

# ISO/IEC 24702 :2006-10 (E)

## Information technology\_ - Generic cabling\_ - Industrial premises

---

### CONTENTS

- FOREWORD.....7
- INTRODUCTION.....8
- 1 Scope..... 10
- 2 Normative references ..... 10
- 3 Definitions and abbreviations..... 13
  - 3.1 Definitions ..... 13
  - 3.2 Abbreviations ..... 15
- 4 Conformance..... 15
- 5 Structure ..... 16
  - 5.1 General ..... 16
  - 5.2 Functional elements ..... 16
  - 5.3 Cabling subsystem ..... 17
    - 5.3.1 General structure..... 17
    - 5.3.2 Campus backbone cabling subsystem ..... 18
    - 5.3.3 Building backbone cabling subsystem..... 18
    - 5.3.4 Floor cabling subsystem ..... 18
    - 5.3.5 Intermediate cabling subsystem..... 19
    - 5.3.6 Centralized cabling architecture..... 19
    - 5.3.7 Design objectives ..... 19
  - 5.4 Interconnection of subsystems ..... 20
  - 5.5 Accommodation of functional elements..... 21
  - 5.6 Interfaces ..... 22
    - 5.6.1 Equipment interfaces and test interfaces ..... 22
    - 5.6.2 Channels and permanent links..... 22
    - 5.6.3 External network interface ..... 22
  - 5.7 Dimensioning and configuring..... 22
    - 5.7.1 General ..... 22
    - 5.7.2 Distributors..... 23
    - 5.7.3 Cables..... 23
    - 5.7.4 Apparatus attachment and equipment cords ..... 23
    - 5.7.5 Patch cords and jumpers ..... 23
    - 5.7.6 TO..... 23
    - 5.7.7 Telecommunications rooms and equipment rooms..... 24
    - 5.7.8 Industrial enclosures ..... 24
    - 5.7.9 Building entrance facilities..... 24
- 6 Channel performance ..... 24
  - 6.1 General ..... 24
  - 6.2 Environmental performance..... 26
    - 6.2.1 General ..... 26
    - 6.2.2 Environmental classification ..... 26
  - 6.3 Transmission performance ..... 28
    - 6.3.1 General ..... 28
    - 6.3.2 Balanced cabling ..... 29
    - 6.3.3 Optical fibre cabling..... 33

7	Reference implementations .....	34
7.1	General .....	34
7.2	Balanced cabling .....	35
7.2.1	General .....	35
7.2.2	Intermediate cabling .....	35
7.2.3	Backbone cabling .....	35
7.3	Optical fibre cabling .....	35
7.3.1	General .....	35
7.3.2	Component choice .....	35
7.3.3	Maximum channel lengths .....	35
8	Cable requirements .....	36
8.1	Introduction .....	36
8.2	Operating environment .....	36
8.3	Balanced cables .....	37
8.4	Optical fibre cables .....	37
8.4.1	All-silica optical fibre cables .....	37
8.4.2	Plastic optical fibre cables .....	38
8.4.3	Plastic clad silica optical fibre cables .....	39
8.4.4	Propagation delay .....	39
9	Connecting hardware requirements .....	39
9.1	Introduction .....	39
9.2	General requirements .....	40
9.2.1	Location .....	40
9.2.2	Design .....	40
9.2.3	Mounting .....	40
9.2.4	Marking and colour coding .....	41
9.3	Operating environment .....	41
9.4	Connecting hardware for balanced cabling .....	41
9.4.1	General requirements .....	41
9.4.2	Performance marking .....	41
9.4.3	Operating environment .....	41
9.4.4	Mechanical and electrical characteristics of balanced connecting hardware .....	42
9.5	Connecting hardware for optical fibres .....	44
9.5.1	Operating environment .....	44
9.5.2	Connecting hardware for all-silica optical fibres .....	45
9.5.3	Connecting hardware for plastic optical fibres .....	45
9.5.4	Connecting hardware for plastic clad silica fibres .....	46
10	Cords .....	47
10.1	General .....	47
10.2	Operating environment .....	47
10.3	Balanced cords .....	47
10.3.1	General .....	47
10.3.2	Cable insertion loss .....	48
10.3.3	Identification .....	48
10.3.4	Operating environment .....	48
10.3.5	Electrical performance requirements for patch cords .....	49

10.4	Optical fibre cords .....	49
10.4.1	General .....	49
10.4.2	Identification .....	50
10.4.3	Performance requirements for patch cords .....	50
10.4.4	Operating environment .....	50
Annex A (normative)	Permanent link performance limits .....	52
A.1	General .....	52
A.2	Balanced cabling .....	52
A.2.1	General .....	52
A.2.2	Additional requirements .....	53
A.2.3	Optical fibre cabling .....	54
Annex B (normative)	Test methods .....	55
B.1	General .....	55
B.1.1	Visual inspection .....	55
B.1.2	Measurements .....	55
B.2	Test parameters for balanced cabling .....	60
B.2.1	General .....	60
B.2.2	Wire map .....	60
B.2.3	Length .....	60
B.2.4	Propagation delay .....	60
B.2.5	Delay skew .....	61
B.2.6	Attenuation (insertion loss) .....	61
B.2.7	Near end crosstalk loss (NEXT, pair-to-pair and power sum) .....	61
B.2.8	Equal level far end crosstalk loss (ELFEXT, pair-to-pair and power sum) .....	61
B.2.9	Attenuation to crosstalk ratio (ACR, pair-to-pair and power sum) .....	61
B.2.10	Return loss .....	61
B.2.11	Coupling attenuation .....	61
B.2.12	Direct current (d.c.) loop resistance .....	62
B.3	Test parameters for optical fibre cabling .....	62
B.3.1	General .....	62
B.3.2	All-silica optical fibre .....	62
B.3.3	Plastic optical fibre .....	62
B.3.4	Plastic clad silica optical fibre .....	62
Annex C (normative)	Reference implementations (not conforming to clause 5) .....	63
C.1	Introduction .....	63
C.2	Connection-less channels .....	63
C.2.1	General .....	63
C.2.2	Channels with no connections .....	63
C.2.3	Channels with inter-connections .....	64
C.3	Channels using balanced cabling bulkhead connections .....	65
Annex D (informative)	Reference implementations .....	68
D.1	Introduction .....	68
D.2	Channels using balanced cabling bulkhead connections with additional connections .....	68

Annex E (informative) Supported applications .....	71
E.1 Supported applications for balanced cabling .....	71
E.2 Supported applications for optical fibre cabling .....	71
Annex F (informative) Introduction to environmental classification in clause 6 .....	73
F.1 General .....	73
F.2 Application of environmental classification .....	73
F.2.1 MICE .....	73
F.2.2 Channel environment .....	73
F.2.3 Component selection .....	74
F.3 The MICE system .....	75
F.4 Guidance with respect to environmental classification .....	79
Bibliography .....	83
Figure 1 – Cabling specified by ISO/IEC 24702 and its relationship to OSI reference model layers .....	9
Figure 2 – Configuration of apparatus-based functional elements within industrial premises .....	17
Figure 3 – Structure of generic cabling for industrial environment .....	18
Figure 4 – Hierarchical structure of generic cabling for industrial premises .....	20
Figure 5 – Inter-relationship of functional elements in an installation with diversity for protection against failure .....	20
Figure 6 – Accommodation of functional elements .....	21
Figure 7 – Test and equipment interfaces .....	22
Figure 8 – Transmission performance of a channel .....	25
Figure 9 – Example of a system showing the location of cabling interfaces and extent of associated channels .....	25
Figure 10 – Eight position jack pin and pair grouping assignments (front view of connector) .....	43
Figure 11 – Four position jack pin and pair grouping assignments (front view of connector) .....	44
Figure A.1 – Permanent link options .....	52
Figure B.1 – Reference planes for link and channels (point-to-point) .....	56
Figure B.2 – The test system and the cabling under test .....	57
Figure C.1 – Balanced cabling channel configurations with no connections .....	64
Figure C.2 – Balanced cabling channel configurations of Figure C.1 with interconnection at distributor .....	65
Figure C.3 – Balanced cabling channel configurations with bulkhead connections .....	66
Figure D.1 – Channel configurations .....	69
Figure F.1 – Example of variation of the environment along a cabling channel .....	74
Figure F.2 – The local environment .....	74
Figure F.3 – Noise ranges of common industrial machine devices .....	80
Figure F.4 – Guidance on separation of cabling from noise sources .....	82
Table 1 – Channel environments .....	26
Table 2 – Details of environmental classification .....	27

Table 3 – Formulae for TCL limits for an unscreened cabling channel.....	30
Table 4 – Informative TCL limits for an unscreened cabling channel at key frequencies .....	30
Table 5 – Formulae for ELTCTL limits for an unscreened cabling channel .....	31
Table 6 – Informative ELTCTL limits for an unscreened cabling channel at key frequencies .....	31
Table 7 – Formulae for coupling attenuation limits for a screened cabling channel .....	32
Table 8 – Informative coupling attenuation limits for a screened cabling channel at key frequencies .....	32
Table 9 – Channel attenuation of optical fibre cabling channels .....	34
Table 10 – Optical fibre channel length equivalence for connecting hardware .....	36
Table 11 – Environmental performance specifications for balanced cables (in addition to IEC 61156-5-1 and IEC 61156-6-1) .....	37
Table 12 – Singlemode optical fibre cable (Category OS2) performance requirements .....	38
Table 13 – Environmental performance specifications for optical fibre cables (in addition to IEC 60794-2 and IEC 60794-3) .....	38
Table 14 – Optical fibre cable performance requirements.....	39
Table 15 – Environmental performance specifications for balanced cabling connecting hardware .....	42
Table 16 – Environmental performance specifications for optical fibre cabling connecting hardware.....	44
Table 17 – Environmental performance specifications for balanced cords (in addition to IEC/PAS 61935-2-20) <sup>a)</sup> .....	49
Table 18 – Environmental performance specifications for optical fibre cords (in addition to IEC 61753-X) .....	51
Table B.1 – Level of accuracy for balanced cabling tester .....	58
Table B.2 – Cabling characteristics of balanced cabling for acceptance, compliance, and reference testing .....	60
Table B.3 – Cabling characteristics of optical fibre cabling for acceptance, compliance, and reference testing .....	62
Table C.1 – Channel equations for balanced cabling .....	65
Table C.2 – Channel equations for bulkhead connections .....	67
Table D.1 – Channel equations .....	70
Table E.1 – Supported applications and maximum channel lengths with all-silica multimode optical fibres .....	71
Table E.2 – Supported applications and maximum channel lengths with all-silica singlemode optical fibres .....	72
Table E.3 – Supported applications and maximum channel lengths with plastic optical fibres .....	72
Table F.1 – Derivation of boundaries for mechanical criteria in Table 2.....	75
Table F.2 – Derivation of boundaries for ingress protection criteria in Table 2.....	75
Table F.3 – Derivation of boundaries for climatic criteria in Table 2 .....	76
Table F.4 – Derivation of boundaries for chemical criteria in Table 2 .....	77
Table F.5 – Derivation of boundaries for electromagnetic criteria in Table 2.....	79
Table F.6 – Guidance for the classification of electromagnetic environments .....	81
Table F.7 – Coupling mechanisms for common noise sources.....	82