

DIN EN 62264-3



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Ersatz für
DIN EN 62264-3:2008-01
Siehe Anwendungsbeginn

**Integration von Unternehmensführungs- und Leitsystemen –
Teil 3: Aktivitätsmodelle für das Betriebsmanagement
(IEC 62264-3:2016);
Englische Fassung EN 62264-3:2017**

Enterprise-control system integration –
Part 3: Activity models of manufacturing operations management
(IEC 62264-3:2016);
English version EN 62264-3:2017

Intégration des systèmes entreprise-contrôle –
Partie 3: Modèles d'activités pour la gestion des opérations de fabrication
(IEC 62264-3:2016);
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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2017-01-20 angenommene Europäische Norm als DIN-Norm ist 2017-12-01.

Für DIN EN 62264-3:2008-01 besteht eine Übergangsfrist bis 2020-01-20.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 62264-3:2016-10.

Für dieses Dokument ist das nationale Arbeitsgremium K 931 „Systemaspekte“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

Die enthaltene IEC-Publikation wurde vom SC 65E „Devices and integration in enterprise systems“ erarbeitet.

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Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf ein Dokument ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils aktuellste Ausgabe des in Bezug genommenen Dokuments.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe des Dokuments.

Der Zusammenhang der zitierten Dokumente mit den entsprechenden Deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Anwender der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der EN 62264-3 veröffentlicht. Zu deren Einleitung und deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 3, der die Begriffe und Abkürzungen festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für die meisten der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Das Original-Dokument enthält Bilder in Farbe, die in der Papierversion in einer Graustufen-Darstellung wiedergegeben werden. Elektronische Versionen dieses Dokuments enthalten die Bilder in der originalen Farbdarstellung.

Änderungen

Gegenüber DIN EN 62264-3:2008-01 wurden folgende Änderungen vorgenommen:

- a) Unterabschnitt 4.1, Betriebsmanagement, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- b) Unterabschnitt 4.2, Funktionale Hierarchie, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.

- c) Unterabschnitt 4.4, Kriterium für die Zuordnung der Aktivitäten unterhalb von Ebene 4, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- d) Unterabschnitt 4.5, Informationskategorien der Produktion, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- e) Unterabschnitt 4.6, Betriebsinformationen, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- f) Unterabschnitt 5.3, Erweitertes Modell der Ausstattungshierarchie, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- g) Unterabschnitt 5.4, Erweitertes Entscheidungshierarchiemodell, wurde in Teil 3 gestrichen. Der entsprechende Unterabschnitt in Teil 1 wurde auch gestrichen und durch eine Verweisung auf ISO 15704 ersetzt.
- h) Anhang A (informativ), Weitere Unternehmensaktivitäten, die das Betriebsmanagement beeinflussen, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- i) Anhang D (informativ), Zugehörige Normen, wurde in Teil 1 aufgenommen und deshalb in Teil 3 gestrichen.
- j) Anhang F (informativ), Anwendung des Entscheidungshierarchiemodells auf das Betriebsmanagement, wurde in Teil 3 gestrichen. Der entsprechende Unterabschnitt in Teil 1 wurde auch gestrichen und durch eine Verweisung auf ISO 15704 ersetzt.
- k) Anhang G (informativ), Abbildung der PSLX-Ontologie auf das Betriebsmanagement, wurde in Teil 3 gestrichen. Das Komitee hat entschieden, dass dieser Anhang eher als PSLX-Whitepaper oder Fachbericht geeignet ist.
- l) Die Bezeichnungen der Daten wurden geändert und an die genormten Bezeichnungen in Teil 4 angepasst.
- m) Die Bezeichnungen wurden in allen Bildern und im Text geändert.
- n) Die folgenden Datenbezeichnungen wurden geändert oder ergänzt:
 - 1) „Detaillierter Produktionsplan“ in „Fertigungsplan“;
 - 2) „Produktionseinplanungsliste“ in „Arbeitsliste“;
 - 3) „Fertigungsauftrag“ in „Arbeitsauftrag“;
 - 4) „Arbeitsauftrag“ in „Arbeitsauftrag“;
 - 5) „Detaillierter Instandhaltungsplan“ in „Betriebsplan“;
 - 6) „Detaillierter Bestandsplan“ in „Betriebsplan“;
 - 7) Ergänzung der „Arbeitsvorlage“ als Objekt, das festlegt, wie die Arbeit auszuführen ist;
 - 8) Ergänzung des Managements von „Arbeitszeitkalendern“ als Aufgabe des Ressourcenmanagements;
 - 9) Ergänzung der Führung von „Arbeitsnachweisen“ als Aufgabe der Nachverfolgung.

Frühere Ausgaben

DIN EN 62264-3: 2008-01

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung^{N1)}

Einleitung

Dieser Teil der IEC 62264 beschreibt Aktivitätsmodelle und Datenflüsse für Betriebsinformationen, die die Integration von Unternehmensführungs- und Leitsystemen ermöglichen. Die modellierten Aktivitäten reichen von den Logistik- und Planungsfunktionen der Ebene 4 bis zu den manuellen und automatisierten Prozesssteuerungsfunktionen der Ebene 2. Die Modelle stimmen mit den in IEC 62264-2 angegebenen Objektmodellen und den Festlegungen der Ebene 3 (Betriebsmanagement und -steuerung) überein.

Das Ziel der Norm sind verringerte Risiken, Kosten und Fehler bei der Implementierung von Unternehmensführungs- und Leitsystemen und Betriebsmanagementsystemen, so dass sie interoperabel und leicht integrierbar sind. Die Norm darf auch zur Verringerung des Aufwands im Zusammenhang mit der Implementierung neuer Produktangebote herangezogen werden.

Diese Norm bietet Modelle und die Terminologie zur Festlegung der Aktivitäten des Betriebsmanagements. Die in der vorliegenden Norm definierten Modelle und die definierte Terminologie:

- heben die gute Praxis des Betriebsmanagements hervor;
- dienen der Verbesserung vorhandener Betriebsmanagementsysteme;
- sind ungeachtet des Grads der Automatisierung anwendbar.

Nachfolgend seien einige Beispiele für den Nutzen bei der Anwendung dieser Norm genannt:

- die Verringerung der Zeitspanne bis zum Erreichen der vollen Produktionsleistung für neue Produkte;
- den Zulieferern wird ermöglicht, geeignete Werkzeuge für den Produktionsbetrieb zu liefern;
- die Bedürfnisse der Produktion können eindeutig und konsequent ermittelt werden;
- die Kosten der Automatisierung von Produktionsprozessen werden reduziert;
- die Versorgungsketten werden optimiert;
- die Wirksamkeit des Engineering-Aufwands im Rahmen des Lebenszyklus wird verbessert.

Es ist nicht die Absicht dieses Teils der Norm:

- festzulegen, dass es nur eine Art der Implementierung des Betriebsmanagements und der Betriebssteuerung gibt;
- Anwender dazu zu zwingen, ihren derzeitigen Weg im Umgang mit dem Betriebsmanagement und der Betriebssteuerung aufzugeben;
- die Entwicklung im Bereich des Betriebsmanagements und der Betriebssteuerung einzuschränken;
- die Anwendung ausschließlich auf die verarbeitende Industrie zu beschränken.

1 Anwendungsbereich

Dieser Teil der IEC 62264 legt Aktivitätsmodelle für das Betriebsmanagement fest, mithilfe derer Unternehmenssysteme die Systemintegration steuern können. Die in diesem Dokument definierten Aktivitäten stimmen mit den in IEC 62264-1 enthaltenen Definitionen von Objektmodellen überein. Die modellierten Aktivitäten reichen von Geschäftsplanungs- und Logistikfunktionen, welche als Funktionen der Ebene 4 definiert sind, bis Prozesssteuerungsfunktionen, die in IEC 62264-1 in Form der Funktionen der Ebene 2 abgebildet sind. Der Anwendungsbereich dieses Dokuments ist beschränkt auf:

^{N1)} Nationale Fußnote: Die Nummerierung aus IEC 62264-3:2016-12 wurde beibehalten.

- ein Modell der Aktivitäten im Zusammenhang mit dem Betriebsmanagement, Funktionen der Ebene 3;
- eine Bestimmung einiger zwischen Aktivitäten der Ebene 3 ausgetauschter Daten.

3 Begriffe und Abkürzungen

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

3.1.1

Kapazitätsterminierung

Planungsmethode, bei der die Arbeit für die Produktionsausrüstung geplant wird, ohne dass die verfügbare Kapazität der Produktionsausrüstung durch eine der Kapazitätsanforderungen an die Produktionsausrüstung überschritten wird

3.1.2

Lager- und Bestandsmanagement

Aktivitäten der Ebene 3 einer Produktionsstätte, die Materialbestand und -transport koordinieren, anweisen, verwalten und verfolgen als Teil des Betriebsmanagements

3.1.3

Arbeitsliste

Sammlung von Arbeitsaufträgen für einen Betrieb/eine Ressource oder mehrere Betriebe/Ressourcen in einem festgelegten Zeitraum

Anmerkung 1 zum Begriff: Dabei kann es sich um Arbeitsaufträge in Form von Anweisungen zur Einrichtung von Maschinen, Betriebsbedingungen für kontinuierliche Prozesse, Anweisungen für den Materialtransport oder zu beginnende Aufgaben in einem Batch-System handeln.

Anmerkung 2 zum Begriff: Arbeitslisten sind auf alle Managementbereiche anwendbar, wie z. B. Instandhaltung, Qualitätsprüfung und Lager und Bestand.

3.1.4

Arbeitsauftrag

Zusammenstellung terminierter Arbeiten, die zur Ausführung übertragen werden

3.1.5

Leistungskennzahl

KPI

quantifizierbarer Grad des Erreichens eines kritischen Ziels

[QUELLE: ISO 22400-1-2014, 2.1.5]

3.1.6

Instandhaltungsmanagement

Aktivitäten innerhalb der Ebene 3 einer Produktions-/Fertigungsstätte, die die Funktionen zur Instandhaltung von Einrichtungen, Werkzeugen und Assets koordinieren, anweisen, steuern und verfolgen, um die Verfügbarkeit für die Produktion und die Planung reaktiver, periodischer, vorbeugender und proaktiver Wartungsmaßnahmen sicherzustellen

3.1.7

Produktions-/Fertigungsstätte

Werk oder Betriebskomplex innerhalb eines Werks, das bzw. der die Ressourcen und die Aktivitäten zur Nutzung der Ressourcen beinhaltet

3.1.8

Betriebsmanagement

Aktivitäten der Ebene 3 einer Produktions- oder Fertigungsstätte, die das Personal, die Einrichtungen und das Material innerhalb der Produktion/Fertigung koordinieren, anweisen, steuern und verfolgen

Anmerkung 1 zum Begriff: Diese Norm gliedert das Betriebsmanagement in vier Kategorien (Produktionsmanagement, Instandhaltungsmanagement, Qualitätsmanagement und Lager- und Bestandsmanagement) und verweist auf andere Unternehmensaktivitäten, die das Betriebsmanagement beeinflussen.

3.1.9

Produktionsmanagement

Aktivitäten innerhalb der Ebene 3 einer Produktions-/Fertigungsstätte, welche die Funktionen koordinieren, steuern und verfolgen, die Rohmaterialien, Energie, Ausrüstung, Personal und Information nutzen, um Produkte innerhalb der festgelegten Kosten, Qualität, Mengen, Sicherheit und Terminvorgaben herzustellen

3.1.10

Qualitätsmanagement

Aktivitäten innerhalb der Ebene 3 einer Produktions-/Fertigungsstätte, die die Funktionen zur Qualitätsmessung und Berichterstattung koordinieren, anweisen, steuern und verfolgen

3.1.11

Nachverfolgung

Aktivität, mit der unter Verwendung von Verfolgungsinformationen ein organisierter Bericht über die Nutzung einer Ressource oder eines Produkts ab einem beliebigen Zeitpunkt, vorwärts oder rückwärts, abgerufen werden kann

3.1.12

Verfolgung

Aktivität der Aufzeichnung von Attributen von Ressourcen und Produkten über alle Schritte der Instanziierung, Nutzung, Änderung und Verteilung hinweg

3.1.13

Betrieb

Anlage, Produktionseinheit, Produktionslinie, Lager oder ein anderes Ausstattungselement derselben Ebene, die/das als Erweiterung des Ausstattungshierarchiemodells definiert ist

Anmerkung 1 zum Begriff: Um die Konformität mit vorhandenen Schema-Implementierungen zu wahren, wird die festgelegte englische Benennung „work center“ anstelle der GB-englischen Benennung „work centre“ verwendet.

3.1.14

Arbeitsvorlage

Art der Arbeitsbeschreibung, die eine Vorlage für eine nach einem Arbeitsauftrag auszuführende Arbeit darstellt

3.1.15

Betriebsplan

Plan, der die Aktivitäten des Produktions-, Instandhaltungs-, Lager- und Bestands- oder Qualitätsmanagements oder eine Kombination dieser Aktivitäten im Detail festlegt

3.2 Abkürzungen

Für die Anwendung dieser Norm gelten die folgenden Abkürzungen.

AGV	fahrerloses Transportfahrzeug (en: automated guided vehicles)
AMS	Asset-Managementsystem (en: asset management system)
ASRS	automatisches Regalbediensystem (en: automated storage and retrieval system)
CAPE	computergestützte Fertigungsprozesssimulation (en: computer-aided process engineering)
CAD	computergestützte Konstruktion (en: computer-aided design)
CAE	computergestützte Entwicklung (en: computer-aided engineering)
CASE	computergestützte Softwareentwicklung (en: computer-aided software engineering)
CIM	computergestützte Fertigung (en: computer integrated manufacturing)
CNC	computergestützte numerische Steuerung (en: computerized numerical control)

DCS	dezentrales Steuerungssystem (en: distributed control system)
ERP	Unternehmensressourcenplanung (en: enterprise resource planning)
EWI	elektronische Arbeitsanweisungen (en: electronic work instructions)
HR	Personalwirtschaft (en: human resources)
KPI	Leistungskennzahl (en: key performance indicator)
LIMS	Laborinformations- und -managementsystem (en: laboratory information management system)
MOM	Betriebsmanagement (en: manufacturing operations management)
MES	Fertigungsausführungssystem (en: manufacturing execution system)
MPS	Hauptproduktionsplan (en: master production schedule)
MRP	Materialressourcenplanung (en: material resource planning)
OEE	Gesamtanlageneffektivität (en: overall equipment effectiveness)
PAT	prozessanalytische Technologie (en: process analytical technology)
PERA	Perdue-Unternehmensreferenzarchitektur (en: purdue enterprise reference architecture)
PDM	Produktdatenmanagement (en: product data management)
PLC	speicherprogrammierbare Steuerung (en: programmable logic controller)
PLM	Produktlebenszyklusmanagement (en: product life-cycle management)
PRM	Purdue-Referenzmodell für computergestützte Fertigung (en: purdue reference model for computer-integrated manufacturing)
QA	Qualitätssicherung (en: quality assurance)
R&D	Forschung und Entwicklung (en: research and development)
RFQ	Angebotsanforderung (en: request for quote)
ROA	Gesamtkapitalrendite (en: return on assets)
SCADA	Datensteuerung, Datenerfassung, Datenüberwachung (en: supervisory control and data acquisition)
SOC	Standardbetriebsbedingungen (en: standard operating conditions)
SOP	Standardarbeitsgang (en: standard operating procedure)
SQC	statistische Qualitätskontrolle (en: statistical quality control)
SPC	statistische Prozesskontrolle (en: statistical process control)
WIP	laufende Arbeiten (en: work in process)
WMS	Lagerverwaltungssystem (en: warehouse management system)

– Leerseite –

English Version

Enterprise-control system integration - Part 3: Activity models of
manufacturing operations management
(IEC 62264-3:2016)

Intégration des systèmes entreprise-contrôle - Partie 3:
Modèles d'activités pour la gestion des opérations de
fabrication
(IEC 62264-3:2016)

Integration von Unternehmensführungs- und Leitsystemen -
Teil 3: Aktivitätsmodelle für das Betriebsmanagement
(IEC 62264-3:2016)

This European Standard was approved by CENELEC on 2017-01-20. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 65E/456/CDV, future edition 2 of IEC 62264-3, prepared by SC 65E "Devices and integration in enterprise systems" of IEC/TC 65 "Industrial process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62264-3:2017.

The following dates are fixed:

- latest date by which the document has to be (dop) 2017-10-20
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-01-20
standards conflicting with the
document have to be withdrawn

This document supersedes EN 62264-3:2007.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 3: Activity models of manufacturing operations management

INTRODUCTION

This part of IEC 62264 shows activity models and data flows for manufacturing information that enables enterprise-control system integration. The modelled activities operate between Level 4 logistics and planning functions and Level 2 manual and automated process control functions. The models are consistent with the object models given in IEC 62264-2 and the Level 3 (manufacturing operations and control) definitions.

The goal of the standard is to reduce the risk, cost and errors associated with implementing enterprise systems and manufacturing operations systems in such a way that they inter-operate and easily integrate. The standard may also be used to reduce the effort associated with implementing new product offerings.

This standard provides models and terminology for defining the activities of manufacturing operations management. The models and terminology defined in this standard are:

- to emphasize the good practices of manufacturing operations;
- to be used to improve existing manufacturing operations systems;
- to be applied regardless of the degree of automation.

Some potential benefits produced when applying the standard may include:

- reducing the time to reach full production levels for new products;
- enabling vendors to supply appropriate tools for manufacturing operations;
- enabling more uniform and consistent identification of manufacturing needs;
- reducing the cost of automating manufacturing processes;
- optimizing supply chains;
- improving efficiency in life-cycle engineering efforts.

It is not the intent of this part of the standard to:

- suggest that there is only one way of implementing manufacturing operations;
- force users to abandon their current way of handling manufacturing operations;
- restrict development in the area of manufacturing operations;
- restrict use only to manufacturing industries.

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 3: Activity models of manufacturing operations management

1 Scope

This part of IEC 62264 defines activity models of manufacturing operations management that enable enterprise system to control system integration. The activities defined in this document are consistent with the object models definitions given in IEC 62264-1. The modelled activities operate between business planning and logistics functions, defined as the Level 4 functions and the process control functions, defined as the Level 2 functions of IEC 62264-1. The scope of this document is limited to:

- a model of the activities associated with manufacturing operations management, Level 3 functions;
- an identification of some of the data exchanged between Level 3 activities.

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.

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

IEC 62264-2, *Enterprise-control system integration – Part 2: Object and attributes for enterprise-control system integration*

ISO 22400-1, Automation systems and integration – Key performance indicators (KPIs) for manufacturing operations management – Part 1: Overview, concepts and terminology

ISO 22400-2, Automation systems and integration – Key performance indicators for manufacturing operations management – Part 2: Definitions and descriptions

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1

finite capacity scheduling

scheduling methodology where work is scheduled for production equipment, in such a way that no production equipment capacity requirement exceeds the capacity available to the production equipment

3.1.2

inventory operations management

activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track inventory and material movement within manufacturing operations

3.1.3

job list

collection of job orders for one or more work centers and/or resources for a specific time frame

Note 1 to entry: This may take the form of job orders for the set-up instructions for machines, operating conditions for continuous processes, material movement instructions, or batches to be started in a batch system.

Note 2 to entry: Job lists are applicable to all operations management areas, such as maintenance, quality test and inventory.

3.1.4

job order

unit of scheduled work that is dispatched for execution

3.1.5

key performance indicator

KPI

quantifiable level of achieving a critical objective

[SOURCE: ISO 22400-1-2014, 2.1.5]

3.1.6

maintenance operations management

activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track the functions that maintain the equipment, tools and related assets to ensure their availability for manufacturing and ensure scheduling for reactive, periodic, preventive, or proactive maintenance

3.1.7

manufacturing facility

site, or area within a site, that includes the resources within the site or area and includes the activities associated with the use of the resources

3.1.8

manufacturing operations management

activities within Level 3 of a manufacturing facility that coordinate, direct, manage and track the personnel, equipment and materials in manufacturing

Note 1 to entry: This standard details manufacturing operations management in terms of four categories (production operations management, maintenance operations management, quality operations management and inventory operations management) and provides references for other enterprise activities affecting manufacturing operations.

3.1.9

production operations management

activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track the functions that use raw materials, energy, equipment, personnel and information to produce products, with the required costs, qualities, quantities, safety and timeliness

3.1.10

quality operations management

activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track the functions that measure and report on quality

3.1.11

tracing

activity that provides an organized record of resource and product use from any point, forward or backward, using tracking information

3.1.12

tracking

activity of recording attributes of resources and products through all steps of instantiation, use, change and disposition

3.1.13

work center

process cell, production unit, production line, storage zone, or any other equivalent level equipment element defined as an extension to the equipment hierarchy model

Note 1 to entry: For compatibility with existing schema implementations the defined term "work center" is used in place of the UK English spelling "work centre".

3.1.14

work master

type of work definition that is a template for work to be performed for a job order

3.1.15

work schedule

detailed schedule that defines production, maintenance, inventory or quality operations activities, or any combination of the activities

3.2 Abbreviations

For the purposes of this standard, the following abbreviations apply.

AGV	Automated guided vehicles
AMS	Asset management system
ASRS	Automated storage and retrieval system
CAPE	Computer-aided process engineering
CAD	Computer-aided design
CAE	Computer-aided engineering
CASE	Computer-aided software engineering
CIM	Computer integrated manufacturing
CNC	Computerized numerical control
DCS	Distributed control system
ERP	Enterprise resource planning
EWI	Electronic work instructions
HR	Human resources
KPI	Key performance indicator
LIMS	Laboratory information management system
MOM	Manufacturing Operations Management
MES	Manufacturing execution system
MPS	Master production schedule
MRP	Material resource planning
OEE	Overall equipment effectiveness
PAT	Process analytical technology
PERA	Purdue enterprise reference architecture
PDM	Product data management
PLC	Programmable logic controller

PLM	Product life-cycle management
PRM	Purdue reference model for computer-integrated manufacturing
QA	Quality assurance
R&D	Research and development
RFQ	Request for quote
ROA	Return on assets
SCADA	Supervisory control and data acquisition
SOC	Standard operating conditions
SOP	Standard operating procedure
SQC	Statistical quality control
SPC	Statistical process control
WIP	Work in process
WMS	Warehouse management system

4 Structuring concepts

4.1 Activity models

Figure 1 illustrates the activity models of this standard in relationship to Part 1 and Part 2. The activities in this standard exchange information with activities defined as Level 4 and Level 2 activities. The grey circles indicate the activities detailed in this standard. The information flows between the activities of this standard, indicated as heavy dashed lines, are described in general in this standard. In addition, the information flows between the activities of this standard and dependent Level 2 activities are identified.

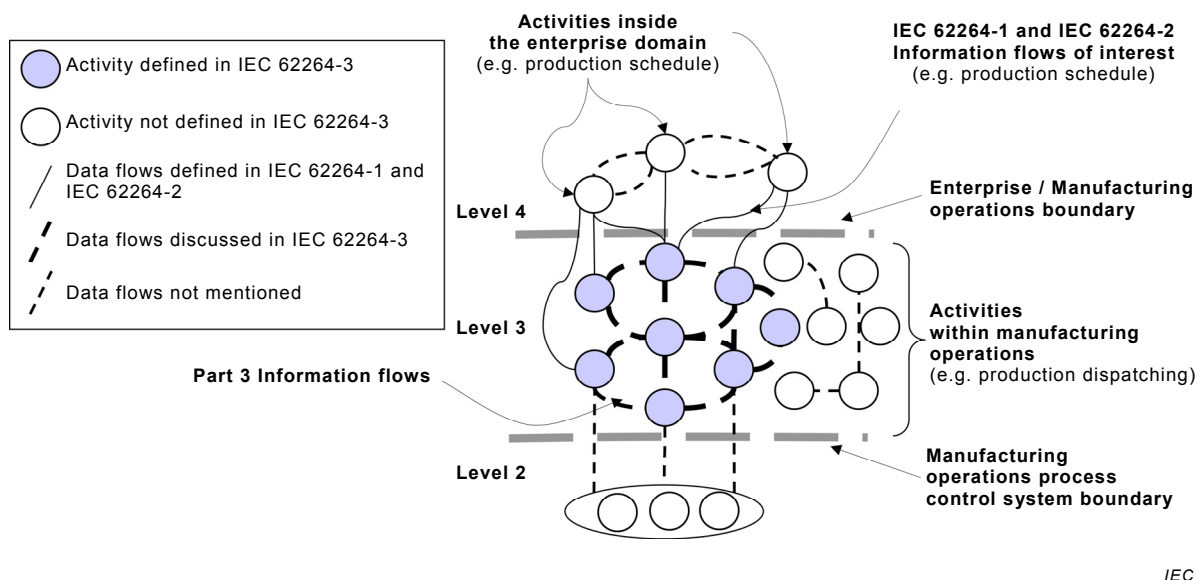


Figure 1 – Activity relationships

4.2 Manufacturing operations management elements

The shaded areas in the Manufacturing Operations Management Model in Part 1 represent the manufacturing operations management activities modelled in this standard. Manufacturing operations management is the collection of production operations management, maintenance

operations management, quality operations management, inventory operations management and other activities of a manufacturing facility.

This standard defines four formal models: production operations management, maintenance operations management, quality operations management and inventory operations management. These are detailed in Clauses 6, 7, 8 and 9 and are listed below.

- a) The production operations management model, which shall include the activities of production control (3.0) that operate as Level 3 functions and the subset of the production scheduling (2.0) that operate as Level 3 functions and as defined in Part 1.
- a) The maintenance operations management model, which shall include the activities of maintenance management (10.0) that operate as Level 3 functions.
- b) The quality operations management model, which shall include the activities of quality assurance (6.0) that operate as Level 3 functions.
- c) The inventory operations management model, which shall include the activities of management of inventory and material including product inventory control (7.0) and material and energy control activities (4.0) defined as operating as Level 3 functions and as shown in the Manufacturing Operations Management Model in Part 1.

NOTE 1 The numbers in parenthesis “()” refer to the functional model depicted in Part 1.

NOTE 2 Other categories of operations management can exist depending on company policy or organization. They are not formally modelled in this standard but they can make use of the generic standard model.

5 Structuring models

5.1 Generic template for categories of manufacturing operations management

5.1.1 Template for management of operations

A generic model for management of operations shall be used as a template to define the production operations management, maintenance operations management, quality operations management and inventory operations management models. This model is shown in Figure 2. This generic model is extended for each specific area in later clauses.

NOTE The fine details of the generic model are different for each of the manufacturing operations management areas.

5.1.2 Use of the generic model

The generic model is instantiated for the four categories listed in 5.1.1. However, this same template may be instantiated for other possible manufacturing operations categories or for other operations areas within the enterprise.

EXAMPLE 1 A company could apply the model to receiving operations management and shipping operations management where these are separately managed.

EXAMPLE 2 A company could apply the model to cleaning and sterilization operations management, where these are separately managed.

EXAMPLE 3 A company could apply the model to independent logistics operations management categories for inbound logistics, outbound logistics, internal transfer and inventory control.

NOTE 5.1.2 is normative so that companies that apply the generic model to areas other than the four detailed in this standard can determine and document their degree of conformance to the model.

When the generic model is instantiated for a new category, the activities within a category shall include the definitions of resource management, definition management, dispatching, tracking, data collection, analysis, detailed scheduling, and execution management.

5.1.3 Generic activity model

There shall be a hierarchy used in this standard that starts at a category of operations management. Each category is composed of a collection of activities and each activity is composed of a set of tasks. The generic model applies to the sets of activities.

The generic activity model defines a general request-response cycle that starts with requests or schedules, converts them into a detailed schedule, dispatches work according to the detailed schedule, manages the execution of work, collects data and converts the collected data back into responses. This request-response cycle is supported with:

- analysis of the work performed for improvements or corrections;
- management of the resources used in execution of the performed work;
- management of the definitions of the performed work.

The generic activity model and the detailed models are not intended to represent an actual implementation of a manufacturing information system. However, they do provide a consistent framework for such systems. Actual systems may use different structures supporting other task arrangements. The purpose of these models is to identify possible data flows within manufacturing operations. The ovals in the model indicate collections of tasks, identified as the main activities. Lines with arrowheads indicate a set of important information flows between the activities. The terms without ovals indicate data objects defined in Part 2 or other parts of the standard.

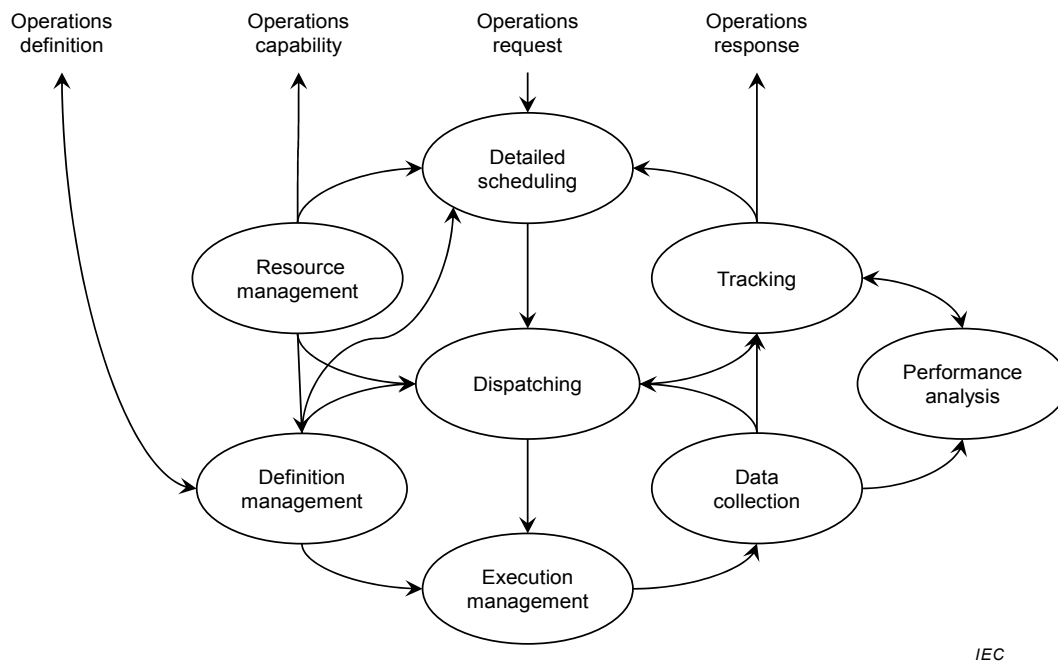


Figure 2 – Generic activity model of manufacturing operations management

NOTE Not all information flows are depicted in Figure 2. In any specific implementation, information from any activity may be required by any other activity. Where the model is expanded for specific activities, the lines indicating information flows are not intended to be exclusive lists of information exchanged.

5.2 Interaction among generic activity models

5.2.1 Information flows between generic activity models

In addition to the information flows within the activities of specific operations categories, there are also information flows between the different categories. Some of this information is defined in the following clauses, but not all information flows are explicitly defined in this standard.

NOTE Specific implementations of activity models may give prominence to one specific activity model over others.

EXAMPLE 1 In pharmaceutical industries, quality operations may provide the direction for other operations.

EXAMPLE 2 In distribution centres, inventory operations may provide the direction for other operations.

EXAMPLE 3 In consumer packaged goods, production operations may provide the direction for other operations.

EXAMPLE 4 In refining, inventory operations may provide the direction for production operations.

5.2.2 Handling resources within the generic activity models

Information about resources (materials, personnel, physical assets, and equipment) may be handled within any one of the four activity models of manufacturing operations (production, quality, maintenance and inventory) presented in this standard.

Although data for different resources may be found in different models, there are primary reporting paths through which information should be obtained.

- a) Personnel information specific to each activity model may be obtained from the specific activity model.
- b) Equipment information specific to each activity model may be obtained from the specific activity model.
- c) Material information specific to each activity model may be obtained from the specific activity model. However, material inventory information, including finished goods and raw materials, may be obtained from the inventory activity model. Material movement operations may be managed by activities in the production, quality, maintenance, or inventory activity models. A specific material movement instance only exists within one activity model at any given point in time.
- d) Physical asset information specific to each activity model may be obtained from the specific activity model.

5.2.3 Scheduling interactions

An activity in a detailed activity model has interactions with other activities in the same model and interactions with equivalent activities in other activity models. Interactions within each activity model are described in Clauses 6, 7, 8 and 9.

There are many interactions associated with detailed scheduling between activity models because of the need to coordinate between many work tasks assigned to a same resource on a given time interval. Also, the definitions of work tasks in the different types of operations management are closely related.

Clear definition of interactions between detailed production scheduling, detailed inventory scheduling, detailed maintenance scheduling and detailed quality-test scheduling should be specified. For interactions with production the following three interactions shall be defined, as illustrated in Figure 3.

- a) Interaction between detailed production scheduling and detailed inventory scheduling. This is defined as coordination of information, at the start or completion of production, of the quantity of materials that is consumed or produced during production and stored or moved by inventory operations.

NOTE Scheduling of transportation can be defined in either detailed production scheduling or detailed inventory scheduling.

EXAMPLE 1 Production not scheduled to start before the scheduled issuing of the corresponding inventory of materials.

EXAMPLE 2 Completion of scheduled production triggers a scheduled inventory operation.

- b) Interaction between detailed production scheduling and detailed maintenance scheduling. This is defined as coordination of information about equipment that provides capability and capacity

during production and needs to be reserved for maintenance depending on the equipment condition.

EXAMPLE 3 Not scheduling corrective maintenance and production on equipment simultaneously.

EXAMPLE 4 Scheduling maintenance based on scheduled use of equipment for production.

c) Interaction between detailed production scheduling and detailed quality-test scheduling. This is defined as coordination of information about the quality of produced and consumed materials, which need to be quality-tested depending on the required level of quality and the latest production performance.

EXAMPLE 5 Detailed inspection schedule embedded in the work schedule.

EXAMPLE 6 Inspection operations requests production operations to schedule rework of the product.

Figure 3 shows an integrated scheduling framework across Level 3.

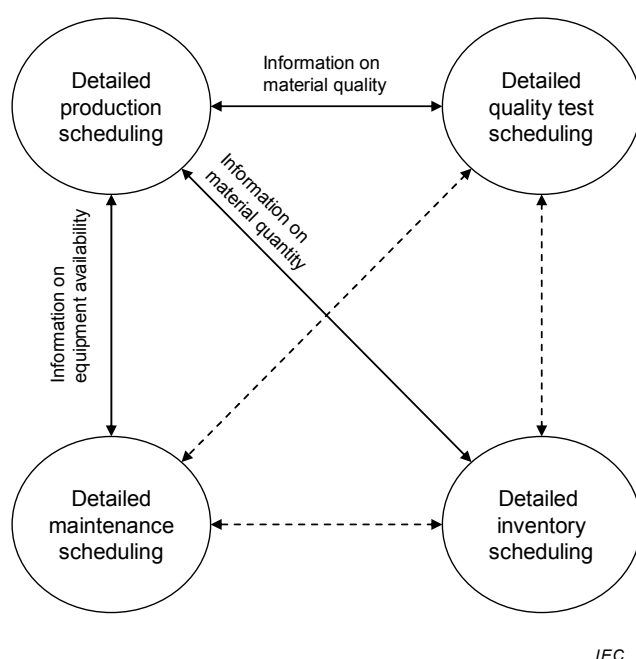


Figure 3 – Detailed scheduling interactions

5.3 Hierarchy of planning and scheduling

In this subclause, planning is defined as an activity for clarifying actions or operations to achieve a given goal and reserving enough amount of resource capacity to hit minimum targets. Scheduling is defined as an activity for allocating actions and operations to particular resources at particular times, taking into account various actual constraints and optimization of several evaluation parameters.

Figure 4 illustrates that in terms of the hierarchy, planning ranks higher than scheduling because a schedule is made using the results of a plan. Planning determines the goals for scheduling. Some constraints and sub-goals for objective functions in scheduling problems are determined in advance by planning activities. The results of scheduling show whether or not the result of planning is feasible and efficient. If it is not feasible, planning usually generates another result for scheduling. Feasibility and efficiency of scheduling are types of constraints of planning.

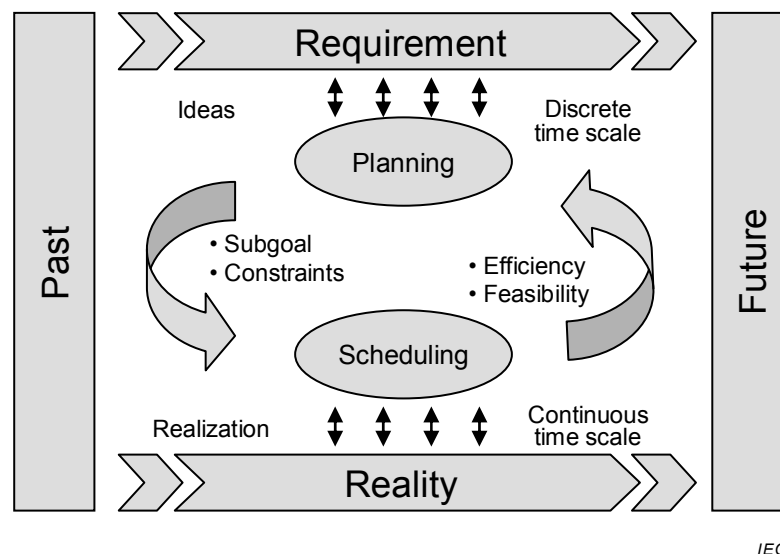


Figure 4 – Schematic relationship of planning and scheduling

The differences between planning and scheduling are the kinds of results which are related to different aspects of time concepts. Figure 4 also illustrates these two concepts.

In planning, the main results will be target quantities that apply over certain periods of time. The results of planning are represented on a discrete time scale as periodic times.

EXAMPLE 1 Results of planning might be “50,000 widgets this month”, “divisional sales of \$480,000 next month”, “summary of overtime hours for next week”, etc.

Results in scheduling represent the specific timing of actions, for example, start time and completion time of operation, inventory issue time, shipping time, etc. The results of sequence information for operations are represented on a continuous time scale as relative or absolute times.

EXAMPLE 2 Results of scheduling might be “9:00 Monday run Job order 2345 for 6 shifts at 100 % utilization”, “9:00 Wednesday perform preventative maintenance on E887e”.

5.4 Resource definition for scheduling activities

5.4.1 Consumed resources and non-consumed resources

A resource is defined in IEC 62264-1 as personnel, equipment, physical assets, and/or material and energy. In this standard, particularly from the viewpoint of detailed scheduling activities, resources can be divided into two different groups: consumed resources generally corresponding to personnel hours worked, materials (including energy) and non-consumed resources generally corresponding to personnel skills and equipment use. Consumed resources and non-consumed resources are typically handled differently in scheduling activities.

A consumed resource quantity is changed by operations processes. This type of resource usually includes raw materials (including energy), WIP inventories and final products and may also include personnel hours worked or equipment time. The quantity of the resource typically changes before or after operations.

A non-consumed resource is not used up by operations processes but is scheduled on the basis of capacity. The quantity of the resource typically does not change before or after operations.

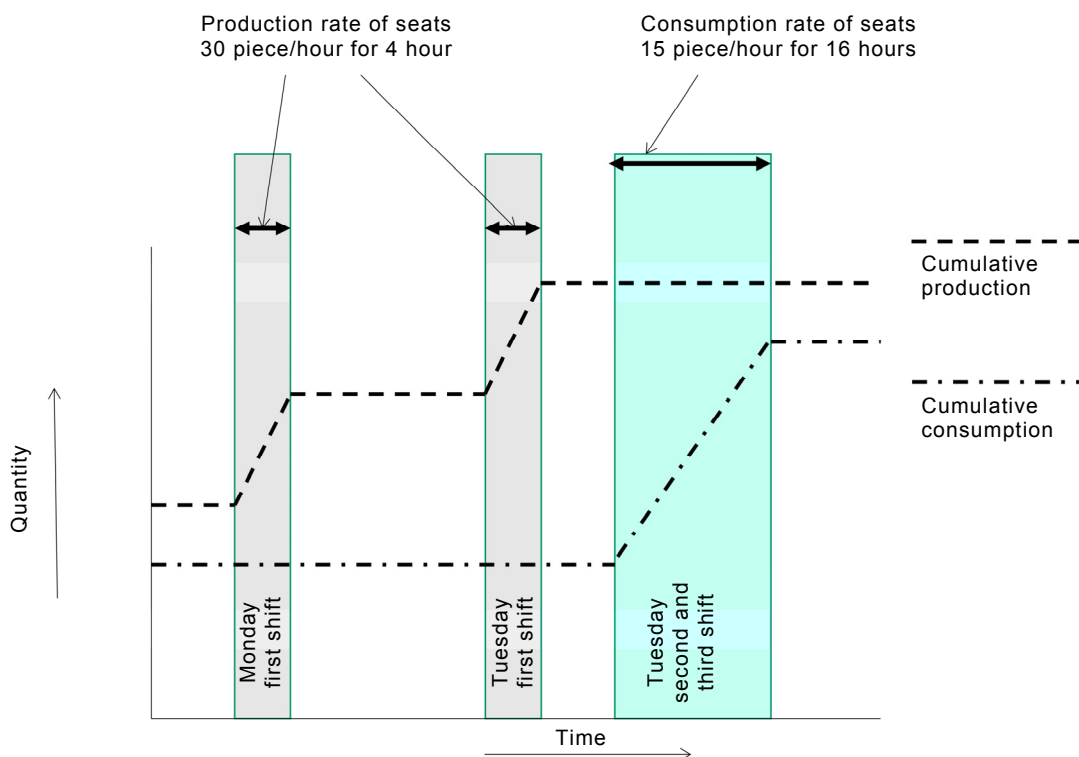
5.4.2 Resource capacity and availability

In IEC 62264-1 and IEC 62264-2, operations scheduling depends on the availability of both consumed and non-consumed resources. Available capacity in this standard is a portion of operations capacity that can be attained but is not committed to current or future operations processes and may be defined as a rate.

EXAMPLE 1 As shown in Figure 5 for a bicycle factory, the available capacity for production is 30 bicycle seats per hour for four hours of operation, during first shift, Monday and Tuesday, in the grey bars.

EXAMPLE 2 For a bicycle factory, the available capacity for consumption is 15 bicycle seats per hour of operation, during second and third shift, Tuesday, in the green bar.

EXAMPLE 3 Projected inventory for bicycle seats within a bicycle factory is 80 seats at the start of the first shift on Monday and 200 seats at the end of the first shift and 320 seats at the end of Tuesday first shift. At the end of Tuesday third shift 240 seats would be consumed, and inventory is 80.



IEC

Figure 5 –Inventory for a consumable resource

NOTE Consumed resources and non-consumed resources are typically handled differently in scheduling activities. In IEC 62264-1 and IEC 62264-2, production scheduling depends on the availability of both consumed and non-consumed resources. Production capacity is determined by both the availability of consumed resources (inputs such as raw material, components) and the availability and capacity of non-consumed resources (the physical system such as equipment, facilities and people).

6 Production operations management

6.1 General activities in production operations management

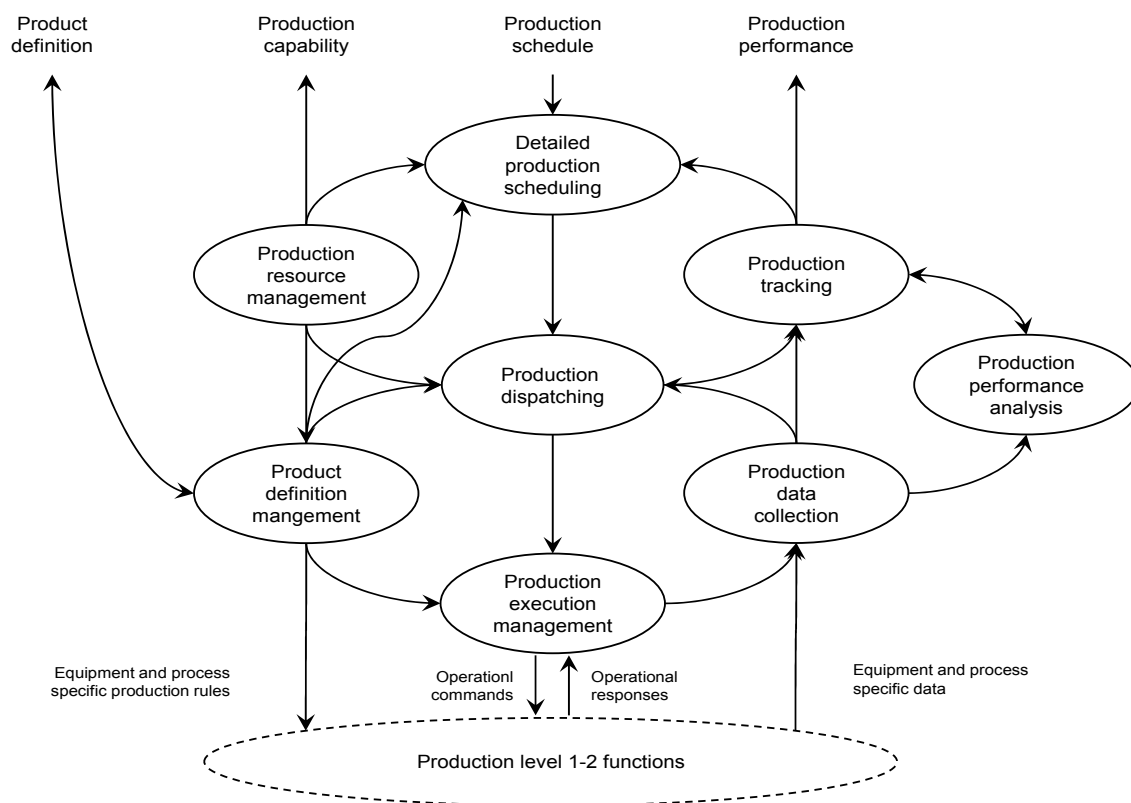
Production operations management shall be defined as the collection of activities that coordinate, direct, manage and track the functions that use raw materials, energy, equipment, personnel and information to produce products, with the required costs, qualities, quantities, safety and timeliness. The general activities in production operations management are listed in IEC 62264-1 and include

- a) reporting on production including variable manufacturing costs;
- b) collecting and maintaining data on production, inventory, manpower, raw materials, spare parts and energy usage;
- c) performing data collection and off-line analysis as required by engineering functions;
NOTE This may include statistical quality analysis and related control functions.
- d) performing needed personnel functions, such as work period statistics (for example, time, task), vacation schedule, work force schedules, union line of progression and in-house training and personnel qualification;
- e) establishing the immediate work schedule for its own area accounting for maintenance, transportation and other production-related requests;
- f) locally optimizing the costs for individual production areas while carrying out the production schedule established by the Level 4 functions;
- g) modifying production schedules to compensate for plant production interruptions that may occur in its area of responsibility.

6.2 Production operations management activity model

The production operations management model in the Manufacturing Operations Management Model in Part 1 is expanded to a more detailed activity model of production operations shown in Figure 6. The four elements of information (product definition, production capability, production schedule, and production performance) correspond to the exchanged information defined in IEC 62264-1 and illustrated in Figure 6. The oval-labelled production Level 1-2 functions represent the Level 1 and Level 2 sensing and control functions.

The activities defined here are not intended to imply an organizational structure of systems, software, or personnel. The model is provided to help in the identification of activities that may be performed and in the identification of roles associated with the activities. It defines what is done, not how it should be organized. Different organizations may have a different arrangement of roles and assignment of roles to personnel or systems.



IEC

Figure 6 – Activity model of production operations management

Not all production requests and production responses cross the boundary to the Level 4 functions. While production operations may be driven by production schedules, there can be production requests and production responses used internally within manufacturing operations management to handle situations such as rework, local intermediates, or consumable production.

Not all information flows within production operations management are depicted in Figure 6. In any specific implementation, information from any activity may be required by any other activity. Where activities in the production operations management model are defined in detail in this clause, some additional information flows are identified. Not all data sources and data sinks are identified in the detailed models.

6.3 Information exchange in production operations management

6.3.1 Equipment and process specific production rules

Equipment and process specific production rules shall be defined as the specific instructions sent to Level 2 based on the specific assigned tasks.

EXAMPLE Programmes for CNC machines for a specific product type, PLC programmes that change on the basis of the process under control, or unit recipes where these are executed in Level 2 or Level 1 equipment.

NOTE See IEC 61131-3 for examples of this type of data.

6.3.2 Operational commands

Operational commands shall be defined as the request information sent to Level 2. These are typically commands to start or complete elements of a job order. This information may also be SOPs displayed or given to operators, such as procedures for setting up machines or cleaning of machines.