

Telecommunications installations — Generic cabling — Industrial premises



STANDARD

AS/NZS



AS/NZS ISO/IEC 24702:2007

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CT-001, Communications Cabling. It was approved on behalf of the Council of Standards Australia on 10 April 2007 and on behalf of the Council of Standards New Zealand on 20 April 2007.

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Australian/New Zealand Standard™

Telecommunications installations — Generic cabling—Industrial premises

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CT-001, Communications Cabling.

This Standard incorporates Amendment No. 1 (January 2012). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

A1 | This Standard is identical with, and has been reproduced from ISO/IEC 24702:2006, *Information technology—Generic cabling—Industrial premises* and Amendment 1 (2009), which is added at the end of the source text.

The objective of this Standard is to specify generic cabling that supports a wide range of communications services including automation, process control and monitoring applications for use within industrial premises or industrial areas within other types of premises comprising single or multiple buildings on a campus.

As this Standard is reproduced from an international standard, the following applies:

- (a) Its number appears on the cover and title page while the international standard number appears only on the cover.
- (b) In the source text ‘this International Standard’ should read ‘this Australian/New Zealand Standard’.
- (c) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

<i>Reference to International Standard</i>		<i>Australian/New Zealand Standard</i>	
ISO/IEC		AS/NZS	
11801	Information technology—Generic cabling for customer premises	3080	Telecommunications installations—Generic cabling for commercial premises (ISO/IEC 11801:2002, MOD)
18010	Information technology—Pathways and spaces for commercial premises cabling	3084	Telecommunications installations—Telecommunications pathways and spaces for commercial buildings (ISO/IEC 11801:2002, MOD)
IEC		AS	
60529	Degrees of protection provided by enclosures (IP Code)	60529	Degrees of protection provided by enclosures (IP Code)
		AS/IEC	
61131	Programmable controllers	61131	Programmable controllers
61131-2	Part 2: Equipment requirements and tests	61131.2	Part 2: Equipment requirements and tests
		AS/NZS IEC	
61935	Testing of balanced communication cabling in accordance with ISO/IEC 11801	61935	Testing of balanced communication cabling in accordance with ISO/IEC 11801
61935-1	Part 1: Installed cabling	61935.1	Part 1: Installed cabling
61935-2	Part 2: Patch cords and work area cords	61935.2	Part 2: Patch cords and work area cords

Only international references that have been adopted as Australian or Australian/New Zealand Standards have been listed.

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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INTRODUCTION

Within premises, the importance of the information technology cabling infrastructure is similar to that of other fundamental building utilities such as heating, lighting and mains power. As with other utilities, interruptions to service can have serious impact. Poor quality of service due to lack of design foresight, use of inappropriate components, incorrect installation, poor administration or inadequate support can threaten an organization's effectiveness.

Historically, the cabling within premises comprised both application-specific and multipurpose networks. The subsequent growth of generic cabling designed in accordance with ISO/IEC 11801 has supported the development of high-data-rate applications based upon a defined cabling model.

This International Standard recognizes the benefit of generic cabling to interconnect several pieces of apparatus within industrial premises or industrial areas within other types of premises (within and between structures and buildings) and should be read in conjunction with ISO/IEC 11801.

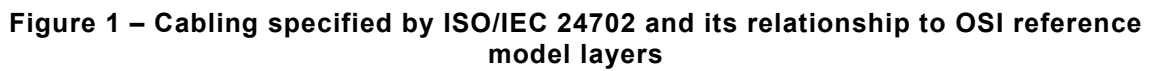
This International Standard provides, for industrial premises:

- a) users with an application-independent generic cabling system and an open market for cabling components;
- b) requirements for infrastructures that support critical automation, process control and monitoring applications in a range of industrial environments;
- c) users with a flexible cabling scheme such that modifications are both easy and economical;
- d) building professionals, production and control engineers with guidance allowing the accommodation of cabling:
 - before specific requirements are known; i.e. in the initial planning either for construction or refurbishment;
 - by further deployment as the requirements of specific industrial areas are defined;
- e) industry and standardisation bodies with a cabling system which supports current products and provides a basis for future product development and applications standardisation.

This International Standard specifies multi-vendor cabling, and is related to

- the associated standard for generic cabling within commercial premises (ISO/IEC 11801),
- standards for cabling components developed by Technical Committees of ISO and IEC,
- standards for the quality assurance and installation of information technology cabling (series ISO/IEC 14763 and IEC 61918) and testing of installed cabling (IEC 61935-1),
- applications developed by the technical committees of IEC, subcommittees of ISO/IEC JTC 1 and study groups of ITU-T (for example Fieldbus, LANs and ISDN).

Within this International standard the cabling, defined between the interfaces shown in Figure 1, contains passive components only.



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AUSTRALIAN/NEW ZEALAND STANDARD

Telecommunications installations—Generic cabling—Industrial premises**1 Scope**

This International Standard specifies generic cabling that supports a wide range of communications services including automation, process control and monitoring applications for use within industrial premises or industrial areas within other types of premises, comprising single or multiple buildings on a campus. It covers balanced cabling and optical fibre cabling.

This standard is based upon and references the requirements of ISO/IEC 11801. It contains additional requirements that are appropriate to industrial premises in which the maximum distance over which communications services have to be distributed is 10 000 m. The principles of this International Standard may also be applied to installations that do not fall within this range.

In addition to the requirements of ISO/IEC 11801, this International Standard specifies

- a) a modified structure and configuration for generic cabling within industrial premises in which information technology applications are used to support process monitoring and control functions,
- b) implementation options,
- c) additional requirements that reflect the range of operating environments within industrial premises.

Safety (electrical safety and protection, fire, etc.) and electromagnetic compatibility (EMC) requirements are outside the scope of this International Standard and are covered by other standards and regulations. However, information given in this document may be of assistance in meeting these standards and regulations.

2 Normative references

The following referenced documents are indispensable for the application 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 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof*

IEC 60512-4-2, *Connectors for electronic equipment – Tests and measurements – Part 4-2: Voltage stress tests – Test 4b: Partial discharge*

IEC 60512-6-2, *Connectors for electronic equipment – Tests and measurements – Part 6-2: Dynamic stress tests – Test 6b: Bump*

IEC 60512-6-3, *Connectors for electronic equipment – Tests and measurements – Part 6-3: Dynamic stress tests – Test 6c: Shock*

IEC 60512-6-4, *Connectors for electronic equipment – Tests and measurements – Part 6-4: Dynamic stress tests – Test 6d: Vibration (sinusoidal)*

IEC 60512-8, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 8: Connector tests (mechanical) and mechanical tests on contacts and terminations*

IEC 60512-9, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 9: Miscellaneous tests*

IEC 60512-11-4, *Connectors for electronic equipment – Tests and measurements – Part 11-4: Climatic tests – Test 11d: Rapid change of temperature*

IEC 60512-11-7, *Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test*

IEC 60512-11-9, *Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat*

IEC 60512-11-10, *Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold*

IEC 60512-11-12, *Connectors for electronic equipment – Tests and measurements – Part 11-12: Climatic tests – Test 11m: Damp heat, cyclic*

IEC 60512-19-3, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 19: Chemical resistance tests – Section 3: Test 19c – Fluid resistance*

IEC 60512-23-3, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 23-3: Test 23c: Shielding effectiveness of connectors and accessories*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60603-7, *Connectors for frequencies below 3 MHz for use with printed boards – Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality*

IEC 60793-1-40, *Optical fibres – Part 1-40: Measurement methods and test procedures – Attenuation*

IEC 60793-1-41, *Optical fibres – Part 1-41: Measurement methods and test procedures – Bandwidth*

IEC 60793-1-44, *Optical fibres – Part 1-44: Measurement methods and test procedures – Cut-off wavelength*

IEC 60793-2-30, *Optical fibres – Part 2-30: Product specifications – Sectional specification for category A3 multimode fibres*

IEC 60793-2-40, *Optical fibres – Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

IEC 60794-1-2, *Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures*

IEC 60794-2, *Optical fibre cables – Part 2: Indoor cables – Sectional specification*

IEC 60794-3, *Optical fibre cables – Part 3: Sectional specification – Outdoor cables*

IEC 61076-2-101, *Connectors for electronic equipment – Part 2-101: Circular connectors – Detail specification for circular connectors M8 with screw- or snap-locking, M12 with screw-locking for low voltage applications*

IEC 61076-3-106, *Connectors for electronic equipment – Product requirements – Part 3-106: Rectangular connectors – Detail specification for protective housings for use with 8-way shielded and unshielded connectors for industrial environments incorporating the IEC 60603-7 series interface*

IEC 61131-2, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61156 (all parts), *Multicore and symmetrical pair/quad cables for digital communications – Measurement of coupling attenuation of balances cabling in laboratory conditions*

IEC 61156-5-1 (all parts), *Multicore and symmetrical pair/quad cables for digital communications*

IEC 61156-5-1, *Multicore and symmetrical pair/quad cables for digital communications – Part 5-1: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Horizontal floor wiring - Blank detail specification*

IEC 61156-6-1, *Multicore and symmetrical pair/quad cables for digital communications – Part 6-1: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz – Work area wiring – Blank detail specification*

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre(cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion/twist*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-30, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-30: Tests – Solar radiation*

IEC 61300-2-34, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-34: Tests – Resistance to solvents and contaminating fluids*

IEC 61300-2-44, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-44: Tests – Flexing of the strain relief of fibre optic devices*

IEC 61300-2-46, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-46: Tests – Damp heat, cyclic*

IEC 61300-3-34, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-34: Examinations and measurements – Attenuation of random mated connectors*

IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components performance standard – Specification for the testing of optical fibre communication cabling in accordance with ISO/IEC 24702 – Cords – Blank detail specification*

IEC 61754-20, *Fibre optic connector interfaces – Part 20: Type LC connector family*

IEC 61918, *Digital data communications for measurement and control – Installation of communication networks in industrial control systems*

IEC 61935-1, *Testing of balanced communication cabling in accordance with ISO/IEC 11801 – Part 1: Installed cabling*

IEC 61935-2, *Testing of balanced communication cabling in accordance with ISO/IEC 11801 – Part 2: Patch cords and work area cords*

IEC 62012-1, *Multicore and symmetrical pair/quad cables for digital communications to be used in harsh environments – Part 1: Generic specification*

ISO/IEC 11801:2002, *Information technology – Generic cabling for customer premises*

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

NOTE Refer to the second edition of ISO/IEC 11801, published in 2002, where this date has been specified. For undated references, use the latest edition of ISO/IEC 11801.

ISO/IEC 14763 (all parts), *Information technology – Implementation and operation of customer premises cabling*

ISO/IEC 14763-1, *Information technology – Implementation and operation of customer premises cabling – Part 1: Administration*

ISO/IEC TR 14763-2, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*

ISO/IEC 14763-3, *Information technology – Implementation and operation of customer premises cabling – Part 3: Testing of optical fibre cabling*

ISO/IEC 18010, *Information technology – Pathways and spaces for customer premises cabling*

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this International Standard the following definitions apply in addition to those of ISO/IEC 11801.

3.1.1

apparatus

one or more pieces of equipment having specific and defined overall functions within industrial premises served by one or more network interfaces

3.1.2**apparatus attachment cord**

cords used to connect a telecommunications outlet (TO) to a network interface

3.1.3**automation island**

cabling together with active and passive components within apparatus served by a network interface

3.1.4**bulkhead**

a wall or barrier which maintains the ingress and climatic environmental classifications applicable on either side

3.1.5**channel**

end-to-end transmission path connecting any two pieces of application-specific equipment

NOTE 1 Equipment and apparatus attachment cords are included in the channel but not the connecting hardware into the application-specific equipment.

NOTE 2 This channel definition covers passive elements only. Active elements, such as transmitters or receivers, are not part of any channel in this standard.

3.1.6**floor cable**

cable connecting the floor distributor to the intermediate distributor

3.1.7**floor distributor**

distributor used to make connections between the floor cable, other cabling subsystems and active equipment

3.1.8**functional performance**

level of transmission performance able to support intended Class of applications

3.1.9**intermediate cable**

cable connecting the intermediate distributor to the TO

3.1.10**intermediate distributor**

the distributor used to make connections between the intermediate cable, other cabling subsystems and active equipment

3.1.11**MICE**

classification system that describes the environment conditions that are local to a channel based upon the following factors:

- mechanical (M),
- ingress (I),
- climatic and chemical (C),
- electromagnetic (E)

3.1.12**network interface**

interface between the apparatus attachment cabling and the apparatus network

3.1.13**operating temperature**

stabilised temperature of the cabling combining ambient temperature with any increase due to the application being supported

3.1.14**telecommunications**

includes the transmission of information in support of automation, process control and monitoring applications

NOTE This definition applies to this International Standard in addition to the definition given in ISO/IEC 11801.

3.1.15**telecommunications outlet (TO)**

a fixed connecting device where the intermediate cable terminates and which provides the interface to the apparatus attachment cabling

3.2 Abbreviations

For the purposes of this International Standard the following abbreviations apply in addition to those of ISO/IEC 11801.

AO	automation outlet
ELTCTL	equal level transverse conversion transfer loss
FD	floor distributor
ID	intermediate distributor
MICE	mechanical, ingress, climatic and chemical, electromagnetic
NI	network interface
TCL	transverse conversion loss
TO	telecommunications outlet

4 Conformance

For a cabling system to conform to this International Standard:

- a) the structure and configuration shall conform to the requirements of clause 5;
- b) the interfaces to the cabling at the telecommunications outlet (TO) shall conform to the requirements of clause 9 with respect to mating interfaces and performance when subjected to environmental conditions, local to the interfaces (see note 1), as defined by the applicable environment of clause 6;
- c) connecting hardware at other places in the cabling structure shall conform to the requirements of clause 9 when subjected to environmental conditions, local to the connecting hardware (see note 1), as defined by the applicable environmental Class(es) of clause 6;
- d) channels (see note 2) shall conform to the requirements of the applicable transmission performance Class of clause 6 when subjected to environmental conditions, local to the channels (see note 1), as defined by the applicable environment of clause 6. This shall be achieved by one of the following:
 - a channel design and implementation ensuring that the prescribed channel performance Class of clause 6 is met;
 - attachment of appropriate components to a permanent link design meeting the prescribed performance Class of Annex A. Channel performance shall be assured where a channel is created by adding more than one cord to either end of a permanent link meeting the requirements of Annex A;
 - using the reference implementations of clause 7 and compatible cabling components conforming to the requirements of clauses 8, 9 and 10, based upon a statistical approach of performance modelling;

e) local regulations concerning safety and electromagnetic emissions shall be met.

The channel transmission performance requirements of clause 6 are also achieved when subjected to environmental conditions local to the channels, as defined in clause 6 using the reference implementations of Annex C and compatible cabling components conforming to the requirements of clauses 8, 9 and 10, based upon a statistical approach of performance modelling (see note 3).

Test methods to ensure conformance with the channel and link requirements of clause 6 and Annex A respectively are specified in IEC 61935-1 and Annex B of this standard. The treatment of measured results that fail to meet the requirements of this clause, or lie within the relevant measurement accuracy, shall be clearly documented within a quality plan as described in ISO/IEC 14763-2.

NOTE 1 The applicable environment of clause 6, local to the cabling or cabling component(s), is that of the external environment or that modified environment created by use of mitigating installation techniques.

NOTE 2 The word "channel" refers to the passive cabling between the interfaces described in clauses 5 and 6 and is used specifically in this context throughout this International Standard. The meaning of the word "channel" as used in other standards is not applicable.

NOTE 3 The use of components suitable for use when subject to certain environmental conditions does not automatically assure that the resulting channel meets the applicable transmission performance Class of clause 6 when subjected to those environment conditions.

Installation and administration of cabling in accordance with this standard should be carried out in accordance with the ISO/IEC 14763 series of standards.

This document does not specify which tests and sampling levels should be adopted. The test parameters to be measured and the sampling levels to be applied for a particular installation should be defined in the installation specification and quality plans for that installation prepared in accordance with ISO/IEC 14763-2.

Specifications marked "ffs" (for further study) are preliminary and are not required for conformance to this International Standard.

5 Structure

5.1 General

This clause identifies the functional elements of generic cabling for industrial premises, describes how they are connected together to form subsystems and identifies the interfaces at which application-specific components are connected. Applications listed in Annex E are supported by connecting active equipment at the TOs and the distributors.

In general, all functional elements, subsystems and interfaces from the campus distributor to the floor distributor as described in ISO/IEC 11801 are applicable.

5.2 Functional elements

In addition to the distributors specified in ISO/IEC 11801 this standard specifies the following functional elements and interfaces of generic cabling for industrial premises:

- floor cable;
- intermediate distributor (ID);
- intermediate cable;
- TO;
- network interface (NI).

As shown in Figure 2, an ID is able to serve TOs on separate pieces of apparatus or multiple TOs on a single piece of apparatus. The type and nature of the apparatus cabling are beyond the scope of this International Standard.

Groups of functional elements are connected together to form cabling subsystems.

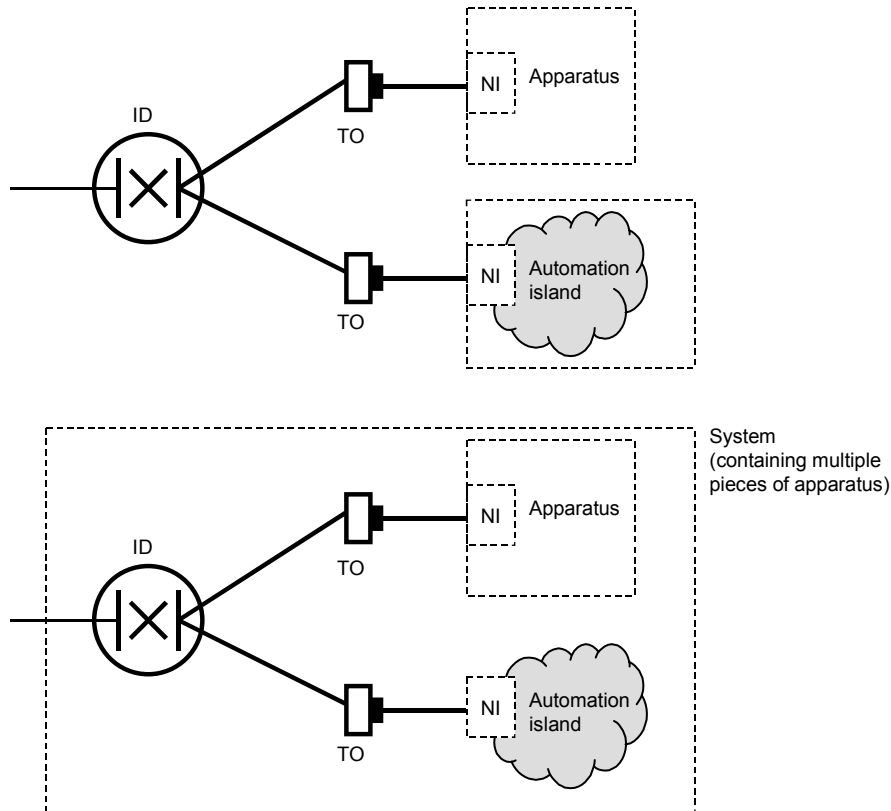


Figure 2 – Configuration of apparatus-based functional elements within industrial premises

5.3 Cabling subsystem

5.3.1 General structure

Generic cabling schemes for industrial premises contain up to four types of cabling subsystems: campus backbone, building backbone, floor and intermediate. In addition, cabling is necessary to connect telecommunication, process control and monitoring equipment to the generic cabling but this cabling is application-specific and therefore not specified by this International Standard. The composition of the subsystems is described in 5.3.2, 5.3.3, 5.3.4 and 5.3.5. The cabling subsystems are connected together to create a generic cabling structure as shown in Figure 3.

The distributors provide the means to configure the cabling to support different topologies such as bus, star and ring. Campus, building and floor distributors can also be used to support cabling in accordance with ISO/IEC 11801.

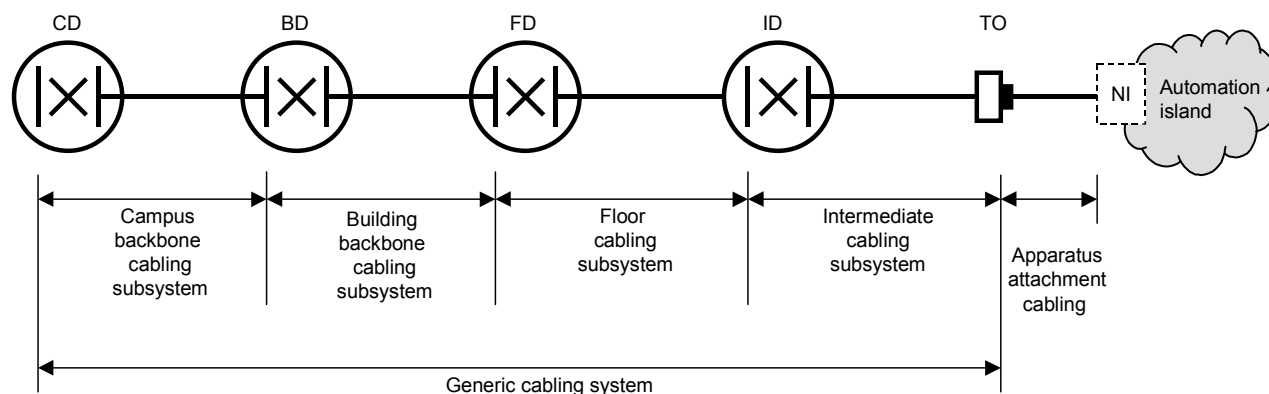


Figure 3 – Structure of generic cabling for industrial environment

The number and type of subsystems that are included in a generic cabling implementation depends upon the size and structure of the campus, building and the strategy of the user.

Connections between cabling subsystems are either active, requiring application-specific equipment or passive. Connection to application-specific equipment adopts either an interconnect or a cross-connect approach (see ISO/IEC 11801). Passive connections between cabling subsystems shall be achieved using cross-connections generally by way of either patch cords or jumpers.

Examples of more complex equipment connection systems that are not in accordance with this clause are described in Annex C and Annex D as follows:

- Annex C describes reference implementations, using the components clauses 8, 9 and 10, which deliver transmission performance in accordance with the Classes of clause 6.
- Annex D describes reference implementations, using the components clauses 8, 9 and 10, that are capable of delivering transmission performance in accordance with the Classes of clause 6 but are not able to be supported in a normative manner by this standard.

5.3.2 Campus backbone cabling subsystem

ISO/IEC 11801 specifies requirements for campus backbone cabling subsystems.

5.3.3 Building backbone cabling subsystem

ISO/IEC 11801 specifies requirements for building backbone cabling subsystems.

5.3.4 Floor cabling subsystem

The floor cabling subsystem extends from a floor distributor (FD) to the IDs connected to it. The subsystem includes

- the floor cables,
- the mechanical termination of the floor cables including the connecting hardware (e.g. of interconnect or cross-connect) at both the FD and IDs together with associated patch cords and/or jumpers,
- any passive connections to the building backbone cabling.

Although equipment cords are included in a channel, they are not considered part of the cabling subsystem because they are application-specific.

The floor cable may also interconnect IDs. However, such connections shall be in addition to those required for the basic hierarchical topology.

5.3.5 Intermediate cabling subsystem

The intermediate cabling subsystem extends from an ID to the TO(s) connected to it. The subsystem includes

- the intermediate cables,
- the mechanical termination of the intermediate cables including the connections at the TO and the ID together with associated patch cords and/or jumpers at the ID,
- the TO.

Although equipment cords and apparatus attachment cords are included in a channel, they are not considered part of the cabling subsystem because they are application-specific.

Connections between an intermediate and floor cabling subsystem are either active, requiring application-specific equipment or passive using either a cross-connect or interconnect approach as defined in ISO/IEC 11801.

Intermediate cables shall be continuous from the ID to the TO(s).

5.3.6 Centralized cabling architecture

ISO/IEC 11801 specifies requirements for centralized cabling architectures.

5.3.7 Design objectives

Generic cabling for industrial premises shall be designed in accordance with the objectives given in ISO/IEC 11801 and shall operate within the environmental conditions defined in clause 6.

5.4 Interconnection of subsystems

In industrial generic cabling, the functional elements of the cabling subsystems are interconnected to form a hierarchical structure as shown in Figure 4.

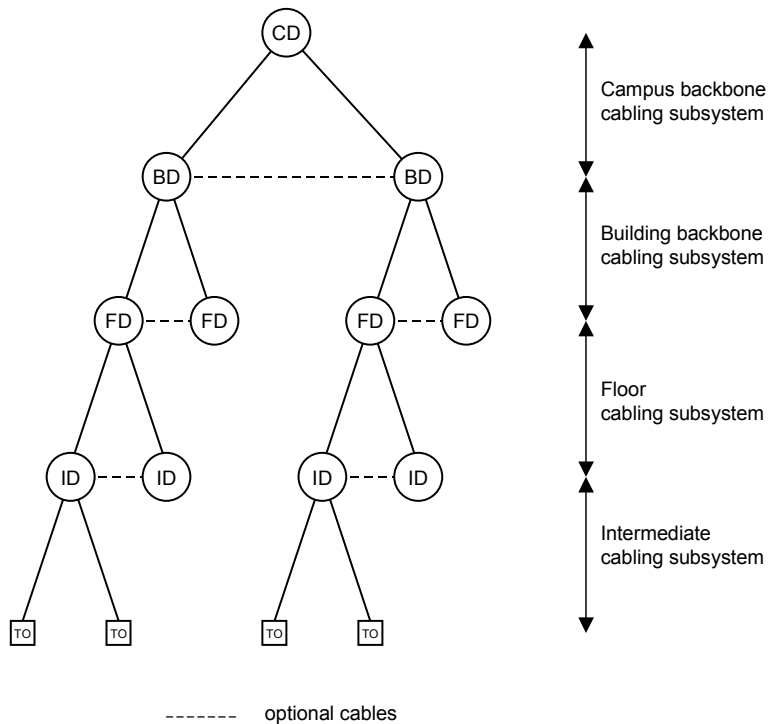


Figure 4 – Hierarchical structure of generic cabling for industrial premises

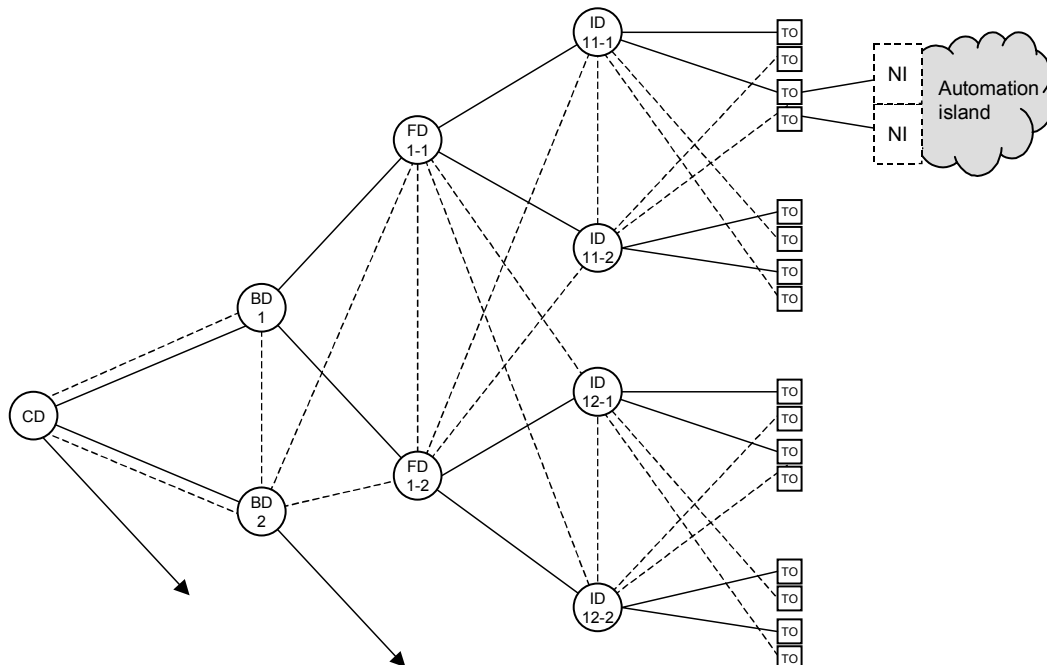


Figure 5 – Inter-relationship of functional elements in an installation with diversity for protection against failure

In certain circumstances, for example for security or reliability reasons, redundancy can be built into a cabling design. Figure 5 is a diagram showing one of many possible examples of the connection of functional elements within the structured framework to provide such redundancy. This might form the basis for the design of generic cabling for a building, providing some protection against such hazards as fire damage or the failure of the external network feeder cable.

5.5 Accommodation of functional elements

Figure 6 shows an example of how the functional elements are accommodated in a building.

FDs and IDs are typically located in industrial enclosures, equipment rooms, telecommunication rooms or adjacent to, on or within, apparatus. Other distributors are typically located in equipment rooms or telecommunications rooms as detailed in ISO/IEC 11801.

Cables are routed using pathways. A variety of cable management systems can be used to support the cables within the pathways including ducts, conduits and trays. Requirements for the pathways and the cable management systems within them are provided in ISO/IEC 18010 and IEC 61918.

TOs are normally located on the fixed building structure. If necessary, the TO can be placed within or on an apparatus.

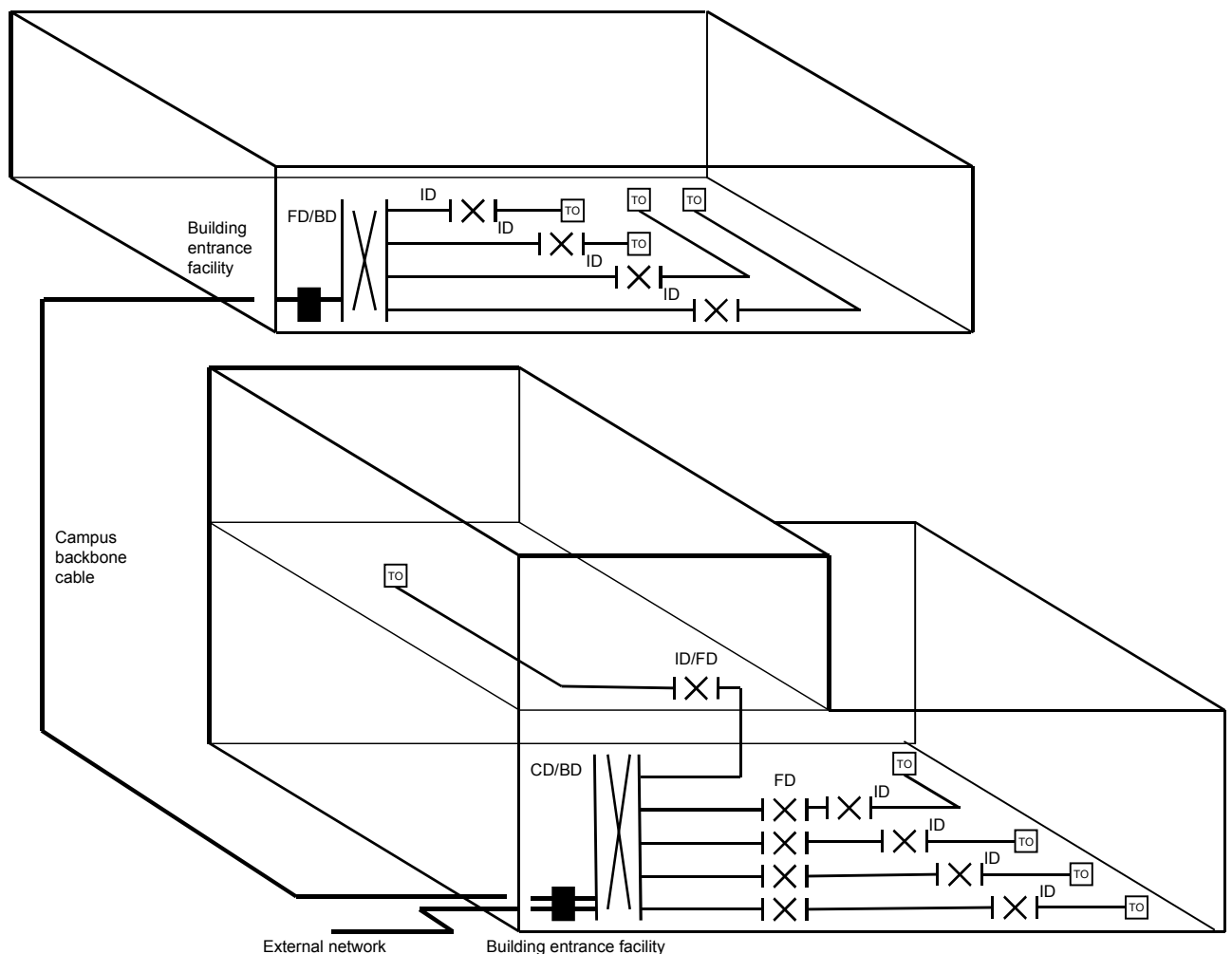


Figure 6 – Accommodation of functional elements

5.6 Interfaces

5.6.1 Equipment interfaces and test interfaces

Equipment interfaces to generic cabling are located at the ends of each subsystem. Any distributor may have an equipment interface to an external service at any port.

Test interfaces to generic cabling are located at the ends of each subsystem.

Figure 7 shows the potential equipment and test interfaces.

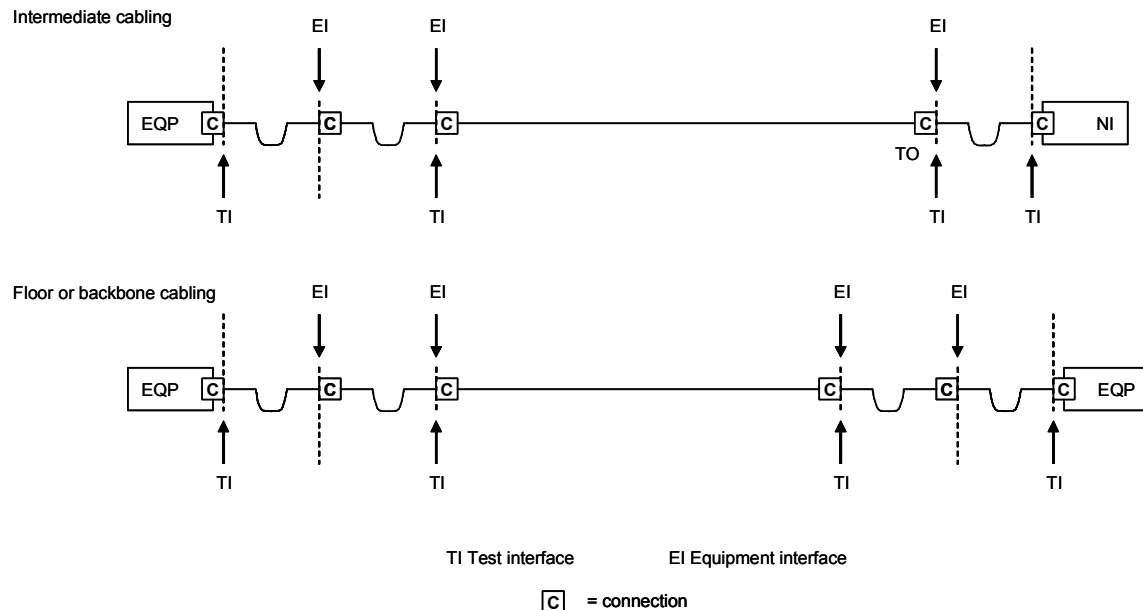


Figure 7 – Test and equipment interfaces

5.6.2 Channels and permanent links

The transmission performance of generic cabling between specific test interfaces is detailed in clause 6 for channels and Annex A for permanent links.

The channel is the transmission path between active equipment interfaces. A typical channel would consist of a cable in the intermediate cabling subsystem together with apparatus attachment and equipment cords. For longer reach services the channel would be formed by the connection of two or more subsystems (as well as with apparatus attachment and equipment cords). It is important that the generic cabling channel is designed to meet the required Class of performance for the applications that are to be supported. The channel excludes the mated connection at the active equipment.

5.6.3 External network interface

See ISO/IEC 11801.

5.7 Dimensioning and configuring

5.7.1 General

ISO/IEC 11801 specifies requirements for dimensioning and configuration for functional elements of generic cabling. The following subclauses specify additional and/or modified requirements for generic cabling for industrial premises.

5.7.2 Distributors

Usually there would be one campus distributor per campus. However, the number of BDs, FDs and IDs shall be determined by the size of the building, the floor space and the disposition of apparatus.

If the premises comprise only a single building that is small enough to be served by a single BD, there is no need for a campus backbone cabling subsystem.

The design of distributors shall ensure that the lengths of patch cords, jumpers and equipment cords are minimised and administration should ensure that the design lengths are maintained during operation. Distributors should be located in such a way that the resulting cable lengths are consistent with the channel performance requirements of clause 6

Where the components of clauses 8, 9 and 10 are used the distributors shall be located in accordance with the reference implementations of clause 7. Where other components are used, distributors shall be located so that the desired performance Class of clause 6 is delivered.

The functions of multiple distributors may be combined.

5.7.3 Cables

Cable types used in the reference implementations of clause 7 are given in clause 8. Hardware for connecting cables shall only provide direct onward attachment for each conductor and shall not provide any contact between more than one incoming or outgoing conductor (e.g. bridge taps shall not be used).

5.7.4 Apparatus attachment and equipment cords

The apparatus attachment cord connects the TO to the network interface. Equipment cords connect active equipment to the generic cabling at distributors. Both are non-permanent and application-specific. Assumptions have been made concerning the length and the transmission performance of these cords; the assumptions are identified when relevant.

The performance contribution of these cords shall be taken into account in the design of the channel. Clause 7 provides guidance on cord lengths for reference implementations of generic cabling.

5.7.5 Patch cords and jumpers

Patch cords and jumpers are used within cross-connect implementations at distributors. The performance contribution of these cords shall be taken into account in the design of the channel. Clause 7 provides guidance on cord/jumper lengths for reference implementations of generic cabling.

5.7.6 TO

The design of generic cabling for industrial premises should provide for TOs to be installed and located according to the requirements of the apparatus.

TOs may be presented singly or in groups, as indicated in the following list:

- each apparatus network shall be served by a minimum of one TO;
- the TO shall be configured with either balanced cable terminated in accordance with 9.4 or optical fibres terminated in accordance with 9.5;

- where balanced cable is used, a 4 pair balanced cable should be terminated at the TO;
 - 2 pairs per TO, terminated in accordance with 9.4.4.2, may be used, however this may require pair reassignment and will not support some applications (see Annex E);
 - 2 pairs per TO, terminated in accordance with 9.4.4.3, may be used, however the interface of 9.4.4.3 cannot provide all the transmission performance options provided by the interface of 9.4.4.2 and will not support some applications (see Annex E);
- there shall be provision for identification, visible to the user, at the location of each TO;
- application-specific devices, if used, shall be external to the TO.

Care should be taken that the initial pair assignment and all subsequent changes are recorded (see ISO/IEC 14763-1 for details of recommended administration schemes). Pair reassignment by means of inserts is allowed.

5.7.7 Telecommunications rooms and equipment rooms

See ISO/IEC 11801.

5.7.8 Industrial enclosures

Industrial enclosures shall provide all the facilities (space, power, etc.), in accordance with national and local regulations, for industrial control equipment, ID and power distribution equipment. IDs will typically be located within industrial enclosures to provide connectivity to equipment within and adjacent to the industrial enclosure. The equipment within the industrial enclosure will conform to the appropriate environmental classes outlined in clause 6. The industrial enclosures may or may not provide incremental environmental protection for their contents.

5.7.9 Building entrance facilities

See ISO/IEC 11801.

6 Channel performance

6.1 General

This clause specifies the minimum channel performance of generic cabling for industrial premises. The channel performance is specified as a combination of environmental performance and transmission performance.

The environmental performance of the cabling is specified in terms of Classes as specified in 6.2.

The transmission performance of the cabling is specified for individual channels for balanced cable and optical fibre in terms of Classes as specified in 6.3.

The environmental and transmission performance of a channel is specified at and between the connections to active equipment as shown in Figure 8. The transmission and environmental performance of the connections at the active equipment are the responsibility of the equipment supplier in support of the applications listed in Annex E.

The channel comprises only passive sections of cable, connections, apparatus attachment cords, equipment cords, patch cords and jumpers.

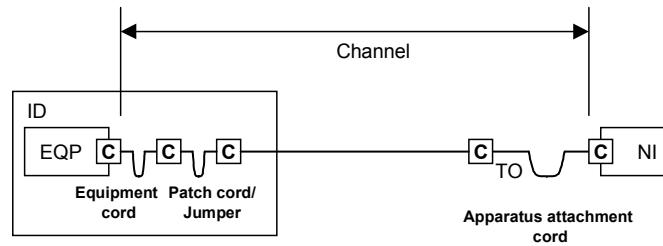


Figure 8 – Transmission performance of a channel

Application support depends on channel transmission performance only, which in turn depends on cable length, the number of connections and the performance of the components within the environments to which the channel is subjected.

The required transmission performance Class shall be met for all environmental performance Classes specified for the channel.

Transmission performance shall be assured by the selection of cabling components suitable for the environmental Class(es) or by the use of pathway systems and installation practices that provide the required protection to the installed cabling.

Channels are implemented using either

- intermediate cabling only,
- floor cabling only,
- building backbone cabling only,
- campus backbone cabling only,
- combinations of the above.

Figure 9 shows an example of a NI connected to a host using two channels; an optical fibre channel and a balanced cabling channel. The optical fibre and balanced cabling channels are connected together using an optical fibre to balanced cable converter. There are four channel interfaces; one at each end of the balanced cabling channel, and one at each end of the optical fibre cabling channel.

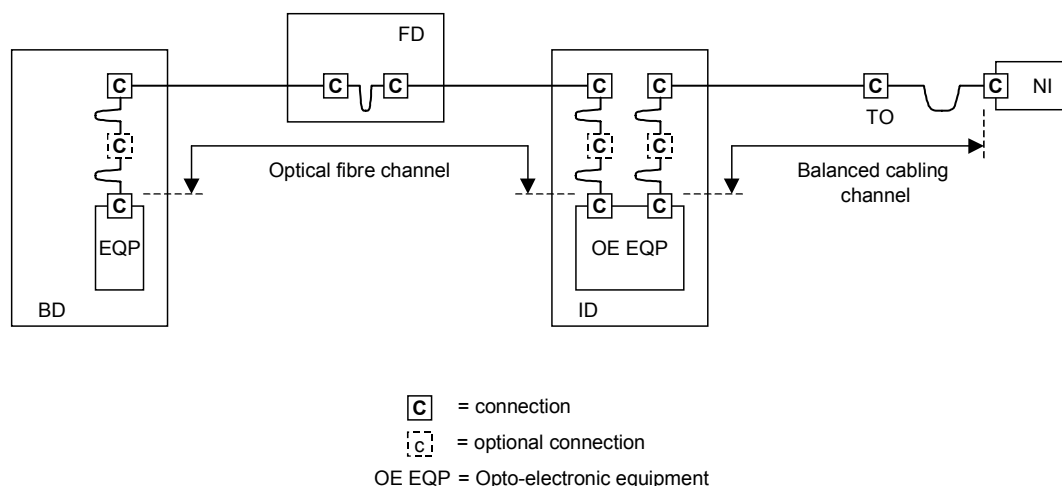


Figure 9 – Example of a system showing the location of cabling interfaces and extent of associated channels

6.2 Environmental performance

6.2.1 General

The environmental performance specifications of channels are classified to cover the different conditions under which channels are required to operate in industrial premises.

The environmental classification described in this clause shall be used for the selection of components and/or the protection afforded to them.

It is possible for the different locations within a channel to be subject to different environments. For example, one end of a channel may be in an office area and the other end of the channel may be subjected to a more severe environment. The description of the channel environment has to be divided up accordingly.

Furthermore, the applicable environment is that local to the cabling components within the channel. The local environment may, where relevant, be created by installation techniques applied to the channel in order to mitigate more extreme environments than exist within the premises.

NOTE With regard to temperature the local environment is considered to be the operating temperature of the cabling.

6.2.2 Environmental classification

This International Standard classifies the environment for generic cabling within industrial premises as defined in Table 1.

Certain environments (e.g. nuclear, chemical, fire, explosive, damage risk from animals, salt mist) demand for additional requirements beyond those of this clause. Further details on specific environments are shown in Annex F.

Table 1 – Channel environments

	1	2	3
Mechanical rating	M ₁	M ₂	M ₃
Ingress rating	I ₁	I ₂	I ₃
Climatic rating	C ₁	C ₂	C ₃
Electromagnetic rating	E ₁	E ₂	E ₃

The definition of a given classification includes the definition of lower classifications i.e. channels designed to operate under environmental conditions defined by M₂ shall continue to operate under environmental conditions defined by M₁.

Channel environments may be classified by using any combination of the MICE scheme, for example M₁I₂C₃E₁. Care should be taken to accurately classify the channel environment in such a way as to allow the selection of suitable components.

For the purposes of this standard

- M₁I₁C₁E₁ describes a typical environment such as that assumed within ISO/IEC 11801,
- M₂I₂C₂E₂ describes a worst case light industrial environment,
- M₃I₃C₃E₃ describes a worst case industrial environment as defined by this standard.

The environmental Classes are defined in Table 2 and shall be met by design.

For each M, I, C or E group, the classification of a given environment is determined by the most demanding parameter within the M, I, C or E group. However, the selection of

components shall be based on the specific demands of each of the parameters within the M, I, C or E group, which may be less demanding than the overall classification of the group.

Table 2 – Details of environmental classification

Mechanical	M₁	M₂	M₃
Shock/bump (see a))			
Peak acceleration	40 ms ⁻²	100 ms ⁻²	250 ms ⁻²
Vibration			
Displacement amplitude (2 Hz to 9 Hz)	1,5 mm	7,0 mm	15,0 mm
Acceleration amplitude (9 Hz to 500 Hz)	5 ms ⁻²	20 ms ⁻²	50 ms ⁻²
Tensile force	See b)	See b)	See b)
Crush	45 N over 25 mm (linear) min.	1 100 N over 150 mm (linear) min.	2 200 N over 150 mm (linear) min.
Impact	1 J	10 J	30 J
Bending, flexing and torsion	See b)	See b)	See b)
Ingress	I₁	I₂	I₃
Particulate ingress (∅ max.)	12,5 mm	50 µm	50 µm
Immersion	None	Intermittent liquid jet ≤12,5 l/min ≥6,3 mm jet >2,5 m distance	Intermittent liquid jet ≤12,5 l/min ≥6,3 mm jet >2,5 m distance and immersion (≤1 m for ≤30 min)
Climatic and chemical	C₁	C₂	C₃
Ambient temperature	-10 °C to +60 °C	-25 °C to +70 °C	-40 °C to +70 °C
Rate of change of temperature	0,1 °C per min	1,0 °C per min	3,0 °C per min
Humidity	5 % to 85 % (non-condensing)	5 % to 95 % (condensing)	5 % to 95 % (condensing)
Solar radiation	700 Wm ⁻²	1 120 Wm ⁻²	1 120 Wm ⁻²
Liquid pollution (see c)) Contaminants	Concentration × 10 ⁻⁶	Concentration × 10 ⁻⁶	Concentration × 10 ⁻⁶
Sodium chloride (salt/sea water)	0	<0,3	<0,3
Oil (dry-air concentration) (for oil types see b))	0	<0,005	<0,5
Sodium stearate (soap)	None	>5 × 10 ⁴ aqueous non-gelling	>5 × 10 ⁴ aqueous gelling
Detergent	None	ffs	ffs
Conductive materials	None	Temporary	Present
a) Bump: the repetitive nature of the shock experienced by the channel shall be taken into account. b) This aspect of environmental classification is installation-specific and should be considered in association with IEC 61918 and the appropriate component specification c) A single dimensional characteristic, i.e. Concentration × 10 ⁻⁶ , was chosen to unify limits from different standards.			