Comfort

Easy to say ... Difficult to describe

by Lawrence Drake

Comfort is what we sell. While forced air TV commercials promote comfort based on high efficiency furnaces that have nothing what so ever to do with comfort, radiant heating offers the real thing. But why is radiant heating more comfortable than forced air? The truth is in the engineering term "operative temperature." This is a concept that is not easy to explain and difficult to perceive, but it is what every customer comes to understand and love about their radiant heating system.

We recently moved into an older forced air home after living with radiant heating for almost twenty years. Of course, the plan is to retrofit the house with radiant floor heating, but we haven't gotten around to it yet. The result is that we are spending a winter with an "old fashioned" heating system and getting a real dose of what the majority of Americans accept as normal. Frankly, it is not comfortable.

The outdoor temperature hit 6 below zero last night. My wife and I had our sweaters on and she said she was still chilly. I told her to turn up the thermostat, but she replied that it was already set at 72 degrees. At that point I launched into my lecture on operative temperature, but my student had heard it far too many times before and was unwilling to sit through it again. She just wrapped a crochet blanket around her shoulders, waved me away, and went back to reading her book.

So what is "Operative Temperature?" Well, it is sort of like another term that has become more familiar to us due to its use by weather forecasters, "Wind Chill." It is not the actual temperature, but the temperature it feels like. Everybody knows that it feels a lot colder outside when the wind is blowing. Even a cold winter day can feel warm when the wind is calm and the sun is shinning.

Americans have bought into the myth that the thermostat on the wall sets the comfort level and that 68 to 70 degrees is the optimum temperature to set the thermostat. Secretly, they turn up the thermostat as it gets colder outside. Environmentalists preach keeping the thermostat turned down between 65 to 68 degrees and throwing on more sweaters to save energy. If only they understood operative temperature, they would discover there is a way to live at those lower temperatures without the sweaters.

Air temperature is less than half the story when it comes to comfort. Sure, we all know deep in our hearts that humidity, air movement, and cold surfaces can affect our comfort, but it all seems to come back to that inaccurate knob on the wall in our customers minds. When the outdoor temperatures plummet, things begin to change on the inside. The thermostat on the wall only measures the air around it, and that measurement doesn't reflect some pretty dramatic things taking

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place that affect our comfort.

For starters, as the outside air gets colder, its ability to hold moisture is reduced. When that cold air leaks into the house and is warmed by expansion, it has even less moisture per cubic foot, causing the inside relative humidity to drop dramatically. Humans feel most comfortable when the relative humidity is between 30 - 50%. On a real cold day, the outdoor relative humidity can be 90%, but once that air gets indoors and expands, it can literally be dryer than the Sahara Desert. What happens to the moisture on your skin when it is real dry? It evaporates rapidly. Evaporating moisture is a cooling mechanism.

As the outdoor temperature drops, a forced air furnace runs more often and longer. Basically it is creating an indoor windy day. Good forced air designs try and minimize the "wind chill" affect of moving air. Nonetheless, the air is moving, and moving air creates the chill sensation as it increases evaporation of skin moisture.

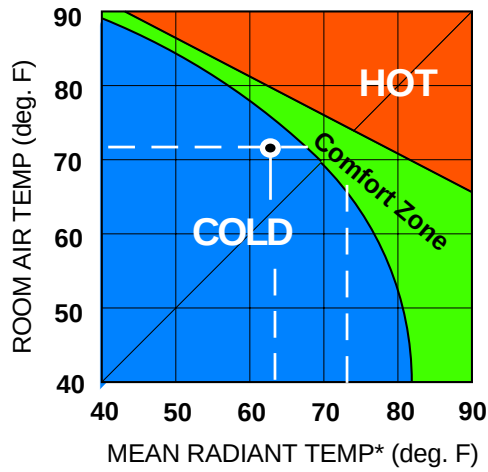
Have you ever felt a wall or window when it was real cold outside? It is cool, if not downright frigid. If you put a thermometer on that outside wall, you could watch the surface temperature drop in direct proportion with the falling outdoor temperature. The interesting thing is that a thermometer just a foot away from that wall would register room air temperature, say 70 degrees. This is probably the phenomenon that is least understood but has the largest affect on comfort. The combination of room air temperature and "mean radiant" temperature have more to do with our feeling of comfort in a building than any other single factor. (see fig.1)

My wife sets the thermostat at 72 degrees but gets chilled as the temperature drops outside. She could turn the thermostat up. Why? To compensate for the drop in surface temperatures (mean radiant temperature) which surround her. These cold surfaces are drawing heat from her faster than the 72 degree air can replace it. Or, as she chose to do, wrap a blanket around her shoulders to reduce her heat loss to those cold surfaces and leave the thermostat at 72.

What would happen if we were to raise the temperature of the surfaces (mean radiant temperature) around her? Depending on how much we raised them, she could eliminate the blanket, take off the sweater and still leave the thermostat at 72. In fact, if we raised them far enough, she could turn the thermostat down to 68 degrees and still feel comfortable! Take away the moving air, add a little humidity and she would be in comfort heaven. What a concept! This has got to make homeowners and environmentalists happy. To be more comfortable at a lower, energy-saving, temperature is a win-win strategy in anybody's book.

Put a warm surface, be it a heated floor, wall panel, or ceiling, in close proximity to a person to counteract those cool surfaces and you have a radiant heating system. Those warmed surfaces also gently warm the air and all but eliminate the "chill factor." It is a dramatic affect. Only those who have lived with a radiant system can truly appreciate the difference. That is why, after living twenty years with radiant heating, I can't wait to get our radiant system installed in this old forced air house. And that is why we sell radiant heating. We are selling comfort and we need to do our best to explain the difference to potential customers. Try tracking a few sample temperatures for them on the Comfort Chart in fig. 1 and watch the lights come on.

Figure 1 - Comfort Chart



***the approximate average of surrounding surface temperatures.**

This chart illustrates that when room air temperature and the surrounding surfaces temperatures are at 72˚F, occupants are comfortable, but as wall and window surface temperatures drop (mean radiant temp.) a 72˚F room air temperature begins to feel cold.