



ANSI/TIA-942-B-2017
APPROVED: JULY 12, 2017

TIA STANDARD

Telecommunications Infrastructure Standard for Data Centers

TIA-942-B
(Revision of TIA-942-A)

July 2017

**TELECOMMUNICATIONS
INDUSTRY ASSOCIATION**

tiaonline.org

This is a preview. [Click here to purchase the full publication.](#)

NOTICE

TIA Engineering Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for their particular need. The existence of such Standards and Publications shall not in any respect preclude any member or non-member of TIA from manufacturing or selling products not conforming to such Standards and Publications. Neither shall the existence of such Standards and Publications preclude their voluntary use by Non-TIA members, either domestically or internationally.

Standards and Publications are adopted by TIA in accordance with the American National Standards Institute (ANSI) patent policy. By such action, TIA does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Standard or Publication.

This Standard does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

Any use of trademarks in this document are for information purposes and do not constitute an endorsement by TIA or this committee of the products or services of the company.

(From Standards Proposal No. ANSI/TIA-PN-942-B-D1, formulated under the cognizance of the TIA TR-42 Telecommunications Cabling Systems, TR-42.1 Subcommittee on Commercial Building Telecommunications Cabling).

Published by
©TELECOMMUNICATIONS INDUSTRY ASSOCIATION
Technology and Standards Department
1320 N. Courthouse Road, Suite 200
Arlington, VA 22201 U.S.A.

**PRICE: Please refer to current Catalog of
TIA TELECOMMUNICATIONS INDUSTRY ASSOCIATION STANDARDS
AND ENGINEERING PUBLICATIONS
or call IHS, USA and Canada
(1-877-413-5187) International (303-397-2896)
or search online at <http://www.tiaonline.org/standards/catalog/>**

All rights reserved
Printed in U.S.A.

NOTICE OF COPYRIGHT

This document is copyrighted by the TIA.

Reproduction of these documents either in hard copy or soft copy (including posting on the web) is prohibited without copyright permission. For copyright permission to reproduce portions of this document, please contact the TIA Standards Department or go to the TIA website (www.tiaonline.org) for details on how to request permission. Details are located at:

<http://www.tiaonline.org/standards/catalog/info.cfm#copyright>

or

Telecommunications Industry Association
Technology & Standards Department
1320 N. Courthouse Road, Suite 200
Arlington, VA 22201 USA
+1.703.907.7700

Organizations may obtain permission to reproduce a limited number of copies by entering into a license agreement. For information, contact

IHS
15 Inverness Way East
Englewood, CO 80112-5704
or call
USA and Canada (1.800.525.7052)
International (303.790.0600)

NOTICE OF DISCLAIMER AND LIMITATION OF LIABILITY

The document to which this Notice is affixed (the "Document") has been prepared by one or more Engineering Committees or Formulating Groups of the Telecommunications Industry Association ("TIA"). TIA is not the author of the Document contents, but publishes and claims copyright to the Document pursuant to licenses and permission granted by the authors of the contents.

TIA Engineering Committees and Formulating Groups are expected to conduct their affairs in accordance with the TIA Procedures for American National Standards and TIA Engineering Committee Operating Procedures, the current and predecessor versions of which are available at <http://www.tiaonline.org/standards/ec-procedures>) TIA's function is to administer the process, but not the content, of document preparation in accordance with the Manual and, when appropriate, the policies and procedures of the American National Standards Institute ("ANSI"). TIA does not evaluate, test, verify or investigate the information, accuracy, soundness, or credibility of the contents of the Document. In publishing the Document, TIA disclaims any undertaking to perform any duty owed to or for anyone.

If the Document is identified or marked as a project number (PN) document, or as a standards proposal (SP) document, persons or parties reading or in any way interested in the Document are cautioned that: (a) the Document is a proposal; (b) there is no assurance that the Document will be approved by any Committee of TIA or any other body in its present or any other form; (c) the Document may be amended, modified or changed in the standards development or any editing process.

The use or practice of contents of this Document may involve the use of intellectual property rights ("IPR"), including pending or issued patents, or copyrights, owned by one or more parties. TIA makes no search or investigation for IPR. When IPR consisting of patents and published pending patent applications are claimed and called to TIA's attention, a statement from the holder thereof is requested, all in accordance with the Manual. TIA takes no position with reference to, and disclaims any obligation to investigate or inquire into, the scope or validity of any claims of IPR. TIA will neither be a party to discussions of any licensing terms or conditions, which are instead left to the parties involved, nor will TIA opine or judge whether proposed licensing terms or conditions are reasonable or non-discriminatory. TIA does not warrant or represent that procedures or practices suggested or provided in the Manual have been complied with as respects the Document or its contents.

If the Document contains one or more Normative References to a document published by another organization ("other SSO") engaged in the formulation, development or publication of standards (whether designated as a standard, specification, recommendation or otherwise), whether such reference consists of mandatory, alternate or optional elements (as defined in the TIA Procedures for American National Standards) then (i) TIA disclaims any duty or obligation to search or investigate the records of any other SSO for IPR or letters of assurance relating to any such Normative Reference; (ii) TIA's policy of encouragement of voluntary disclosure (see TIA Procedures for American National Standards Annex C.1.2.3) of Essential Patent(s) and published pending patent applications shall apply; and (iii) Information as to claims of IPR in the records or publications of the other SSO shall not constitute identification to TIA of a claim of Essential Patent(s) or published pending patent applications.

TIA does not enforce or monitor compliance with the contents of the Document. TIA does not certify, inspect, test or otherwise investigate products, designs or services or any claims of compliance with the contents of the Document.

ALL WARRANTIES, EXPRESS OR IMPLIED, ARE DISCLAIMED, INCLUDING WITHOUT LIMITATION, ANY AND ALL WARRANTIES CONCERNING THE ACCURACY OF THE CONTENTS, ITS FITNESS OR APPROPRIATENESS FOR A PARTICULAR PURPOSE OR USE, ITS MERCHANTABILITY AND ITS NONINFRINGEMENT OF ANY THIRD PARTY'S INTELLECTUAL PROPERTY RIGHTS. TIA EXPRESSLY DISCLAIMS ANY AND ALL RESPONSIBILITIES FOR THE ACCURACY OF THE CONTENTS AND MAKES NO REPRESENTATIONS OR WARRANTIES REGARDING THE CONTENT'S COMPLIANCE WITH ANY APPLICABLE STATUTE, RULE OR REGULATION, OR THE SAFETY OR HEALTH EFFECTS OF THE CONTENTS OR ANY PRODUCT OR SERVICE REFERRED TO IN THE DOCUMENT OR PRODUCED OR RENDERED TO COMPLY WITH THE CONTENTS.

TIA SHALL NOT BE LIABLE FOR ANY AND ALL DAMAGES, DIRECT OR INDIRECT, ARISING FROM OR RELATING TO ANY USE OF THE CONTENTS CONTAINED HEREIN, INCLUDING WITHOUT LIMITATION ANY AND ALL INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGES FOR LOSS OF BUSINESS, LOSS OF PROFITS, LITIGATION, OR THE LIKE), WHETHER BASED UPON BREACH OF CONTRACT, BREACH OF WARRANTY, TORT (INCLUDING NEGLIGENCE), PRODUCT LIABILITY OR OTHERWISE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE FOREGOING NEGATION OF DAMAGES IS A FUNDAMENTAL ELEMENT OF THE USE OF THE CONTENTS HEREOF, AND THESE CONTENTS WOULD NOT BE PUBLISHED BY TIA WITHOUT SUCH LIMITATIONS.

[This is a preview. Click here to purchase the full publication.](#)

Telecommunications Infrastructure Standard for Data Centers

Table of Contents

1	SCOPE	1
2	NORMATIVE REFERENCES.....	1
3	DEFINITION OF TERMS, ACRONYMS AND ABBREVIATIONS, AND UNITS OF MEASURE	2
3.1	General.....	2
3.2	Definition of terms	2
3.3	Acronyms and abbreviations.....	7
3.4	Units of measure	8
4	DATA CENTER DESIGN OVERVIEW.....	9
4.1	General.....	9
4.2	Relationship of data center spaces to other building spaces.....	9
4.3	Availability and Security	10
4.4	Consideration for involvement of professionals	11
5	DATA CENTER CABLING SYSTEM INFRASTRUCTURE	12
6	DATA CENTER TELECOMMUNICATIONS SPACES AND RELATED TOPOLOGIES ...	15
6.1	General.....	15
6.2	Data center structure.....	15
6.2.1	Major elements	15
6.2.2	Basic data center topology	16
6.2.3	Reduced data center topologies	17
6.2.4	Distributed data center topologies	17
6.2.5	Topologies for broadband coaxial cabling	18
6.3	Energy efficient design.....	18
6.3.1	General	18
6.3.2	Energy efficiency recommendations.....	19
6.4	Common requirements for computer rooms and entrance rooms	22
6.4.1	General	22
6.4.2	Architectural design	22
6.4.3	Environmental design	24
6.4.4	Electrical design	24
6.4.5	Fire protection	25
6.4.6	Water infiltration	25
6.4.7	Access	25
6.5	Computer room requirements	25
6.5.1	General	25
6.5.2	Location	26
6.5.3	Environmental design - HVAC	26
6.5.4	Electrical design	26
6.6	Entrance room requirements.....	26
6.6.1	General	26

6.6.2	Location	26
6.6.3	Quantity	26
6.6.4	Entrance conduit routing under access floor	27
6.6.5	Access provider and service provider spaces	27
6.6.6	Building entrance terminal	27
6.6.7	Architectural design	27
6.7	Main distribution area	28
6.7.1	General	28
6.7.2	Location	28
6.7.3	Facility requirements	28
6.8	Intermediate distribution area	28
6.8.1	General	28
6.8.2	Location	29
6.8.3	Facility requirements	29
6.9	Horizontal distribution area	29
6.9.1	General	29
6.9.2	Location	29
6.9.3	Facility requirements	29
6.10	Zone distribution area	29
6.11	Equipment distribution areas	29
6.12	Telecommunications room	30
6.13	Data center support areas	30
6.14	Cabinets and racks	30
6.14.1	General	30
6.14.2	"Hot" and "cold" aisles	30
6.14.3	Placement relative to floor tile grid	31
6.14.4	Access floor tile cuts	31
6.14.5	Installation of racks on access floors	32
6.14.6	Racks and cabinets in entrance room, MDAs, IDAs and HDAs	32
7	DATA CENTER CABLING SYSTEMS	33
7.1	General	33
7.2	Choosing media	33
7.2.1	General	33
7.2.2	Cable fire rating requirements	33
7.3	Horizontal Cabling	33
7.3.1	General	33
7.3.2	Topology	34
7.3.3	Horizontal cabling length	34
7.3.4	Direct attach cabling	34
7.3.5	Recognized media	35
7.3.6	Optical fiber connectors	35
7.3.7	Coaxial cable connectors	35
7.4	Backbone cabling	36
7.4.1	General	36
7.4.2	Topology	36
7.4.3	Redundant cabling topologies	37
7.4.4	Recognized media	37
7.4.5	Optical fiber connectors	38
7.4.6	Coaxial cable connectors	38
7.4.7	Backbone cabling lengths	38
7.5	Centralized optical fiber cabling	38
7.5.1	General	38
7.5.2	Implementation	38
7.6	Cabling transmission performance and test requirements	38
7.6.1	General	38

7.6.2	Additional requirements for field testing of 75-ohm coaxial cabling	38
8	DATA CENTER CABLING PATHWAYS	40
8.1	General.....	40
8.2	Security for data center cabling	40
8.3	Routing of telecommunications cables	40
8.3.1	Separation between power or lighting and balanced twisted-pair cables.....	41
8.3.2	Separation of fiber and balanced twisted-pair cabling	41
8.4	Telecommunications entrance pathways.....	41
8.4.1	Entrance pathway types	41
8.4.2	Diversity	41
8.4.3	Sizing	41
8.5	Access floor systems	42
8.5.1	General	42
8.5.2	Access floor performance requirements	42
8.5.3	Floor tile cut edging.....	42
8.6	Cable trays	42
8.6.1	General	42
8.6.2	Cable trays in access floor systems	43
8.6.3	Overhead cable trays.....	43
8.6.4	Coordination of cable tray routes.....	43
9	DATA CENTER REDUNDANCY	44
9.1	Introduction	44
9.2	Redundant maintenance holes and entrance pathways.....	45
9.3	Redundant access provider services	45
9.4	Redundant entrance room	45
9.5	Redundant main distribution area	46
9.6	Redundant backbone cabling	46
9.7	Redundant horizontal cabling	46
10	CABLING INSTALLATION REQUIREMENTS	46
11	CABLING TRANSMISSION PERFORMANCE REQUIREMENTS	46
12	CABLING FOR INTELLIGENT BUILDING SYSTEMS	46
13	CABLING FOR WIRELESS ACCESS POINTS	46
14	CABLING FOR DISTRIBUTED ANTENNA SYSTEMS.....	46
15	POWER DELIVERY OVER BALANCED TWISTED-PAIR CABLING	46
16	GROUNDING AND BONDING.....	46
17	FIRESTOPPING	47
18	PHYSICAL SECURITY	47
19	ADMINISTRATION.....	47
ANNEX A	(INFORMATIVE) CABLING DESIGN CONSIDERATIONS.....	49
A.1	Application cabling lengths.....	49
A.1.1	T-1, E-1, T-3 and E-3 circuit lengths.....	49
A.1.2	Baluns E-3 and T-3 circuits.....	51

A.1.3	TIA-232 and TIA-561 console connections	52
A.2	Cross-connections	53
A.3	Separation of functions in the main distribution area	53
A.3.1	Twisted-pair main cross-connect	53
A.3.2	Coaxial main cross-connect	53
A.3.3	Optical fiber main cross-connect	53
A.4	Separation of functions in the horizontal distribution area	54
A.5	Cabling to end equipment	54
A.6	Fiber design consideration	54
A.7	Balanced twisted-pair design consideration	54
ANNEX B	(INFORMATIVE) ACCESS PROVIDER INFORMATION	55
B.1	Access provider coordination	55
B.1.1	General	55
B.1.2	Information to provide to access providers	55
B.1.3	Information that the access providers should provide	55
B.2	Access provider demarcation in the entrance room	56
B.2.1	Organization	56
B.2.2	Demarcation of low-speed circuits	56
B.2.3	Demarcation of T-1 circuits	59
B.2.4	Demarcation of E-3 & T-3 circuits	59
B.2.5	Demarcation of optical fiber circuits	60
ANNEX C	(INFORMATIVE) COORDINATION OF EQUIPMENT PLANS WITH OTHER ENGINEERS	61
ANNEX D	(INFORMATIVE) DATA CENTER SPACE CONSIDERATIONS	62
ANNEX E	(INFORMATIVE) DATA CENTER SITE SELECTION AND BUILDING DESIGN CONSIDERATIONS	63
E.1	General	63
E.2	Architectural site selection and building design considerations	63
E.3	Electrical site selection and building design considerations	63
E.4	Mechanical site selection and building design considerations	64
E.5	Telecommunications site selection and building design considerations	64
E.6	Security site selection and building design considerations	64
E.7	Other site selection considerations	65
ANNEX F	(INFORMATIVE) DATA CENTER INFRASTRUCTURE RATING	66
F.1	General	66
F.1.1	Redundancy overview	66
F.1.2	Overview	66
F.2	Redundancy	66
F.2.1	N - Base requirement	66
F.2.2	N+1 redundancy	67
F.2.3	N+x redundancy	67
F.2.4	2N or N+N redundancy	67
F.2.5	2(N+1) redundancy	67
F.2.6	Concurrent maintainability and testing capability	67
F.2.7	Fault tolerant	67
F.2.8	Capacity and scalability	67
F.2.9	Isolation	67
F.2.10	Data center rating	67
F.3	Telecommunications	68
F.3.1	I Data Center: Basic (telecommunications)	68
F.3.2	II Data Center: Redundant Component (telecommunications)	69

F.3.3	III Data Center: Concurrently Maintainable (telecommunications).....	69
F.3.4	IV Data Center: Fault Tolerant (telecommunications)	70
F.4	Architectural and structural	71
F.4.1	General	71
F.4.2	I Data Center: Basic (architectural).....	71
F.4.3	II Data Center: Redundant Component (architectural).....	71
F.4.4	III Data Center: Concurrently Maintainable (architectural)	71
F.4.5	IV Data Center: Fault Tolerant (architectural).....	71
F.5	Electrical.....	71
F.5.1	I Data Center: Basic (electrical)	71
F.5.2	II Data Center: Redundant Component (electrical)	72
F.5.3	III Data Center: Concurrently Maintainable (electrical).....	72
F.5.4	IV Data Center: Fault Tolerant (electrical).....	73
F.6	Mechanical systems.....	73
F.6.1	I Data Center: Basic (mechanical).....	73
F.6.2	II Data Center: Redundant Component (mechanical)	73
F.6.3	III Data Center: Concurrently Maintainable (mechanical).....	74
F.6.4	IV Data Center: Fault Tolerant (mechanical).....	74
ANNEX G	(INFORMATIVE) DATA CENTER DESIGN EXAMPLES	88
G.1	Small data center design example	88
G.2	Corporate data center design example.....	89
G.3	Internet data center design example.....	91
ANNEX H	(INFORMATIVE) CABLING GUIDELINES FOR DATA CENTER FABRICS	94
H.1	Traditional Switch Architecture	94
H.2	Multiple Connections.....	96
H.3	Data Center Switch Fabrics	97
H.3.1	Data center fabric fat-tree	97
H.3.2	Data center fabric full-mesh.....	101
H.3.3	Data center fabric inter-connected meshes	103
H.3.4	Data center fabric centralized switch	104
H.3.5	Data center fabric virtual switch.....	106
ANNEX I	(INFORMATIVE) BIBLIOGRAPHY	108