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TECHNICAL REPORT

Information technology – Generic cabling – Introduction to the MICE environmental classification

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INFORMATION TECHNOLOGY – GENERIC CABLING – INTRODUCTION TO THE MICE ENVIRONMENTAL CLASSIFICATION

FOREWORD

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- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where, for any other reason, there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the technical committee has collected data of a different kind from that which is normally published as an International Standard, for example 'state of the art'.

ISO/IEC 29106, which is a Technical Report of type 3, has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

Technical reports of types 1 and 2 are subject to review within three years of publication to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

This Technical Report of type 3 has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

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

INFORMATION TECHNOLOGY – GENERIC CABLING – INTRODUCTION TO THE MICE ENVIRONMENTAL CLASSIFICATION

1 Scope

This Technical Report acts as an introduction to the concepts used to develop the MICE environmental classification system used in cabling standards developed by ISO/IEC. It also provides detailed explanation of the sources used to define the boundaries of MICE classifications.

2 Reference documents

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.

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

ISO/IEC 15018, *Information technology – Generic cabling for homes*

ISO/IEC 24702, *Information technology – Generic cabling – Industrial premises*

IEC 60068-2-5:1975, *Environmental testing – Part 2: Tests. Test Sa: Simulated solar radiation at ground level*

IEC 60654-4:1987 *Operating conditions for industrial-process measurement and control equipment. Part 4: Corrosive and erosive influences*

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60721-3-3, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weatherprotected locations*

IEC 61000-2-5, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 5: Classification of electromagnetic environments. Basic EMC publication*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

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

IEC 61326:2001, *Electrical equipment for measurement, control and laboratory use – EMC requirements*

IEC 61918, *Industrial communication networks – Installation of communication networks in industrial premises*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this Technical Report the definitions of the applicable generic cabling standards ISO/IEC 11801, ISO/IEC 15018 and ISO/IEC 24702 apply.

3.2 Abbreviations

For the purposes of this Technical Report the abbreviations of the applicable generic cabling standards ISO/IEC 11801, ISO/IEC 15018 and ISO/IEC 24702 apply.

4 Application of environmental classification

4.1 MICE

The term MICE referenced in generic cabling standards produced by ISO/IEC[1] relates to the classification of the environment of the cabling channel.

There are four primary environmental criteria used to classify an environment:

- the M element, defining the mechanical characteristics of the environment;
- the I element, defining the ingress protection characteristics of the environment;
- the C element, defining the climatic and chemical characteristics of the environment;
- the E element, defining the electromagnetic characteristics of the environment.

Each of the four primary environmental criteria are further divided into specific parameters and levels for those parameters. The MICE classification for a given location is therefore defined as $M_aI_bC_cE_d$ where a, b, c and d are the individual sub-classifications (levels) for the M, I, C and E criteria respectively.

The suffixes for the four primary environmental criteria are either 1, 2 or 3. For example, the most benign environment is described as $M_1I_1C_1E_1$ whereas the most harsh environment within the scope of this standard would be defined as $M_3I_3C_3E_3$.

4.2 Channel environment

The applicable MICE classification may vary along the length of the cabling channel. As shown in the industrial premises cabling example of Figure 1, the ingress protection characteristics of the environment in the automation area and at the automation island are different from, and more severe than, those characteristics on the factory floor or in the telecommunications room.

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1 The documents prepared by subcommittee 25 of ISO/IEC joint technical committee 1: Information technology.

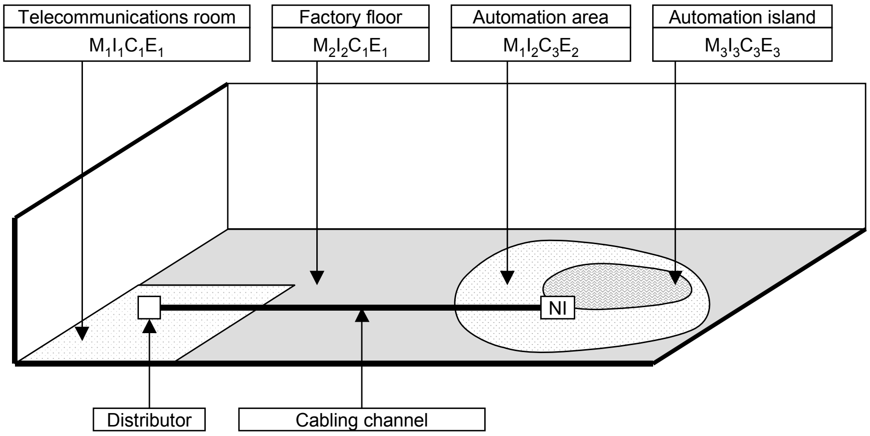

Figure 1 – Example of variation of the environment along an industrial premises cabling channel

The environment to be classified is that local to the cabling. Where no environmental protection is provided to the cabling, the classification of the local environment is also that of the overall environment at that location.

However, where technical or economic restrictions preclude the use of components compatible with the overall environment, mitigation or isolation techniques may be applied to modify one or more of the M, I, C or E environments local to the cabling in order to allow appropriate components to be installed.

The mitigation or isolation techniques typically involve the use of alternative pathways and/or pathway systems as shown in Figure 2.

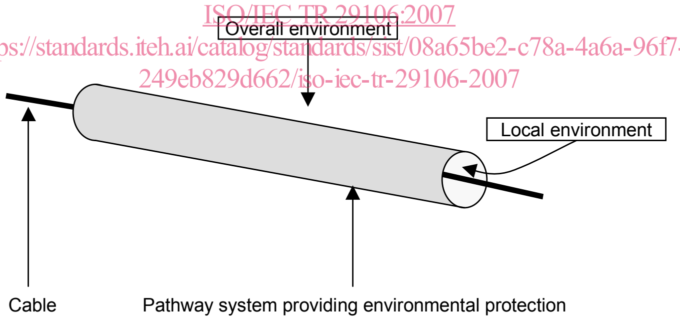

Figure 2 – The local environment

4.3 Component selection

The components used within a channel should be selected to be compatible with the MICE classification of the channel at the point where the components are to be installed.

Table 1, taken from ISO/IEC 24702:2006, shows the parameters used to classify the local environment under the M, I, C and E criteria. While the classification of an environment is determined by the most demanding parameter within each criteria group, the selection of components may reflect the specific demands of all the parameters within the group, including those that may be less demanding than the overall classification of the environment.

The MICE classification system is intended to address approximately 80 % of the environments to which cabling may be subjected. There are some environments beyond the boundaries of $M_3I_3C_3E_3$. Such environments are beyond the scope of this Technical Report and require special handling.

Table 1 – Details of environmental classification

Mechanical	**M_1**	**M_2**	**M_3**
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	**I_1**	**I_2**	**I_3**
Particulate ingress (dia. 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 minutes)
Climatic and chemical	**C_1**	**C_2**	**C_3**
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 minute	1,0 °C per minute	3,0 °C per minute
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 $\times 10^{-6}$	Concentration $\times 10^{-6}$	Concentration $\times 10^{-6}$
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 $\times 10^4$ aqueous non-gelling	>5 $\times 10^4$ aqueous gelling
Detergent	None	ffs	ffs
Conductive materials	None	Temporary	Present
Gaseous pollution (see b)) Contaminants	Mean/Peak (Concentration $\times 10^{-6}$)	Mean/Peak (Concentration $\times 10^{-6}$)	Mean/Peak (Concentration $\times 10^{-6}$)
Hydrogen sulphide	<0,003/<0,01	<0,05/<0,5	<10/<50
Sulphur dioxide	<0,01/<0,03	<0,1/<0,3	<5/<15
Sulphur trioxide (ffs)	<0,01/<0,03	<0,1/<0,3	<5/<15

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 $\times 10^{-6}$, was chosen to unify limits from different standards.

Climatic and chemical (continued)	C_1	C_2	C_3
Chlorine wet (>50 % humidity)	<0,000 5/<0,001	<0,005/<0,03	<0,05/<0,3
Chlorine dry (<50 % humidity)	<0,002/<0,01	<0,02/<0,1	<0,2/<1,0
Hydrogen chloride	−/<0,06	<0,06/<0,3	<0,6/3,0
Hydrogen fluoride	<0,001/<0,005	<0,01/<0,05	<0,1/<1,0
Ammonia	<1/<5	<10/<50	<50/<250
Oxides of Nitrogen	<0,05/<0,1	<0,5/<1	<5/<10
Ozone	<0,002/<0,005	<0,025/<0,05	<0,1/<1
Electromagnetic	E_1	E_2	E_3
Electrostatic discharge – Contact (0,667 μC)	4 kV	4 kV	4 kV
Electrostatic discharge – Air (0,132 μC)	8 kV	8 kV	8 kV
Radiated RF – AM	3 V/m at (80 MHz to 1 000 MHz) 3 V/m at ((1 400 MHzto 2 000 MHz) 1 V/m at (2 000 MHz to 2 700 MHz)	3 V/m at (80 MHz to 1 000 MHz) 3 V/m at ((1 400 MHz to 2 000 MHz) 1 V/m at (2 000 MHz to 2 700 MHz)	10 V/m at (80 MHz to 1 000 MHz) 3 V/m at ((1 400 MHz to 2 000 MHz) 1 V/m at (2 000 MHz to 2 700 MHz)
Conducted RF	3 V at 150 kHz to 80 MHz	3 V at 150 kHz to 80 MHz	10 V at 150 kHz to 80 MHz
EFT/B (comms)	500 V	1 000 V	1 000 V
Surge (transient ground potential difference) – signal, line to earth	500 V	1 000 V	1 000 V
Magnetic field (50/60 Hz)	1 Am^{-1}	3 Am^{-1}	30 Am^{-1}
Magnetic field (60 Hz to 20 000 Hz)	ffs	ffs	ffs

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 $\times$ 10^{-6}, was chosen to unify limits from different standards.