the completion of unloading a component from a pontoon. Situation: A pontoon with the respective component arrived at the marshalling port. The unloading procedure starts. This information should be exchanged
5	Loading on installation vessel completed	This example shows an EPCIS message according to this International Standard for the loading of a component on a pontoon. Situation: The installation vessel arrived at the marshalling port. The provision of components for the installation vessel at the port's quayside has already been performed. Furthermore, the loading procedure of two components has been completed.

Table B.1 *(continued)*

Example	Logistic step	Verbal description of the example
6	Installation vessel starts installation of a component	This example shows an EPCIS message according to this International Standard for the start of the installation of a component at the offshore installation site. Situation: The installation vessel arrived at the offshore installation site. The installation vessel just started the installation procedure for the component. This information should be exchanged.

In order to illustrate the examples depicted in Table B.1, Table B.2 shows the different identifiers used in this case. All identifiers presented in Table B.2 are arbitrarily chosen. Some of these numbers do not conform to the respective check sum mechanisms. This ensures that identifiers used in these examples do not represent any kind of object or party existing in the real world. All geo coordinates used in the following examples are arbitrarily chosen. They do not represent any manufacturing or port location.

Table B.2 — Exemplarily identifiers

Object, location or party	Type	Identifier type	Exemplarily identifier value
Manufacturer	Party	SGLN	4312345.00000.0
Quayside of the manufacturer	Location	SGLN	4312345.00001.1
Transport operator	Party	SGLN	4344444.00000.0
Port operator	Party	SGLN	4380298.00000.0
Port	Location	SGLN	4380298.01234.0
Quayside of the port	Location	SGLN	4380298.01234.1
Storage area in the port	Location	SGLN	4380298.01234.2
Installation operator	Party	SGLN	4355555.00000.0
Wind farm	Location	SGLN	4366666.00000.1
Specific WTG in the wind farm	Location	SGLN	4366666.00000.12
Pontoon	Object	GIAI	4344444.12345400
Installation vessel	Object	IMO number	7654322
Component 1	Object	SGTIN	4312345.04711.6789
Component 2	Object	SGTIN	4312345.04711.6790

B.2 Example 1 — Planning message for a component

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<epcis:EPCISDocument
xmlns:epcis="urn:epcglobal:epcis:xsd:1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ISO29404="http://my.unique.namespace" schemaVersion="1">
    <EPCISBody>
       <EventList>
          <ObjectEvent>
              <eventTime>2012-04-03T09:15Z</eventTime>
              <epcList>
                 <epc>urn:epc:id:sgtin:4312345.04711.6789</epc>
              </epcList>
              <action>ADD</action>
              <disposition>http://my.unique.namespace/disp/planned</disposition>
              <readPoint>
                  <id>urn:epc:id:sgln:4312345.00000.0</id>
              </readPoint>
              <ISO29404:eventOrigin>urn:epc:id:sgln:4312345.00000.0
              </ISO29404:eventOrigin>
              <ISO29404:locationOfProduction>urn:epc:id:sgln:4312345.00000.0
```

```
            </ISO29404:locationOfProduction>
            <ISO29404:locationOfPort>urn:epc:id:sgln:4380298.01234.0
            </ISO29404:locationOfPort>
               <ISO29404:locationOfIntermediateStorage>
               urn:epc:id:sgln:4380298.01234.2
               </ISO29404:locationOfIntermediateStorage>
               <ISO29404:WindFarm>urn:epc:id:sgln:4366666.00000.1
               </ISO29404:WindFarm>
               <ISO29404:requiredTransportmedium>
               urn:epc:id:giai:4344444.12345400
               </ISO29404:requiredTransportmedium>
               <ISO29404:PTProvisionProduction>2012-05-01T09:00Z
               </ISO29404:PTProvisionProduction>
               <ISO29404:PTDepartureProduction>2012-05-03T09:00Z
               </ISO29404:PTDepartureProduction>
               <ISO29404:PTArrivalPort>2012-05-03T20:00Z
               </ISO29404:PTArrivalPort>
               <ISO29404:PTProvisionPort>2012-05-25T20:00Z
               </ISO29404:PTProvisionPort>
               <ISO29404:PTDeparturePort>2012-05-26T12:00Z
               </ISO29404:PTDeparturePort>
               <ISO29404:PTStartInstallation>2012-05-27T8:30Z
               </ISO29404:PTStartInstallation>
               <ISO29404:PTEndInstallation>2012-05-27T16:00Z
               </ISO29404:PTEndInstallation>
            </ObjectEvent>
         </EventList>
      </EPCISBody>
</epcis:EPCISDocument>
```

B.3 Example 2 — Updating estimated time of production completion

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<epcis:EPCISDocument
xmlns:epcis="urn:epcglobal:epcis:xsd:1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ISO29404="http://my.unique.namespace"
schemaVersion="1">
  <EPCISBody>
     <EventList>
        <ObjectEvent>
            <eventTime>2012-04-30T09:15Z</eventTime>
            <epcList>
               <epc>urn:epc:id:sgtin:4312345.04711.6789</epc>
            </epcList>
            <action>OBSERVE</action>
            <disposition>http://my.unique.namespace/disp/planned</disposition>
            <readPoint>
                <id>urn:epc:id:sgln:4312345.00000.0</id>
            </readPoint>
            <ISO29404:eventOrigin>urn:epc:id:sgln:4312345.00000.0
            </ISO29404:eventOrigin>
            <ISO29404:locationOfProduction>urn:epc:id:sgln:4312345.00000.0
            </ISO29404:locationOfProduction>
            <ISO29404:locationOfPort>urn:epc:id:sgln:4380298.01234.0
            </ISO29404:locationOfPort>
            <ISO29404:locationOfIntermediateStorage>
            urn:epc:id:sgln:4380298.01234.2
            </ISO29404:locationOfIntermediateStorage>
            <ISO29404:WindFarm>urn:epc:id:sgln:4366666.00000.1
            </ISO29404:WindFarm>
            <ISO29404:requiredTransportmedium>urn:epc:id:giai:4344444.12345400
            </ISO29404:requiredTransportmedium>
            <ISO29404:ETProvisionProduction>2012-04-30T20:00Z
            </ISO29404:ETProvisionProduction>
            <ISO29404:PTProvisionProduction>2012-05-01T09:00Z
            </ISO29404:PTProvisionProduction>
            <ISO29404:PTDepartureProduction>2012-05-03T09:00Z
            </ISO29404:PTDepartureProduction>
            <ISO29404:PTArrivalPort>2012-05-03T20:00Z
            </ISO29404:PTArrivalPort>
```

```
            <ISO29404:PTProvisionPort>2012-05-5T20:00Z
            </ISO29404:PTProvisionPort>
            <ISO29404:PTDeparturePort>2012-05-26T12:00Z
            </ISO29404:PTDeparturePort>
            <ISO29404:PTStartInstallation>2012-05-27T8:30Z
            </ISO29404:PTStartInstallation>
            <ISO29404:PTEndInstallation>2012-05-27T16:00Z
            </ISO29404:PTEndInstallation>
         </ObjectEvent>
      </EventList>
   </EPCISBody>
</epcis:EPCISDocument>
```

B.4 Example 3 — Loading of component on the pontoon

```
<?xml version=”1.0” encoding = “UTF-8” standalone=”yes”?>
<epcis:EPCISDocument
xmlns:epcis=”urn:epcglobal:epcis:xsd:1”
xmlns:xsi=”http://www.w3.org/2001/XMLSchema-instance”
xmlns:ISO29404=”http://my.unique.namespace”
schemaVersion=”1”>
   <EPCISBody>
       <EventList>
          <AggregationEvent>
             <eventTime>2012-05-01T08:12Z</eventTime>
                <parentID>urn:epc:id:giai:4344444.12345400</parentID>
                <childEPCs>
                   <epc>urn:epc:id:sgtin:4312345.04711.6789</epc>
                   <epc>urn:epc:id:sgtin:4312345.04711.6790</epc>
                </childEPCs>
                <action>ADD</action>
                <bizStep>urn:epcglobal:epcis:cbv:bizstep:loading</bizStep>
                <disposition>http://my.unique.namespace/disp/loading_completed
                </disposition>
                <readPoint>
                   <id>urn:epc:id:sgln:4312345.00001.1</id>
                </readPoint>
                </ISO29404:eventOrigin>urn:epc:id:sgln:4344444.00000.0
                <ISO29404:eventOrigin>
                <ISO29404:geoLocation>geo:55.232,0.0311</ISO29404:geoLocation>
            </AggregationEvent>
       </EventList>
    </EPCISBody>
</epcis:EPCISDocument>
```

B.5 Example 4 — Completion of unloading of components in the marshalling port

```
<?xml version=”1.0” encoding=”UTF-8” standalone=”yes”?>
<epcis:EPCISDocument
xmlns:epcis=”urn:epcglobal:epcis:xsd:1”
xmlns:xsi=”http://www.w3.org/2001/XMLSchema-instance”
xmlns:ISO29404=”http://my.unique.namespace”
schemaVersion=”1”>
   <EPCISBody>
       <EventList>
          <AggregationEvent>
             <eventTime>2012-05-04T07:00Z</eventTime>
             <parentID>urn:epc:id:giai:4344444.12345400</parentID>
             <childEPCs>
                <epc>urn:epc:id:sgtin:4312345.04711.6789</epc>
                <epc>urn:epc:id:sgtin:4312345.04711.6790</epc>
             </childEPCs>
             <action>DELETE</action>
             <bizStep>urn:epcglobal:epcis:cbv:bizstep:unloading</bizStep>
             <disposition>http://my.unique.namespace/disp/unloading_completed
             </disposition>
             <readPoint>
                <id>urn:epc:id:sgln:4380298.01234.0</id>
             </readPoint>
             <ISO29404:eventOrigin>urn:epc:id:sgln:4344444.00000.0
```

```
            </ISO29404:eventOrigin>
          </AggregationEvent>
        </EventList>
     </EPCISBody>
</epcis:EPCISDocument>
```

B.6 Example 5 — Loading on installation vessel completed

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<epcis:EPCISDocument
xmlns:epcis="urn:epcglobal:epcis:xsd:1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ISO29404="http://my.unique.namespace"
schemaVersion="1">
   <EPCISBody>
      <EventList>
         <AggregationEvent>
            <eventTime>2012-05-01T08:12Z</eventTime>
            <parentID>http://my.unique.namespace/id/0200/7654322</parentID>
            <childEPCs>
               <epc>urn:epc:id:sgtin:4312345.04711.6789</epc>
               <epc>urn:epc:id:sgtin:4312345.04711.6790</epc>
            </childEPCs>
            <action>ADD</action>
            <bizStep>urn:epcglobal:epcis:cbv:bizstep:loading</bizStep>
            <disposition>http://my.unique.namespace/disp/loading_completed
            </disposition>
            <readPoint>
               <id>urn:epc:id:sgln:4380298.01234.0</id>
            </readPoint>
         <ISO29404:eventOrigin>urn:epc:id:sgln:4355555.00000.0
         </ISO29404:eventOrigin>
         </AggregationEvent>
      </EventList>
   </EPCISBody>
</epcis:EPCISDocument>
```

B.7 Example 6 — Installation vessel starts installation of a component

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<epcis:EPCISDocument
xmlns:epcis="urn:epcglobal:epcis:xsd:1"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ISO29404="http://my.unique.namespace"
schemaVersion="1">
    <EPCISBody>
        <EventList>
            <ObjectEvent>
               <eventTime>2012-05-26T9:24Z</eventTime>
               <epcList>
                   <epc>urn:epc:id:sgtin:4312345.04711.6789</epc>
               </epcList>
            <action>OBSERVE</action>
            <bizStep>urn:epcglobal:epcis:cbv:bizstep:installing</bizStep>
            <disposition>http://my.unique.namespace/disp/installation_started
            </disposition>
            <readPoint>
               <id>urn:epc:id:sgln:4366666.00000.12</id>
            </readPoint>
            <ISO29404:eventOrigin>urn:epc:id:sgln:4355555.00000.0
            </ISO29404:eventOrigin>
            <ISO29404:geoLocation>geo:57.045,0.0205</ISO29404:geoLocation>
            <ISO29404:PTStartInstallation>2012-05-27T8:30Z
            </ISO29404:PTStartInstallation>
            <ISO29404:PTEndInstallation>2012-05-27T16:00Z
            </ISO29404:PTEndInstallation>
            </ObjectEvent>
         </EventList>
     </EPCISBody>
</epcis:EPCISDocument>
```

Bibliography

[1] ISO 6346, *Freight containers — Coding, identification and marking*

[2] ISO 19111:2007, *Geographic information — Spatial referencing by coordinates*

[3] ISO/IEC 15417, *Information technology — Automatic identification and data capture techniques — Code 128 bar code symbology specification*

[4] ISO/IEC 15420, *Information technology — Automatic identification and data capture techniques — EAN/UPC bar code symbology specification*

[5] ISO/IEC 15438, *Information technology — Automatic identification and data capture techniques — PDF417 bar code symbology specification*

[6] ISO/IEC 15459-1, *Information technology — Automatic identification and data capture techniques — Unique identification — Part 1: Individual transport units*

[7] ISO/IEC 15459-2, *Information technology — Automatic identification and data capture techniques — Unique identification — Part 2: Registration procedures*

[8] ISO/IEC 16022, *Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification*

[9] ISO/IEC 16390, *Information technology — Automatic identification and data capture techniques — Interleaved 2 of 5 bar code symbology specification*

[10] ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz General*

[11] ISO/IEC 24723, *Information technology — Automatic identification and data capture techniques — GS1 Composite bar code symbology specification*

[12] ISO/IEC 24724, *Information technology — Automatic identification and data capture techniques — GS1 DataBar bar code symbology specification*

[13] ISO/IEC 24728, *Information technology — Automatic identification and data capture techniques — MicroPDF417 bar code symbology specification*

[14] Berners-Lee T., Masinter L., McCahill M. Uniform Resource Locators (URL). RFC 1738, December 1994, http://www.ietf.org/rfc/rfc1738

[15] Berners-Lee T., Fielding R., Masinter L. Uniform Resource Identifiers (URI): Generic Syntax. RFC2396, August 1998, http://www.ietf.org/rfc/rfc2396

[16] Berners-Lee T., Fielding R., Masinter L. Uniform Resource Identifier (URI): Generic Syntax. RFC3986, January 2005, http://www.ietf.org/rfc/rfc3986

[17] Biron P., & Malhotra A. XML Schema Part 2: Datatypes Second Edition. W3C Recommendation, May 2001, http://www.w3.org/TR/xmlschema-2

[18] Bray T., Paoli J., Sperberg-McQueen C.M., Maler E., Yergeau F. Extensible Markup Language (XML) 1.0 (Third Edition). W3C Recommendation, February 2004, http://www.w3.org/TR/2004/REC-xml-20040204/

[19] Leach P., Mealling M., Salz R. A Universally Unique IDentifier (UUID) URN Namespace. RFC4122, July 2005, http://www.ietf.org/rfc/rfc4122.txt

[20] Moats R. URN Syntax. Internet Engineering Task Force Request for Comments RFC-2141, May 1997, http://www.ietf.org/rfc/rfc2141.txt

[21] THOMPSON H., BEECH D., MALONEY M., MENDELSOHN N. XML Schema Part 1: Structures Second Edition. W3C Recommendation, May 2001, http://www.w3.org/TR/xmlschema-1

[22] IMO Resolution A.600(15) IMO ship identification number scheme

[23] GS1 EPC Tag Data Standard 1.9

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