Fire Testing and Foam Plastic Insulation in Exterior Cavity Walls

A major area of concern in designing new building construction is meeting NFPA285, Fire Testing Requirement for Foam Plastic Insulation, International Building Code (IBC) 2009 Edition, Chapter 26.

The paragraphs of concern are:

2603.3: Surface Burning Characteristics:

> Must comply with ASTM E 84 with a maximum Flame Spread of 75 and a maximum Smoke Developed of 450. Plastic foams can meet these requirements. Dow CavityMate has values of 5 and 165, respectively.

2603.4 Thermal Barrier:

> Any foam plastic shall be separated from the building interior by a thermal barrier that must be ½ inch of gypsum board or equivalent. The sheathing meets this requirement.

2603.5 Exterior Walls of Buildings of Any Height.

2603.5.1 Fire-resistance-rated Walls:

> Comply with ASTM E 119. There is usually no problem with meeting this requirement.

2603.5.2 Thermal Barrier:

> Any foam plastic shall be separated from the building interior by a thermal barrier meeting 780 CMR 2603.4, which in turn says that the thermal barrier must be ½ inch of gypsum board or equivalent. The sheathing meets this requirement.

2603.5.3 Potential Heat:

> The potential heat of foam plastic in any portion of the wall or panel shall meet the NFPA 285 Intermediate Scale Multistory Test (see below). Also, the potential heat of the foam plastic shall be determined by NFPA 259. I have not heard of the latter being a problem. Neither has our local Styrofoam rep.

2603.5.4 Flame Spread and Smoke Developed Indexes:

> Must comply with ASTM E 84 with a maximum Flame Spread of 75 and a maximum Smoke Developed of 450. Plastic foams can meet these requirements. Dow CavityMate has values of 5 and 165, respectively.

The Issues

The wall assembly should be tested in accordance with the NFPA 285 Intermediate Scale Multistory Test, a test which requires a large, two-story sample, and costs in the vicinity of $80,000 to $100,000. Please note that this is an assembly test, not a test of a single material, and has not been performed for many assemblies. In addition, since it is a whole assembly, the design must match the details of the assembly tested.

Compliance, therefore, requires that the whole wall assembly be tested and that the built construction match the whole wall assembly. No element can be changed without testing (see exception below). Manufacturers are beginning to have assemblies tested, but initial assemblies do not have adequate weatherproofing characteristics (the wall might meet Code, but would leak, in other words) -- not a good choice; most metal claddings will not pass. It would also be very difficult to test public-bid projects, since the tested walls are proprietary. To date there is no consolidated list of assemblies that have passed. Some manufacturers, in fact, have withheld information out of fear that their competitors might steal some of their approaches.

Faced with this daunting situation, most of our clients have migrated from using foam plastic in their exterior cavity wall assemblies to using mineral wool insulation. Although mineral wool certainly solves the fire problem, there are two concerns with this approach:

> First, the insulating value of mineral wool is about 3.5, whereas the insulating value of extruded polystyrene, the most common foam insulation, is around 5.0. So there is a significant lessening of the thermal performance of the wall, leading to significantly increased energy usage.
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> Second, mineral wool is not closed-cell so there is concern that the insulation value could be even further reduced since most cavity wall claddings pass water, which eventually wets the insulation layer.

Are There Solutions?

The first concern is not amenable to mitigation, unless and until a new, non-plastic, financially feasible insulation is developed with a higher R-value.

With regard to the second concern, we have seen mineral wool that is so wet that you can squeeze water out of it. Although mineral wool insulation that is designed for cavity walls usually has been specially treated to shed water, it can take up water at horizontal projections that are not sloped to drain. On the other hand, it dries fairly readily. There is currently significant national debate about this issue. It is noted that mineral wool has been used with success for decades in Canada and Europe. It is reported that water stays in the bottom 3-4 inches at horizontal projections and with aging of the fibers the non-drainable part increases to 6-7 inches. In Europe there are specially treated rock wool products in which this non-drainable part is shorter. It has also been reported that these rock wool products will dry out in 1-2 days, given ventilation.

The Current Situation

Research needs to be conducted on the actual incidence of fires caused or made worse by foam plastic insulation and on alternative solutions. The NFPA is reportedly planning to charter a research study on NFPA 285. I hope to be on the Technical Advisory Committee for that effort. One foam plastic insulation manufacturer reports that they expect to perform tests that show that all claddings, including metal, will pass, yet continues to delay the date of the tests. And we have not seen the details (are they weatherproof?)

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