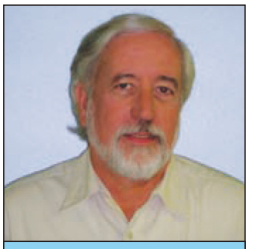
MECHANICAL CODE DISCUSSION

Thermal Factors—R-values, U-factors & SHGCs — Consistency on all Construction Documents



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THIS CODE DISCUSSION IS the third in a series on the code requirements to design a residential HVAC system in accordance with ACCA Manuals J, D, and S. The focus of this issue is the importance to accurately list and use correct R-values, U-factors, and Solar Heat Gain Coefficients (SHGCs) on *the plans, Manual J load calculation* and *REScheck energy code* compliance documents. These thermal factors, along with the difference in temperature between inside and outside the building, are used to calculate the heat loss and gain through the building envelope.

Definitions:

R-value: (Thermal Resistance) The capacity of an insulating material to resist heat flow. The higher the R-value, the greater the insulating power. Typically used to identify the thermal performance of insulation products, including fiberglass batts, blown fiberglass, cellulose, foam insulation panels, spray foam and other building insulation products.

U-factor: (Thermal Transmittance) The rate of heat loss is indicated in terms of the U-factor of construction assembly. U-factors are typically used to represent the thermal performance of windows; however, also used to calculate the heat flow through wall, roof, and floor construction assemblies. The lower the U-factor, the greater the assembly's resistance to heat flow and the better its insulating properties. The U-factor is the reciprocal of the R-value, the R-value the reciprocal of the U-factor.

SHGC: (Solar Heat Gain Coefficient) The fraction of incident solar radiation admitted through a window, both directly transmitted and absorbed and subsequently released inward. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits. A window with a SHGC of 0.30 will allow 30% of the solar radiation (heat in the sun's rays) in through the window, reflecting 70% of the heat in the sun's rays back outside. A low SHGC reduces summer heat gain through east and west windows. This will be discussed in future issues.

R-values, U-factors — Application:

The reciprocal relationship between R-values and U-factors is expressed in a couple of simple equations:

$R = 1 \div U$ and $U = 1 \div R$

Example: A window with an assembly 0.33 U-factor, $R = 1 \div U \rightarrow R = 1 \div 0.33 \rightarrow R = 3.0$

Yes, a window with a 0.33 U-factor is a R-3 window.

It's critical to remember U-factors are for an entire *assembly,* all the components of the window. The U-factor on the window is an area weighted average of the U-factors of both the frame and glass. As vinyl is a better insulator (lower U-factor) than aluminum, vinyl windows will have a lower assembly U-factor than aluminum

The Art of Manpower Management

by Dave Yates,
Contractor Magazine

WHEN YOUR SHOP GROWS to a point that you have left the truck and assume a superintendent's position, your perspective changes: if you have a good grasp of the trade, as well as your workforce, you can begin to grow into that role in a good way. Learning how to manage your people becomes as important as getting the work done. Doing it right means you have the time necessary to do your job and keep your people doing theirs. With your eye on productivity and the bottom line, managing your workforce can either be a freeing experience or it can be a nightmare. It all depends on how you do it.

The first rule is never forget who you are. **You are the boss! You make the decisions that will make or break your company.** Listening to your field personnel on matters of productivity, material ordering and so forth is a good thing, but making the final decisions is your thing, and when it comes right down to it, you make the tough calls and stand by the results...good or bad.

Once you have assumed the mantle of field superintendent, you must **constantly evaluate your workforce.** All journeymen are not created equal—not every journeyman has the same skill set or ability. This is a fact, not a value judgment. Everyone on the payroll has strong and weak points. **The field superintendent must be able to position the best people for each job and constantly revise his crews according to the work required.** Part of the decision making here is to know your people and their levels of tradecraft, reliability and knowledge.

Example: It would be better to man a small project with one of your more experienced journeymen and your greenest apprentice. Putting a known quantity (experienced journeyman) in charge of the project and pairing him with your least experienced apprentice accomplishes two things. First, it means that the superintendent (you) can spend less time managing the job because, presumably, the guy you have working it is competent and you know he knows that he is doing on all levels. Second because the job is basic, it gives the green apprentice the opportunity to gain experience at a level upon which he can build moving forward. Basic is good. Complicated can come later as far as apprentices are concerned.

More important, the superintendent can spend more of his time in a productive mode, keeping his eye more focused on the big project with only minimal input on the small one. The less experienced journeyman, now on the larger job, now has the opportunity to expand his trade skills while in the company of more experienced guys, which is a win for everyone concerned.

This is a reprint from CONTRACTOR, the News Magazine of Mechanical Contracting. Dave Yates, a retired master plumber, founded Sunflower Plumbing & Heating in Shirley, NY in 1975. ■

windows with similar glass. New manufactured windows will include a NFRC Label which includes the assembly U-factor and SHGC.

Considering R-19 fiberglass batts in 2 x 6 wall cavities; we do not calculate the U-factor for the wall by simply using the equation above. The R-value in the cavity is R-19; however, the R-value of the wood studs and plates is approximately R-1 per inch, or R-6 for all the wall area that is wood framing. An area weighted average calculation performed, for a wall with studs on 16" centers, results in a R-14 for the wall assembly. The U-factor for this wall will be $1 \div 14 = 0.07$

Architects, builders, HVAC contractors, insulation contractor, window suppliers, plans examiners, building inspectors and home owners should understand inconsistencies in the R-values, U-factors and SHGCs on construction documents, may result in improper HVAC system design. I often review plans with R-values lower than the R-values listed on the load calculation and the REScheck. Builders are upset when I reject the plans and require corrections, when I'm simply attempting to insure the home is comfortable and energy efficient. A load calculation based on inaccurate R-values, U-factors and SHGCs will not accurately represent the actual building heat loss and heat gain.

In the next issue of The Pipeline, we'll discuss calculations used to determine the actual conduction heat loss and heat gain for a structure. Your questions and comments on this subject and others are welcome.. —Brent ■