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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



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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).

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This document was prepared by Technical Committee ISO/TC 23, Tractors and machinery for agriculture and forestry, Subcommittee SC 19, Agricultural electronics.

A list of all parts in the ISO 7673 series can be found on the ISO website.

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

Introduction

Agricultural and food producers find themselves needing to feed a growing global population with limited resources, in the context of ever-increasing regulatory pressure, market price volatility, and supply-chain interest in traceability and sustainability. This increasingly requires data-driven decision-making based on sound scientific principles regarding the use of crop inputs (applied to crops through *field operations*) such as water, seeds, fertilizers, and crop protection products. The data to drive these decision processes are often captured and shared across multiple hardware and software platforms, each of which may have its own formats and code lists for representing the meaning of data. This lack of uniformity in data representation prevents the agrifood industry from realizing the promise of data-driven, principled decision-making at scale, and making a greater contribution to the Sustainable Development Goals.

Data exchange standards that enable the free flow of data among the sources of the data inputs that drive decision-making, the systems that use those inputs to produce insights and support decisions regarding field operations, and the systems that control the equipment that performs those operations, are fundamental for allowing producers and vendors alike to manage data and to make better decisions that use less crop inputs and energy resources while protecting harvest yield, quality, and sustainability. Two noteworthy benefits they provide are:

- Data exchange standards facilitate broader (i.e., more technologies) and more comprehensive (i.e., greater level of detail and precision) systems integration. This is achieved by reducing development and maintenance costs for data handling systems.
- The standards promote reliable system interoperation: standards-compliant tools are expected to work together; the end user benefits by having confidence that two products from different sources will work together as expected.

Agricultural field operations data —

Part 1: Core concepts

1 Scope

This Standard enables the exchange at scale of agricultural field operations data. This includes:

- The data used to drive agricultural field operation (3.9) decisions, such as weather, soil moisture, and field scouting, and
- The data used to implement those decisions as field operations (such as irrigation, spraying, and planting)

These data are currently stored and represented in a variety of proprietary original equipment manufacturer (OEM) formats. This standard seeks to provide an industry-wide data model that can be used for unambiguous data exchange by actors in the agrifood industry.

1.1 The scope of the Standard is based on two major aspects of agricultural and food processes:

- 1. Observations:** the field, atmospheric, plant, or other *in situ* measurements that can drive decision-making in agricultural and food systems. This includes weather stations, soil moisture sensors, or crop-related sensing, as well as other inputs usable by decision-support systems (3.5). This is an agrifood systems implementation of the ISO 19156 standard for observations and measurements (ISO, 2011).
- 2. Operations, or field operations (3.9):** activities associated with the production of a crop in the field. This includes application of products such as seeds (i.e., planting), chemicals, fertilizers, and water (using an irrigation system (3.11)). It includes, but is not restricted to, management-level communications and record keeping. Field operations data are based around a Recommendation (3.14), which describes a suggested course of action; a Work Order (3.15), which describes an ordered course of action; and a Work Record (3.16), which describes what *actually happened*. This work is based on, and extends, the ISO11783-10 standard (ISO, 2015) for communications between agricultural machinery and farm management information systems or FMIS (3.8).

1.2 The Standard currently consists of three parts:

1.2.1 Part 1 (this document): Core Concepts, Processes, and Objects

- Business processes associated with field operations
- The Actors and their role(s) in the process
- Core documents and their relationships
- Common components
- Identity — Compound identifiers
- Time, space, people, geopolitical-context-dependent data
- Reference data
- Setup and configuration data

1.2.2 Part 2: Observations (3.13) and measurements (3.12)

- Observations: An agriculture-specific implementation of the ISO 19156 standard
- Field observations, including soil water content and local field weather
- Setup and configuration of sensors and loggers
- Derived weather data

1.2.3 Part 3: Irrigation Operations

- Location and geometry of the irrigation system
- Documenting the operation of different parts of an irrigation system
- Flows and pressure schedules (how much and when)
- Work orders for irrigation systems
- Work records: Reporting how much and where, water and (possibly) chemicals were applied.

2 Normative references

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

ISO/FDIS 6709, *Standard representation of geographic point location by coordinates*

ISO 8601, *Data objects and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 13249-3:2011, *Information technology — Database languages — SQL multimedia and application packages — Part 3: Spatial (WKT)*

ISO 19109, *Geographic information — Rules for application schema*

ISO 19112:2003, *Geographic information — Spatial referencing by geographic identifiers*

ISO 19156:2011, *Geographic information — Observations and measurements*

ISO/IEC 19501:2005, *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

centre pivot irrigation machine

automated irrigation machine consisting of a number of self-propelled towers supporting a pipeline rotating around a pivot point and through which water supplied at the pivot point flows radially outward for distribution by sprayers or sprinklers located along the pipeline

[SOURCE: ISO 11545:2009, 2.1]

3.2

crop plan

a high-level document describing how a crop will be grown on a given area of land during a crop season. It can range from very abstract to very specific.

3.3

cropzone

A parcel of land, not necessarily contiguous (e.g., an agricultural field or paddock, or a part thereof), that an agricultural producer is growing a particular crop or genotype on, during a specified period of type (e.g., a crop season).

3.4

datum

parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system.

[SOURCE: ISO 19111:2019, 3.1.15]

3.5

decision support system

DSS

a computerized information system used to help individuals or organizations make informed, decisions that may involve data analysis, integration of model results, and the application of a set of defined rules, criteria and guidelines. A Decision Support System is a type of, or may be part of, a Farm Management Information System.

3.6

direct position

position described by a single set of coordinates within a coordinate reference system.

[SOURCE: ISO 19129:2009(en), 4.1.11]

3.7

document

recorded information or material object which can be treated as a unit in a documentation process.

[SOURCE: ISO 5127:2017, 3.1.1.38]

3.8

farm management information system

FMIS

office computer system used by a farmer or contractor that includes the software for farm management, such as book-keeping, payroll, resource management for machines, products, workers, field management, geographical information system, decision support systems and task management

[SOURCE: ISO 11783-1:2017(en), 3.23]

3.9

field operation

a task or activity, whether planned or actual (i.e., that already happened), that is connected with the production of a crop. Planting, spraying, spreading, tillage, irrigation and harvest are all examples of field operations.

3.10

global navigation satellite system

GNSS

satellite based navigation system that provides autonomous global positioning of a receiving device

Note 1 to entry: Global positioning system (GPS), and global navigation satellite system (Glonass), Galileo and BeiDo are typical examples of global navigation satellite systems.

[SOURCE: ISO 19901-10:2021(en), 3.41]

3.11

irrigation system

assembly of pipes, components, and devices installed in the field for the purpose of irrigating a specific area

[SOURCE: ISO 20670:2023(en), 3.49]

3.12**measurement**

a set of operations having the object of determining the value of a quantity.

[SOURCE: ISO 19101-2: 2018, 3.1.41]

3.13**observation**

act carried out by an observer to determine the value of an observable property of an object (feature-of-interest) by using a procedure, with the value provided as the result.

[SOURCE: ISO 19156:2023, 3.13]

3.14**recommendation**

a course of action proposed by someone with *expertise* (e.g., an agronomist, crop scout or irrigation consultant). A recommendation is advisory ("This is what I recommend we should do.")

3.15**work order**

a set of instructions, given by someone with authority for a specific course of action to take in a field operation. ("This is what we are going to do.") Two examples: an irrigation work order describes the amount of water to apply to a specified area of land over a certain time period; a seeding work order describes seed products (e.g., varieties, seed treatments) and the rates to apply them with (e.g., seeds per unit area) over a specified area of land, over the time period of interest.

3.16**work record**

a document that describes what actually happened while performing the *field operation* (3.9). ("This is what was actually done.") It may differ from the work order because the operator performing the field operation may have adjusted to particular conditions (e.g., suspended the operation because the ground was too wet and returned the next day.)

4 Symbols (and abbreviated terms)

No symbols are defined for this standard.

4.1 Note on multiplicity of properties

This standard defines an abstract object model. The standard utilizes UML diagrams to *specify* the classes and their properties. The body text of the document *describes* the properties. For the reader's convenience, we have included the multiplicity specification in the body text of each classes' description. [Table 1](#) shows the UML multiplicity specification and its meaning, as used in the body text of this standard. When the multiplicity is not shown (in the diagram or the description), the multiplicity shall be assumed as [\[1\]](#).

Table 1 — Multiplicity codes

Text	Meaning
[0..1]	The property is optional and may appear only once
[1]	The property is required and shall appear only once
[0..*]	The property is optional and may appear any number of times
[1..*]	The property is required and may appear any number of times

5 The Management Process

Field operations such as planting, irrigation and harvest are producer business processes. These processes must be supported with data exchange, both for coordination among the different actors directly involved in each process, and for communication with information consumers, such as trade partners and regulatory

agencies. These processes vary in detail from producer to producer, but there is value in defining a broadly applicable core set. Modelling field operations processes enables clarity and quality control in decision-making. The models are inevitably a simplification of what happens on a farm. Nonetheless, they can serve as effective tools for supporting data-driven decisions.

6 Business Process Model and Notation (ISO/IEC 19510:2013)

Business Process Modelling Notation (BPMN) diagrams provide a visual representation of a workflow, and the exchanges of data that take place among the actors participating in it. In this standard, BPMN diagrams represent the workflow for data-driven field operations decision processes, communicating a decision as a Recommendation (3.14) and Work Order (3.15), and acquiring a Work Record (3.16) of what happened as the work was executed. The models provide a clear representation of the workflow that can be easily understood by all participants, thus supporting a structured method for achieving high quality field operations decision-making.

Figure 1 below shows a BPMN diagram with a key / guide to help interpret the example shown in Figure 2. The diagram is divided into horizontal pools. Each pool describes a process performed by an actor, as a sequence of activities. Interactions among actors are represented as *messages* (shown as dotted lines) that can flow between pools.

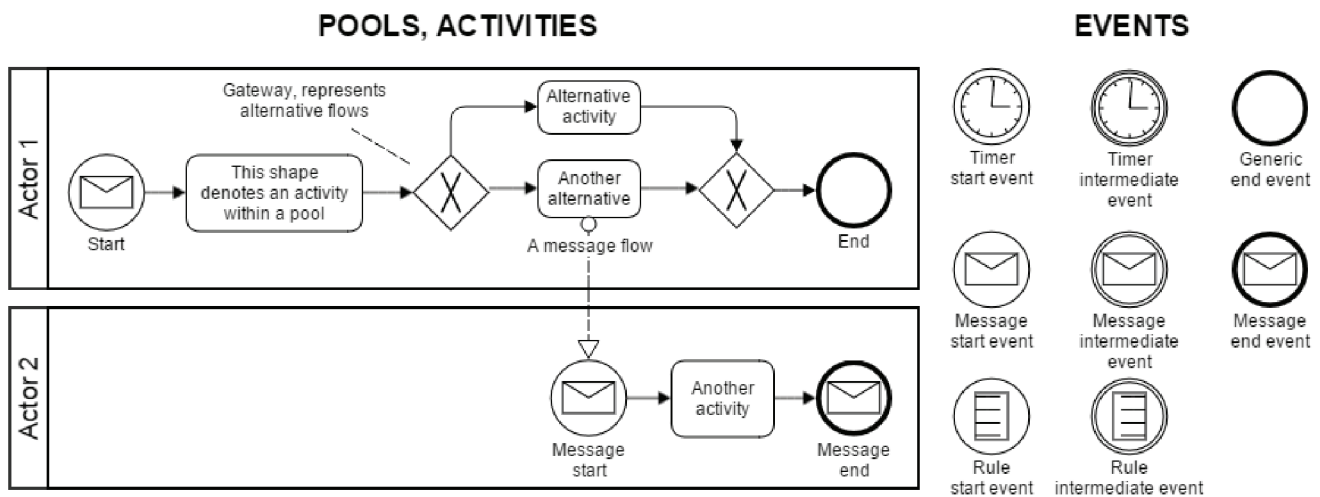


Figure 1 — BPMN key diagram

Different processes are initiated in different ways. Those processes shown starting with a clock face icon have a scheduled start time. Those that are shown starting with an envelope icon start when the corresponding message is received. As an example, the diagram in Figure 2 shows the multiple concurrent processes that take place in an irrigation operation.

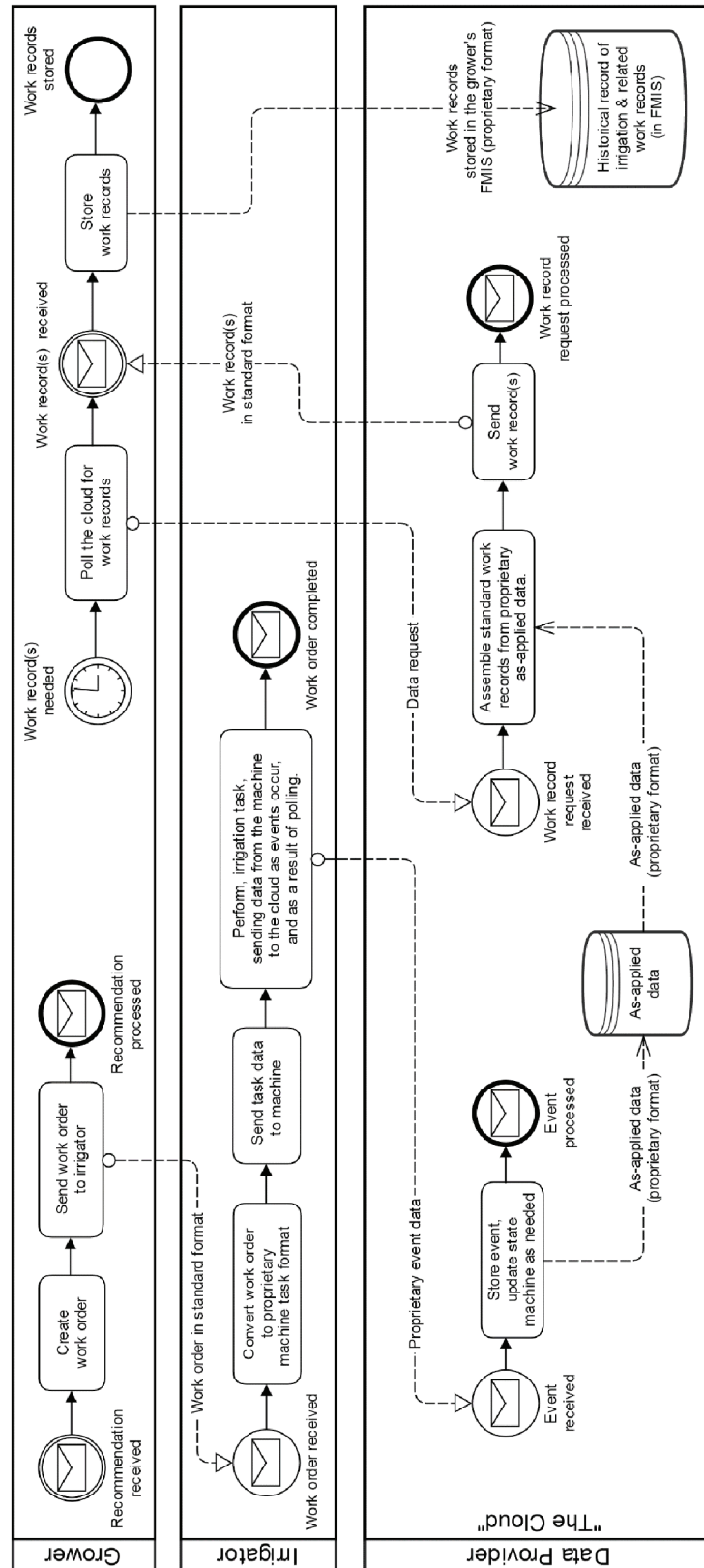


Figure 2 — Sample BPMN diagram for precision irrigation data

Part 2 of this Standard uses a specific BPMN for observations and measurements, while Part 3 describes a BPMN for irrigation operations.