Back 2 Basics,

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New Movie Theater Design-Bid-Build Project

Application: *ASHRAE 2015 Application Handbook,* chapter 5 (Places of Assembly)

Equipment: Boilers

This month's B2B will focus on Places of Assembly as described in the 2015 *ASHRAE Handbook — HVAC Application*. To select the optimum HVAC system for the theater application, the designer is directed to 2012 *ASHRAE Handbook — HVAC Systems and Equipment*, and more specifically, to chapters 1 (HVAC System Analysis and Selection), 2 (Decentralized Cooling and Heating), 13 (Hydronic Heating and Cooling), and 32 (Boilers).

Project delivery method shall be design-bid-build. Theater owner will provide her own O&M staff along with theater- and owner-furnished equipment and startup.

For this month's equipment selection, a 3-modular condensing boiler shall heat the theater. Each unit shall be 360 MBH output, 95% thermal efficiency, Energy Star compliant, natural gas, and capable of modulating down to 20% of rate input. Hot water shall be 160°F HWS and 130°F HWR at peak heating and 110°F HWS and 80°F HWR at low load. Furnish and install with gas train, 4-in pressure, and required gas relief vent(s). Fan shall be variable speed blower system, 24 VAC control circuit and control panel, temperature and pressure gages, automatic HWS shutoff valve, temperature sensors (HWS, HWR, flue, and outdoor air), low-water flow protection, and water pressure relief valve piped to funnel floor drain adjacent to boiler. Boilers shall operate using 30% polypropylene glycol, and three unit controls shall be capable of variable speed oil pumping to maintain constant ΔT along with lead-lag staging of units. Boiler venting shall be sidewall and not exceed 24 ft. Combustion makeup air shall be from within room via direct outdoor duct terminating at boiler.

Hot water distribution shall be a reverse return system out to the theater's two central air handling units' preheat coils and dehumidification heating coils, as well as terminal unit heaters. Units will have direct expansion cooling, with MERV 8 prefilter and MERV 11 final filter. A roof-mounted fan shall be used for exhaust. Pumping shall be primary-secondary with variable speed pumps using in-line circulators. Each pump shall be piped to include HWS and HWR shutoff valves, strainer with blow-off valve, two-position ATC valve, circulator, and balancing valve for fine-tuning flow. One pressure gage shall be used with individual connection and associated petcocks at pump inlet, pump outlet, and immediately after balancing valve.

Each boiler shall be piped to include HWS and HWR shutoff valves, strainer with blow-off valve, two-position ATC valve, and circulator. One pressure gage shall be used with individual connection and associated petcocks at inlet and outlet of boiler.

An air separator shall be located at each boiler along with an in-line separator and automatic water makeup connection located between the boilers and the secondary pumps. Each terminal heating coil (air handling units and unit heaters) shall be installed with HWS and HWR shutoff valves, strainer with blow-off valve, and two-position ATC valve. One pressure gage shall be used with individual connection and associated petcocks at inlet and outlet of coil. Piping shall be type L copper and insulation thickness per the State Energy code. Supply air ductwork shall be per SMACNA and sealed air-tight and insulated per State Energy code. Supply air ductwork shall be pressure tested for 3 in. A return air fan shall provide airside economizer. There shall be an exhaust air system, and all return air and exhaust air ductwork shall be per SMACNA and rated for 2 in pressure.

General Contractor shall include the following shop drawing submittal data:

- Equipment submittals - Pump & 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 boiler and AHU furnished ATC with overall ATC submittal.

A third-party commissioning and testing, adjusting, & balancing firm shall complete the following:

- TAB system flow diagram of entire hot water system with GPMs and pump heads indicated at each piece of equipment
- TAB system flow diagram of entire supply, return, and exhaust air systems with cfms and static pressures at each piece of equipment and at major branch runouts as it enters and leaves the duct shaft
- Commissioning functional performance test of HVAC systems (heating and central air systems and HVAC interface with security system)

The theater owner shall retain a security consultant.

BASIS OF DESIGN – NEW MOVIE THEATER PROJECT CONSTRUCTION PHASE ENGINEER'S PUNCH LIST

The design engineer shall check off the boxes from the list of company's standardized field observation checklists below, which he will need to upload on to his tablet computer prior to heading out to the construction site to complete his final HVAC inspection and punchlist. These checklists will be touch screen type. When the engineer returns to the office or he 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 Architect ❑ Owner Representative ❑ IPD Manager ❑ Construction Manager
❑ General Contractor ❑ Design-Build Contractor ❑ Facility Manager ❑ HVAC Subcontractor
❑ ATC Subcontractor ❑ State Energy Department ❑ ASHRAE ❑ Piping Subcontractor
❑ Sheet Metal Subcontractor ❑ 3rd Party TAB Consultant ❑ 3rd Party Commissioning Consultant
❑ Equipment Manufacturers ❑ Building Inspector ❑ Others: (insert list)_____

HVAC CONTRACT SPECIFICATION CHECKLISTS (check the appropriate boxes)

❑ Division 1 Project Closeout ❑ Theater Equipment ❑ 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)

❑ Theater Equipment ❑ 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 ❑ Equipment Room
❑ Tel-Data ❑ Others (insert list) _____

HVAC STARTUP CHECKLISTS (check the appropriate boxes)

❑ Theater Equipment ❑ 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 ❑ Equipment Room ❑ Tel-Data
❑ Others (insert list)_____

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

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

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