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FITZEMEYER & TOCCI

Mechanical / Electrical Engineering Solutions

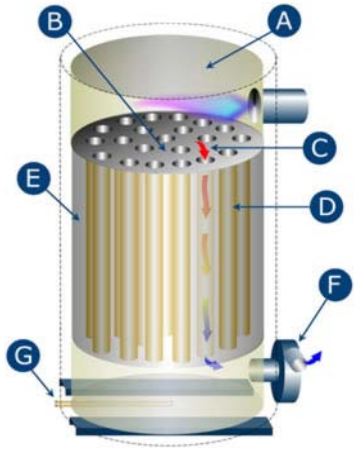
FOCUS ON TECHNOLOGY

ENERGY EFFICIENT CONDENSING WATER HEATERS AND BOILERS

BY SCOTT BETTANO - FITZEMEYER & TOCCI ASSOCIATES, INC.

Energy costs in recent years have reached an all time high and show no signs of slowing down. We now see building owners being more energy conscious than ever before. One of the most energy efficient technologies available today is that of the condensing water heater and boiler. Condensing water heaters and boilers can reach up to 99% efficiency, depending on flow rate and water temperature, reducing heating costs by as much as 25% in comparison to conventional systems.

How does the condensing technology work? Condensing technology utilizes a part of the energy which disappears up the chimney or flue in other heating systems; the condensation heat retained latently in the flue gases. With condensing technology, the water vapor contained in the flue gases is condensed on the relatively cool heat exchanger surfaces of the boiler. The released heat is transmitted directly into the boiler or water heater and the thermal flue gas losses are minimized. The result is 15 - 20% more energy being put to work rather than being expended into the atmosphere as it would be using a conventional boiler or water heater. Although the new condensing boilers and water heaters have a higher initial purchase price, the energy savings are so substantial, the payback is usually within the first 5 years based on medium to large capacity systems. An example of this payback was provided to us by PVI, who manufactures both condensing water heaters and boilers. At 94% thermal efficiency, PVI's POWER VT is one of most efficient water heaters on the market. Even when compared to mid-efficiency systems, POWER VT provides rapid pay-back, generally within the first 5 years. For example, the POWER VT consumes 22,641 therms annually compared to a conventional gas fired water heater at 85% efficiency which consumes 25,039 therms annually, based on 7,000 gallons per day hot water delivery at 100° F rise. Assuming $.95/therm, that translates to an annual fuel savings of $2,278 and a five year fuel savings of $11,390.



POWER VT® Condensing Water Heater

A. Combustion Chamber
B. Furnace Tube Sheet
C. Flue Gas Path
D. Firetube Heating Surfaces
E. ASME Pressure Vessel for hot water storage
F. Induced Draft Blower for connection to category IV vent
G. Condensate Drain

In condensing areas of the water heater, stainless steel components, electroless nickel plating and acid-inert polymers augment the steel pressure vessel.

There are also some significant design advantages to be considered with condensing technology. With condensing water heaters, smaller vent sizes are achieved through positive pressure. Conventional water heaters rely on negative pressure to move hot combustion gases through the vent, requiring larger diameter vent sizes. The hot combustion gases also means air-insulated double-wall material is often recommended to ensure the flue gas remains hot enough to naturally rise through the entire vent. Because flue products exiting condensing water heaters are cool and the vent is pressurized, less expensive pipe material such as CPVC is acceptable.

One of the most significant design advantages of a condensing water heater is the built-in induced-draft fan that produces the positive pressure under which the water heater is vented. Non-condensing heaters must adhere to guidelines that dictate flue diameter and the configuration of vertical and horizontal lengths of the flue system, which can often be restricted by congested mechanical room layouts. When these guidelines are compromised, heater operation can become unreliable. A motorized power vent is often required to assist in the venting process, where as the positive vent pressure in the condensing water heater is sufficient enough to overcome almost all limits on vent configuration. This can be especially useful in retrofit applications.

Fitzemeyer & Tocci has provided information on this new product in an effort to keep our clients appraised of new technologies. As such, this article is intended for informational purposes only and does not constitute endorsement of the product by Fitzemeyer & Tocci Associates.

Information on this new product may be obtained by contacting Dave McGrath at Towerhill Sales, dmcgrath@towerhillsales.com

As always, we welcome your questions and comments. If you would like further information, please feel free to contact Stephen J. Montibello, PE, a Principal with F&T, who can be reached at 781-481-0210, ext. 175.

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Partners Health Care - MGH/NSMC/MGPO
MGH/North Shore Center for Outpatient Care
Danvers, Massachusetts

Architect: Shepley Bulfinch Richardson & Abbott

The **scope** of this project was to design HVAC, plumbing, fire protection and electrical systems for a new 122,000 sf ambulatory care center and core/shell for a 78,000 sf medical office building.

The **design challenge** was to provide cost effective HVAC, plumbing, electrical and fire protection systems for a state-of-the-art healthcare facility based upon a retail model of an outpatient healthcare facility.

Our **solution** involved providing heat for the building by a gas fired hot water boiler plant consisting of high efficiency gas fired boilers located in a penthouse mechanical room. Cooling and ventilation is provided by large commercial grade packaged roof top units which are concealed behind architectural roof screens. Variable air volume (VAV) terminal boxes with hot water reheat coils provide airflow for space pressure and temperature control. Modular gas fired steam boilers provide ventilation pre-heat and global humidification at each rooftop unit. Specialized areas requiring higher humidity, such as operating rooms, use local humidifiers. A 100% redundant medical equipment chiller system provides process chilled water to MRI's, Linac's, and CT scan equipment. A dedicated drycooler condenser water system provides cooling to the data center and IDF rooms. The entire system is controlled by a direct digital control energy management system.

The electrical system included a new medium-voltage distribution system to serve the 5000 Ampere 480/277V 3Ph 4W electrical service. A 1500kW/1875kVA emergency generator located on the exterior of the building in a sound-attenuated weatherproof enclosure provides emergency power for the building essential electrical system. The essential electrical system provides life safety, critical, equipment and elevator power for the ACC and life safety power for the MOB. The building will utilize energy-efficient lighting coupled to a lighting control system to meet energy code requirements.

The plumbing design included new sanitary waste, natural gas, hot and cold domestic water and medical gas and vacuum systems.

The fire protection design included new wet pipe sprinkler and standpipe system throughout both buildings.

Public Service of New Hampshire
Manchester, New Hampshire

Architect: Lavallee/Brensinger Architects

The **scope** of this project was to design HVAC, plumbing, fire protection and electrical systems for a new 45,000 sf, 2-story building including the PSNH Call Center and one level of parking.

The **design challenge** was to provide cost effective HVAC, plumbing, electrical and fire protection systems for a state-of-the-art Call Center.

Our **solution** involved providing an under-floor type, variable volume air distribution system throughout the call center floor area. The system consisted of two main air handlers (located in mechanical rooms on the garage level) supplying air into an under-floor supply air plenum and distributed to the space via floor mounted VAV terminal outlets. The call center open office regions were provided with floor mounted variable volume terminal boxes throughout the aisle areas; arranged into 6-8 temperature control zones (each with a space thermostat). Perimeter office and support areas (walled rooms) were provided with dedicated floor boxes and wall mounted thermostat to control the respective space temperature (and perimeter radiation as applicable). Return air from the floor was through high-wall or ceiling mounted, return air grilles ducted back to the air handling units. Both air handlers supplied one continuous under-floor plenum area and were sized for approximately 75% air-side redundancy. Should one air handler fail (or be down for maintenance) the second air handler automatically ramps up to support the entire plenum space.

The electrical system included a new 600 Ampere 480/277V 3Ph 4W electrical service fed from a new PSNH Electric Utility Company pad mounted transformer which was fed from the existing utility primary service in the street. A new emergency electrical service for the building was provided through a new diesel-fired emergency generator located exterior to the building in a weatherproof sound-attenuated enclosure. The fire alarm system included a new fully addressable, non-coded, microprocessor-based fire alarm system.

The plumbing design included new sanitary waste, natural gas and hot and cold domestic water systems. The fire protection design included a new fire protection water service to support NFPA 13 compliant wet-pipe (office area) and dry-pipe (garage area) sprinkler systems. Class III dry stand-pipe systems are provided in stairwells.

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