Wood in Collectors

Q: In the near future I intend to construct flat-plate solar collectors for use in a hot air system. I would like to construct the collector structure out of wood using commonly available materials such as pines, plywood, or waferboard. Can I expect the wood to maintain its structural integrity under high heat conditions? Is there any danger of fire?—Louis P. Cirelli Jr., Methuen, Mass.

A: The use of wood in collector housings has been questioned and investigated by a number of parties. The consensus seems to be: use caution or avoid the use of wood altogether. The degradation of wood under long-term exposure to high temperatures has been well documented. The degradation is a function of temperature and time and is cumulative from one high-temperature exposure to the next. Most researchers feel that degradation is insignificant below 200°F. Long-term exposure to temperatures from 200° to 300°F will cause the wood to lose weight and strength and under some conditions to char. Charring is caused by a slow glowing combustion process that is exothermic, or heat producing. If this heat is trapped and temperatures sufficiently elevated, flaming combustion could occur. Specific design temperatures are not available since many variables determine the ignition point. In tests conducted by DOE, charring of plywood collector backings was observed after one summer of stagnation in test collectors with peak temperatures of 290°F. Plywood and waferboard pose no greater problems than solid wood since the phenolic adhesives used are unaffected at these temperatures.

The goal, then, is to keep wood temperatures low by insulating it, keeping it from touching the absorber, and avoiding high-temperature stagnation conditions. Low-temperature single-glazed collectors with summer venting would be in order. A full discussion of this issue appeared in *Solar Age*, 6/81, page 42.

Insulating a Slab

Q: I am in the process of designing a car wash that will use passive solar heating in the self-service bays. In the article "Choices in Underground Insulation," (*Solar Age*, 3/83) you discussed below-grade insulation and waterproofing and recommended the use of extruded polystyrene. What thickness should I use under a 6-inch slab that has SolaRoll™ auxiliary heating installed in the concrete? In addition, what is the best arrangement and material to use as a vapor barrier under the slab? I have received contradictory advice from solar dealers regarding the placement of the vapor barrier—above and below the insulation have been recommended.—J. Joe Wolfinger, Gettysburg, Pa.

A: In a heated slab, heat losses into ground and outward through the edges of the slab and foundation wall are quite significant Designers generally insulate both directly under the slab and around the perimeter as well. In cold climates it is advisable to use a minimum of 2 inches of extruded polystyrene under the slab. Many increase the thickness to 3 or 4 inches at the outer 2 to 4 feet of the slab. On the perimeter wall, 2 inches are commonly used, again increasing the thickness toward the ground's surface. In any case, careful attention should be paid to insulating the slab edge, where heat loss is greatest. Details that thermally isolate the slab edge from the foundation wall and outdoors appear to work the best.

For a vapor barrier, most choose 6- to 10-mil polyethylene. Because extruded polystyrene will absorb little moisture, the vapor barrier can be placed above or below the insulation. Some builders prefer to place it below the insulation or even below the gravel bed because they find it easier to work around here without destroying the material. If you wish to pour the concrete directly on the plastic, you might protect it first with a layer of heavy felt building paper. If migration of moisture into the building is not a concern, as we suspect it is not in a car wash bay, you may eliminate the vapor barrier altogether.

Radiant-Slab Fluids

Q: What are the latest feelings about the relative suitability of various plastics (e.g., polybutylene, EPDM, etc.) for carrying transfer fluids in concrete radiant slab floors? Which are acceptable for water? Propylene glycol? Syltherm 444?—C.R. MacCluer, East Lansing, Mich.

A: Plastic piping varies in wall thickness, density, and chemical composition. Consequently, each grade has its own temperature, pressure, and chemical compatibility limitations. High-temperature polybutylene pipe is rated for 200°F continuous use at 80 psi with water and glycols, making it applicable to many radiant floor designs. EPDM tubing, the type used in SolaRoll, will handle up to 300°F for water and glycols. Neither EPDM nor polybutylene is recommended for use with silicone oils or hydrocarbons. High-density polyethylene tubing, not the type commonly found in retail building outlets, can also handle water temperatures typical of these systems, but with glycols and silicone oils, temperature limitations apply. For a given application, it would be wise to consult with the manufacturer of the specific material. Some manufacturers don't recommend the use of brass fittings embedded in concrete. If possible, buried joints should be avoided altogether.