Put Your Infra-Red Heating Knowledge to the Test

It would be reasonable to assume that an infra-red heater produces nothing but infra-red heat. But what are the facts? In 1990, the Canadian Gas Research Institute (CGRI) tested four standard luminous heaters distributed in Canada to the ANSI Z83.6 standard. Results indicated that the infra-red heat component (radiant efficiency) varied from as low as 16.5% to 44.3%. At least one (and possibly more) of the heaters tested fell below the CSA International requirement of a 35% infra-red component. At infra-red outputs below the 35% minimum, system-sizing reductions cannot be justified, suggested energy savings would not be realized, and the infra-red system could be so inefficient that it would cost more to operate than a forced air system—the ultimate indignity for an infra-red heating system.

Surprised? Then it’s time to ask some pointed questions:
- Why is infra-red output so important?
- Is there a difference in the standard for infra-red tube heaters (low intensity) and infra-red luminous heaters (high heaters)?
- How much infra-red heat is enough?
- How do you pick out top performing infra-red heaters?

It pays to know the answers whether you are struggling with an under performing infra-red heating system (you will soon know why), installing infra-red heating, or are considering purchasing infra-red heaters.

Why is infra-red output so important?
The infra-red heat component generated by the heating system not only provides direct personal comfort within the space while the system ‘cycles on’, but is also stored as a reservoir of heat in the floor slab and other masses at work level. This effectively provides radiant and convection heat (and hence comfort at work level) during the ‘off’ cycle. Any convection heat rising directly from the heaters is, for the most part, wasted heat. In short, better infra-red heaters are better producers of infra-red heat.

Is there a difference in the standard for infra-red tube heaters (low intensity) and infra-red luminous heaters (high heaters)?

Good question. Approval standards for gas-fired appliances in North America are set by CSA International, the main overseer of the newly unified American Gas Association (AGA) and Canadian Gas Association (CGA). The joint ANSI Z83.19/CSA 2.35-2001 certification standards, which will come into full effect in the near future, require a luminous (high intensity) heater to test at a minimum 35% infra-red efficiency. For example, that means a 100,000 Btuh gas appliance will be approved as a luminous infra-red heater if it produces 35,000 Btuh of radiant heat.

There are, however, no recognized standards or test methods to measure the infra-red efficiency of radiant tube heaters. Any claims of infra-red efficiency for a particular tube heater are, at present unsubstantiated. Regardless of any “distribution” or “reflectivity” claims, if the greater portion of a heater’s output is convection heat, fuel dollars are not being effectively utilized in the workspace.

How much infra-red heat is enough?
This question is best answered by looking at three examples of infra-red installations:

Example #1: 35% infra-red efficient heating system in building with a calculated heat loss of 100,000 and a 15% infra-red system input reduction.

Example #2: 67% infra-red efficient heating system in building with a calculated heat loss of 100,000 and a 15% infra-red system input reduction.

Example #3: 67% infra-red efficient heating system in building with a calculated heat loss of 100,000 and a 30% infra-red system input reduction (the proper reduction for high performance infra-red systems).

Experience has shown that an improved technology luminous heating system with a 67% infra-red efficiency should use a design factor representing a 30% reduction of the calculated heat.
loss, not 15%. This level of input has proven to yield desirable comfort levels: 70,000 Btuh puts 46,900 Btuh of infrared heat to work level (approximately 58% more infrared heat than the 35% efficient system). Not only is input reduced, but “on-cycle” duration is also shortened somewhat (but not to the point of “short cycling”).

Waste convection heat to the ceiling/roof is decreased to 32,150 Btuh—further lessening transmission heat losses and the exfiltration/infiltiration heat losses associated with stratification. Required interlocked mechanical exhaust volumes are also reduced by nearly 18% with the higher efficiency infrared system.

What about heat losses associated with interlocked mechanical exhaust?

It is commonly argued that during the heating system “on-cycle” the low volume of required interlocked exhaust, at a low ambient temperature, merely substitutes for a portion of the volume of normal exfiltration air. As a result, there is no additional volume of warmed air lost from the structure due to the interlocked exhaust and hence no effect on heat loss. Still, as system efficiency increases and ambient temperature and exfiltration decrease in the upper reaches of a building, a lower volume of mechanical exhaust can only aid in reducing heat loss.

How do you pick out a top performing infrared heater?

In energy sensitive Europe, improved technology installations are the norm, with many manufacturers offering infrared heater models in the mid 60% efficiency range. With even further technological advancements, infrared heating systems have been developed with an ultra-high 81% infrared output efficiency. These ultra-efficient systems have been installed in North America with great success for the past ten years using a 41.5% design heat loss reduction factor. They deliver the same amount of infrared heat to work level as the 67% efficient system with approximately 20% less gas consumption.

The 46,900 Btuh of infrared heat delivered to work level with a 67% efficient infrared heater and 70,000 Btuh input can now be produced at 81% infrared efficiency with an input of only 58,500 Btuh – a 41.5% reduction from the calculated heat loss. The convection heat component is now just 11,115 Btuh – sufficient to provide for the reduced roof transmission heat losses. Now, the upper reaches of the structure above work level experience greatly reduced ambient temperatures with resultant lower transmission and exfiltration heat losses. Required interlocked exhaust volumes are again reduced even further. Input is drastically reduced, but comfort at the work level is maintained.

As you would expect, these advanced infrared systems require a bigger upfront investment, but when
the energy savings generate a return on investment in as short a period as one year, most business decision makers will opt for higher efficiency every time. Further, the lower fuel inputs result in the reduction of the products of combustion, and hence a reduction in greenhouse gas emissions to the environment. Don’t accept unsubstantiated claims of infra-red efficiency. At present the only accepted standard is the ANSI Z83.6/CSA2.35-2001 test methodology. Demand that any claims of infra-red efficiency be put to the test by an accredited independent agency.

Ultraviolet Bio-Wall Case Study
A Mould Miracle

Designed to resist bio-terrorism, this ultraviolet Bio-Wall system is solving mould and air quality problems in a Florida hospital. In November 2001, the Charter Springs Hospital in Ocala, Florida, experienced a compressor failure in their 30-ton A/C unit cooling one wing of the hospital. Because the wing was empty, the building supervisor decided to postpone replacing the compressor. In the heat and humidity of Florida, this decision turned out to be a big mistake. Within a few weeks, mould and mildew covered the walls, the ceiling, and the space above the dropped ceiling. The mould spores in the air were so heavy that anyone in the area had to wear a mask just to breathe. Building Supervisor Gil Lopez decided to hire a professional cleaning service to eliminate the problem.

“This cleaning was very expensive and took several days to complete. At the same time, we replaced the compressor in the A/C unit and got the system back on line,” he says. He hoped he had cured the problem, but to his surprise, the mould returned. Again, at great cost, he hired the cleaning service to sanitize the wing, and another few days were taken to complete the job.

Once more, the mould returned a couple of weeks later. By now, Lopez was frustrated and decided to call in a ventilation specialist to look at the situation. He contacted IAQ specialist, Fred Huffman of Clean Air Innovations who recommended installing a Sanuvox UV Bio-Wall ultraviolet system in the A/C unit cooling that wing of the hospital. Originally, the UV Bio-Wall was designed to protect an HVAC system from bio-terrorism attacks by letting the air purifier treat 100% of the air in the entire duct at one time. Once this threat subsided, Sanuvox Technologies began using the Bio-Wall in a variety of applications, one of which could solve the hospital’s problem by protecting the facility as well as the HVAC system from mould.

“The cost of installing the Sanuvox Bio-Wall was a fraction of the cleaning job, so it was worth a try,” says Lopez. Three days after the Bio-Wall was installed, the wing smelled as fresh as the outdoors, and the mould and mildew disappeared. “That was over six months ago,” says Lopez, “and it has not returned.”

But the story doesn’t end here, Lopez grins. “Two weeks later we got another surprise. We found large numbers of insects dying all over the wing. The insects were feeding on the mould and mildew, and when their food source died, so did the insects. This hospital wing has never been so fresh-air clean and bug free, and we have the Sanuvox system to thank,” concludes Lopez.

Editor’s note: For information on Sanuvox Bio-Wall UV air purification systems see your wholesaler or call toll-free 1-888-SANUVOX or visit www.sanuvox.com

Plumbing: Anti-Hammer Device Stopped Work

Up to about 15 years ago we put in anti-hammer tubes to prevent water hammering. The ‘powers that be’ found that the tubes got water logged over time, so it’s no longer code. In commercial installs, spring loaded devices are used especially at the end of long runs or at the end of a series of fixtures like urinals. To replace the air in the anti-hammers that have become water logged just follow this simple procedure: Open all the faucets and drain down the water in the entire system. The idea is that when you turn the water back on it will compress the air at the highest point at the end of each pipe. That’s what the ‘powers that be’ realized that plumbers were not plumbing for and home owners would not do.