STANDARDS

a BICSI International Standard

ANSI/BICSI 002-2019

Data Center Design and Implementation Best Practices

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ANSI/BICSI 002-2019

Data Center Design and Implementation Best Practices

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PREFACE

Revision History

June 18, 2010 First publication of this standard, titled BICSI 002-2010, *Data Center Design and Implementation Best Practices*

March 15, 2011 Revision of BICSI 002-2010 published as ANSI/BICSI 002-2011, *Data Center Design and Implementation Best Practices*

Major revisions include:

- Addition of Section 9, *Electrical*
- Addition of Section 14, *Telecommunications*

Minor revisions include: definitions, updating of graphics for printing and readability, other editorial corrections

December 9, 2014 Revision of ANSI/BICSI 002-2011 published as ANSI/BICSI 002-2014, *Data Center Design and Implementation Best Practices*

Major revisions include:

- Revision of Class F0 – F4 electrical infrastructure, including the removal of the requirement for a second power utility connection in Section 9, *Electrical*.
- Revised telecommunications Availability Classes C3 and C4 concerning the redundancy of main and horizontal distributors in Section 14, *Telecommunications*.
- Added, expanded and revised Availability Class structure to mechanical, telecommunications and network infrastructure (see Sections 9, 14, and 15 respectively).
- Addition of Appendix C, Alignment of Data Center Services Reliability with Application and System Architecture.
- Addition and revision of content for modular and containerized data centers in Section 6, *Space Planning* and Section 9, *Electrical*.
- Introduced content on DCIM and renamed Section 13 to *Data Center Management and Building Systems.*
- Expanded content regarding DC power and safety in Section 9, *Electrical.*
- Addition of hot and cold aisle containment in Section 6, *Space Planning* and Section 11, *Fire Protection*.
- Added and expanded content regarding designing for energy efficiency in multiple sections and added Appendix G, *Design for Energy Efficiency.*
- Addition of Appendix D, Data Center Services Outsourcing Models.
- Addition of Appendix E, Multi-Data Center Architecture.
- Updated cabinet door air flow and cable capacity calculations in Section 14, *Telecommunications.*

Minor revisions include:

- Moved former Section 5, *Space Planning* to directly after former Section 6, *Site Planning*.
- Restructuring of Section 5, *Site Planning*, Section 14, *Telecommunications*, and Section 16, *Commissioning*.
- Expansion of content to reflect both new and international design practices.
- Revisions to Appendix B, *Reliability and Availability*, to accommodate extension of availability classes.
- Update Section 8, *Structural*, to align with revisions to the *IBC* and related standards.

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- Updated Section 10, *Mechanical*, to reflect expanded ASHRAE guidelines for temperature and humidity.
- Updated Section 11, *Fire Protection* section to reflect changes in NFPA 75 and NFPA 76.
- Updated Section 14, *Telecommunications*, to reflect updates to ISO, TIA, and CENELEC data center cabling standards including cable types (removed OM1 and OM2, recommend OM4, added Category 8) and addition of intermediate distributor.
- Revised content regarding zinc whiskers and moved to Section 7, *Architectural*.
- Added content on testing equipment, system testing, acceptance testing, equipment operations and maintenance manuals, and system training to Section 16, *Commissioning*.
- Revised and moved system availability information to Appendix B, *Reliability and Availability*. (content formerly in Section 17, *Maintenance*).
- Added new content on maintenance plans and service contracts in Section 17, *Maintenance.*
- General content relocation and editorial corrections to improve readability and reduce ambiguity.

May 1, 2019 Revision of ANSI/BICSI 002-2014 published as ANSI/BICSI 002-2019, *Data Center Design and Implementation Best Practices*

Notable content relocation to BICSI 009-2019 includes:

- Operational security topics from Section 12*, Security*
- Operational maintenance topics from Section 17*, Data Center Maintenance*

Major revisions include:

- Revision and addition of content for, and related to, equipment cabinets and racks, including open racks and Open Compute Project® infrastructure within multiple sections
- Revision of computer room requirements and recommendations in Section 6, *Space Planning*
- Expansion of electrical busway content in multiple sections
- General restructure, including an update and expansion to heat rejection and cooling system technologies in Section 10, *Mechanical Systems*
- Restructure of Section 12, *Security*
- Title change of Section 13 to *Facility, Ancillary and IP-enabled Systems*, with addition of applicable content
- Revision and expansion of Section 16, *Commissioning*
- Addition of Appendix H, *Colocation Technical Planning*

Minor revisions include:

- Additions or revisions to airports volcanoes, and microgrids in Section 5, *Site Selection*
- Revision of access control and video surveillance systems within multiple sections
- Expansion of equipment access and pathway (e.g., ramps) requirements and recommendations within Section 6, *Space Planning* and Section 7, *Architectural*
- Update to access floors requirements for seismically active areas in Section 8, *Structural*
- Addition of lithium ion (Li-ion) batter information within multiple sections
- Alignment of telecommunications bonding and grounding terminology to international usage in Section 9, *Electrical Systems*
- Revision of equipment cabinet and rack bonding in Section 9, *Electrical Systems*
- Addition of oxygen deletion systems and fire alarm systems and an update to gaseous fire suppression systems in Section 11, *Fire Protection*
- Addition of time synchronization in Section 12, *Security*
- Expansion of content related to entrance facilities, entrance rooms, and meet-me rooms in multiple sections
- Addition of ICT infrastructure requirements for supporting and non-computer room systems
- Revision to permissible backbone and horizontal cabling media and addition of optical fiber connector cleaning in Section 14, *Telecommunications Cabling, Infrastructure, Pathways and Spaces*

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- Expansion of network topologies and fabrics in Section 15, *Information Technology*
- Addition of maintenance plan philosophies in Section 17, *Data Center Maintenance*
- Addition of existing facility assessments to *Appendix A, Design Process*
- General content relocation and editorial corrections to improve readability and reduce ambiguity

Document Format (Usability Features)

This standard has the following usability features as aids to the user:

- Additions and changes, other than those for editorial purposes, are indicated with a vertical rule within the left page margin.
- Deletion of one or more paragraphs is indicated with a bullet (•) between the content that remains

NOTE: The relocation of content within or between sections (e.g., Section 10, *Mechanical Systems*, Section 12, *Security*) related to structure, readability, or content alignment is not indicated.

Translation Notice

This standard may have one or more translations available as a reference for the convenience of its readers. As that act of translation may contain inconsistencies with the original text, if differences between the translation and the published English version exist, the English text shall be used as the official and authoritative version.

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1 Introduction

1.1 General

This standard is written with the expectation that the reader is familiar with the different facets of the design process (See Appendix A). The reader should understand from which role and point of view he or she intends to use this document (e.g., information technology, facilities, other corporate internal or external to the owner). Refer to Sections 1.2.1 – 1.2.3 below.

1.2 Purpose

This standard provides a reference of common terminology and design practice. It is not intended to be used by architects and engineers as their sole reference or as a step-by-step design guide, but may be used by such persons to determine design requirements in conjunction with the data center owner, occupant, or consultant.

This standard is intended primarily for:

- Data center owners and operators
- Telecommunications and information technology (IT) consultants and project managers
- Telecommunications and IT technology installers

Additionally, individuals in the following groups are also served by this standard.

1.2.1 Users Within IT

1.2.1.1 IT and Telecommunications Designers

IT and telecommunications designers and consultants may use BICSI 002 in conjunction with the appropriate local telecommunications infrastructure standard (e.g., ANSI/TIA-942-B, AS/NZS 2834-1995 Computer Accommodation, CENELEC EN 50173 Series, ISO/IEC 24764) to design the telecommunications pathways, spaces, and cabling system for the data center. The telecommunications designer/consultant should work with the data center architects and engineers to develop the IT and telecommunications equipment floor plan using guidelines specified in this standard.

1.2.1.2 IT and Telecommunications Management

IT and telecommunications management may use BICSI 002 as an aid in defining initial data center design requirements based on required levels of security, reliability, and availability. IT and telecommunications should work with information protection management, the business continuity group, and end user departments to determine the required levels of security, reliability, and availability.

1.2.1.3 IT Operations Management

Working with facilities groups, IT operations managers may use BICSI 002 to guide the requirements they specify to outsource suppliers who provide computing services and server room IT operations.

1.2.1.4 Information Security

Information security personnel may use BICSI 002 as a guide in defining and implementing information protection and security and assisting in the development of standard policies and operating procedures.

1.2.2 Users Within Facilities Group

1.2.2.1 Technical Representatives Within Facilities Group Capital Projects

Facilities group technical representatives may use BICSI 002 as a guide during the project planning phase as they estimate costs, prepare preliminary design and construction schedules, and prepare requests for professional services (RFPS) for the design and construction of new or renovated IT facilities. Thus, after the method of project delivery is determined, BICSI 002 becomes a referenced document in the RFPS that the facilities group prepares and issues to architecture and engineering (A/E) and design-build (D/B) firms. These companies, in turn, bid on the design and construction of the IT facilities.

1.2.2.2 Facilities Management Representatives Within Facilities Group

Facilities operations and management may use BICSI 002 as a guide in planning the operation and maintenance of corporate IT facilities so that these facilities maintain defined levels of reliability and availability. For example, BICSI 002 provides guidance in defining training needs and maintenance schedules of critical equipment for operations and maintenance personnel.

1.2.3 Staff Outside IT and Facilities Groups

1.2.3.1 Physical Security Management

Security staff responsible for physical security management may use BICSI 002 as a guide in determining physical security and fire protection system requirements for IT facilities.

1.2.3.2 External Resources

1.2.3.2.1 Telecommunications Consulting Firms

BICSI 002 is useful to telecommunications consulting firms or design/build installation firms by providing guidance in the design and construction of IT facilities for the corporation.

1.2.3.2.2 A/E and Construction Firms

BICSI 002 is useful to A/E and construction firms to guide them in the process of design and construction of IT facilities. It provides a reference of common terminology and reliability topologies. It is not intended to be used by A/E and construction firms as their sole reference, and it is not meant to provide a step-by-step design guide for the A/E or D/B firms; however, it may be used by such persons to guide design requirements in conjunction with the data center owner, occupant, or consultant.

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 data center 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. Where possible, requirements and recommendations were separated to aid in clarity.

Notes, cautions and warnings found in the text, tables, or figures are used for emphasis or for offering informative suggestions.

2 Scope

This standard provides best practices and implementation methods that complement TIA, CENELEC, ISO/IEC and other published data center standards and documents. It is primarily a design standard, with installation requirements and guidelines related to implementing a design. The standard includes other installation requirements and guidelines for data centers where appropriate.