

RETROFIT OF A 25,000-SEAT INDOOR ARENA USING DESIGN-BUILD PROJECT DELIVERY

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

Owner Team: Arena Corporation Inc.

Building Program Committee: Internal owner representative, owner representative (consultant), facility manager (outsource staff), committee chairperson, and committee secretary.

Project Delivery Team:

- D-B project manager; job superintendent; mechanical-electrical D-B coordinator; HVAC consulting, plumbing, electrical, structural, and fire protection engineers; and security consultants.

HVAC Project Team:

- HVAC supervisor (outsource staff), automatic temperature control (ATC) technician (outsource staff), building automation systems (BAS), and BAS technician (outsource staff).

OWNER'S BUILDING PROGRAM

Application:

- Places of Assembly, Chapter 5; Enclosed Vehicle Facilities, Chapter 16; and Kitchen Ventilation, Chapter 34.

Project Type:

- Renovation, retrofit of the HVAC systems with more energy-efficient equipment, and infrastructure (central heating & cooling).

References:

- 2016 ASHRAE Handbook – HVAC Systems and Equipment.

Other References:

- Cooling Technology Institute (cooling towers); ASHRAE GreenGuide: Design, Construction, and Operation of Sustainable Buildings; ASHRAE Fundamentals of Design and Control of Central Chilled Water Plants; ASHRAE Standard 202 (Commissioning Process for Buildings & Systems); ASHRAE Guideline 0 (Commissioning); and DBIA (Design-Build Institute of America) and applicable International Society for Pharmaceutical Engineering (ISPE) documents.

DESIGN INTENT DOCUMENT

- The HVAC system selection and design intent is based on the process outlined in ASHRAE Handbook 2016, Chapter 1, HVAC System Analysis and Selection. It should include the owner's building program goals and any additional goals as well as any system constraints and constructability constraints. The final system selection shall be decentralized HVAC air systems and terminal units with a central plant heating and central plant air conditioning software computerized maintenance management system (CMMS) software interface.
- For the program and project's functional goals, refer to Chapter 1, 2016 Handbook. The budgeting goals lie in the operating cost.
- Available utilities include gas (natural) electrical power, emergency power, central plant chilled water, condenser water, central plant hot water heating, and a BAS system.

Existing Conditions:

- 19,000-square-foot arena with a 6,000-square-foot open garage.
- Retrofit central air system(s) supply air and/or return air cfm and new general exhaust, toilet exhaust, and kitchen exhaust.

Heating System(s):

- New gas condensing boilers with a new waste heat boiler, hot water heating two-pipe system, new steam generator, and associated steam humidifiers within each existing central air system and gas-fire infrared radiant heaters at the entrances.

Air Conditioning System(s):

- New variable-speed compressor water-cooled chillers, chilled water, condenser water, and open draw-through cooling towers.
- Central air systems.
- Other air systems include general, toilet, and kitchen exhaust.

Special System(s):

- Energy recovery of exhaust air water-to-water coils.

Terminal Units:

- Cabinet unit heater units; a VAV fan powered with hot water heating coils; finned tube radiation; infrared radiant heaters; a steam humidifier within central air units; and registers, grilles, and diffusers (floor, wall, and ceiling).

Fans:

- Centrifugal (forward and backward curve based on selections) and VFD where applicable.

Pumps:

- Horizontal split case, closed-loop chilled water system, open-loop condenser water system, VFD for parallel pumps (one standby), and primary-secondary chilled water pumps.

DESIGN CRITERIA DOCUMENT

- The HVAC design criteria shall be in sync with the project delivery method and the owner's project requirements noted above.
- The utility shall be natural gas to serve two new central boilers, 100-boiler horsepower (BHP) units sized with one boiler intended to be a standby. A 40-BHP waste heat boiler shall operate in sync as the lead boiler year-round. The new automatic controls shall be interfaced with the existing BAS.
- The retrofitted central plant hot water system shall be primary pump per boiler and secondary/standby pump with VFDs.
- The utility shall be 480/3/60 electrical power to serve two new 75-ton chillers, each sized with one chiller intended to be a standby. The controls shall be interfaced with the existing BAS.
- The new retrofitted central plant chilled water system shall be primary pump and standby pump with a secondary pump and standby, all equipped with VFDs.
- Four retrofitted central air systems with new VFDs within their respective fan rooms shall provide heating in the winter to maintain 65°F and in the air conditioning season at 76°.
- Conceptual/schematic phase system flow diagrams with each HVAC system, along with ATC sequences of operation. **ES**



Project Delivery Method:

- Design-Build (D-B)
- Construction Management @ Risk (CM with GMP)
- Design-Bid-Build (D-B-B)

Owner Team:

- Owner Representative (consultant)
- Project Manager of Capital Projects
- Facility Manager (in-house staff)
- Facility Manager (outsource staff)

Project Delivery Team:

- Design-Build (D-B) Project Manager
- Integrated Project Delivery (IPD) Project Manager
- Construction Management (CM) Project Manager
- Mechanical-Electrical Coordinator

HVAC Project Team:

- HVAC Supervisor (in-house staff)
- HVAC Supervisor (outsource staff)
- HVAC Technician (in-house staff)
- ATC Technician (outsource staff)
- Third-Party Testing, Adjusting, and Balancing (TAB) Technician

OWNER'S BUILDING PROGRAM

Application:

- Retail Facilities, Chapter 2
- Commercial & Public Buildings, Chapter 3
- Places of Assembly, Chapter 5
- Enclosed Vehicle Facilities, Chapter 16

Project Type:

- New Construction
- Renovation
- Infrastructure (central heating, cooling, and/or cogeneration)
- Energy Audit and Retrofit

References:

- 2016 ASHRAE Handbook – HVAC Systems and Equipment
- 2017 ASHRAE Handbook – Fundamentals
- 2018 ASHRAE Handbook – Refrigeration
- 2019 ASHRAE Handbook – HVAC Applications

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Other References:

- Cooling Technology Institute (cooling towers)
- ASHRAE Fundamentals of Design and Control of Central Chilled-Water Plants
- ASHARE Guide for Buildings in Hot and Humid Climates

DESIGN INTENT DOCUMENT

- The owner's building program goals and additional goals
- System constraints and constructability constraints
- Finalized system selection shall be centralized HVAC air systems and remote heating and cooling plants
- Automatic controls shall include existing temperature controls and equipment furnished controls
- Program and project goals

DESIGN CRITERIA DOCUMENT

- The HVAC design criteria shall be in sync with the project delivery method and the owner's building program requirements.
- The utility shall be natural gas to serve the new central boiler plant that shall serve three firetube hot water boilers. Two 800 boiler horsepower (BHP) shall be sized at two-thirds capacity and one 200 BHP unit is intended to be a standby for these two boilers as well as to operate during the air conditioning season.
- The utility shall be 480/3/60 electrical power to serve two new 75-ton chillers, each sized with one chiller intended to be a standby. The controls shall be interfaced with the existing BAS.
- The new retrofitted central plant chilled water system shall be primary pump and standby pump with a secondary pump and standby all with VFDs.
- The pipe distribution shall be standard underground distribution to new tertiary pumps with VFDs within each building.
- The HVAC design engineer shall provide system flow diagrams at the design development phase.
- The HVAC design engineer shall include an electrical data sheet to coordinate with the electrical design engineer, a plumbing data sheet to coordinate with plumbing design engineer, and equipment and distribution weights to coordinate with the structural design engineer at the conceptual/schematic phase.