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Engineering for a sustainable future…

What Architects Need to Know About:

Hot Water Heating Systems

Overview

Hot water heating systems are one of the most efficient ways to transfer heat from an energy source, or boiler, to remote areas of a building. This is because large amounts of heat can be transported to remote areas via comparatively small supply and return pipes.

The system consists of a hot water heating boiler, circulating pump, expansion tank, distribution piping and radiators, convectors and/or fan coil units. Hot water is generated at the boiler, typically with a gas burner and circulated to the space heating units via a recirculating pump.

There has been a revolution in boiler design over the past few years due to a very competitive market place and the invention of condensing boiler systems a well as associated hybrid systems.

Types of Boiler Systems

Up until the 1980's all boilers were "natural draft" or "induced draft" type. In both cases air for burner combustion was introduced to the boiler burner directly from the boiler room. Induced draft boilers used combustion fans to improve efficiency and combustion within the boiler.

Induced Draft Boiler

In mid-1980's condensing boilers were first introduced and began to see some usage in Europe. Not until the last 10 years have condensing boilers finally become mainstream in the United States. These highly efficient boilers now are widely applied in all types and sizes of buildings. Multiple boilers can be arranged in series to provide highly efficient staging up to almost any building size and heating load.

Condensing boilers are distinguished from natural or forced draft boilers by their ability to "condense" the latent heat of combustion out of the flue gases. In a natural or forced draft boiler this latent heat is simply vented to outside, resulted in a significant waste of energy.

Condensing Boiler

Energy Efficiency

The most efficient natural or forced draft system may reach an AFUE rating of 85%. By comparison, condensing boilers are achieving efficiencies up to 96%. In addition, many of the condensing boilers have a greater ability to modulate, or stage, the gas burner to more precisely match the heating load of the building. This results in even greater annual energy savings. Over the life cycle of the building these efficiency gains can save tens, or hundreds of thousands of dollars in energy costs.

Aesthetics
Hot water heating systems can help achieve higher ceilings and minimize constructability issues be eliminating large ducts in the ceiling spaces. The wide variety of radiators and fan coil unit designs available allow these heating systems to be integrated into the architecture of the building. These can allow for a clean, neat appearance that matches the interior design requirements for the building.

Specific Architectural Issues
There are a number of architectural considerations for hot water heating systems which should be discussed with your engineer.

Pros:
1. Boilers are a very efficient means of transporting energy, in the form of heat, throughout a building. Large ducts can be replaced with small hot water heating pipes.
2. There is a wide variety of fan coils and radiators available to meet both functional and aesthetic concerns for all areas of a building.
3. Hot water radiant floor heating is becoming more popular in high performance buildings. For many years radiant floor systems have been used in Kindergarten classrooms where the benefits of a warm floor are ideal for toddlers.

Cons:
1. Boilers generally require a dedicated equipment room, although the space requirements are less with modern condensing boilers.
2. Boiler systems require routine maintenance and monitoring which may not be suitable for all facilities.
3. Natural draft boilers (non-condensing boilers) require combustion air intake and relief openings through the wall or roof and gas vents through the roof.

Compact Condensing Boiler Installation