



BSI Standards Publication

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

National foreword

This Published Document is the UK implementation of ISO/IEC TS 29125:2017+A2:2024. It supersedes PD ISO/IEC TS 29125:2017+A1:2020, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO/IEC text carry the number of the ISO/IEC amendment. For example, text altered by ISO/IEC amendment 1 is indicated by A1 A1.

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A list of organizations represented on this committee can be obtained on request to its committee manager.

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TECHNICAL SPECIFICATION



AMENDMENT 2

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

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	7
3.1 Terms and definitions.....	7
3.2 Abbreviated terms.....	8
4 Conformance.....	8
5 Cabling selection and performance.....	9
6 Installation conditions	9
6.1 General.....	9
6.2 Ambient temperature.....	9
6.3 Temperature rise and current capacity	9
6.4 Factors affecting temperature increase	12
6.4.1 General	12
6.4.2 Installation near equipment.....	12
6.4.3 Cable count within a bundle.....	12
6.4.4 Reducing temperature increase	14
6.4.5 Cable bundle suspended in air.....	17
6.4.6 Administration.....	18
7 Remote power delivery over balanced cabling	18
8 Connecting hardware.....	20
Annex A (informative) Mitigation considerations for installed cabling.....	21
A.1 General.....	21
A.2 Minimum cabling class	21
A.3 Bundle size and location	21
A.4 Mitigation options.....	21
Annex B (informative) Modelling temperature rise for cable types, bundle sizes and installation conditions	22
B.1 Model basics.....	22
B.2 Power dissipated (P).....	22
B.3 Temperature difference from ambient temperature to bundle surface (ΔT_U)	23
B.3.1 Model equations	23
B.3.2 Typical values for constant ρ_U	23
B.4 Temperature difference from bundle surface to bundle centre (ΔT_{th})	23
B.4.1 Model equations	23
B.4.2 Typical values for constant ρ_{th}	23
B.5 Temperature variation within the bundle ($\Delta T(x)$)	24
B.6 Alternative presentation of the model.....	24
B.7 Adaptation model used to derive temperature rise vs. cables in a bundle	24
B.8 Calculations.....	25
B.9 Example.....	25
B.10 Coefficients for air and conduit.....	26
Annex C (informative) Transmission parameters related to remote powering.....	27
C.1 DC loop resistance.....	27

C.2	DC resistance unbalance (within pair)	27
C.3	DC resistance unbalance (pair to pair)	28
Annex D (informative)	Illustrations of heating of various bundle sizes and configurations	30
D.1	Limiting cable bundle size	30
D.2	Separating into smaller bundles	31
Annex E (informative)	Test protocol	32
E.1	Background	32
E.2	Test set-up	32
Annex F (informative)	Detailed test procedure	35
F.1	General	35
F.2	Test set-up	35
F.2.1	Thermocouple placement	35
F.2.2	Measurement of cable bundle in air	36
F.2.3	Measurement of cable bundle in conduit	37
Bibliography		39
Figure 1	– Examples of end point powering systems using signal pairs (top) and spare pairs (bottom)	18
Figure 2	– Examples of mid-span powering systems	19
Figure B.1	– Temperature rise profile	21
Figure D.1	– 91-cable bundle	30
Figure D.2	– Three bundles of 37 cables	30
Figure D.3	– Three bundles of 37 cables with separation	31
Figure E.1	– 37-cable bundle and temperature location	32
Figure E.2	– "Perfect bundle" and thermocouple configuration	33
Figure E.3	– Conductor configuration	33
Figure F.1	– Placement of thermocouple	35
Figure F.2	– Securing of the thermocouple	36
Figure F.3	– Test set-up for cable bundles in air	37
Figure F.4	– Test set-up for cable bundles in conduit	38
Table 1	– Maximum current per conductor versus temperature rise in a 37-cable bundle in air and conduit (all 4 pairs energized)	10
Table 2	– Calculated worst case current per conductor versus temperature rise in a bundle of 37 4-pair cables (all pairs energized)	11
Table 3	– Temperature rise versus cable bundle size (500 mA per conductor)	12
Table 4	– Temperature rise for a type of cable versus the number of energized pairs in a 37-cable bundle (500 mA per conductor)	15
Table B.1	– Bundling coefficients for different types of cables and cords (all 4 pairs energized)	26
Table C.1	– Maximum DC loop resistance of channels	27
Table C.2	– DC resistance unbalance of cables, connecting hardware and channels	28
Table C.3	– DC resistance unbalance (pair to pair)	29

INFORMATION TECHNOLOGY –

TELECOMMUNICATIONS CABLING REQUIREMENTS FOR REMOTE POWERING OF TERMINAL EQUIPMENT

FOREWORD

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- 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 cancels and replaces ISO/IEC TR 29125:2010. This 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.

FOREWORD to Amendment 1

This amendment has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The text of this amendment is based on the following documents:

DTS	Report on voting
JTC1-SC25/2919/DTS	JTC1-SC25/2945/RVDTS

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

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;
- **A2** guidance on wire diameter and bundling on heating; **A2**
- 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.

A1 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. **A1**

A1 INTRODUCTION to the amendment

This amendment incorporates changes necessary to include remote powering using single pair cabling. **A1**

A2 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. **A2**

INFORMATION TECHNOLOGY –

TELECOMMUNICATIONS CABLING REQUIREMENTS FOR REMOTE POWERING OF TERMINAL EQUIPMENT

1 Scope

This document

- A1** 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; **A1**
 - **A2** 1-pair balanced cabling using currents per conductor of up to 2 000 mA; **A2**
- 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 **A2** 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 cabling. **A2**

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 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 specify this temperature up to 60 °C in MICE C₁ environments and 70 °C in MICE C₂ and C₃ 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.

A1 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 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 ^{A1}

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.

^{A2} Table 5 – Maximum current per conductor versus temperature rise in a 37 1-pair cable bundle in air and conduit

Temperature rise K	Current per conductor					
	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. ^{A2}

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. [A1](#)

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	
	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.												

[A2](#) Table 6 – Calculated worst case current per conductor versus temperature rise in a bundle of 37 1-pair cables of different conductor diameters in air and conduit

ΔT	0,40 mm diameter mA		0,51 mm diameter mA		0,57 mm diameter mA		0,65 mm diameter mA		0,81 mm diameter mA		1,02 mm diameter mA	
	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit	air	conduit
2	384	327	490	417	548	466	624	532	779	663	981	835
4	543	463	693	590	775	660	883	753	1 101	938	1 387	1 181
6	666	567	849	723	949	808	1 082	922	1 349	1 149	1 699	1 446
8	769	655	981	835	1 096	933	1 249	1 065	1 558	1 327	1 962	1 670
10	860	732	1 096	934	1 225	1 044	1 397	1 190	1 742	1 484	2 194	1 867
12	942	802	1 201	1 023	1 342	1 143	1 530	1 304	1 908	1 625	2 403	2 046
14	1 017	867	1 297	1 105	1 450	1 235	1 653	1 409	2 061	1 755	2 596	2 210
16	1 087	926	1 387	1 181	1 550	1 320	1 767	1 506	2 203	1 877	2 775	2 362
18	1 153	983	1 471	1 253	1 644	1 400	1 874	1 597	2 337	1 991	2 943	2 506
20	1 216	1 036	1 551	1 321	1 733	1 476	1 976	1 684	2 463	2 098	3 102	2 641
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 conductor diameters of cable. Manufacturers' and/or suppliers' specifications give information relating to a specific cable.												
NOTE 1 The current per conductor for each 1-pair cable is also dependent on the cable construction.												
NOTE 2 Currents above 2 000 mA are for information only. A2												

6.4 Factors affecting temperature increase

6.4.1 General

The steady state temperature for the conductor of any power carrying cable is reached when the generation of heat within the cable (Joule effect) is equal to the heat dissipated into the environment, be it the open atmosphere, trays, ducts or other cables which can also be power carrying cables.

6.4.2 Installation near equipment

Ambient temperature near equipment will be higher and also installation of telecommunications cables and cords in hot aisles will lead to higher ambient temperature around the patch cord bundle.

6.4.3 Cable count within a bundle

A2 This document uses 37-cable bundles as the basis for developing the temperature rise and current per conductor with all pairs energized. For other cases (e.g. where bundle count exceeds 37 cables), the guidelines provided in 6.4.4 can be used.

Refer to Table 7 to determine the maximum temperature rise using 2 000 mA per conductor for 1-pair cable bundles of different count.

NOTE The temperature rise of one cable is lower than that of a 7-cable bundle shown in all tables. **A2**

A1 Table 3 – Temperature rise versus 4-pair cable bundle size (500 mA per conductor) **A1**

Number of cables	Temperature rise °C											
	0,4 mm cords		Cat 5 cables		Cat 6 cables		Cat 6 _A cables		Cat 7 cables		Cat 7 _A cables	
	air	cond-uit	air	cond-uit	air	cond-uit	air	cond-uit	air	cond-uit	air	cond-uit
1	1,9	3,1	1,1	1,7	0,8	1,3	0,7	1,1	0,7	1,1	0,6	0,9
7	5,7	9,1	3,5	5,2	2,6	4,0	2,3	3,3	2,3	3,3	1,7	2,6
19	10,5	16,5	6,7	9,7	5,1	7,4	4,4	6,1	4,4	6,1	3,1	4,7
24	12,2	19,1	7,9	11,3	6,0	8,7	5,1	7,1	5,1	7,1	3,6	5,5
37	16,2	25,1	10,7	15,2	8,2	11,6	7,0	9,5	7,0	9,5	4,7	7,2
48	19,3	29,8	13,0	18,2	10,0	14,0	8,5	11,4	8,5	11,4	5,7	8,5
52	20,3	31,4	13,8	19,3	10,6	14,8	9,0	12,0	9,0	12,0	6,0	9,0
61	22,7	34,9	15,5	21,6	12,0	16,6	10,1	13,4	10,1	13,4	6,7	10,0
64	23,5	36,1	16,1	22,4	12,4	17,1	10,5	13,9	10,5	13,9	6,9	10,3
74	26,0	39,8	17,9	24,9	13,9	19,1	11,7	15,4	11,7	15,4	7,7	11,3
91	30,1	45,9	21,0	29,0	16,4	22,2	13,8	17,9	13,8	17,9	8,9	13,1

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 1 The temperature rise (°C) is based upon a current of 500 mA per conductor, for all pairs in all cables in the bundle.

NOTE 2 The current per conductor for each category is dependent on the cable construction.