Back 2 Basics

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Justice Facility Chiller Replacement Construction Management Project

This month's B2B will focus on an infrastructure central chiller plant replacement. To select the optimum HVAC system for the chiller replacement application, the designer is directed to 2016 *ASHRAE Handbook – HVAC Systems and Equipment*, and more specifically chapter 1 (HVAC System Analysis and Selection), chapter 3 (Central Heating and Cooling), chapter 13 (Hydronic Heating and Cooling), chapter 14 (Condenser Water Systems and Cooling Equipment), and chapters 38 through 43 (Components).

Project delivery method shall be construction management (CM) with a guaranteed maximum price (GMP). The justice facility has its own O&M staff experienced in central chilled water for conventional air-conditioning operation at this 120,000-sq-ft institutional facility.

For this month's HVAC application, the equipment selections are two gas-fired, 200-ton absorption chillers with two matching roof-mounted draw-through cooling towers to be phased in to replace two antiquated, oversized, electric, centrifugal, 250-ton water chillers and associated blow-through cooling towers. The chilled water shall be 46°F CHWS and 58°F CHWR with 14.4-ft pressure drop through a 2-pass evaporator. The condenser water will be at 85°F CWS and 100°F CWR with 18-ft pressure drop through 1-pass condenser. Units shall be furnished with hinged absorber and condenser headers for ease of maintenance.

Energy source shall be natural gas at 2 in mercury at the burner and 2,040 MBH unit capacity, furnished with pre-piped gas train and required gas relief vents piped directly to outdoors. Burner shall be modulating in lieu of hi-low control.

Electrical shall be 480/3/60 with pre-wired electrical power to automatic controls and starters for gas burner, purge pump, refrigerant pump, and absorbent pumps. A factory-installed control logic panel shall control the entire chiller installation, including its associated pumps and new chilled water pumps, condenser water pumps, and cooling tower system installation.

Unit shall be furnished with all required temperature and pressure gages, flow switches, safety controls and alarms, and shutoff valves. Each unit shall be furnished and installed by the HVAC subcontractor and include absorption unit flue pipe, chilled water pumps and condenser water pumps, associated piping, flue pipe, insulation, and 100 psig dry compressed air. City water make-up shall be by plumbing subcontractor with new backflow preventer.

Combustion makeup air shall be from within room via direct outdoor duct terminating at each chiller. Chilled water pumping shall be primary-secondary with variable speed pumps. Condenser pumps shall be split-case, horizontal pumps, each serving one new chiller. Each pump shall be piped to include supply and return shutoff valves, strainer with blow-off valve, 2-position ATC valve, and balancing valve for fine-tuning flow.

One compound pressure gage (condenser water system) and regular pressure gage (chilled water system) shall be used with individual connection and associated petcocks at strainer inlet, pump inlet, pump outlet, and immediately after balancing valve. An air separator shall be located in secondary chilled water system with an in-line separator and automatic water makeup connection located upstream of the CHWS secondary pumps. Chilled water piping shall be schedule 40 steel and condenser water system shall be schedule 80 steel with insulation thickness per the State Energy code.

Design team shall include the HVAC design engineer as the prime consultant with structural, plumbing, and electrical sub-consultants. The owner shall assign a project manager and retain a 3rd-party commissioning and TAB firm, as well as a security consultant. The CM shall have a project manager, in-house estimating including mechanical and electrical estimators, and their own in-house registered professional engineer.

The design team, along with the owner's project manager, and the CM input, shall produce conceptual drawings, design development (DD) drawings and specifications, and contract documents (CD) in sync with the CM providing budget estimates in the conceptual phase and guaranteed maximum project cost between the DD and CD phases. The HVAC design engineer shall also complete a hydraulic model of the entire chilled water system (new and existing). The justice facility shall have its O&M personnel review the documents throughout the design phase and receive introduction training of the new equipment. The O&M staff shall observe equipment startup, CM subcontractors' punch list, and the commissioning system demonstration.

The CM shall include the following during the shop drawing submittal phase:

- Equipment submittals - Pump and fan curves - Startup sheet - Troubleshooting sheets - O&M manuals, parts, and lubricants - ATC and energy management submittal including one complete ATC submittal integrating manufacturer's chiller unit furnished ATC into an integrated overall ATC submittal.

The 3rd-party Cx and TAB firm shall complete the following:

- TAB system flow diagram of entire (new and existing) chilled water and condenser water systems with GPMs and pump heads indicated at each pump.
- TAB system flow diagram of entire supply and return water system drawing in sync with data from the hydraulic model with GPMs and pressure drops at each piece of new and existing terminal units and at major branch runouts.
- Commissioning functional performance test of HVAC systems (chilled water and condenser water systems).

Refer to The Facility Files for additional information pertaining to completing the B2B test.

JUSTICE FACILITY CHILLER REPLACEMENT CONSTRUCTION MANAGEMENT PROJECT
CONSTRUCTION PHASE – DESIGN ENGINEER'S PUNCHLIST

The design engineer shall check off the boxes from the list of company's standardized field observation checklists below that she will need to upload on to her tablet computer prior to heading out to the construction site to complete her final HVAC inspection and punchlist. These checklists will be touchscreen type. When the engineer returns to the office or she sends the completed checklists via the internet to the office, the completed checklists shall be automatically downloaded to the company's computer server and placed in the job folder's "Project Closeout" section of the folder. The completed checklists, along with associated digital photographs taken at the time of the field visit, will automatically be electronically sent to the following individuals and departments.

TEAM CORRESPONDENCE DIRECTORY CHECKLIST (check the appropriate boxes)

❑ Project Engineer ❑ Owner Project Manager ❑ IPD Manager ❑ Construction Manager
❑ General Contractor ❑ Design-Build Contractor ❑ O&M Manager ❑ HVAC Subcontractor
❑ ATC Subcontractor ❑ State Energy Department ❑ ASHRAE ❑ Piping Subcontractor
❑ Sheet Metal Subcontractor ❑ 3rd-Party Cx & TAB Consultant ❑ Security Consultant
❑ Equipment Manufacturers ❑ Building Inspector
❑ Others: (insert list)_____

HVAC CONTRACT SPECIFICATION CHECKLISTS (check the appropriate boxes)

❑ Division 1 Project Closeout ❑ Owner-Furnished Equipment ❑ Structural ❑ Electrical ❑ Plumbing
❑ Fire Protection ❑ HVAC ❑ Infection Control ❑ ATC ❑ Boilers ❑ Pumps ❑ Chillers ❑ Fans
❑ Air Handlers ❑ Terminal Units ❑ Piping System ❑ Sheet Metal System
❑ TAB ❑ Commissioning ❑ Others: (insert list)_____

HVAC CONTRACT DRAWING INSTALLATION CHECKLIST (check the appropriate boxes)

❑ Textile Process Equipment ❑ Owner-Furnished Equipment ❑ Structural ❑ Electrical ❑ Plumbing
❑ Fire Protection ❑ HVAC ❑ Chillers ❑ ATC ❑ Boilers ❑ Pumps ❑ Cooling Towers ❑ Fans ❑ Air Handlers ❑ Terminal Units ❑ Piping System ❑ Sheet Metal System ❑ Equipment Room ❑ Tel-Data
❑ Others: (insert list)_____

HVAC STARTUP CHECKLISTS (check the appropriate boxes)

❑ Owner-Furnished Equipment ❑ Structural ❑ Electrical ❑ Plumbing ❑ Fire Protection ❑ HVAC
❑ Infection Control ❑ ATC ❑ Boilers ❑ Chillers ❑ Cooling Towers ❑ Pumps ❑ Fans ❑ Air Handlers
❑ Terminal Units ❑ Piping System ❑ Sheet Metal System ❑ Equipment Room ❑ Tel-Data
❑ Others: (insert list)_____

COMMISSIONING FPT (FUNCTIONAL PERFORMANCE TEST) (check the appropriate boxes)

❑ Owner-Furnished Equipment ❑ Structural ❑ Electrical ❑ Plumbing ❑ Fire Protection ❑ HVAC System ❑ Infection Control System ❑ ATC System ❑ Central HVAC Air System ❑ Heating System
❑ Chilled Water System ❑ Condenser Water System ❑ Boilers ❑ Pumps ❑ Chillers ❑ Fans ❑ Air Handlers ❑ Terminal Units ❑ Piping System ❑ Sheet Metal System ❑ Equipment Room ❑ Tel-Data
❑ Others: (insert list)_____

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