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Data quality —

Part 66: Data quality management: Assessment indicators for data processing in manufacturing operations

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

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

A list of all parts in the ISO 8000 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

Digital data delivers value by enhancing all aspects of organizational performance, including:

— operational effectiveness and efficiency;

— safety;

— reputation with customers and the wider public;

— compliance with statutory regulations;

— consumer costs, revenues and stock prices.

The influence on performance originates from data being the formalized representation of information. This information enables organizations to make reliable decisions. This decision making can be performed by human beings directly and also by automated data processing including artificial intelligence systems.

Through widespread adoption of digital computing and associated communication technologies, organizations become dependent on digital data. This dependency amplifies the negative consequences of the lack of quality in this data. These consequences are the decrease of organizational performance.

The biggest impact of digital data comes from two key factors:

— the data having a structure that reflects the nature of the subject matter;

— the data also being computer processable (machine readable) rather than just being for a person to read and understand.

ISO 9000 explains that quality is not an abstract concept of absolute perfection. Quality is actually the conformance of characteristics to requirements and, thus, any item of data can be of high quality for one use but not for another use that has differing requirements.

EXAMPLE 1 When storing start times for meetings, a calendar application requires less precision than a control system would for storing the times at which to activate a propulsion unit during a spaceflight.

The nature of digital data is fundamental to establishing requirements that are relevant to the specific decisions that are made by each organization.

EXAMPLE 2 ISO/TS 8000-1 identifies that data has syntactic (format), semantic (meaning) and pragmatic (usefulness) characteristics.

To support the delivery of high-quality data, the ISO 8000 series addresses:

— data governance, data quality management and maturity assessment;

EXAMPLE 3 ISO 8000-61 specifies a process reference model for data quality management.

— creating and applying requirements for data and information;

EXAMPLE 4 ISO 8000-110 specifies how to exchange characteristic data that is master data.

— monitoring and measuring data and information quality;

EXAMPLE 5 ISO 8000-8 specifies approaches to measuring data and information quality.

— improving data and, consequently, information quality;

EXAMPLE 6 ISO/TS 8000-81 specifies an approach to data profiling, which identifies opportunities to improve data quality.

— issues that are specific to the type of content in a data set.

EXAMPLE 7 ISO/TS 8000-311 specifies how to address quality considerations for product shape data.

Data quality management covers all aspects of data processing, including creating, collecting, storing, maintaining, transferring, exploiting and presenting data to deliver information.

Effective data quality management is systemic and systematic, requiring an understanding of the root causes of data quality issues. This understanding is the basis for not just correcting existing nonconformities but also implementing solutions that prevent future reoccurrence of those nonconformities.

EXAMPLE 8 If a data set includes dates in multiple formats including "yyyy-mm-dd", "mm-dd-yy" and "dd-mm-yy", then data cleansing can correct the consistency of the values. Such cleansing requires additional information, however, to resolve ambiguous entries (such as, "04-05-20") and cannot address any process issues and people issues, including training, that have caused the inconsistency.

As a contribution to this overall capability of the ISO 8000 series, this document supports the application of ISO 8000-62 to determine the process maturity of data quality management in manufacturing organizations. This support is provided by specifying assessment indicators for data processing in manufacturing operations management specified by IEC 62264-1.

Organizations can use this document on its own or in conjunction with other parts of the ISO 8000 series.

This document supports activities that affect:

— one or more information systems;

— data flows within the organization and with external organizations;

— any phase of the data life cycle.

By implementing parts of the ISO 8000 series, an organization achieves the following benefits:

— establishing reliable foundations for digital transformation;

— recognizing how data in digital form has become a fundamental asset class that organizations rely on to deliver value;

— securing evidence-based trustworthiness of data and information for all stakeholders;

— creating portable data that protects against the loss of intellectual property and that is reusable across the organization and applications;

— achieving traceability of data back to original sources;

— ensuring all stakeholders work with common understanding of explicit data requirements.

ISO/TS 8000-1 provides a detailed explanation of the structure and scope of the whole ISO 8000 series.

Annex A contains an identifier that unambiguously identifies this document in an open information system.

Data quality —

Part 66:
Data quality management: Assessment indicators for data processing in manufacturing operations

1 Scope

This document specifies assessment indicators to support the assessment of organizational process maturity for data quality management in the context of manufacturing operations management as specified by IEC 62264-1.

The following are within scope of this document:

— assessment indicators that are work products generated by data processing (as specified by ISO 8000-61) and, thus, enable rating of process performance, a process attribute specified by ISO/IEC 33020;

— the role played by each work product in the processes of manufacturing operations management;

— the connection of each work product to the outcomes of the processes of manufacturing operations management.

The following are outside the scope of this document:

— assessment indicators for any of the other process attributes specified by ISO/IEC 33020;

— methods or procedures to measure process capability.

2 Normative references

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

ISO 8000-2, *Data quality — Part 2: Vocabulary*

ISO 8000-61, *Data quality — Part 61: Data quality management: Process reference model*

ISO 8000-62, *Data quality — Part 62: Data quality management: Organizational process maturity assessment: Application of standards relating to process assessment*

IEC 62264-1, *Enterprise-control system integration — Part 1: Models and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8000-2 and IEC 62264-1 apply.

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

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

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

NOTE The term "product" appears in both ISO 8000-2 and IEC 62264-1 but with different definitions. Both definitions provide, however, a useful and relevant explanation of the meaning of the term.

4 Process maturity assessment

Given the fundamental role of data in decision making, any type of organization can deliver significant benefits through data quality management. This delivery is sustainable, however, only when the organization understands and continually improves existing capability to perform data quality management. This understanding is the primary outcome of process maturity assessment.

This document applies to process maturity assessment in the specific context of (see Figure 1):

— implementations of the data processing as specified by the process reference model for data quality management in ISO 8000-61;

— implementations of the data processing as part of manufacturing operations management as specified by the functional model in IEC 62264-1 and as identified by this document (see Clause 5).

In this context, the process maturity assessment shall:

— conform to ISO 8000-62;

— assess implementations of data processing that conforms to ISO 8000-61;

— perform process attribute rating of process performance using the work products specified by Clause 7.

NOTE 1 Process performance is a process attribute specified by ISO/IEC 33020 (see Clause 6).

NOTE 2 These work products are assessment indicators that conform to the requirements of ISO/IEC 33004.

NOTE 3 The work products are information inputs to and outputs from individual processes of manufacturing operations management.

This document harmonizes the different ways of describing processes in IEC 62264-1, ISO 8000-61 and ISO/IEC 33063 (see Annex B).

5 Manufacturing operations management

5.1 Scope of manufacturing operations management

IEC 62264-1 specifies manufacturing operations management to cover the categories of:

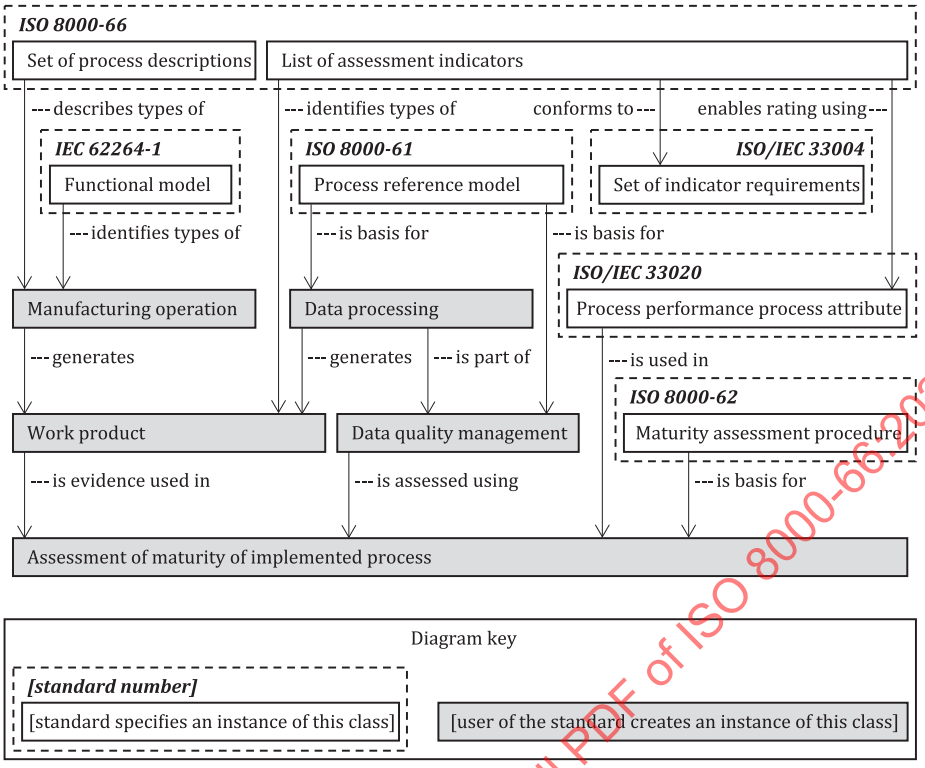
— production operations management;

— inventory operations management;

— quality operations management;

— maintenance operations management.

Within these categories are eight functions of manufacturing operations management (see Table 1). These functions are connected by a series of information flows (see Figures 2 to 4).



NOTE See ISO/IEC 19505-1 for details on the notation in this diagram.

Figure 1 — Key concepts covered by this document and related standards

This document provides details on these eight functions, each one with the following process descriptions:

— production scheduling (see 5.2);

— production control — process support engineering (see 5.3);

— production control — production operations control (see 5.4);

— production control — production operations planning (see 5.5);

— material and energy control (see 5.6);

— product inventory control (see 5.7);

— quality assurance (see 5.8);

— maintenance management (see 5.9).

Table 1 — Categories and constituent functions of manufacturing operations management as specified by IEC 62264-1

Category	Function
Production operations management	Production scheduling (A11)
	Production control: process support engineering (A12)
	Production control: production operations control (A13)
	Production control: production operations planning (A14)
Inventory operations management	Material and energy control (A3)
	Product inventory control (A2)
Quality operations management	Quality assurance (A5)
Maintenance operations management	Maintenance management (A4)
NOTE The identifier in brackets (i.e. "A11") is the node number of the corresponding function in the model of manufacturing operations management represented by Figures 2 to 4.	

Each process description consists of the following information:

— process label: identifying the process;

NOTE 1 The process label is also known as the process name.

— process purpose: describing the benefit that the process delivers to the executing organization or other stakeholders;

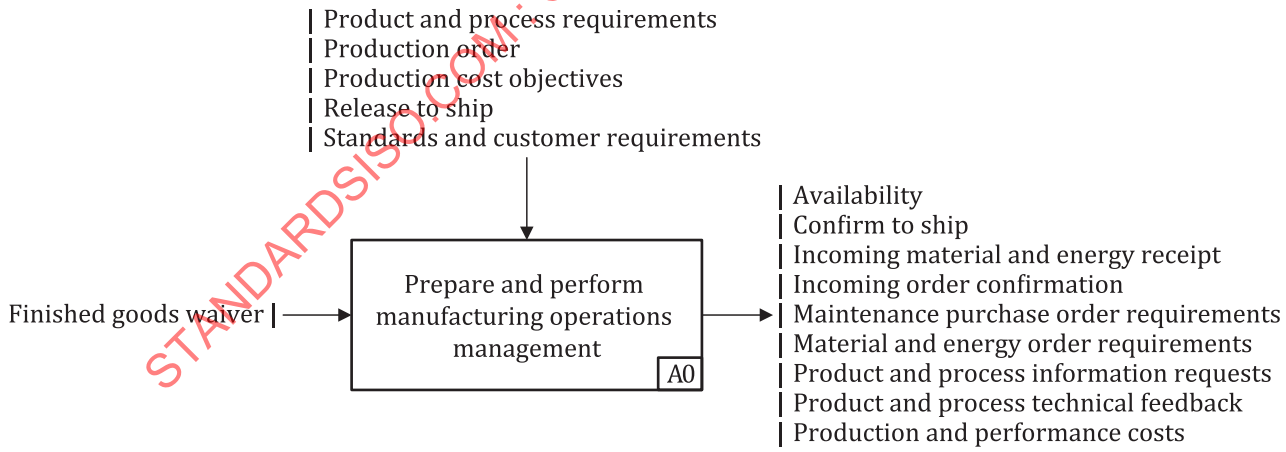
— process outcomes: identifying the information generated or modified by the function;

NOTE 2 These outcomes are specified by IEC 62264-1.

— process activities: identifying at a generic level how the function delivers the outcomes.

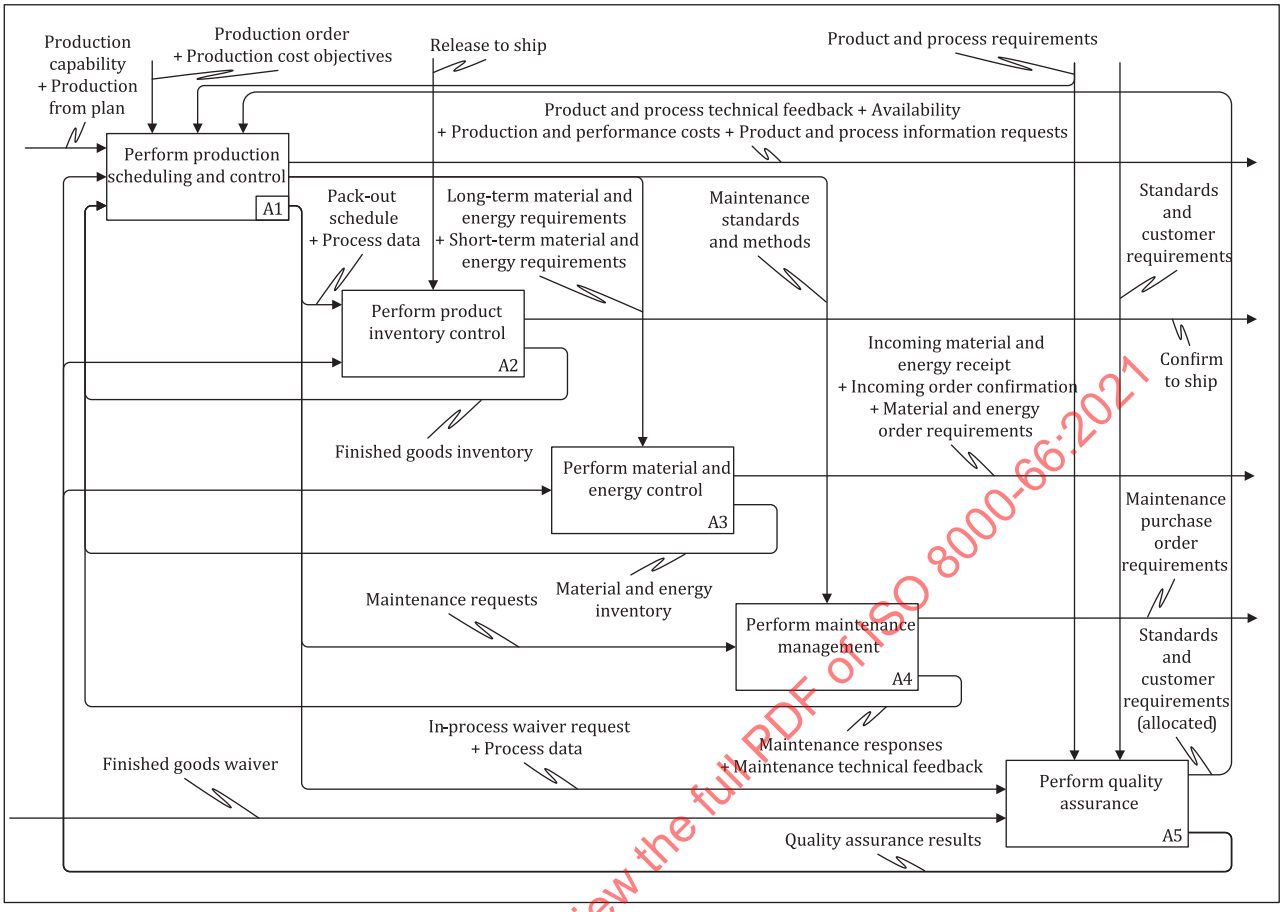
NOTE 3 This content builds on the constituent detailed functions specified by IEC 62264-1.

NOTE 4 This approach to process descriptions is consistent with ISO 8000-61.



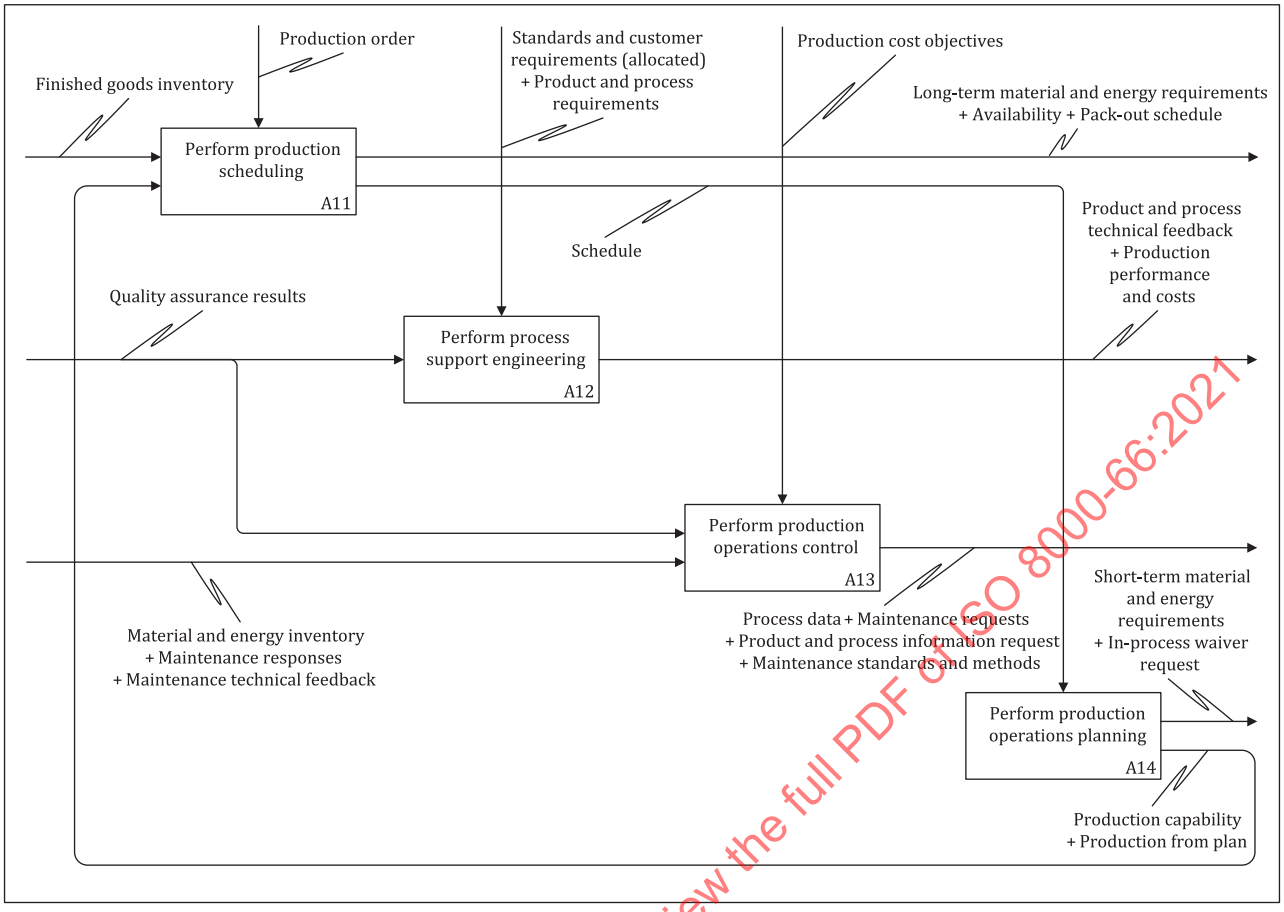
NOTE See ISO/IEC/IEEE 31320-1 for details on the notation in this diagram.

Figure 2 — A-0 context diagram for manufacturing operations management



NOTE See ISO/IEC/IEEE 31320-1 for details on the notation in this diagram.

Figure 3 — A0 diagram for prepare and perform manufacturing operations management



NOTE See ISO/IEC/IEEE 31320-1 for details on the notation in this diagram.

Figure 4 — A1 diagram for perform production scheduling and control

5.2 Production scheduling

5.2.1 Purpose of production scheduling

The purpose of production scheduling is to arrange, control and optimize work and workloads in manufacturing operations. This scheduling is the basis for allocating plant and machinery resources, planning human resources and production processes and purchasing materials.

5.2.2 Outcomes of production scheduling

The process generates the following information items:

a) production schedule;

b) actual production versus planned production;

c) production capacity and resource availability;

d) current order status.

5.2.3 Production scheduling activities

The following are the production scheduling activities:

— Determine production schedule: The production process is planned by allocating available resources (e.g. plant, personnel, materials, tools, energy, environment) to meet production orders.

— Identify long-term raw material requirements: Identify the purchasing sources between the main and subsidiary materials, establish the purchasing schedule considering the quantity, unit, source, price and inventory status.

— Determine pack-out schedule for end products: The final assembly schedule is possibly only for final mixing, cutting and packaging regardless of assembly. Develop a schedule for the production of the finished product to manufacture the product to the specific order of the customer in the environment of custom-made or custom-assembled. Due to limited production capacity and availability of materials, the process schedule is established after a customer order is received.

— Determine available product for sales: Identify the quantity of products that can be shipped by identifying inventory status and order status and finished products according to the production schedule.

5.3 Production control — Process support engineering

5.3.1 Purpose of production control — Process support engineering

Process support engineering ensures the availability and readiness of production processes that are effective and efficient.

5.3.2 Outcomes of production control — Process support engineering

The process generates the following information items:

a) minor equipment and process modifications;

NOTE 1 These modifications can include new design drawings.

b) instructions on how to handle equipment;

NOTE 2 These instructions can include standard operating procedures.

c) instructions on how to make products;

NOTE 3 These instructions include production rules and the standard materials, equipment, and other resources used.

d) material safety data sheets;

e) instructions on how to install equipment;

NOTE 4 This equipment can include vendor equipment.

f) environmental and safety operating limits and constraints;

g) engineering standards and online operating instructions.

NOTE 5 These standards cover process equipment design techniques and process operational methods.

5.3.3 Production control activities — Process support engineering

The following are the process support engineering activities:

— Issue requests for modification or maintenance: Request for equipment repairs, process changes and equipment maintenance are issued.

— Coordinate maintenance and engineering functions: Execute maintenance to facilitate engineering functions of the equipment.

— Provide technical standards and methods to operations and maintenance functions: Technical standards and methods appropriate to operational processes and maintenance functions are provided.

— Follow up on equipment and process performance: Analyse the results of equipment usage and determine performance of equipment suitable for production. It also analyses process performance to identify improvements.

— Provide technical support to operators: Addressing technical problems raised by operators regarding machinery, product quality and operational safety. Technology supports are provided in a timely manner to meet technical requirements.

— Follow up on technological developments: Prioritize technology development and ensure that technological capacity leads to practical performance.

5.4 Production control — Production operations control

5.4.1 Purpose of production control — Production operations control

Production operations control ensures that production meets requirements (including demand requirements) and that other processes are informed about the current status of production.

5.4.2 Outcomes of production control — Production operations control

The process generates the following information items:

a) status of production requests;

b) production data;

NOTE 1 This can include data to calculate production costs and performance.

c) process data;

NOTE 2 This can include equipment performance feedback.

d) status of resources;

e) status of maintenance work order requests;

f) requests for maintenance;

g) diagnostic and self-test results;

h) process history;

i) requests for support from process support engineering;

j) requests for analysis of material.

5.4.3 Production control activities — Production operations control

The following are the production operations control activities:

— Produce product according to schedule and specifications: The production of a product conforms with the applicable production schedule and the product conforms with applicable specifications.

— Report production, process and resource information: Identify the information that accompanies production, information of process performance and the resources information required.

— Monitor equipment, validate operational measurements and determine need for maintenance: Identify and determine whether maintenance is required for the equipment, to check various measurements from an operational point of view and to monitor the equipment.

— Prepare equipment for maintenance and return to service after maintenance: Identify and prepare the equipment required for maintenance and return the equipment after maintenance.

— Perform diagnostics and self-check of production and control equipment: Diagnosis of equipment involved in production control activities and self-inspection to identify abnormalities.

— Balance and optimize production within site or area: Ensure production makes use of available resources in a way to meet strategic organizational requirements such as agility, resilience and financial targets.

— Manage labour for site or area and manage documents: Ensure resources are available and ready to support effective, efficient production.

5.5 Production control — Production operations planning

5.5.1 Purpose of production control — Production operations planning

Production operations planning ensures that the organization understands intended timelines and associated resources for production.

5.5.2 Outcomes of production control — Production operations planning

The process generates (or modifies where indicated) the following information items:

a) material and energy inventory report (modifies);

b) material and energy requirements required to meet the production plan;

c) site or area production plan for operations control;

d) available capability of the production resources.

5.5.3 Production control activities — Production operations planning

The following are the production operations planning activities:

— Set up short-term production plan based on production schedule: Develop a short-term production plan for operation based on the production schedule.

— Check schedule against raw material availability and product storage capacity: The production plan is checked taking into account the availability of raw materials and product storage capacity.

— Check schedule against equipment and personnel availability: The production plan is checked for equipment availability and personnel availability.

— Determine percentage of capacity status: Identifies any variation between available production capacity and that being required by the plan.

— Modify production plan hourly to account for equipment outage, manpower and raw materials availability: The production plan is revised hourly to account for equipment outage, manpower and raw materials availability.

5.6 Material and energy control

5.6.1 Purpose of material and energy control

The purpose of material and energy control is to ensure resources are available and ready to meet current and future demands from production operations.

5.6.2 Outcomes of material and energy control

The process generates the following information items:

a) material and energy order requests;

b) incoming confirmation of received materials and energy;

c) material and energy inventory reports;

d) manual and automated transfer instructions for operations control.

5.6.3 Material and energy control activities

The following are the material and energy control activities:

— Manage inventory, transfers and quality of material and energy: Identify the current inventory status, transfer status and quality to understand the flow of materials and energy.

— Generate requests for purchasing materials and energy based on short- and long-term requirements: Request for purchase of necessary materials and energy, taking into account product production scheduling and inventory status.

— Calculate and report inventory balance and losses of raw material and energy utilization: Report on inventory and loss status of materials and energy.

— Receive incoming material and energy supplies and request quality assurance tests: Receive the materials and energy supplied and check that the quality is appropriate.

— Notify purchasing of accepted material and energy supplies: Ensures the organization sustains coherent traceability of all transactions that have a financial implication.

5.7 Product inventory control

5.7.1 Purpose of product inventory control

The purpose of product inventory control is to ensure an available supply of materials (without unnecessary excess) by supervising the acquisition, storage and accessibility of those materials.

5.7.2 Outcomes of product inventory control

The process generates (or modifies where indicated) the following information items:

a) finished goods inventory;

b) inventory balances;

c) pack-out schedule (modifies);

d) release to ship (modifies);

e) confirm to ship;

f) storage requirements.

5.7.3 Product inventory control activities

The following are the product inventory control activities:

— Manage inventory of finished products: Identify the type and quantity of finished products.

— Make reservations for specific product in accordance with product selling directives: Ensures rapid, deliberate fulfilment of demands for production where there are specific implications for sales strategy or customer satisfaction.

— Generate pack-out end product in accordance with delivery schedule: Making reservations for specific products in accordance with product selling directives. Prepare the final packaged product according to the delivery schedule of the finished product. Prepare specific products according to product sales instructions as needed.

— Report on inventory to production scheduling: Be prepared to reflect the current inventory status in production schedule planning.

— Report on balance and losses to product cost accounting: The balance and loss of the material are identified and reflected in product cost accounting.

— Arrange physical loading and shipment of goods in coordination with product shipping administration: Contributes to fast execution of the value chain from raw material to product in use by customer.

5.8 Quality assurance

5.8.1 Purpose of quality assurance

The purpose of quality assurance is to provide confidence that quality requirements will be fulfilled. This confidence arises from tests that generate definitive evidence on the quality of incoming material and outgoing products.

5.8.2 Outcomes of quality assurance

The process generates the following information items:

a) quality assurance test results;

b) approval to release materials or waivers on compliance;

c) applicable standards and customer requirements for material quality.

5.8.3 Quality assurance activities

The following are the quality assurance activities:

— Test and classify materials: Material classification according to material verification and product classification system for quality assurance is provided.

— Set standards for material quality: It provides standards for manufacturing and verification laboratories that meet the needs of technology, marketing and customer service.

— Issue standards to manufacturing and testing laboratories in accordance with requirements from technology, marketing and customer services: Ensures coherence across the organization in

exploiting re-use of knowledge and achieving interoperability between elements at all levels of the enterprise.

— Collect and maintain material quality data: Product data are checked against statistical quality control tasks and customer requirements to ensure proper quality before shipping.

— Release material for further use (delivery or further processing): Carry out further delivery and processing of necessary materials for post quality assurance.

— Certify that product was produced according to standard process conditions: Notify material deviations to process engineering for re-evaluation for process update.

— Check product data versus customer requirements and statistical quality control routines to ensure adequate quality before shipment: Reduces the threat of customer dissatisfaction and product re-work.

— Relay material deviations to process engineering for re-evaluation to upgrade processes: Sustains compatibility between all potential raw material and the current configuration of production processes.

5.9 Maintenance management

5.9.1 Purpose of maintenance management

The purpose of maintenance management is to ensure the availability of systems and equipment by effective and efficient interventions to sustain functionality. These interventions depend on determining maintenance requirements, objectives, strategies and responsibilities. The process implements these items by such means as maintenance planning, maintenance control and the improvement of the activities and economics of maintenance (see ISO 20815).

5.9.2 Outcomes of maintenance management

The process generates the following information items:

a) maintenance schedules;

NOTE 1 These schedules specify plans for future work orders.

b) maintenance work orders;

NOTE 2 These work orders specify specific equipment to be taken out of service and made available for maintenance functions.

c) diagnostic and self-test requests.

NOTE 3 These tests are performed on equipment.

5.9.3 Maintenance management activities

The following are the maintenance management activities:

— Provide maintenance for existing installations: Sustains production capability to meet current and future production schedules.

— Provide preventative maintenance programme: Intervenes to reduce risk of equipment failure causing production delays and unacceptable consequential costs.

— Provide equipment monitoring to anticipate failure, including self-check and diagnostic programmes: Generates a data stream that can inform decisions about maintenance.

— Place purchase order requests for materials and spare parts: Ensures the availability of the right resources at the right time to support the right maintenance instance.

— Develop maintenance cost reports and coordinate outside contract work effort: Enables the organization to identify unacceptable trends in costs and exploit external support to best effect and efficiency.

— Provide status and technical feedback on performance and reliability to process support engineering: Establishes the basis on which to identify opportunities to adjust production processes to make more appropriate use of production installations.

6 Assessing process capability

Assessing process capability is the core activity when determining the maturity of data quality management in an organization. ISO 8000-62 specifies how organizations can use a maturity model in assessing their process maturity with respect to data quality management as specified in ISO 8000-61.

As specified by ISO/IEC 33020, a six-point ordinal scale is appropriate for assessing process capability (see Table 2). This scale shows the lowest level (incomplete) where a process fails to deliver the process purpose through to the highest level (innovating) where a process is subject to continual improvement.

An organization is at the process capability levels performed onwards when achieving the corresponding process attributes. Each process attribute is a measurable property of process capability. This property has a value according to an ordinal scale (see Table 3).

The ratings of the process attributes determine process capability level (see Table 4).

Table 2 — Process capability levels and process attributes (see ISO/IEC 33020:2019, 5.2)

Process capability level	Process attribute
Incomplete process	(Not applicable)
Performed process	PA 1.1. Process performance
Managed process	PA 2.1. Performance management PA 2.2. Documented information management
Established process	PA 3.1. Process definition PA 3.2. Process deployment PA 3.3. Process assurance
Predictable process	PA 4.1. Quantitative analysis PA 4.2. Quantitative control
Innovating process	PA 5.1. Process innovation
NOTE See ISO/IEC 33020:2019, 5.2, for a full description of each process capability level and process attribute.	

Table 3 — Ordinal scale for measuring process attributes (see ISO/IEC 33020:2019, 5.3)

Ordinal	Meaning	Values
N Not achieved	There is little or no evidence of the defined process attribute in the assessed process.	0 to ≤ 15 %
P Partially achieved	There is some evidence of an approach to, and some achievement of, the defined process attribute in the assessed process. Some aspects of achievement of the process attribute can be unpredictable.	> 15 % to ≤ 50 %
L Largely achieved	There is evidence of a systematic approach to, and significant achievement of, the defined process attribute in the assessed process. Some weaknesses related to this process attribute can exist in the assessed process.	> 50 % to ≤ 85 %
F Fully achieved	There is evidence of a complete and systematic approach to, and full achievement of, the defined process attribute in the assessed process. No significant weaknesses related to this process attribute can exist in the assessed process.	> 85 % to ≤ 100 %

Table 4 — Process capability level ratings (see ISO/IEC 33020:2019, 5.6)

Process capability level	Process attribute	Rating
Performed process	PA 1.1. Process performance	Largely achieved (L) or Fully achieved (F)
Managed process	PA 1.1. Process performance	Fully achieved (F)
	PA 2.1. Performance management	Largely achieved (L) or Fully achieved (F)
	PA 2.2. Documented information management	Largely achieved (L) or Fully achieved (F)
Established process	PA 1.1. Process performance	Fully achieved (F)
	PA 2.1. Performance management	Fully achieved (F)
	PA 2.2. Documented information management	Fully achieved (F)
	PA 3.1. Process definition	Largely achieved (L) or Fully achieved (F)
	PA 3.2. Process deployment	Largely achieved (L) or Fully achieved (F)
	PA 3.3. Process assurance	Largely achieved (L) or Fully achieved (F)
Predictable process	PA 1.1. Process performance	Fully achieved (F)
	PA 2.1. Performance management	Fully achieved (F)
	PA 2.2. Documented information management	Fully achieved (F)
	PA 3.1. Process definition	Fully achieved (F)
	PA 3.2. Process deployment	Fully achieved (F)
	PA 3.3. Process assurance	Fully achieved (F)
	PA 4.1 Quantitative analysis	Largely achieved (L) or Fully achieved (F)
	PA 4.2 Quantitative control	Largely achieved (L) or Fully achieved (F)
Innovating process	PA 1.1. Process performance	Fully achieved (F)
	PA 2.1. Performance management	Fully achieved (F)
	PA 2.2. Documented information management	Fully achieved (F)
	PA 3.1. Process definition	Fully achieved (F)
	PA 3.2. Process deployment	Fully achieved (F)
	PA 3.3. Process assurance	Fully achieved (F)
	PA 4.1 Quantitative analysis	Fully achieved (F)
	PA 4.2 Quantitative control	Fully achieved (F)
	PA 5.1 Process innovation	Largely achieved (L) or Fully achieved (F)

7 Work products

Assessment indicators (see Clause 4) are necessary to perform rating of process attributes (see Clause 6 and ISO/IEC 33020).

This document specifies assessment indicators that apply to data processing as specified by ISO 8000-61. Each indicator is a work product that is an information flow in the functional model of manufacturing operations management, where the model is specified by IEC 62264-1:2013, 6.5. Each information flow:

— is an input to or output from a process in manufacturing operations management (see Clause 5);

— can connect two processes in manufacturing operations management (see Clause 5);

NOTE 1 This connection takes the form of the information flow being an output from one process and an input to another.

— relates to one or more outcomes of each process for which the flow is an input or output.

As assessment indicators, the role of these work products is to provide evidence of the complete, consistent execution of data processing within the processes for manufacturing operations management. This execution corresponds to process performance, which is a process attribute in the process assessment model specified by ISO 8000-62 (see Clause 6). These indicators provide the means to assess maturity without dictating specific methods by which to perform the individual processes (i.e. a work product is objective evidence of one or more successful outcomes and, hence, maturity of a process).

The following set of work products enables an organization to identify the requirements that apply to those work products in the context of the processes for manufacturing operations management implemented by the organization. These requirements are the basis on which to test the characteristics of each work product, providing the evidence as an input to assessment.

Each of the following processes generates work products that are assessment indicators:

— production scheduling (see Table 5);

— production control: process support engineering (see Table 6);

— production control: production operations control (see Table 7);

— production control: production operations planning (see Table 8);

— material and energy control (see Table 9);

— product inventory control (see Table 10);

— quality assurance (see Table 11);

— maintenance management (see Table 12).

If an organization is only assessing the process maturity of data quality management for a sub-set of the processes for manufacturing operations management, then the organization only needs to consider the assessment indicators relating to those processes.

NOTE 2 In Tables 5 to 12, inputs are plant, labour, materials, tooling, energy and a clean environment.

NOTE 3 In Tables 5 to 12, outputs are the products from manufacturing facilities either for other facilities or for the end buyer. The extent to which a particular product is processed within a particular facility is governed by transaction cost.

NOTE 4 See Annex C for a list of where the work products originate in IEC 62264-1.

Table 5 — Work products for production scheduling

Work product role	Work product name	Associated process outcome
Input	Production order	5.2.2 d)
	Production capability	5.2.2 c)
	Production from plan	5.2.2 b)
	Finished goods inventory	5.2.2 c)
Output	Long-term material and energy requirements	5.2.2 b)
	Availability	5.2.2 c) 5.2.2 d)
	Schedule	5.2.2 a)
	Pack out schedule	5.2.2 a)

Table 6 — Work products for production control — Process support engineering

Work product role	Work product name	Associated process outcome
Input	Standards and customer requirements(allocated)	5.3.2 b) 5.3.2 c) 5.3.2 e)
	Product and process requirements	5.3.2 f) 5.3.2 g)
	Quality assurance results	5.3.2 a) 5.3.2 b) 5.3.2 c)
Output	Product and process technical feedback	5.3.2 a) 5.3.2 d)
	Production performance and costs	5.3.2 b) 5.3.2 d)

Table 7 — Work products for production control — Production operations control

Work product role	Work product name	Associated process outcome
Input	Production cost objectives	5.4.2 d)
	Material and energy inventory	5.4.2 e)
	Quality assurance results	5.4.2 b) 5.4.2 c) 5.4.2 f)
	Maintenance responses	5.4.2 e) 5.4.2 g)
	Maintenance technical feedback	5.4.2 e)
Output	Process data	5.4.2 c) 5.4.2 i)
	Product and process information request	5.4.2 a) 5.4.2 b) 5.4.2 h)
	Maintenance requests	5.4.2 e)
	Maintenance standards and methods	5.4.2 f)

Table 8 — Work products for production control — Production operations planning

Work product role	Work product name	Associated process outcome
Input	Schedule	5.5.2 c)
Output	Production capability	5.5.2 d)
	Production from plan	5.5.2 b) 5.5.2 c)
	Short-term material and energy requirements	5.5.2 a) 5.5.2 b)
	In-process waiver request	5.5.2 c)

Table 9 — Work products for material and energy control

Work product role	Work product name	Associated process outcome
Input	Long-term material and energy requirements	5.6.2 b)
	Short-term material and energy requirements	5.6.2 c)
	Quality assurance results	5.6.2 d)
Output	Incoming material and energy receipt	5.6.2 d)
	Material and energy inventory	5.6.2 d)
	Incoming order confirmation	5.6.2 b)
	Material and energy order requirements	5.6.2 a)

Table 10 — Work products for product inventory control

Work product role	Work product name	Associated process outcome
Input	Pack out schedule	5.7.2 c)
	Release to ship	5.7.2 d)
	Process data	5.7.2 f)
	Quality assurance results	5.7.2 b)
Output	Confirm to ship	5.7.2 c) 5.7.2 e)
	Finished goods inventory	5.7.2 a)

Table 11 — Work products for quality assurance

Work product role	Work product name	Associated process outcome
Input	Finished goods waiver	5.8.2 c)
	In-process waiver request	5.8.2 c)
	Process data	5.8.2 b)
	Product and process requirements	5.8.2 c)
	Standards and customer requirements	5.8.2 c)
Output	Quality assurance results	5.8.2 a)
	Standards and customer requirements (allocated)	5.8.2 c)

Table 12 — Work products for maintenance management

Work product role	Work product name	Associated process outcome
Input	Maintenance standards and methods	5.9.2 a) 5.9.2 b) 5.9.2 c)
	Maintenance requests	5.9.2 a) 5.9.2 b) 5.9.2 c)
Output	Maintenance purchase order requirements	5.9.2 b)
	Maintenance responses	5.9.2 a) 5.9.2 b)
	Maintenance technical feedback	5.9.2 c)