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**Lighting busways—Particular safety
requirements for power supply use**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal of revision of Japanese Industrial Standard submitted by the Institute of Electrical Installation Engineers of Japan (IEIEJ) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS C 8473**:2006 is replaced with this Standard.

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Lighting busways—Particular safety requirements for power supply use

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **IEC 61534-1** published in 2003 with some modifications of the technical contents.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

This Standard specifies safety requirements of lighting busways for power supply use in consideration of attaching the tap-off unit for power supply. For those busways compatible with busways intended for luminaires, **JIS C 8472** shall also be applied.

This Standard is a safety-requirement standard of lighting busways for power supply use, and the main product standard of lighting busways is **JIS C 8366**.

1 Scope

1.1 This Standard specifies general requirements and tests for powertrack (PT) systems with a rated voltage not exceeding 277 V a.c. single phase, or 480 V a.c. two or three phase 50 Hz/60 Hz, with a rated current not exceeding 50 A. These systems are used for distributing electricity in household, commercial and industrial premises.

NOTE : In the corresponding International Standard, the extension of the scope to cover d.c. and communication systems is under consideration.

1.2 Powertrack systems, according to this Standard, are intended for use under the following conditions:

- an ambient temperature in the range -5°C to $+40^{\circ}\text{C}$, the average value over a 24 h period not exceeding 35°C ;
- a situation not subject to a source of heat likely to raise temperatures above the limits specified above;
- an altitude not exceeding 2 000 m above sea level;
- an atmosphere not subject to excessive pollution by smoke, chemical fumes, prolonged periods of high humidity or other abnormal conditions.

In locations where special conditions prevail, as in ships, vehicles and the like and in hazardous locations, for instance, where explosions are liable to occur, special constructions may be necessary.

This Standard does not apply to:

- cable trunking systems and cable ducting systems covered by **IEC 61084**
- busbar trunking systems covered by **IEC 60439-2**
- electrical supply track systems for luminaires covered by **JIS C 8472**

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 61534-1:2003 *Powertrack systems—Part 1: General requirements* (MOD)

The symbols which denote the degree of correspondence in the contents in the corresponding International Standard and **JIS** are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and any revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent edition (including amendments) shall be applied.

JIS C 0664:2003 *Insulation coordination for low-voltage equipment Part 1: Principles, requirements and tests*

NOTE : Corresponding International Standard: IEC 60664-1:1992 *Insulation coordination for equipment within low-voltage systems—Part 1: Principles, requirements and tests* (MOD)

JIS C 0920:2003 *Degrees of protection provided by enclosures (IP Code)*

NOTE : Corresponding International Standard: IEC 60529:2001 *Degrees of protection provided by enclosures (IP Code)*¹⁾ (IDT)

JIS C 0922:2002 *Protection of persons and equipment by enclosures for electrical apparatus—Probes for verification*

NOTE : Corresponding International Standard: IEC 61032:1997 *Protection of persons and equipment by enclosures—Probes for verification* (IDT)

JIS C 2134:2007 *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

NOTE : Corresponding International Standard: IEC 60112:2003 *Method for the determination of the proof and the comparative tracking indices of solid insulating materials* (IDT)

JIS C 2809:1999 *Flat, quick-connect terminations*

NOTE : Corresponding International Standard: IEC 60760:1989 *Flat, quick-connect terminations* (MOD)

JIS C 2814-1:2009 *Connecting devices for low-voltage circuits for household and similar purposes—Part 1: General requirements*

NOTE : Corresponding International Standard: IEC 60998-1:2002 *Connecting devices for low-voltage circuits for household and similar purposes—Part 1: General requirements* (MOD)

JIS C 2814-2-3:2009 *Connecting devices for low-voltage circuits for household and similar purposes—Part 2-3: Particular requirements for connecting devices as separate entities with insulation-piercing clamping units*

NOTE : Corresponding International Standard: IEC 60998-2-3:2002 *Connecting devices for low-voltage circuits for household and similar purposes—Part 2-3: Particular requirements for connecting devices as separate entities with insulation-piercing clamping units* (MOD)

JIS C 6575-1:2009 *Miniature fuses—Part 1: Definitions of miniature fuses and general requirements for miniature fuse-links*

NOTE : Corresponding International Standard: IEC 60127-1:1988 *Miniature fuses—Part 1: Definitions of miniature fuses and general requirements for miniature fuse-links*²⁾ (MOD)

JIS C 8269-1:2000 *Low-voltage fuses—Part 1: General requirements*

NOTE : Corresponding International Standard: IEC 60269-1:1998 *Low-voltage fuses—Part 1: General requirements* (IDT)

JIS C 8282-1:2007 *Plugs and socket-outlets for household and similar purposes—Part 1: General requirements*

NOTE : Corresponding International Standard: IEC 60884-1:2002 *Plugs and socket-outlets for household and similar purposes—Part 1: General requirements* (MOD)

JIS C 8303:2007 *Plugs and receptacles for domestic and similar general use*

JIS C 8306:1996 *Testing methods for wiring devices*

JIS C 8366 *Lighting busways*

JIS C 8472 *Lighting busways—Particular safety requirements for luminaires use*

JIS C 60068-2-75:2004 *Environmental testing—Part 2-75: Tests—Test Eh: Hammer tests*

NOTE : Corresponding International Standard: IEC 60068-2-75:1997 *Environmental testing—Part 2-75: Tests—Test Eh: Hammer tests* (IDT)

JIS C 60364-4-44 *Electrical installations of buildings—Part 4-44: Protection for safety—Protection against voltage disturbances and electromagnetic disturbances*

NOTE : Corresponding International Standard: IEC 60364-4-44:2003 *Electrical installations of buildings—Part 4-44: Protection for safety—Protection against voltage disturbances and electromagnetic disturbances* (IDT)

JIS C 60695-2-11:2004 *Fire hazard testing—Glow-wire flammability test method for end-products*

NOTE : Corresponding International Standard: IEC 60695-2-11:2000 *Fire hazard testing—Part 2-11: Glowing / hot-wire based test methods—Glow-wire flammability test method for end-products* (IDT)

JIS C 60695-10-2:2000 *Fire hazard testing—Part 10-2: Abnormal heat—Ball pressure test*

NOTE : Corresponding International Standard: IEC 60695-10-2:1995 *Fire hazard testing—Part 10: Guidance and test methods for the minimization of the effects of abnormal heat on electrotechnical products involved in fires—Section 2: Method for testing products made from non-metallic materials for resistance to heat using the ball pressure test*³⁾ (IDT)

JIS C 60695-11-2:2007 *Fire hazard testing—Part 11-2: Test flames—1 kW nominal pre-mixed flame—Apparatus, confirmatory test arrangement and guidance*

NOTE : Corresponding International Standard: IEC 60695-11-2:2003 *Fire hazard testing—Part 11-2: Test flames—1 kW nominal pre-mixed flame—Apparatus, confirmatory test arrangement and guidance* (IDT)

JIS H 8610:1999 *Electroplated coatings of zinc on iron or steel*

NOTE : Corresponding International Standard: ISO 2081:1986 *Metallic coatings—Electroplated coatings of zinc on iron or steel* (MOD)

JIS H 8617:1999 *Electroplated coatings of nickel and chromium*

NOTE : Corresponding International Standard: ISO 1456:1988 *Metallic coatings—Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium* (MOD)

JIS H 8619:1999 *Electroplated coatings of tin*

NOTE : Corresponding International Standard: ISO 2093:1986 *Electroplated coatings of tin—Specification and test methods* (MOD)

IEC 60060-1:1989 *High-voltage test techniques. Part 1: General definitions and test requirements*

IEC 60417 *Graphical symbols for use on equipment*

IEC 60417-DB:2002⁴⁾ *Graphical symbols for use on equipment—Part 1: Overview and application*

IEC 60999-1:1999 *Connecting devices—Electrical copper conductors—Safety requirements for screw-type and screwless-type clamping units—Part 1: General requirements and particular requirements for clamping units for conductors from 0.2 mm² up to 35 mm² (included)*

IEC 60999-2:1995 *Connecting devices—Safety requirements for screw-type and screwless-type clamping units for electrical copper conductors—Part 2: Particular requirements for clamping units for conductors above 35 mm² up to 300 mm²*

IEC 61210:1993 *Connecting devices—Flat quick-connect terminations for electrical copper conductors—Safety requirements*

Notes ¹⁾ There exists a consolidated edition (2.1) including **IEC 60529** (1989) and its Amendment 1 (1999).

- 2) There exists a consolidated edition (1.1) including **IEC 60127-1** (1988) and its Amendment 1 (1999).
- 3) There exists a consolidated edition (1.1) including **IEC 60695-10-2** (1995) and its Amendment 1 (2001).
- 4) DB refers to the on-line **IEC** database.

3 Terms and definitions

For the purposes of the Standard, the following terms and definitions apply.

3.1 powertrack system (PT system)

assembly of system components including a powertrack by which accessories may be connected to an electrical supply at one or more points (pre-determined or otherwise) along the powertrack

3.2 system component

part specifically designed for the PT system which may or may not incorporate an accessory

3.3 powertrack

system component which is a generally linear assembly of spaced and supported busbars providing electrical connection of accessories

NOTE : A powertrack may also provide mechanical support for accessories.

3.4 busbar

main current-carrying conductor(s) to which, for example, one or more tap-off units, accessories or electrical system components may be connected

3.5 accessory

electrical device complying with its own standard and associated with or incorporated in the PT system

3.6 rewirable accessory

accessory so constructed that a cable can be fitted or replaced using a tool

3.7 non-rewirable system component

system component so constructed that it forms a complete unit with the cable after connection and assembly by the manufacturer of the system component

3.8 connector

device which provides the electrical connection and possibly the mechanical connection of powertracks

3.9 supply connector

device enabling the supply wiring to be connected to the powertrack

3.10 live parts

conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor [IEV 195-02-19, modified]

3.11 rated voltage, rated current

value assigned to a PT system by the manufacturer and to which operation and performance characteristics are referred

3.12 clamping unit

part(s) of a terminal necessary for the mechanical clamping and the electrical connection of the conductor(s) including the parts which are necessary to ensure the correct contact pressure

3.13 termination

part of a PT system to which a conductor(s) is attached providing a non-reusable connection

3.14 terminal

part of the PT system composed of one or more clamping unit(s) to which a conductor(s) is attached providing a reusable connection

3.15 insulation piercing connecting device (IPCD)

connecting device for the connection and possible disconnection of one conductor or the interconnection of two or more conductors, the connection being made by piercing, boring through, cutting through, removing, displacing or making ineffective in some other manner the insulation of the conductor(s) without previous stripping

NOTE : The removal of the sheath of the cable, if necessary, is not considered as a previous stripping.

3.16 flat quick-connect termination

electrical connection consisting of a male tab and a female connector which can be inserted and withdrawn with or without the use of a tool

3.17 plug

accessory intended for connection to a flexible cable intended for frequent manual engagement with a socket-outlet

3.18 socket-outlet

accessory having a set of contacts designed to engage with the pins of a corresponding plug and which may have terminals or terminations for the connection of conductors

3.19 fuse-link

part of the fuse including the fuse-element(s) and intended to be replaced after the fuse has operated

3.20 type test

test of one or more PT systems made to a certain design to show that the design meets certain specifications [IEV 151-16-16, modified]

3.21 routine test

test to which each PT system is subjected during or after manufacture to ascertain whether it complies with the relevant requirements of this Standard [IEV 151-16-17, modified]

NOTE : Routine tests are specified in Annex G.

3.22 dummy track

device for maintaining visual appearance and mechanical integrity which may be with or without current-carrying parts

3.23 tap-off unit

system component intended for infrequent manual engagement with the busbars directly or indirectly via a tap-off outlet

3.24 tap-off outlet

aperture into which the tap-off unit engages

3.25 clearance

shortest distance in air between two conductive parts

3.26 creepage distance

shortest distance along the surface of the insulating material between two conductive parts [IEV 151-15-50]

3.27 overvoltage

voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions

3.28 transient overvoltage

short duration overvoltage of a few milliseconds or less, oscillatory or non-oscillatory, usually highly damped [IEV 604-03-13]

3.29 overvoltage category

numeral defining a transient overvoltage condition

3.30 rated impulse withstand voltage

highest peak value of impulse voltage or prescribed form and polarity assigned by the manufacturer and which does not cause breakdown of insulation under specified conditions

3.31 rated insulation voltage

r.m.s. withstand voltage value assigned by the manufacturer to the PT system or to a part of it, characterising the specified (long term) withstand capability of its insulation

NOTE : The rated insulation voltage is not necessarily equal to the rated voltage of the PT system which is primarily related to functional performance.

3.32 basic protection

protection against electric shock under fault-free conditions [IEV 195-06-01]

3.33 fault protection

protection against electric shock under single fault conditions (for example, failure of basic insulation) [IEV 195-06-02, modified]

3.34 functional insulation

insulation between live parts which is necessary only for the proper functioning of the PT system [IEC 195-02-41, modified]

3.35 basic insulation

insulation of live parts which provides basic protection against electric shock [IEV 195-06-06, modified]

3.36 supplementary insulation

independent insulation applied as fault protection in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation (fault protection) [IEV 195-06-07, modified]

3.37 double insulation

insulation comprising both basic insulation and supplementary insulation [IEV 195-06-08, modified]

3.38 reinforced insulation

insulation of live parts which provides a degree of protection against electric shock equivalent to double insulation [IEV 195-06-09, modified]

3.39 solid insulation

insulation material interposed between two conductive parts

3.40 pollution

addition of foreign matter, solid, liquid, or gaseous, that can result in a reduction of electric surface resistivity

3.41 pollution degree

numeral characterising the expected pollution of the micro-environment

3.42 micro-environment

immediate environment of the insulation which particularly influences the dimensioning of creepage distances

3.43 macro-environment

environment of the room or other location in which the equipment is installed or used

3.44 ordinary person

person who is neither a skilled person nor an instructed person [IEV 195-04-03]

3.45 (electrically) skilled person

person with relevant education and experience to enable him or her to avoid dangers and to prevent risks which electricity may create [IEV 195-04-01, modified]

3.46 (electrically) instructed persons

person adequately advised or supervised by skilled persons to enable him or her to avoid dangers and to prevent risks which electricity may create [IEV 195-04-02, modified]

3.47 entry membrane

component or an integral part of a PT system used to protect the cable and which may be used to support the cable, conduit or ducting or trunking at the point of entry

NOTE : It may also provide ingress protection.

3.48 special purpose tool

tool which is unlikely to be readily available in a normal household, for example, a key for a three-angle headed screw

3.49 stress corrosion cracking

spontaneous failure of metals by cracking under the combined action of corrosion and residual or applied tensile stress

3.50 residual tensile stress

tensile stress that remains within a body as a result of plastic deformation

3.51 applied tensile stress

tensile stress that is set up and exists in a body during application of an external load

3.52 exposed-conductive-parts

conductive part of equipment which can be touched and which is not normally live, but which can become live when basic insulation fails [IEV 195-06-10]

NOTE : A conductive part of electrical equipment which can only become live through contact with an exposed-conductive-part which has become live is not considered to be an exposed-conductive-part itself.

3.53 hazardous-live-part

live part which, under certain conditions, can give a harmful electric shock [IEV 195-06-05]

4 General requirements

4.1 PT systems shall be so designed and constructed that in normal use their performance is reliable and without unreasonable hazard to the user or the surroundings.

4.2 Compliance is checked by all relevant tests according to this Standard.

4.3 Accessories associated with or incorporated in a system component shall and need only comply with the relevant standard for that accessory if any.

5 General notes on tests

5.1 Tests according to this Standard are type tests.

5.2 Unless otherwise specified in this Standard, the samples shall be tested as delivered under normal or simulated conditions of use, at an ambient temperature of $(20 \pm 5) ^\circ\text{C}$. The samples used for the tests shall be representative of normal production in respect of all details which may affect the test results. Unless otherwise specified,

samples shall be assembled and mounted in accordance with the manufacturers instructions. Samples of non-rewireable system components shall be supplied with an appropriate flexible cable which shall be at least 1 m long.

5.3 Generally, a total of 10 samples of any one type shall be subjected to inspection and tests in the following order of clauses:

- 3 samples: clauses **6** to **13**
- 3 samples: clauses **9**, **11** to **17** and **20**
- 3 samples: clause **18**
- 1 sample: clause **19**

Unless otherwise specified, a sample means an individual component, a powertrack not less than 1 m in length, or a combination typifying the system as a whole.

5.4 Unless otherwise specified, three samples are subjected to the tests and the requirements are satisfied if the tests are met.

If one of the samples does not satisfy a test due to an assembly or manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated and also the tests which follow shall be made in the required sequence on another full set of samples, all of which shall comply with the requirements.

NOTE : If only one set of samples for the initial test was submitted in the first place, with one failed bunch, the entire set of samples will be failed. Manufacturers are permitted to submit another set of samples for additional test together with the set of samples for the initial test, in case any bunch of samples in the initial set fails. If this was done, the test laboratory can conduct a further test with the above-mentioned set of samples for additional test, i.e. without requesting another set of samples, failing the product only when this additional set of samples have failed.

6 Ratings

6.1 PT systems shall have:

- a) a rated voltage not exceeding 480 V a.c.;
- b) a rated current not exceeding 50 A.

6.2 Compliance is checked in conjunction with **8.2**.

7 Classification

PT systems and/or system components shall be classified as follows:

7.1 According to resistance to impact for installation and application:

- PT system for light impact: 1 J;
- PT system for medium impact: 2 J;

- PT system for heavy impact: 5 J;
- PT system for very heavy impact: 20 J.

7.2 According to whether the tap-off units are intended to be connected and disconnected with the system energised and/or their load connected.

7.2.1 Tap-off units not intended to be connected or disconnected when the system is energised.

7.2.2 Tap-off units intended to be connected or disconnected when the system is energised but without a load connected.

7.2.2.1 By ordinary person, skilled person or instructed person.

7.2.2.2 By skilled person or instructed person.

7.2.3 Tap-off units intended to be connected or disconnected when the system is energised and with a load connected.

7.3 According to degrees of protection provided by enclosures according to **JIS C 0920**.

7.3.1 According to protection against ingress of solid foreign objects.

7.3.2 According to protection against ingress of water.

7.4 According to degree of pollution:

- pollution degree 1;
- pollution degree 2;
- pollution degree 3.

NOTE 1 Details for the pollution degrees are given in Annex D.

NOTE 2 A PT system suitable for use in a particular situation may be used in a less polluted situation.

NOTE 3 A PT system designed with creepage and clearance distances for a particular pollution degree may be used in a higher pollution degree environment providing additional enclosures or seals are used.

7.5 According to the rated impulse withstand voltage:

- 330 V;
- 500 V;
- 800 V;
- 1 500 V;
- 2 500 V;
- 4 000 V.

NOTE : The relationship between rated impulse withstand voltage, rated voltage and overvoltage category is given in Annex C.

8 Marking and documentation

8.1 Each system component shall be marked with:

- a) the name or trademark of the manufacturer or responsible vendor;
- b) product identification which may comprise, for example, a colour, a catalogue number, a symbol.

In the case where the PT system is supplied as an assembly then only the assembly need be marked, and this shall not be on easily removable parts.

Where it is not possible to mark a component due to its size then it will be sufficient to mark the smallest package unit according to **8.1**.

8.2 In addition to **8.1** the powertrack, tap-off units and supply connectors shall be marked with:

- a) rated voltage in volt
- b) rated current in ampere
- c) nature of supply.
- d) Since attachment of system components other than those conforming to **JIS C 8366** series including this Standard to the powertrack with dimensions shown in figure 0A may cause a danger of electric shock, the said powertrack shall be provided with a prohibition against attaching system components other than these shall be marked on the powertrack.

In the installation instructions attached to the conforming system components, the powertrack to which the system component concerned can be attached shall be specified, and a cautionary instruction to limit attachment to the specified powertracks shall be given.

If symbols are used they shall be in accordance with **8.7**.

8.3 Line, neutral and earth terminals for external conductors shall be marked using the symbols in accordance with **8.7** alternatively these marks can be placed adjacent to the terminal.

8.4 If necessary for correct installation, for example for screwless type or insulation piercing terminals, the following information shall be given by marking adjacent to terminals:

- connection and disconnection procedure;
- cross-sectional areas and types of connectable conductors.

NOTE : Type of connectable conductors could include solid, stranded, flexible, copper or aluminium.

Alternatively the information may be given on the smallest package unit or in the manufacturer's installation instructions.

In addition, the location of protective devices such as fuses, circuit breakers and residual current devices which are not visible after installation shall be marked in their vicinity with the appropriate symbol or text, which shall be visible after installation.

In the case of fuses or other protective devices which can be replaced without the use of a tool, the appropriate current shall also be marked and, if necessary, the appropriate voltage.

Compliance is checked by inspection.

8.5 The manufacturer or responsible vendor shall provide documentation giving the information necessary for the proper and safe installation and use of the PT system for:

- system components of the PT system;
- the purpose of the system components and their assemblies;
- the classification of the PT system according to clause 7;
- guidance to reach the declared performance;
- guidance regarding periodic inspection and/or maintenance where required;
- static loading characteristics (see 14.2), if any.

Compliance is checked by inspection.

8.6 Information according to 8.1, 8.2, 8.3, 8.4 and 8.5 which is provided with the smallest package unit or in the manufacturer's installation instructions shall be in the form of illustrations and/or in a language which is acceptable to the country in which the PT system is intended to be installed.

Compliance is checked by inspection

8.7 Symbols are as follows:

Ampere	A
Volt	V
Hertz	Hz
Alternating current	~ [IEC 60417-5032 (DB:2002-10)] or a.c.
Line	L, or in the case of more than one L1, L2, L3, etc.
Neutral	N
Protective earth	 [IEC 60417-5019 (DB:2002-10)]
Noiseless (clean) earth	 [IEC 60417-5018 (DB:2002-10)]
Fuse	 [IEC 60417-5016 (DB:2002-10)]

IP code according to **JIS C 0920** IPXX

NOTE 1 Details of construction of symbols are given in **IEC 60417-1**.

NOTE 2 Lines formed by the construction of the tool are not considered as part of the marking.

For the marking of rated current and rated voltage figures may be used alone. The figure for the rated current shall be placed before or above that for the rated voltage and separated from the latter by a line. If the symbol for the nature of supply is used, it shall be placed next to the marking for rated current and rated voltage.

For example 10 A 250 V~ or 10/250~ or $\frac{10}{250}$ ~

Compliance is checked by inspection.

8.8 Marking on the product shall be easily legible and durable.

The marking according to **8.2**, **8.3** and **8.4** shall not be placed on easily removable parts and screws or washers.

Compliance is checked by inspection, using normal or corrected vision, without additional magnification and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

After the test the marking shall be legible. Labels shall not be easily removable and shall not have curled.

NOTE 1 Petroleum spirit is defined as the aliphatic solvent hexane with a content of aromatics of maximum 0.1 % volume, a kauri butanol value of 29, initial boiling point 65 °C, a dry point of 65 °C and a density of approximately 0.68 g/cm³.

NOTE 2 Marking on the product may be applied, for example, by moulding, pressing, engraving, printing, adhesive labels or waterslide transfers.

NOTE 3 The durability of marking made by engraving, moulding or pressing is deemed to comply with the requirements without testing.

9 Construction

9.1 For tap-off units classified according to **7.2.1** it shall not be possible to connect or disconnect it without the use of a tool, unless the design of the tap-off unit is such that it is not possible to connect or disconnect it with the PT system energised.

Compliance is checked by inspection and by manual test.

9.2 For tap-off units classified according to **7.2.2.1** it shall not be possible to connect or disconnect it with the tap-off unit under load.

Compliance is checked by inspection and by manual test.

9.3 For tap-off units classified according to **7.2.2.2** the tap-off unit shall be clearly marked to indicate that it shall not be connected or disconnected under load and shall only be accessible by the use of a tool or intended to have restricted access by an ordinary person.

NOTE : Examples of tap-off units having restricted access by an ordinary person include:

- a) tap-off units situated under a raised access floor;
- b) tap-off units situated either > 2.5 m above floor level or within a suspended ceiling.

Compliance is checked by inspection and by manual test.

9.4 For non-rewirable system components it shall not be possible to break the terminations and/or replace the cable without making the system component permanently useless.

Compliance is checked by inspection and if necessary by manual test.

9.5 System components with the provision for fuse-links shall be so designed that ordinary persons cannot gain access to live parts when replacing fuse-links. However, the system shown in figure 0A may be exempted from this requirement if a prohibition against exchanging the fuse-links under energized condition is described on the product itself or in the installation instructions.

Compliance is checked by inspection and test according to 11.1.1.1.

9.6 PT systems shall be so designed that they cause no damage to the insulation of conductors or sheath of cables, both during installation and in normal use.

Compliance is checked by inspection.

9.7 PT systems including tap-off units intended for use with flexible cables shall be so designed that if a flexible cable is fitted which may be moved in normal use, a cord anchorage shall be provided such that the conductors are relieved from strain by resisting the pull and twist forces on flexible cables, where they are connected to the terminals and the sheath of the flexible cable is kept in position and is protected from abrasion. It shall be clear how the relief from strain and the prevention of twisting is intended to be effected. Methods such as tying the cable into a knot or tying the ends with string shall not be used.

Cord anchorages shall be of insulating material or, if of metal, shall be provided with an insulating lining fixed to the metal parts. However, this requirement need not be applied if the instruction manual declares the suitable cable or cord for clamping the cord anchorage and clearly indicates the method of clamping.

Cord anchorages shall be so designed that:

- a) the flexible cable cannot be released from the outside of the system component without the aid of a tool;
- b) the flexible cable cannot touch the clamping screws of the cord anchorage, if these screws are accessible or electrically connected to accessible metal parts, when the system component is mounted as in normal use;
- c) the flexible cable is not clamped by a metal screw which bears directly on to the flexible cable;
- d) at least one part of it is securely fixed to the system component, except in cases where the construction is such that when the cable moves during normal use, the terminal is not under tension;
- e) clamping the flexible cable does not require the use of a special purpose tool;
- f) they are suitable for the types and dimensions of flexible cable declared by the manufacturer;
- g) clamping the flexible cable is easily possible without restricting the correct re-assembly of the system component;

- h) means such as screws or other fixing devices which are used when clamping the flexible cable shall not serve to fix other parts of the system component unless either:
- the system component would be rendered manifestly incomplete if that part was omitted or replaced in an incorrect position, or
 - that part intended to be fixed cannot be removed without further use of a tool.
- i) it shall not be possible to push the flexible cable into the PT system to such an extent as would impair safety or so that the cord anchorage becomes ineffective.

Compliance is checked by inspection, manual tests and the tests according to **9.7.2** and **9.7.3** following the preparation of the sample according to **9.7.1**.

9.7.1 The system component is fitted with a flexible cable of the appropriate cross-sectional area and with the minimum dimensions specified in **9.7**, item **f**). The conductors are introduced into the terminals and the terminal screws are tightened just sufficiently to prevent the position of the conductors from easily changing. Clamping screws, if any, shall be tightened with the torque value declared by the manufacturer or in the absence of this information with the value according to table 5.

Non-rewirable system components and their flexible cables are subjected to the test as delivered.

9.7.2 The flexible cable is then subjected 100 times to a pull as specified in table 1. The pulls are applied in the most unfavourable direction. Each pull is applied in one smooth and continuous motion for a duration of 1 s.

NOTE 1 Care should be taken to exert the same pull on all parts (core, insulation and sheath) of the cable simultaneously.

Immediately afterwards, the flexible cable is subjected for 1 min to a torque as specified in table 1. The torque is applied as near as practicable to the cord entry.

After the test, the cable shall not have been displaced longitudinally by more than 2 mm. For rewirable system components, the end of the conductors shall not have moved noticeably in the terminals.

For non-rewirable system components, there shall be no break in the electrical connections. Clearances and creepage distances shall not have been reduced below the values specified in clause **10** and the cord anchorage shall show no damage impairing its further use.

For the measurement of the longitudinal displacement, a mark is made on the flexible cable while it is subjected to the pull, at a distance of approximately 20 mm from the end of the sample, before starting the tests. If, for non-rewirable system components, there is no definite end to the sample, an additional mark is made on the body of the sample.

After the tests, the displacement of the mark on the flexible cable in relation to the sample is measured while the flexible cable is subjected to the pull.

NOTE 2 Examples of test apparatus are shown in figures 1 and 2.