DRAFT INTERNATIONAL STANDARD IEC/DIS 62264-5

ISO/TC **184**/SC 5 Secretariat: **ANSI**

Voting begins on **2015-08-07**

Voting terminates on **2015-11-07**

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION
INTERNATIONAL ELECTROTECHNICAL COMMISSION • МЕЖДУНАРОДНАЯ ЭЛЕКТРОТЕХНИЧЕСКАЯ КОММИСИЯ • COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

Enterprise-control system integration —

Part 5:
Business to manufacturing transactions

Intégration du système de commande d'entreprise —

Partie 5: Transactions entre systèmes de gestion de commande d'entreprise et systèmes de fabrication

ICS 25.040.40

This draft is submitted to a parallel enquiry in ISO and a CDV vote in the IEC.

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

© International Electrotechnical Commission, 2015

© International Electrotechnical Commission, 2015

CONTENTS

FOREWORD 12
INTRODUCTION 14
1. Scope 15
2. Normative references 15
3. Definitions, abbreviations, and conventions 15
3.1 Terms and definitions 15
3.2 Abbreviations 16
3.3 Conventions 16
4. Transaction messages and verbs 16
4.1 Introduction 17
4.2 Transaction models 17
4.3 Message structure 19
4.3.1 General Structure 19
4.3.2 Application identification area 19
4.3.3 Data Area 20
4.3.4 Message nouns 20
4.3.5 Wildcard 20
5. Message verbs 21
5.1 Verbs and transaction models 21
5.2 GET verb 23
5.3 SHOW verb 24
5.4 PROCESS verb 24
5.5 ACKNOWLEDGE verb 25
5.6 CHANGE verb 26
5.7 CANCEL verb 26
5.8 CONFIRM verb 27
5.9 RESPOND verb 29
5.10 SYNC verb 29
5.11 SYNC ADD verb 29
5.12 SYNC CHANGE verb 30
5.13 SYNC DELETE verb 30
5.14 Verb actions and the use of IDs 30
6. Message nouns 31
6.1 Introduction 31
6.2 Defined message contents 31
6.2.1 Equipment 31
6.2.2 Equipment Capability Test Specification 31
6.2.3 Equipment Class 31
6.2.4 Job List 31
6.2.5 Job Response 31
6.2.6 Material Class 32
6.2.7 Material Definition 32
6.2.8 Material Lot 32
6.2.9 Material Sublot 32
6.2.10 Material Test Specification 32
6.2.11 Operations Capability 32

6.2.12 Operations Definition 32
6.2.13 Operations Schedule 33
6.2.14 Operations Performance 33
6.2.15 Person 34
6.2.16 Personnel Class 34
6.2.17 Physical Asset 34
6.2.18 Physical Asset Class 34
6.2.19 Physical Asset Capability Test Specification 34
6.2.20 Process Segment 34
6.2.21 Resource Relationship Network 34
6.2.22 Resource Relationship Network Connection Type 35
6.2.23 Qualification Test Specification 35
6.2.24 Transaction Service Profile 35
6.2.25 Work Alert Definition 35
6.2.26 Work Alert 35
6.2.27 Work Calendar Definition 35
6.2.28 Work Calendar 35
6.2.29 Work Capability 36
6.2.30 Work Directive 36
6.2.31 Work Master 36
6.2.32 Work Performance 36
6.2.33 Work Schedule 37
6.2.34 Workflow Specification 37
6.2.35 Workflow Specification Type 37
6.2.36 Production Specific Models 38
6.3 Personnel model 39
6.3.1 Personnel model elements 39
6.3.2 Personnel class verbs 40
6.3.3 Personnel class verb actions 40
6.3.4 Person verbs 42
6.3.5 Person verb actions 42
6.3.6 Qualification test specification verbs 44
6.3.7 Qualification test specification verb actions 44
6.4 Role based equipment model 45
6.4.1 Role based equipment model elements 45
6.4.2 Equipment class verbs 46
6.4.3 Equipment class verb actions 46
6.4.4 Equipment verbs 47
6.4.5 Equipment verb actions 47
6.4.6 Equipment capability test specification verbs 49
6.4.7 Equipment capability test specification test verb actions 49
6.5 Physical asset model 50
6.5.1 Physical asset model elements 50
6.5.2 Physical asset class verbs 51
6.5.3 Physical asset class verb actions 51
6.5.4 Physical asset verbs 53
6.5.5 Physical asset verb actions 53
6.5.6 Physical asset capability test specification verbs 55
6.5.7 Physical asset capability test specification test verb actions 55

6.6 Material model 56
6.6.1 Material model elements 56
6.6.2 Material class verbs 58
6.6.3 Material class verb actions 58
6.6.4 Material definition verbs 59
6.6.5 Material definition verb actions 59
6.6.6 Material lot verbs 61
6.6.7 Material lot verb actions 61
6.6.8 Material sublot verbs 63
6.6.9 Material sublot verb actions 63
6.6.10 Material test specification verbs 65
6.6.11 Material test specification verb actions 65
6.7 Process segment model 66
6.7.1 Process segment model elements 66
6.7.2 Process segment verbs 67
6.7.3 Process segment verb actions 67
6.8 Operations capability model 68
6.8.1 Operations capability model elements 68
6.8.2 Operations capability verbs 69
6.8.3 Operations capability verb actions 69
6.9 Operations definition model 72
6.9.1 Operations definition model elements 72
6.9.2 Operations definition verbs 72
6.9.3 Operations definition verb actions 72
6.10 Operations schedule model 73
6.10.1 Operations schedule model elements 73
6.10.2 Operations schedule verbs 74
6.10.3 Operations schedule verb actions 74
6.11 Operations performance model 76
6.11.1 Operations performance model elements 76
6.11.2 Operations performance verbs 76
6.11.3 Operations performance verb actions 77
6.12 Resource relationship network model 79
6.12.1 Resource relationship network model elements 79
6.12.2 Resource relationship network verbs 79
6.12.3 Resource relationship network verb actions 79
6.12.4 Resource relationship connection type verbs 80
6.12.5 Resource relationship connection type verb actions 80
6.13 Work alerts 82
6.13.1 Work alert model elements 82
6.13.2 Work alert definition verbs 82
6.13.3 Work alert definition actions 82
6.13.4 Work alert verbs 83
6.13.5 Work alert verb actions 84
6.14 Work calendar 85
6.14.1 Work calendar elements 85
6.14.2 Work calendar definition verbs 86
6.14.3 Work calendar definition actions 86
6.14.4 Work calendar verbs 86

6.14.5 Work calendar actions 86
6.15 Work capability model 88
6.15.1 Work capability model elements 88
6.15.2 Work capability verbs 88
6.15.3 Work capability verb actions 88
6.16 Work definition model 90
6.16.1 Work definition model elements 90
6.16.2 Work master verbs 91
6.16.3 Work master verb actions 91
6.16.4 Work directive verbs 92
6.16.5 Work directive verb actions 92
6.17 Work record 93
6.17.1 Work record elements 93
6.17.2 Work record verbs 93
6.17.3 Work record verb actions 93
6.18 Work schedule model 95
6.18.1 Work schedule elements 95
6.18.2 Work schedule verbs 95
6.18.3 Work schedule verb actions 95
6.18.4 Job list verbs 96
6.18.5 Job list verb actions 96
6.19 Work performance model 98
6.19.1 Work performance elements 98
6.19.2 Work performance verbs 98
6.19.3 Work performance verb actions 98
6.19.4 Job response verbs 99
6.19.5 Job response verb actions 99
6.19.6 Job response list verbs 100
6.19.7 Job response list verb actions 100
6.20 Workflow specification model 102
6.20.1 Workflow specification elements 102
6.20.2 Workflow specification verbs 102
6.20.3 Workflow specification verb actions 102
6.20.4 Workflow specification type 103
6.20.5 Workflow specification type verbs 103
6.20.6 Workflow specification type verb actions 103
6.21 Transaction Profile 104
7. Completeness, compliance and conformance 107
7.1 Completeness 107
7.2 Compliance 107
7.3 Conformance 107
Annex A – Production operations transactions 110
A.1 Product definition model 110
A.1.1 Product definition model elements 110
A.1.2 Product definition verbs 110
A.1.3 Product definition verb actions 110
A.2 Production schedule model 111
A.2.1 Production schedule model elements 111
A.2.2 Production schedule verbs 112

A.2.3 Production schedule verb actions 112
A.3 Production performance model 114
A.3.1 Production performance model elements 114
A.3.2 Production performance verbs 114
A.3.3 Production performance verb actions 115
A.4 Production capability model 117
A.4.1 Production capability model elements 117
A.4.2 Production capability verbs 117
A.4.3 Production capability verb actions 117
Annex B – Transaction models and business scenario examples 120
B.1 Coordinating activities 120
B.2 Usage scenarios 121
B.3 Operations schedule and operations performance 121
B.3.1 Push Model 121
B.3.2 Pull model 121
B.3.3 Publish model 122
B.4 Operations schedule changes 122
B.4.1 Push model 122
B.4.2 Publish model 123
B.5 Operations schedule cancelled 123
B.5.1 Push model 123
B.5.2 Push and pull model 123
B.6 Daily operations performance 124
B.6.1 Push model 124
B.6.2 Pull model 124
B.6.3 Publish model 125
B.7 Operations schedule based on operations capability 125
B.7.1 Pull and push model 125
B.7.2 Publish and push model 126
B.8 Operations schedule changes 126
B.9.1 Push and pull model 126
B.8.2 Publish model 127
B.9 Material quantity changed 128
B.9.1 Push model 128
B.9.2 Publish and push model 128
B.9.3 Push and pull model 129
Annex C – Questions on the use of transactions 130
Annex D – Bibliography and References 132
Annex E – Patterns for Verbs 133
E.1 Patterns 133
E.2 Actions for GET verb 133
E.3 Actions for PROCESS verb 134
E.4 Actions for CHANGE message 134
E.5 Actions for CANCEL message 135
Annex F – General rules for identifying nouns from object models 138
F.1 Patterns 138
F.2 Hierarchical Object Model 138
F.3 Non-hierarchical Object Model 139

Figures

Figure 1 – Typical exchanged messages in a transaction 18
Figure 2 – Typical exchanged data set 19
Figure 3 – Typical layout of an application identification area 20
Figure 4 – GET with wildcard and SHOW response 21
Figure 5 – GET and SHOW transaction 24
Figure 6 – PROCESS/ACKNOWLEDGE transaction with an acknowledge always option 25
Figure 7 – Example of acknowledge to a process message 26
Figure 8 – CHANGE/RESPOND transaction with a respond always option 26
Figure 9 – CANCEL message 27
Figure 10 – GET and SHOW transaction with a CONFIRM always 27
Figure 11 – Example of a GET message with Confirm OnError 28
Figure 12 – Confirm Message 28
Figure 13 – SYNC ADD transaction with confirmation 30
Figure 14 – SYNC DELETE transaction with no confirmation 30
Figure 15 – Object grouping for the personnel model 40
Figure 16 – Object grouping for the role based equipment model 45
Figure 17 – Object grouping for the physical asset model 51
Figure 18 – Object grouping for the material model 56
Figure 19 – Object grouping for the process segment model 67
Figure 20 – Object grouping for the Operations capability model 69
Figure 21 – Object grouping for the operations definition model 72
Figure 22 – Object grouping for the operations schedule model 74
Figure 23 – Object grouping for the operations performance model 76
Figure 24 – Object grouping for the resource relationship network model 79
Figure 25 – Object grouping for the work alert model 82
Figure 26 – Object grouping for the work calendar model 85
Figure 27 – Object grouping for the work capability model 88
Figure 28 – Object grouping for the work definition model 91
Figure 29 – Object grouping for the work record model 93
Figure 30 – Object grouping for the work schedule model 95
Figure 31 – Object grouping for the work performance model 98
Figure 32 – Object grouping for the workflow specification model 102
Figure 33 – Transaction profile model 104
Figure 34 – Object grouping for the product definition model 110
Figure 35 – Object grouping for the production schedule model 112
Figure 36 – Object grouping for the production performance model 114
Figure 37 – Object grouping for the production capability model 117
Figure 38 – Coordinating planning and operations processes 120
Figure 39 – Push model; operations schedule and operations performance 121
Figure 40 – Pull model; operations schedule and operations performance 121

Figure 41 – Publish Model; operations schedule and operations performance 122
Figure 42 – Push Model; Operations schedule changes 122
Figure 43 – Publish model: v schedule changes 123
Figure 44 – Push model; operations schedule cancelled 123
Figure 45 – Push and pull model; schedule cancelled 124
Figure 46 – Push model; daily operations performance 124
Figure 47 – Pull model; daily operations performance 125
Figure 48 – Publish model; daily operations schedule 125
Figure 49 – Pull and push model; operations capability and operations schedule 126
Figure 50 – Publish and push model; operations capability and operations schedule 126
Figure 51 – Push and pull model; schedule changes 127
Figure 52 – Publish model; schedule changes after capability changes 128
Figure 53 – Push model; material lot added, material lot quantity changed 128
Figure 54 – Publish and push model; material quantity changes 129
Figure 55 – Push and pull model; material quantity changes 129
Figure 56 – Object model with composite relationships 139
Figure 57 – Example of multiple composite objects 140

Tables

Table 1 - Defined verbs 22
Table 2 – Acknowledge request options 25
Table 3 – Acknowledge element 25
Table 4 – Respond options 26
Table 5 – Confirmation request options 28
Table 6 – Respond element 29
Table 7 – Personnel class verb actions 40
Table 8 – Person verb actions 42
Table 9 – Qualification test specification verb actions 44
Table 10 – Equipment class verb actions 46
Table 11 – Equipment verb actions 48
Table 12 – Equipment capability test specification verb actions 49
Table 13 – Physical asset class verb actions 51
Table 14 – Physical Asset verb actions 53
Table 15 – Physical asset capability test specification verb actions 55
Table 16 – Material Class verb actions 58
Table 17 – Material definition verb actions 60
Table 18 – Material lot verb actions 61
Table 19 – Material sublot verb actions 63
Table 20 – Material test verb actions 66
Table 21 – Process segment verb actions 67
Table 22 – Operations capability verb actions 69
Table 23 – Operations capability element definitions for GET verb 71
Table 24 – Operations definition verb actions 72

Table 25 - Operations schedule verb actions 74
Table 26 – Operations schedule element definitions for GET verb 76
Table 27 – Operations Performance verb actions 77
Table 28 – Operations Performance definitions for GET verb 78
Table 29 – Resource Relationship Network verb actions 79
Table 30 – Resource Relationship Connection Type verb actions 80
Table 31 – Work alert definition additional attributes 82
Table 32 – Work alert definition verb actions 82
Table 33 – Work alert definition element definitions for GET verb 83
Table 34 – Work alert definition additional attributes 84
Table 35 – Work alert verb actions 84
Table 36 – Work alert element definitions for GET verb 85
Table 37 – Work calender definition verb actions 86
Table 38 – Work calendar verb actions 86
Table 39 – Work capability verb actions 88
Table 40 – Work capability element definitions for GET verb 89
Table 41 – Work master verb actions 91
Table 42 – Work directive verb actions 92
Table 43 – Work record verb actions 93
Table 44 – Work Schedule verb actions 95
Table 45 – Job List verb actions 96
Table 46 – Work Schedule and Job List element definitions for GET verb 97
Table 47 – Work performance verb actions 98
Table 48 – Work performance element definitions for GET verb 99
Table 49 – Job response verb actions 99
Table 50 – Job response list verb actions 100
Table 51 – Job response list element definitions for GET verb 101
Table 52 – Workflow Specification verb actions 102
Table 53 – Workflow Specification Type verb actions 103
Table 54 – Attributes of Transaction Profile 105
Table 55 – Attributes of Supported Action 105
Table 56 – Transaction Profile verb actions 105
Table 57 – Supported verb-noun actions 107
Table 58 – Vendor conformance example 108
Table 59 – Product definition verb actions 110
Table 60 – Production schedule verb actions 112
Table 61 – Production Schedule element definitions for GET verb 114
Table 62 – Production Performance verb actions 115
Table 63 – Production Performance definitions for GET verb 116
Table 64 – Production Capability verb actions 117
Table 65 – Production capability element definitions for GET verb 119
Table 66 – GET message with object ID is specified 133
Table 67 – GET message with wildcard in object ID 133

Table 68 – GET message with no object ID specified 133
Table 69 – PROCESS message with Object ID specified 134
Table 70 – PROCESS message with no object ID 134
Table 71 – CHANGE message with object ID 134
Table 72 – CHANGE message with wildcard object ID 135
Table 73 – CANCEL message with object ID 135
Table 74 – CANCEL message with wildcard in object ID 136
Table 75 – SYNC message with object ID 136
Table 76 – SYNC message with wildcard in object ID 136

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 5: Business to manufacturing transactions

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62264-5 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text is based on the following documents:

CDV	Report on voting
65E/100/CDV	65E/156/RVC

Full information on the voting for the approval can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, IEC 62264-2.

The list of all the parts of the IEC 62264 series, under the general title *Enterprise-Control system integration*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This part of IEC 62264 is based on the use of IEC 62264 abstract models previously defined in IEC 62264-2 and IEC 62264-4 combined with verbs to define a transaction model for information exchange. It is recognized that other non-IEC 62264-5 transaction protocols are possible and are not deemed invalid as a result. Transactions occur at all levels within the enterprise and between enterprise partners, and are related to both required and actual activities, but the focus of this part of IEC 62264 is the interface between enterprise/business systems and manufacturing systems.

This standard defines transactions that are exchanged between Level 4 and Level 3, and within Level 3 as defined in the object models of IEC 62264-2 and IEC 62264-4. Models are introduced which provide descriptions of the transactions and explanations of the required transaction processing behaviour.

Technology specific implementations to provide this behaviour are not defined in this standard. This part of IEC 62264 has the intent of providing insight into the level of work required to construct transactional exchanges.

ENTERPRISE-CONTROL SYSTEM INTEGRATION

Part 5: Business to Manufacturing Transactions

1. Scope

This part of IEC 62264 defines transactions in terms of information exchanges between applications performing business and manufacturing activities associated with Levels 3 and 4. The exchanges are intended to enable information collection, retrieval, transfer and storage in support of Enterprise-Control system integration. This part of IEC 62264 is consistent with the IEC 62264-2 and IEC 62264-4 object models attributes. This standard also defines transactions that specify how to exchange the objects defined in IEC 62264-2, IEC 62264-4 and this standard. Other uses of the transaction model are not defined in this part.

The models covered in this standard are: Personnel Model, Equipment Model, Physical Asset Model, Material Model, Process Segment Model, Operations Capability Model, Operations Definition Model, Operations Schedule Model, Operations Performance Model, Resource Relationship Network Model, Work Capability Model, Work Definition Model, Work Schedule Model, Job List Model, Work Performance Model, Workflow Specification Model, Work Calendar, Work Record and Work Alert Model.

2. Normative references

The following normative documents contain provisions, which through reference in this text constitute provisions of this part. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid normative documents.
ISO/IEC 19501-1 Information Technology – Unified Modeling Language (UML)—Part 1: Specification

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

IEC 62264-2, *Enterprise-control system integration – IEC 62264-2: Object modes and attributes*

IEC 62264-3, *Enterprise-control system integration – Part 3: Activity models of manufacturing operations management*

IEC 62264-4, *Enterprise-control system integration – IEC 62264-4: Object modes and attributes for manufacturing operations management integration*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3. Definitions, abbreviations, and conventions

3.1 Terms and definitions

3.1.1
application
an ordered set of physical and logical system processes, performed by a set of resources that conduct a set of transactions intended to accomplish a definite objective; information provider or information user performing the activity that is involved in a transaction

EXAMPLE HMIs, Data Historians, MES and LIMs software are examples of applications.