BS ISO 22400-2:2014+A1:2017

BSI Standards Publication

Automation systems and integration — Key performance indicators (KPIs) for manufacturing operations management

Part 2: Definitions and descriptions

bsi.

National foreword

This British Standard is the UK implementation of ISO 22400-2:2014+A1:2017. It supersedes BS ISO 22400-2:2014, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment 1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee AMT/5, Industrial architectures and integration frameworks.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2017

ISBN 978 0 580 91042 5

ICS 25.040.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 15 January 2014.

Amendments/corrigenda issued since publication

Date	Text affected
31 October 2017	Implementation of ISO Amendment 1:2017

BS ISO 22400-2:2014+A1:2017

INTERNATIONAL STANDARD

ISO 22400-2

First edition
2014-01-15

Automation systems and integration — Key performance indicators (KPIs) for manufacturing operations management —

Part 2: Definitions and descriptions

Systèmes d'automatisation et intégration — Indicateurs de la performance clé pour le management des opérations de fabrication —

Partie 2: Définitions et descriptions

Reference number
ISO 22400-2:2014(E)

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

Contents

Page

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 Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Interoperability, integration and architectures of automation systems and applications*.

ISO 22400 consists of the following parts, under the general title *Automation systems and integration — Key performance indicators (KPIs) for manufacturing operations management*

— *Part 1: Overview, concepts and terminology*

— *Part 2: Definitions and descriptions*

The following parts are under preparation:

— *Part 3: Exchange and use*

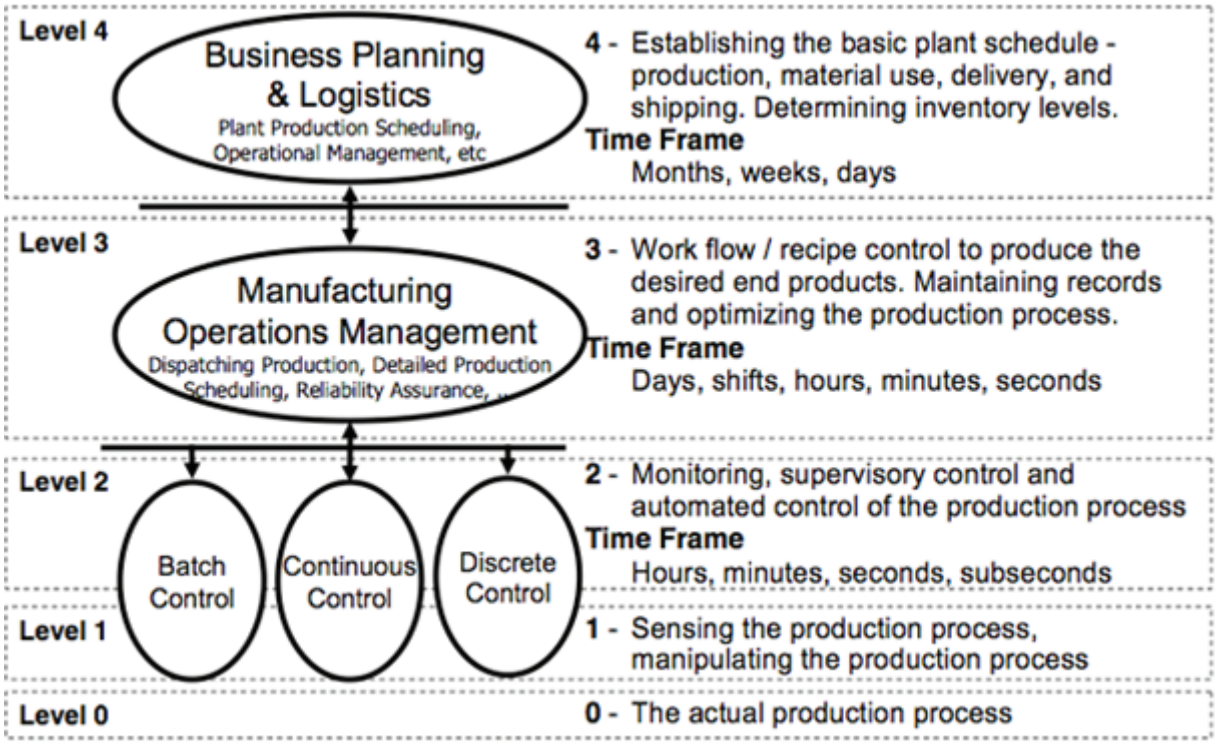
— *Part 4: Relationships and dependencies*

Introduction

This part of ISO 22400 focuses on key performance indicators (KPIs) for manufacturing operations management.

KPIs are defined as quantifiable and strategic measurements that reflect an enterprise's critical success factors. KPIs are very important for understanding and improving manufacturing performance, both from the lean manufacturing perspective of eliminating waste and from the corporate perspective of achieving strategic goals.

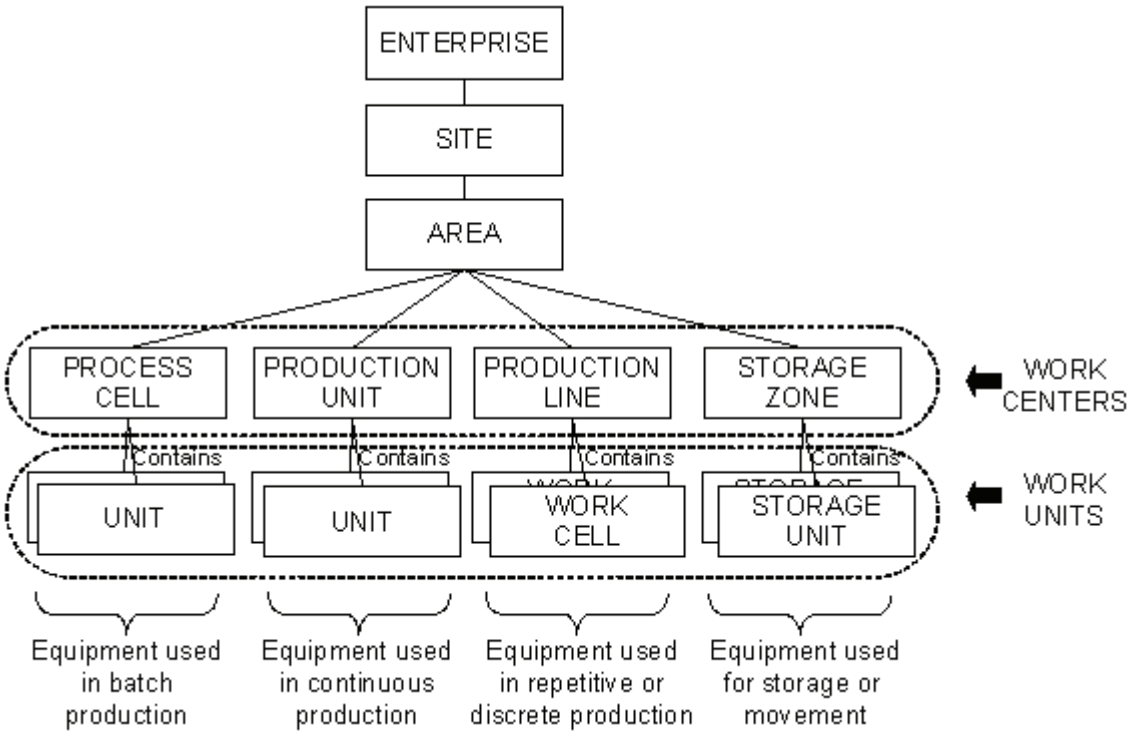
Manufacturing operations management (MOM) is a term used in IEC 62264 to specify a portion of the functional hierarchy model of a manufacturing enterprise. Figure 1 depicts the different levels of the functional hierarchy model: business planning and logistics (Level 4), manufacturing operations and control (Level 3), and batch, continuous, or discrete control (Level 1-2). The levels provide different functions and work in different timeframes.



NOTE Adapted from IEC 62264-3.

Figure 1 — Functional hierarchy

IEC 62264 also specifies a hierarchical structure for the physical equipment (see Figure 2). Enterprise, site and areas are generic terms, whereas there are specific terms for work centres and work units that apply to batch production, continuous production, discrete or repetitive production, and for storage and movement of materials and equipment.



NOTE Adapted from IEC 62264-3.

Figure 2 — Role based equipment hierarchy

This part of ISO 22400 specifies the KPIs "residing" at Level 3, i.e. related to MOM. These KPIs are generated/calculated within Level 3. Some of these KPIs are forwarded to Level 4 for further usage. In order to generate these KPIs, parameters from Levels 2 and 1 might be needed.

The KPIs in this part of ISO 22400 use the most generic terms possible (e.g. work centres and work units), instead of industry specific terms.

MOM, sometimes referred to as manufacturing execution systems (MES), models four major categories of operations management:

— production operations management;

— maintenance operations management;

— quality operations management;

— inventory operations management.

An activity model further details each category. Each activity model includes eight activities:

— detailed scheduling;

— dispatching;

— execution management;

— resource management;

— definition management;

— tracking;

— data collection;

— analysis.

These activities apply to production operations, quality operations, inventory operations and maintenance operations.

Analysis is the performance of calculating KPIs using information from other activities. Workflows can be used to illustrate the important events and steps needed in the calculation process for KPIs.

KPIs alone are not sufficient factors to perform the necessary management and execution operations for an enterprise. For many of the indicators, a company specific threshold is defined. When the value of the indicator exceeds or falls below the threshold, actions are initiated (e.g. to improve efficiency or quality). Often it is necessary to define warning and action limits. Warning limits help to detect the trends in process and equipment changes before company-specific thresholds are violated.

To improve the productivity of the manufacturing resources, information provided by industrial automation systems and control devices about process, equipment, operator, and material can be useful for providing critical feedback through KPIs.

A standardized schema for the expression of these KPIs is intended to:

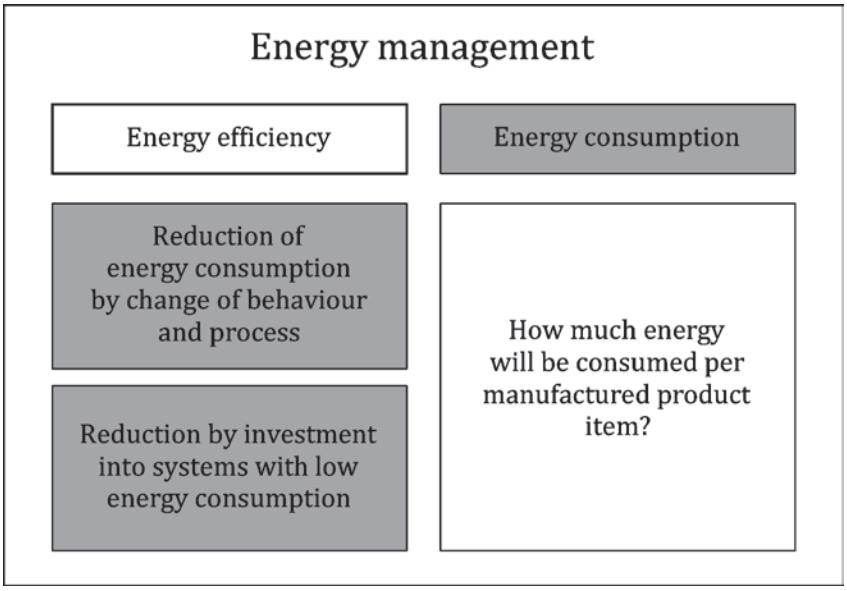
a) facilitate the specification and procurement of integrated systems, in particular, the interoperability requirements among MES applications;

b) provide a means to categorize productivity tools that can be used across applications.

ISO 22400 provides an overview of the concepts, the terminology and the methods to describe and to exchange KPIs for the purpose of managing manufacturing operations. The audience is factory managers responsible for production performance, software suppliers developing KPIs for factory management, engineers engaged in process planning of products, planners and designers of manufacturing systems, and equipment and device suppliers.

KPIs also reside at Level 4, i.e. KPIs related to business planning and logistics, which are outside the scope of this part of ISO 22400. Level 4 KPIs are often related to economic, business, logistic and financial factors. These KPIs are used to assess the progress or extent of compliance with regard to important objectives or critical success factors within a company. Economic KPIs serve as a basis for decisions (problem identification, presentation, information extraction), for economic control (target/actual comparison), for financial documentation and for coordination (behaviour management) of important facts and relationships within the company.

〚A1〛KPIs for energy management within MOM are in accordance with ISO 50001 and ISO 20140, and they complement MOM indicators regarding energy consumption. KPIs for energy management support the evaluation of direct energy consumption per work unit or per order, and per manufactured product item. Figure 3 illustrates the approach and the focus in the determination of energy consumption.〚/A1〛



[A1] Figure 3 — Approach and focus in the determination of energy consumption [A1]

This page deliberately left blank

INTERNATIONAL STANDARD **ISO 22400-2:2014(E)**

Automation systems and integration — Key performance indicators (KPIs) for manufacturing operations management —

Part 2: Definitions and descriptions

1 Scope

ISO 22400 specifies key performance indicators (KPIs) used in manufacturing operations management (MOM).

This part of ISO 22400 specifies a selected number of KPIs in current practice. The KPIs are presented by means of their formula and corresponding elements, their time behaviour, their unit/dimension and other characteristics. This part of ISO 22400 also indicates the user group where the KPIs are used, and the production methodology to which they correspond.

With reference to equipment, the KPIs in this part of ISO 22400 relate to work units, as specified in IEC 62264.

2 Terms and definitions

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

2.1
reference time
base timeline used for time models, corresponding to the planned maximum time interval available for production and maintenance tasks

EXAMPLE A calendar day with 24 hours; a week.

2.2
planned time
planned duration of a specific time period

EXAMPLE The intended duration of an operation or a resource state according to the planning.

2.3
actual time
realized duration of a specific time period

EXAMPLE The actual duration of an operation or a resource state.

Note 1 to entry: Actual time may be less than, equal to, or greater than corresponding planned time.

2.4
time model
partition of the reference time