

NEW MISSION CRITICAL TENANT FIT-OUT USING DESIGN-BUILD PROJECT DELIVERY

Project Delivery Method: Design-Build (D-B)

Owner Team: Data center building owner, owner representative consultant, in-house facility manager, and data center operations manager.

Project Delivery Team: D-B project manager; mechanical-electrical coordinator; architect; and HVAC plumbing, fire protection, electrical, tele-communication, and security consultants.

HVAC Project Team: Project manager; job superintendent, computer room air conditioning (CRAC) equipment manufacturer and technician; piping and sheet metal foremen; a building automation system (BAS) technician; a third-party commissioning consultant (CxC); and a third-party testing, adjusting, and balancing technician.

OWNER'S BUILDING PROGRAM

Application:

- ASHRAE 2019 HVAC Applications, Chapter 19, "Data Centers and Telecommunications Facilities."

Project Type:

- Tenant fit out of 24,000 square feet with 18 inch high raised computer flooring.

References:

- 2019 ASHRAE Handbook – HVAC Applications and 2020 ASHRAE Handbook – HVAC Systems and Equipment. Refer to the "Codes & Standards" section in the back of each ASHRAE Handbook for more information.

Other References:

- ASHRAE UFAD Guide and O&M Guide Set; ASHRAE Humidity Control Design Guide for Commercial & Institutional Buildings; ASHRAE Standards 15 & 34 (refrigeration); ASHRAE Standard 90.1 (minimum energy standards); ASHRAE Standard 90.4 (energy standards for data centers); ASHRAE Standard 202 (commissioning process for buildings & systems); Design-Build Institute of America (DBIA); Association of Energy Engineers (AEE); and the Association of Facilities Engineering (AFE).

DESIGN INTENT DOCUMENT

HVAC Design Intent:

- The HVAC system selection and design intent are based on the process outlined in ASHRAE Handbook 2020, Chapter 1, "HVAC System Analysis and Selection." It should include the owner's building program goals and additional goals, any system constraints and constructability constraints, and the finalized system selection outlining the decentralized HVAC computer room air conditioning system with outdoor ventilation air provided by the existing building central air system serving the floor.

- The tenant fit-out floor space shall be designed to accommodate CRAC units with electric heat, direct expansion (DX) cooling, an electric heated water humidifier, and underfloor air distribution. Units shall be fitted with MERV-13 filters.
- The utility shall be electrical power with emergency power backup along with a new distilled water system for humidification.
- The project is fast-tracked with the prepurchase of CRAC units and the associated air-cooled condensing units. The design-build project schedule is four months from authorization to proceed to system startup and commissioning.
- Tenant space shall be open, and the empty space is ready for construction. The D-B contractor shall prepare the area with equipment layout marked on the floor and refrigerant piping, distilled water piping, condensate drain piping, and electrical power wiring roughed in ready for the prepurchased equipment arrival.
- The roof shall be prepared for the arrival of air-cooled condensers with steel framing installed and made watertight at roof penetrations along with electrical power wiring and refrigerant pipes from below installed and capped for future connection to equipment.

DESIGN CRITERIA DOCUMENT

- The HVAC design criteria shall be in sync with the project delivery method and owner's project requirements noted above.
- A decentralized heating and cooling system shall consist of four CRAC units with underfloor discharge air to the raised computer room space. Each 20-ton unit shall include electric reheat and distilled water humidifiers to maintain 75°F and 50% relative humidity 24 hours a days and shall be fitted with a MERV-13 filter.
- Raised-floor, 2-by-2-foot floor tiles shall be coordinated in anticipation of the data center equipment's arrival. The underfloor supply air shall also be provided directly below specific pieces of computer equipment.
- Each CRAC unit shall be served by a 20-ton air-cooled condensing unit mounted on the roof directly above the tenant space.
- The D-B contractor shall provide conceptual drawings that include equipment weight and electric data as well as the emergency power requirements and plumbing criteria.
- Field fabrication drawings shall become the record drawings at closeout.
- CRAC units and air-cooled condensing units shall be furnished with operation and maintenance (O&M) manuals. The preventive maintenance work orders shall be uploaded to the data center's computerized maintenance management software (CMMS) system.
- The D-B contractor shall have the design engineers provide system training to the in-house O&M staff regarding the air conditioning, humidification, and electrical systems. **ES**

Project Delivery Method:

- Design-Build (D-B)
- Integrated Project Delivery (IPD)
- Construction Management at Risk (CM) with Guaranteed Maximum Price (GMP)
- Design-Bid-Build (D-B-B)
- Performance Contract (PC)

Owner Team:

- Data Center Building Owner
- Owner Representative (consultant)
- Facility Manager (in-house staff)
- Data Center Operations Manager
- Facility Manager (outsource staff)

Project Delivery Team:

- Design-Build (D-B) Project Manager
- Mission Critical (MC) Project Manager
- Mechanical-Electrical Coordinator
- Service Technician
- Architect, Acoustical, Plumbing, Electrical, Structural, Fire Protection, and Security Consultants

HVAC Project Team:

- BAS Technician (in-house staff)
- BAS Technician (outsource staff)
- Third-Party Commissioning Consultant (Cx/C)
- Third-Party Testing, Adjusting, and Balancing (TAB) Technician
- Sheet Metal Foreman
- Piping Foreman

OWNER'S PROGRAM REQUIREMENTS (OPR)

Application:

- Retail Facilities, Chapter 2
- Commercial and Public Buildings, Chapter 3
- Industrial Facilities, Chapter 15
- Clean Spaces, Chapter 19
- Data Centers and Telecommunication Facilities, Chapter 20

Project Type:

- New Construction
- Addition
- Renovation
- Infrastructure (central heating, cooling, and/or cogeneration)
- Tenant Fit-Out

References:

- 2017 ASHRAE Handbook – Fundamentals
- 2018 ASHRAE Handbook – Refrigeration
- 2019 ASHRAE Handbook – HVAC Applications
- 2020 ASHRAE Handbook – HVAC Systems and Equipment
- Refer to "Codes & Standards" in the back of each ASHRAE Handbook for additional reference

Other References:

- ASHRAE Design Guide for Cleanrooms: Fundamentals, Systems, and Performance
- ASHRAE UFAD Guide and O&M Guide Set
- ASHRAE Humidity Control Design Guide for Commercial and Institutional Buildings
- ASHRAE Indoor Air Quality Guide: Best Practice for Design, Construction, and Commissioning
- ASHRAE Design Guide for Dedicated Outdoor Air Systems
- ASHRAE Standard 90.1 (Minimum Energy Standards)
- ASHRAE Standard 90.4 (Energy Standards for Data Centers)

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- ASHRAE Standard 170 (Ventilation of Health Care Facilities)
- ASHRAE Standard 202 (Commissioning Process for Buildings and Systems)

DESIGN INTENT DOCUMENT (DID)

HVAC Design Intent:

- The HVAC System Selection and Design Intent Are Based on the Process Outlined in ASHRAE Handbook 2020, Chapter 1, "HVAC System Analysis and Selection," and Include the Following:
 - Owner Building Program Goals and Additional Goals
 - System Constraints and Constructability Constraints
 - Specialized Systems Shall Include General Exhaust, Toilet Exhaust, and Smoke Exhaust
 - Utility: Gas (natural)
 - Utility: Electrical Power and Emergency Power
 - Utility: Distilled Water Humidification
 - Existing Conditions: Commercial Tenant Space
 - CRAC Units with Electric Heat, DX Cooling, Electric Heated Water Humidifier, and Underfloor Air Distribution
 - Supply Air Systems - Single Duct-Single Zone Units with Electric Heat, Chilled Water Cooling, and Steam Humidifiers
 - MERV-18 Air Filters

DESIGN CRITERIA DOCUMENT

- The System Shall Consist of Four CRAC Units with Underfloor Discharge Air to the Raised Computer Room Space. Each 10-Ton Unit Shall Include Electric Reheat and Distilled Water Humidifiers to Maintain 75°F and 50% Relative Humidity 24 Hours a day and Shall Be Fitted with a MERV-13 Filter.
- Raised-Floor, 2-by-2-Foot Floor Tiles Shall Be Coordinated in Anticipation of the Data Center Equipment Arrival. Underfloor Supply Air Shall Also Be Provided Directly Below Specific Pieces of Computer Equipment.
- Utilities Shall Be Natural Gas to Serve the Existing Central Boiler Plant that Shall Include One Firetube Hot Water Boiler. The Size Shall Be 800 Boiler Horsepower (BHP) Units. The New Automatic Controls Shall Be Interfaced with the Existing BAS System.
- Each CRAC Unit Shall Be Served By a 20-Ton Air-Cooled Condensing Unit.
- Each CRAC Unit Shall Be Served By a 15-Ton Air-Cooled Condensing Unit Taking Into Account Cooling Diversity Factor.
- D-B contractor Shall Provide Conceptual Drawings that Include Equipment Weight and Electric Data as well as Emergency Power Requirements and Plumbing Criteria.