

ANSI/BICSI 007-2017

Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises

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**Committee Approval: June 2017
ANSI Final Action: June 29, 2017
First Published: August 2017**



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PREFACE

Revision History

August 12, 2017 First publication of this standard, titled ANSI/BICSI 007-2017, *Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises*

Translation Notice

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1 Introduction

1.1 General

An intelligent building, or premise, utilizes communication technology to integrate building systems, allowing for intersystem connection and coordination that provides an environment which is safer, more comfortable, productive or efficient. As innovation occurs, systems and applications that have not been traditionally connected to a data or telecommunications network are now utilizing Ethernet and network infrastructure as a means to provide new or expanded functions or as an additional or alternative infrastructure solution. Also, given the increased use of information communication technology (ICT) transmission media (e.g., balanced twisted-pair, optical fiber, wireless) within these systems, the design and implementation methodology based on the historical practice of using legacy, proprietary or application specific cabling systems such as one or two pair solid copper conductor wire is now insufficient.

1.2 Purpose

This standard is intended to be used for any size building, and can be applied to residential and businesses (premises) in all markets. This standard is written for use in the design and implementation of the structured cabling systems used to support building or premise systems which can be integrated through the use of common infrastructure.

This standard may be used to determine design requirements in conjunction with the system owner, occupant, or other project consultants. This standard provides a reference of common technology and design practices, but is not intended to be used by design professionals as their sole reference or as a step-by-step design guide.

1.3 Categories of Criteria

Two categories of criteria are specified - mandatory and advisory.

- Mandatory criteria generally apply to protection, performance, administration, and compatibility; they specify the absolute minimum acceptable requirements.
- Advisory or desirable criteria are presented when their attainment will enhance the general performance of the building system infrastructure in all its contemplated applications.

Mandatory requirements are designated by the word *shall*; advisory recommendations are designated by the words *should*, *may*, or *desirable*, which are used interchangeably in this standard. When possible, recommendations and requirements were separated to aid in clarity.

2 Scope

This standard applies to building systems that utilize information communication technology components, systems and infrastructure to interconnect and share information between building systems. Examples of these systems include, but are not limited to:

- Building automation and management
- Energy and electrical power management
- Lighting
- Audio and video systems (e.g., digital signage, notification)
- Electronic safety and security (ESS) systems

The performance specifications for building systems are not offered in this standard unless they relate to the structured cabling system or other supporting systems requirements and recommendations found within this standard.

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3 Required Standards and Documents

The following standards and documents contain provisions that constitute requirements listed within this standard. Unless otherwise indicated, all standards and documents listed are the latest published version prior to the initial publication of this standard. Parties to agreement based on this standard are encouraged to investigate the possibility of applying a more recent version as applicable.

Where equivalent local codes and standards exist, requirements from these local specifications shall apply. Where reference is made to a requirement that exceeds minimum code requirements, the specification requirement shall take precedence over any apparent conflict with applicable codes.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

- ANSI/ASHRAE/IES Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*

BICSI

- ANSI/NECA/BICSI 607, *Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings*
- ANSI/BICSI 003, *Building Information Modeling (BIM) Practices for Information Technology Systems*
- ANSI/BICSI 005, *Electronic Safety and Security (ESS) System Design and Implementation Best Practices*
- ANSI/BICSI 006, *Distributed Antenna System (DAS) Design and Implementation Best Practices*

British Standards Institution (BSI)

- BS 6701, *Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance*
- BS 7671, *Requirements for Electrical Installations. IET Wiring Regulations*

Canadian Standards Association

- C22.1, *Canadian Electrical Code, Part I, Safety Standard For Electrical Installations*
- Z8000, *Canadian Health Care Facilities - Planning, Design and Construction*

European Committee for Electrotechnical Standardization (CENELEC)

- EN 50173-1, *Information technology—Generic cabling systems—Part 1: General requirements*
- EN 50174-1, *Information technology—Cabling installation—Installation specification and quality assurance*
- EN 50174-2, *Information technology—Cabling installation—Installation planning and practices inside buildings*

Institute of Electrical and Electronics Engineers (IEEE)

- IEEE 802.3, *IEEE Standard for Ethernet*

International Electrotechnical Commission (IEC)

- IEC 60364-4-43, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*
- IEC 60364-5-52, *Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

International Organization for Standardization (ISO)

- ISO/IEC 11801-1, *Generic cabling for customer premises – Part 1: General requirements*
- ISO/IEC 11801-6, *Generic cabling for customer premises – Part 6: Distributed building services*
- ISO/IEC 14763-2, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*
- ISO/IEC 18598, *Information technology – Automated infrastructure management (AIM) systems – Requirements, data exchange and applications*
- ISO/IEC 30129, *Information Technology – Telecommunications bonding networks for buildings and other structures*

National Fire Protection Association (NFPA)

- NFPA 70[®], *National Electrical Code[®] (NEC[®])*
- NFPA 72[®], *National Fire Alarm Code*
- NFPA 99, *Health Care Facilities Code*
- NFPA 101[®], *Life Safety Code[®]*

Telecommunication Industry Association (TIA)

- ANSI/TIA-526-7-A, *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement*
- ANSI/TIA-526-14-C, *Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fibre-Optic Communications Subsystem Test Procedure – Part 4-1: Installed Cable Plant – Multimode Attenuation Measurement*
- ANSI/TIA-568.0-D, *Generic Telecommunications Cabling for Customer Premises*
- ANSI/TIA-568.1-D, *Commercial Building Telecommunications Cabling Standard*
- ANSI/TIA-568-C.2, *Balanced Twisted-Pair Telecommunications Cabling and Components Standard*
- ANSI/TIA-568.3-D, *Optical Fiber Cabling and Components Standard*
- ANSI/TIA-569-D, *Telecommunications Pathways and Spaces*
- ANSI/TIA-606-C, *Administration Standard for Telecommunications Infrastructure*
- ANSI/TIA-607-C, *Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises*
- ANSI/TIA-758-B, *Customer-Owned Outside Plant Telecommunications Infrastructure Standard*
- ANSI/TIA-862-B, *Structured Cabling Infrastructure Standard For Intelligent Building Systems*
- ANSI/TIA-1005-A, *Telecommunications Infrastructure Standard for Industrial Premises*
- ANSI/TIA-1152-A, *Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling*
- ANSI/TIA-5017, *Telecommunications Physical Network Security Standard*
- ANSI/TIA-5048, *Automated Infrastructure Management (AIM) Systems – Requirements, Data Exchange and Applications*

4 Definitions, Acronyms, Abbreviations, and Units of Measurement

4.1 Definitions

For the purposes of this document, the following terms and definitions apply. Some terms and definitions may also be represented by an acronym as listed in Section 4.2.

above finished floor	The standard mounting height or vertical distance for a fixture, ceiling, device, or any other object measured from the finished floor surface to the center line of the object as the measurement point.
acceptance test	A test or set of tests performed to demonstrate satisfactory completion of a predetermined task or group of tasks on which acceptance is dependent.
as-built drawing	See <i>record drawing</i>
backbone	(1) A facility (e.g., pathway, cable, conductors) between any of the following spaces: telecommunications rooms (TRs), common TRs, floor-serving terminals, entrance facilities, equipment rooms, and common equipment rooms (CER). (2) In a data center, a facility (e.g., pathway, cable, conductors) between any of the following spaces: entrance rooms or spaces, main distribution areas, intermediate distribution areas, horizontal distribution areas, and TRs.
backbone cabling	See <i>backbone</i> .
building automation system	A control system comprised of hardware (e.g., controllers, cabling, input/output devices) and a software application or suite of software applications that automate the electrical and mechanical subsystems.
building management system	A system that provides centralized monitoring of two or more building systems that are typically controlled by a building automation system (BAS). A building management system (BMS) may also provide control functionality of the individual BAS systems.
campus	(1) The buildings and grounds having legal contiguous interconnection (e.g., college, university, industrial park, military installation). (2) A premise containing one or more buildings.
channel	The complete transmission path between two pieces of application-specific equipment.
component	Any part or subassembly of devices used in the construction of a system.
coverage area	The area or space served by a device.
coverage area cable	A cable that is used to connect a building system (e.g., building automation, electronic security) device to a service outlet or horizontal connection point.
cross-connect	A facility enabling the termination of cabling elements and their interconnection or cross-connection.
device	A general term given to the components of a system which perform one or more functions (e.g., detection, measurement, observation), but do not provide system management or complex control functionality.
direct connection	A connection method in which the horizontal cabling supporting a device may directly attach or connect the device through a connectorized cable or hard-wired termination, eliminating the need for an equipment cord and corresponding telecommunications or service outlet.
display	A device that shows images, text, or other content by converting analog or digital signals into visible form.

egress	A point or means of exit from a building, property, or location.
equipment cord	A length of cable with connectors on both ends used to join active equipment directly to other active equipment or the cabling infrastructure.
equipment outlet	A generic term for the outermost connection facility in a hierarchical star topology. An equipment outlet is commonly classified as a telecommunication outlet or a service outlet.
equipment room (telecommunications)	An environmentally controlled centralized space for telecommunications and data processing equipment with supporting communications connectivity infrastructure.
electronic safety and security system	Systems that utilize analog and digital transmission of data in addition to mechanical or electrical methods to enhance the safety and security of a facility.
fire detection	The means of detecting the occurrence of heat, smoke or other particles or products of combustion.
firestop	The products, materials and methods used to seal penetrations of a fire resistive barrier that maintains the compartmentation in a building and limits the size and spread of fire and controls the movement of smoke.
gateway	An internetworking service used to connect dissimilar applications running on different networks with different telecommunication protocols. Gateways normally operate at one or more of the top four layers of the Open Systems Interconnection (OSI) Reference Model.
horizontal cabling	(1) The cabling between and including the telecommunications outlet and connector and the horizontal cross-connect. (2) The cabling between and including the building automation system outlet or the first mechanical termination of the horizontal connection point and the horizontal cross-connect. (3) Within a data center, horizontal cabling is the cabling from the horizontal cross-connect (in the main distribution area or horizontal distribution area) to the outlet in the equipment distribution area or zone distribution area.
horizontal connection point	A connection point within horizontal cabling that is placed between the telecommunication room (TR) and equipment outlets or devices supporting intelligent building systems.
horizontal cross-connect	A cross-connect of horizontal cabling to other cabling (e.g., backbone cabling, active equipment).
hybrid cable	An assembly of two or more cables, of the same or differing types of media, categories designation, etc., covered by one overall sheath.
interoperability	The ability of two or more systems to communicate and exchange data, while allowing any of the participating systems to use the exchanged information.
infrared	electromagnetic radiation at frequencies just below visible light; i.e., 300 GHz to 430 THz (wavelengths of 1 mm to 700 nm).
intelligent building	A term given to a building or premise that utilizes communication technology to integrate building systems, allowing for intersystem coordination that provides an environment which is safer, more comfortable, productive or efficient.
Listed	Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction (AHJ), that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states either the equipment, material or services meets appropriate standards or has been tested and found suitable for use in a specified manner.
media (telecommunications)	Wire, cable, or conductors used for telecommunications.

media converter	A device that converts from one type of media to another. Typically referring to a hardware device that connects different transmission media (i.e., from balanced twisted-pair to coax or from balanced twisted-pair to optical fiber).
modified permanent link	The permanently installed portion of horizontal cabling, excluding cords (e.g., test, equipment, patch) that supports a direct connection.
modular plug	The insert (“male”) element of a telecommunications connector that may be keyed or unkeyed, typically has six or eight contact positions, of which not all the positions need to be equipped with contacts. A modular plug is named for the number of position and contacts it has (e.g., 8P8C for 8 positions, 8 contacts). NOTE 1: The receptacle that a modular plug is inserted into is named a <i>modular jack</i> . NOTE 2: Some specific configurations of a modular plug may be termed as a <i>registered jack</i> or <i>RJ##</i> . An example is a RJ45, which is equivalent to an 8P8C configuration.
panel	An electrical device consisting of an enclosure, box or surface that may contain switches, dials, displays or meters for controlling or monitoring other electrical devices.
patch panel	A connecting hardware system that facilitates cable termination and cabling administration using patch cords.
pathway (telecommunications)	A facility for the placement of telecommunications cable.
permanent link	The permanently installed portion of horizontal cabling, excluding cords (e.g., test, equipment, patch).
proprietary	A characteristic of a technique, technology, or device which is owned and controlled by a company or other party and is thereby only usable or adaptable as allowed by that party and not deemed to achieve interoperability.
raceway	An enclosed channel of metal or nonmetallic materials designed expressly for holding wires or cables. Raceways include, but are not limited to: rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquid tight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways. NOTE: Cable tray is not considered a type of raceway.
record drawing (as built)	The revised set of drawings submitted by a contractor or other identified party upon completion of a project or a particular job. Record drawings reflect all changes made in the specifications and working drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the work completed.
service outlet	An outlet that is used to connect a device or equipment to the ICT infrastructure. Service outlets are typically used by building systems and equipment that are not subject to occasional or frequent disconnections and relocations.
supervisory control and data acquisition system	A control system composed of programmable logic controllers (PLCs), data input to the PLCs, custom software, and electrically operated circuit breakers in the distribution gear, that allows automatic operation and monitoring of the electrical system through control panel workstations.
space (telecommunications)	An area whose primary function is to house the installation and termination of telecommunications equipment and cable (e.g., equipment room, telecommunications room, entrance facility).

telecommunications	Any transmission, emission, and reception of information (e.g., symbols, signals, writings, images, sounds) by cable, radio, optical, or other electromagnetic systems.
telecommunications connector	The receptacle and insertion elements which provide a means of aligning, attaching and achieving continuity between the conductors and optical fibers used within telecommunication and information communication and technology (ICT) applications.
telecommunications outlet	An assembly of which consists of a faceplate, body, housing, or supporting bracket, and one or more receptacles or jacks of a telecommunication connector. Telecommunications outlets are typically located to provide ease of connection for communication and data equipment (e.g., computer, phone).
telecommunications room	A telecommunications space that differs from equipment rooms and entrance facilities in that this space is generally considered a floor-serving or tenant-serving (as opposed to building- or campus-serving) space that provides a connection point between backbone and horizontal cabling.
termination	The physical connection of a conductor to connecting hardware.
topology	The physical or logical arrangement of a system.
uninterruptible power supply	A system that provides a continuous supply of power to a load, utilizing stored energy when the normal source of energy is not available or is of unacceptable quality. A UPS will provide power until the stored energy of the system has been depleted, or when the acceptable quality of either an alternative source of power (e.g., generator) or the normal source of power becomes available.
zone cabling	A design methodology that utilizes a connection point centrally located within areas with higher densities of telecommunications outlets and devices being served.

4.2 Acronyms and Abbreviations

Abbreviations and acronyms, other than in common usage, are defined below.

AC	alternating current	IP	Internet protocol
AFF	above finished floor	IR	infrared
AHJ	authority having jurisdiction	LAN	local area network
AIM	automated infrastructure management	LCM	lighting control module
A/V	audio/visual	LED	light emitting diode
AWG	American wire gauge	PDS	protected distribution system
BAS	building automation system	PoE	power over Ethernet
BIM	building information modeling	PON	passive optical network
BMS	building management system	RF	radio frequency
CATV	community antenna television	RFID	radio frequency identification
DAS	distributed antenna system	RTLS	real time location system
DALI	digital addressable lighting interface	SCADA	supervisory control and data acquisition
DC	direct current	SNMP	simple network management protocol
DDC	direct digital control	SO	service outlet
EF	entrance facility	TCP/IP	transmission control protocol/internet protocol
EMI	electromagnetic interference	TE	telecommunications enclosure
EMS	energy management systems	TR	telecommunications room
ER	equipment room	UPS	uninterruptible power supply
ESS	electronic safety and security	WAN	wide area network
HCP	horizontal connection point	WAP	wireless access point
HDTV	high definition television	Wi-Fi	wireless fidelity wireless internet
HVAC	heating, ventilation, and air conditioning	WLAN	wireless local area network
I/O	input/output		
ICT	information communication and technology		

4.3 Units of Measurement

The units of measurement used in this standard are metric. Approximate conversions from metric to U.S. customary units are provided in parentheses; e.g., 100 millimeters (4 inches).

Units of measurement used in this standard are defined below:

°C	degree Celsius	kWh	kilowatt-hour
°F	degree Fahrenheit	lbf	pound force
A	ampere	m	meter
ft	foot	m ²	square meter
ft ²	square foot	MHz	megahertz
H	hour	mm	millimeter
Hz	hertz	N	newton
in	inch	VAC	volt alternating current
kVA	kilovolt-ampere	VDC	volt direct current
kW	kilowatt	W	watt

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5 Communications Infrastructure

5.1 Overview

Intelligent building systems may either share the collective set of cabling system components, cabling pathways, and related telecommunications spaces with a traditional voice/data ICT network or use separate dedicated networks operating in parallel. Regardless of the way these systems are deployed, telecommunications cabling infrastructure standards and telecommunications cabling installation best practices should be followed.

The basic elements of the communications infrastructure are the following:

- Topology
- Spaces
 - Equipment room (ER)
 - Telecommunications room (TR)
 - Telecommunications enclosure (TE)
- Cabling
 - Backbone cabling
 - Horizontal cabling
- Cabling pathways
- Telecommunications outlet (TO) or service outlet (SO)
- Coverage areas

This section addresses the best practices for the installation of a telecommunications infrastructure for intelligent building and premises systems to support a wide range of applications.

Telecommunications infrastructure should follow the requirements of telecommunications cabling standards. However, because cabling for many intelligent building devices are often application-specific there will be exceptions that need to be applied to these standards. When applying specific applications to these cabling systems, the user is cautioned to consult existing application standards, regulations, equipment vendors, and system and service suppliers for applicability, limitations, and ancillary requirements.

5.2 Topology

5.2.1 Requirements

The topology for horizontal and backbone cabling shall be a hierarchical star as per applicable standards (e.g., ISO/IEC 11801-6, ANSI/TIA-862-B).

NOTE: See Figure 5-1 for an example of a hierarchical star topology.

5.2.2 Recommendations

Ancillary systems cabling can be configured using additional topologies, such as those shown in Figure 5-2, depending on the application requirements. For example, ancillary systems may require application-specific cabling (e.g., coaxial cabling, two-pair balanced twisted-pair).

5.3 Spaces

5.3.1 Equipment Rooms

5.3.1.1 Introduction

Equipment rooms (ERs) provide connections between main system (headend) equipment and backbone cabling (the main cross-connect). Equipment rooms are considered to be distinct from telecommunications rooms because of the nature or complexity of the equipment they contain.

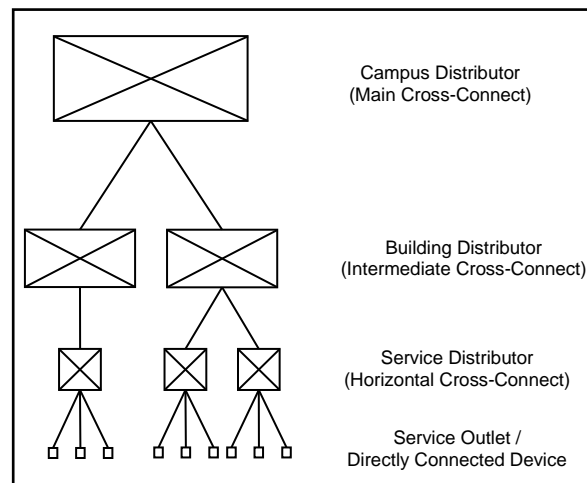


Figure 5-1
Hierarchical Star Topology