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INTERNATIONAL STANDARD

colour inside

Information technology – Telecommunications cabling requirements for remote powering of terminal equipment

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FOREWORD

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This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

ISO/IEC TS 29125 edition 1.2 contains the first edition (2017-04), its amendment 1 (2020-05) [documents JTC1-SC25/2919/DTS and JTC1-SC25/2945/RVDTS] and its amendment 2 (2024-10) [documents JTC1-SC25/3272/DTS and JTC1-SC25/3289/RVDTS].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

The main task of the joint technical committee is to prepare International Standards. In exceptional circumstances, the joint technical committee may propose the publication of a Technical Specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- 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.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

ISO/IEC TS 29125, which is a Technical Specification, has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This first edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) extension of the current per conductor from 300 mA to 500 mA;
b) provision of additional details of installation conditions that were not described in ISO/IEC TR 29125:2010;
c) inclusion of guidelines for cords;
d) inclusion of a model to calculate temperature rise in different bundle sizes.

This Technical Specification 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document specifies the use of generic balanced cabling for customer premises, as specified in the ISO/IEC 11801 series, for remote powering of terminal equipment. It provides guidance on new cabling installations and renovations. The customer premises may encompass one or more buildings or may be within a building that contains more than one organization. The cabling may be installed prior to the selection of remote powering equipment or powered terminal equipment.

ISO/IEC 11801-1 specifies a structure and performance requirements for cabling subsystems that support a wide range of applications. They provide appropriate equipment interfaces to the cabling infrastructure in equipment rooms, telecommunications rooms and work areas.

A growing number of organizations employ equipment at locations that require the provision of remote powering. This document was created to provide supplementary information to ISO/IEC 11801-1 to implement remote powering over generic balanced cabling as specified in ISO/IEC 11801-1.

This document provides additional guidance for remote powering on the use of balanced cabling systems as specified in ISO/IEC 11801-1 and guidance on different installation conditions that require special considerations:

- information to bring together all the considerations about remote powering in a single document;
- guidance on wire diameter and bundling on heating;
- guidance on mating and un-mating of connectors that convey remote power.

This document does not include requirements from national or local safety standards and regulations.

This document was developed based on a number of contributions describing remote powering over telecommunications cabling under different installation conditions. The relevant safety standards and regulations, application standard, and equipment manufacturers give guidance on factors that should be taken into account during design of the generic balanced cabling that supports the distribution of remote powering.

This document extends the current per conductor specified in ISO/IEC TR 29125:2010 from 300 mA to 500 mA. This document covers additional details of installation conditions that are not described in ISO/IEC TR 29125:2010. This document includes guidelines for cords. This document addresses the use of generic balanced single pair cabling for customer premises, to be specified in future amendments of the ISO/IEC 11801 series, for remote powering of terminal equipment. This document uses measurements and empirical models to estimate the thermal performance of single pair cable bundles of various conductor diameters.

INTRODUCTION to Amendment 1

This amendment incorporates changes necessary to include remote powering using single pair cabling.

INTRODUCTION to Amendment 2

This amendment incorporates changes necessary to extend the current for remote powering using single pair cabling up to 2 000 mA.

INFORMATION TECHNOLOGY –

TELECOMMUNICATIONS CABLING REQUIREMENTS FOR REMOTE POWERING OF TERMINAL EQUIPMENT

1 Scope

This document

a) addresses the support of safety extra low voltage (SELV) and limited power source (LPS) applications that provide remote power over:

- 4-pair balanced cabling in accordance with the reference implementations of ISO/IEC 11801 series standards using currents per conductor of up to 500 mA;
- 1-pair balanced cabling using currents per conductor of up to 2 000 mA;

and targets the support of applications that provide remote power over balanced cabling to terminal equipment,

b) covers the transmission and electrical parameters needed to support remote power over balanced cabling,

c) covers various installation scenarios and how these may impact the capability of balanced cabling to support remote powering,

d) specifies design and configuration of cabling as specified in ISO/IEC 11801-1.

NOTE SELV requirements specify a maximum voltage of 60 V DC and LPS is understood in the applications referenced to be up to 100 W supplied within ~~4-pair~~ cabling.

This document includes a mathematical model to predict the behaviour of different bundle sizes, various cabling constructions, and installation conditions for different current capacities.

Safety (e.g. electrical safety and protection and fire) and electromagnetic compatibility (EMC) requirements are outside the scope of this document, and are covered by other standards and regulations. However, information given by this document can be of assistance.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 11801-1, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

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

ISO/IEC TR 24746, *Information technology – Generic cabling for customer premises – Mid-span DTE power insertion*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 11801-1, ISO/IEC 14763-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
power source equipment
equipment that provides power

3.1.2
cable bundle
several cables tied together or in contact with one another in a parallel configuration for at least 1 m, with the cross-section profile of the arrangement basically circular

3.1.3
conductor
element intended to carry electric current

[SOURCE IEC 60050-151:2001, 151-12-05, modified – The 3 Notes have been deleted.]

3.1.4
current carrying capacity
maximum current a cable circuit (one or several conductors) can support resulting in a specified increase of temperature of the conductor beyond the ambient temperature, not exceeding the maximum allowed operating temperature of the cable

[SOURCE: IEC 61156-1:2007/AMD1:2009, 3.24, modified – "increase of temperature" has replaced "increase of the surface temperature".]

3.1.5
remote powering
supply of power to application specific equipment via balanced cabling

3.1.6
temperature rise
difference in temperature between the initial temperature of the conductor without power and the final temperature of the powered conductor at steady state

3.2 Abbreviated terms

EMC	electromagnetic compatibility
FD	floor distributor
HVAC	heating, ventilation and air conditioning
PTZ	pan, tilt, zoom
WAP	wireless access point

4 Conformance

For cabling to comply with this document, the following applies:

a) the design of the cabling shall comply with the relevant cabling design standard of the ISO/IEC 11801 series;

b) the installation shall comply with ISO/IEC 14763-2 as amended by the additional requirements of this document.

5 Cabling selection and performance

Cabling for remote powering ~~should~~ can be implemented using 4-pair and 1-pair balanced cabling.

This cabling will be used simultaneously to support signal transmission and remote power feeding for the terminal equipment. This document assumes the use of balanced cabling components specified in the reference implementation clause of the relevant design standards of the ISO/IEC 11801 series.

The transmission parameters of balanced cables related to remote powering can be found in Annex C.

6 Installation conditions

6.1 General

Cabling may be installed in different types of continuous and non-continuous pathway systems as described in ISO/IEC 14763-2. The installation of a cable within the pathway systems should take into account the specified operating temperature of the cable. Due to the Joule effect, each energized conductor has a temperature rise. Larger cable bundles have more heat generation and therefore the temperature rise is worse than smaller cable bundles.

The cable bundle size is limited by the current capacity in 6.3 and the induced temperature rise that results in an operating temperature of the cable, not to exceed its temperature rating.

The following guidelines for pathway selection and installation should be considered:

a) installation design including the type of pathways selected, the pathway fill factor, whether the pathway is sealed at both ends,

b) the pathway environment and whether the pathway goes through thermally insulated areas, in which case the type of insulation will be a significant factor. For optimal thermal performance, pathway design should avoid any insulated areas,

c) thermal aspects of the entire pathway (e.g. open tray, closed tray, ventilated, non-ventilated, plastic conduit, metal conduit, fire barriers) should be taken into account.

6.2 Ambient temperature

Different segments of a link can have different ambient temperatures, which can influence the amount of remote power that can be delivered. Therefore the ambient temperature in different length segments of a link or channel has a direct impact on the operating temperature of the cable used for the link or channel and can limit the capability of the cable for remote power delivery to powered terminal equipment. The worst case installed cabling condition with respect to the maximum ambient temperature shall be used to determine the maximum operating temperature for a link or channel when subject to remote powering.

6.3 Temperature rise and current capacity

When remote power is applied to balanced cabling, the temperature of the cabling will rise due to resistive heat generation (Joule effect) in the conductors. Depending on cable construction and installed cabling conditions, the heat generated will be dissipated into the surrounding environment until a steady state is reached with the temperature of the cable bundle (operating temperature) higher than the ambient temperature of the surrounding environment. The maximum temperature of any cable shall not exceed the temperature rating of the cable. The standards in the ISO/IEC 11801 series ~~require this temperature to be 60 °C (minimum)~~ specify this temperature up to 60 °C in MICE C_1 environments and 70 °C in MICE C_2 and C_3 environments.

Temperature rise in the cable will lead to an increase in insertion loss as indicated in the reference implementations of the ISO/IEC 11801 series standards and should be taken into account when selecting cables and using them in links or channels. The maximum length of the channel or link should be reduced based on the maximum temperature of the cable using the de-rating factors in ISO/IEC 11801-1.

The maximum current per conductor for different temperature rise in a bundle of 37 cables of 4-pair Category 5 cables with solid conductors, and 37 cords of 4-pair 0,40 mm stranded cords with all pairs energized is shown in Table 1.

The maximum current per conductor for different temperature rise in a bundle of 37 cables of 1-pair cables with 0,57 mm diameter conductors, and 37 cords of 1-pair 0,40 mm cords with all pairs energized is shown in Table 5.

Annex B provides an engineering model that may be used for specific cable types, cable constructions, and installation conditions to derive the bundle size for a particular current per conductor. Clause B.7 describes a simplified version of the engineering model in Annex B and was used to derive the worst case values in Tables 1~~, 2, 3 and 4~~ to 9 based on constants calculated from measurements of typical cables for each cable category or conductor diameter. The measurement procedures used to determine the constants are detailed in Annex F.

Table 1 – Maximum current per conductor versus temperature rise in a 37 4-pair cable bundle in air and conduit ~~(all 4 pairs energized)~~

Temperature rise °C	Current per conductor 0,4 mm cords mA		Current per conductor Category 5 cables mA	
	air	**conduit**	**air**	**conduit**
5	278	223	341	287
7,5	340	273	418	351
10	393	315	482	406
12,5	439	352	539	453
15	481	386	591	497
17,5	520	417	638	537
20	556	446	682	574

Temperature rise above 10 °C shown in grey background is not recommended.

NOTE These values are based on conductor temperature measurement of typical cables and cords.

Table 5 – Maximum current per conductor versus temperature rise in a 37 1-pair cable bundle in air and conduit

Temperature rise	Current per conductor					
K	0,57 mm wire diameter mA		0,40 mm stranded wire diameter (cords) mA		1,02 mm stranded wire diameter (cords) mA	
	air	conduit	air	conduit	air	conduit
5	866	738	608	518	1 550	1 320
7,5	1 061	904	744	634	1 900	1 620
10	1 225	1 044	860	732	2 190	1 870
12,5	1 370	1 167	961	819	-	2 090
15	1 501	1 278	1 053	897	-	-
17,5	1 621	1 381	1 137	969	-	-
20	1 733	1 476	1 216	1 036	-	-

Temperature rise above 10 K shown in grey background is not recommended for cables installed in an environment that can reach 50 °C.

NOTE 1 These values are based on conductor temperature measurement of typical cables and cords.

NOTE 2 Currents above 2 000 mA are for information only.

Table 2 shows current capacity for different categories of 4-pair cable, independent of construction, for a given temperature rise. Table 6 shows current capacity for 1-pair cables of conductor diameters of cable, independent of construction, for a given temperature rise.

Table 2 – Calculated worst case current per conductor versus temperature rise in a bundle of 37 4-pair cables (all pairs energized)

ΔT	0,4 mm cords mA		Category 5 cables mA		Category 6 cables mA		Category 6_A cables mA		Category 7 cables mA		Category 7_A cables mA	
°C	air	cond-uit	air	cond-uit	air	cond-uit	air	cond-uit	air	cond-uit	air	cond-uit
2	175	141	215	181	246	207	267	229	267	229	324	264
4	248	199	305	256	348	293	378	324	378	324	459	373
6	304	244	373	314	427	359	463	397	463	397	562	457
8	351	282	431	363	493	414	535	459	535	459	649	528
10	393	315	482	406	551	463	598	513	598	513	725	590
12	430	345	528	444	604	507	655	562	655	562	795	646
14	465	373	571	480	652	548	708	607	708	607	858	698
16	497	399	610	513	697	586	756	649	756	649	918	746
18	527	423	647	544	740	622	802	688	802	688	973	792
20	556	446	682	574	780	655	846	725	846	725	1026	835

Temperature rise above 10 °C shown in grey background is not recommended

The values in this table are based on the implicit DC resistance derived from the insertion loss of the various categories of cable. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.

NOTE The current per conductor for each category is dependent on the cable construction.