# One Chance to Get It Right

**The Glitch:**

Take at look at the photo below showing placement of a 6-inch thick concrete slab containing ⅝" size PEX tubing at 12-inch spacing.  Do you see any details the might compromise the eventually structural or thermal performance of this slab?

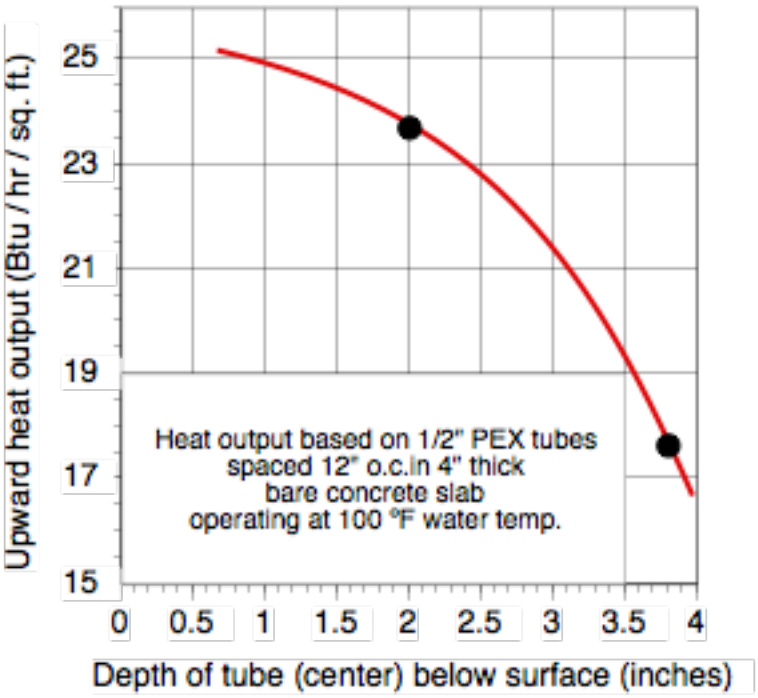
**The Fix:**

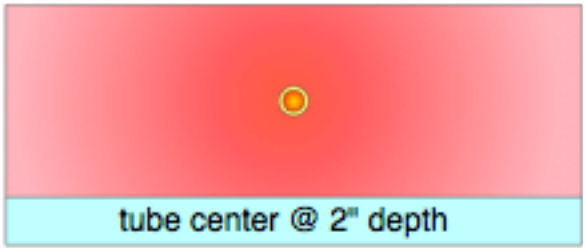
The masons are dumping and leveling the concrete on top of the tubing and welded wire reinforcing (WWR), but making no attempt to lift the WWR or attached tubing above the bottom of the slab.

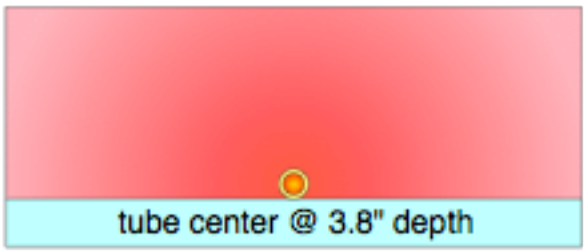
Perhaps they think that the WWR is only there to hold the tubing in place during the pour. It makes me wonder what they do when pouring a slab that *doesn't* contain any tubing. Do they even understand what the WWR is for and where it should be within the slab? I suspect the answer is, sorta know, but don't really care.

The guideline specifications from the *Wire Reinforcing Institute* call for a single layer of welded wire reinforcing (WWR) to be installed between ⅓ and ½ the depth of the slab, measured down from the slab surface. Leaving the (WWR) at the bottom of the slab does not allow proper "engagement" with the concrete, and provides little if any resistance to shrinkage cracking, which is usually the main intended function of (WWR). Thus, even in non-heated slabs, the WWR should be lifted or otherwise supported so that it is embedded at the proper depth in the slab.

Beyond structural performance are the heat transfer implications. Figure 2 shows the variation in upward heat output from a 4-inch thick bare concrete slab based on tubing spaced 12" apart, installed at two depths, and operating at an average water temperature of 100 ºF.




There's a 26 percent drop in heat output for tubing installed at the bottom, rather than the mid-height of the slab. If the slab needs to release heat at a rate of 15 Btu/hr/ft$^2$, the average circuit water temperature needs to increase about 7 ºF if the tubing is left at the bottom of the slab rather than placed approximately at mid-slab thickness.  If the slab

needs to release heat at 30 Btu/hr/ft$^2$, the average circuit water temperature needs to increase 15 ºF. These temperature increases will lower the thermal efficiency of modern hydronic heat sources such as condensing boilers, heat pumps, and solar collectors.

Leaving tubing at the bottom of the slab also increases downward heat loss, and significantly lengthens the slab's response time to changes in water temperature. The latter can lead to pronounced temperature overshoot, especially if there are significant and unpredictable internal heat gains from the sun, people, or equipment.

The bottom line is simple: The depth of the tubing within a heated slab *DOES* make a significant difference in performance. When the tubing is tied to WWR, both the WWR and tubing should be placed at approximately half slab depth.

Why compromise the structure and thermal performance of a heated slab based on careless workmanship? Make sure your written specifications and construction drawings show and describe how to do it right.

If the masons or the GC disagree, perhaps you can show them figure 2. If they still disagree, perhaps they would be willing to sign a release stating that they are now responsible for the performance of the slab.

Yeah right!

- John Siegenthaler