



## “The Path to Performance”

### Postings from a 2016 Energy Star Home Under Construction in Chino Valley, Arizona

#### ***Controlling the Heat Flow and Air Flow in a High-performance Home***

(December 11, 2016 – January 20, 2017)

Construction activity in this 5-week construction period slowed down with holidays and rainy weather in the mix. However, a significant construction activity was accomplished in this period i.e., insulation. Insulation, in this case, addressed both heat and air flow ... both of which are primary components in energy efficiency and comfort in a high-performance home. And, as a reminder, this home is being constructed to be consistent with the Energy Star® New Homes Program guidelines which uses [current building science theory and practical experience](#) to view a high-performance house as a system of its components (i.e., where changes in one part of the building may have effects on all other portions of the building).

#### **“Flash & Fill Insulation” ... Limiting Heat Flow and Air Sealing All in One Operation**

The insulation program designed for this Energy Star® home candidate had always been to have an unvented, conditioned attic space achieved by insulating the bottom of the conditioned space roof deck (and gable ends and knee walls) with 8” of polyurethane spray foam (PSF) to achieve an R-32 insulation value. Besides reducing heat flow, there are several additional benefits of this approach including:

- Air sealing (to create a air-tight structure...a cornerstone concept of energy-efficient construction) between the living area and the attic would not be necessary as the living space and the attic would essentially be within the same pressure boundary (i.e., a part of the same pressurized space). Thus, air leakage from the living area to the attic space (and vice versa) does not make any difference; and
- With the attic and living area essentially at the same temperature, ductwork (carrying warm air in winter and cool air in summer) located in the attic space is not subject to temperature

extremes (and associated comfort and energy efficiency issues) that can be problematic in vented, unconditioned attics.

However, because of competitive pricing, the PSF insulation program was expanded beyond just the roof deck to include:

- 3 inches of PSF in the exterior 2 x 6 wall cavities. Besides being highly insulative (R value of 4.0 per inch), the PSF also achieves superb air sealing of any gaps, cracks, or holes in framing or other wall penetrations (these holes leading to uncontrolled air flow and associated negative effects). Filling the remaining 2-1/2” of the wall cavity would be wet-spray blown-in cellulose



insulation that also has excellent sound deadening qualities. This two-part approach, also termed “flash and fill”, results in a highly insulated wall system (R-21 cavity insulation, not including the exterior rigid insulation soon to be



installed or other wall system materials) ... the benefits of this approach are more completely



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described at this [link to Building Science Corporation](#).

- In addition to using PSF on the conditioned space walls and roof deck, the roof deck and exterior wall cavities of unconditioned spaces (i.e., garage, mechanical room, and enclosed sun room) were also insulated with 4” of PSF (R-16). Foaming the common wall between the garage and the living areas also provides an excellent barrier to the passage of noxious auto fumes into the living area, adding to the indoor air quality of the home.

The PSF insulation work was implemented as described in early January by a crew from [TightSeal](#) and the cellulose insulation (and sound wall) work was implemented by [Advantage Home Performance](#). The insulation work was further inspected by [E3 Energy](#) (a certified rater in the Energy Star® program), a requirement for certification as an Energy Star® home.

#### Structured Wiring

Prior to placing insulation (i.e., while the wall framing was still open and accessible), the homeowner developed and implemented a structured wiring plan i.e., data, tv, phone, and video lines. Structured wiring runs (Cat 5e and RG-11 cable) began at a media panel located in the mechanical room, branched out throughout the entire home and terminated at wall junction boxes. When the home is completed, the modem, router and ethernet switch in the media panel will provide reliable internet connections (in addition to wireless), and other lines will be available for satellite TV and video home security.



#### Floor Protection

Since the homeowner is planning on stained concrete as the finished floor surface, the homeowner made an extra effort to protect that



floor from inevitable messes expected to be made in the process of insulating, drywalling, painting and the routine worker muddy boots in and out of the house. A rolled heavy-duty cardboard (Ramboard) was laid down by the homeowners over the entire concrete slab, including the garage.... so far, the product is doing its job!

#### Tongue-in-Groove Patio Ceiling

As work proceeded on the interior of the home, tongue-in-groove “cactus pine” was delivered for installation in the patio ceilings. Upon delivery, the material was protected from getting wet by stacking



it in the garage and covering it. The homeowners then proceeded to apply a protective finish coat to all 6 sides of the material (even though the patios will not be in the direct path of rain or sun). The framing



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crew began installation of the TIG in the first half of January.

#### Interior/Exterior Door Installation

Insulated fiberglass exterior doors and solid wood (alder) interior doors were delivered and installed in January to further close in the home. The homeowner had also constructed a custom solid oak



entry door that was installed. Local craftsman [Keith Mion](#) assisted the homeowner in these door installation efforts. After these installations, the homeowner further enhanced the home’s air tightness by sealing the gaps around windows and exterior doors with low-expanding foam and/or caulk. Elimination of air leakage will lead to a more comfortable and energy efficient home.

#### Blocking

Another mundane but necessary chore completed by the homeowner prior to the installation of insulation (again, while the walls are still open) was locating and installing blocking. This blocking provided a secure backing into which hardware for cabinets, towel bars, barn doors, range hood, and wall-mounted TV can be secured.



#### Water Yard Line

The water supply for the home will come from a 410-ft deep well which the homeowner completed several years ago. Valley Pump was contracted and extended the water and power line in a trench from the house to well (about 30 ft). When weather permits, they will also install an appropriate pump in the well and a pressure tank in the mechanical room.

#### Roofing Tiles

After stacking concrete tiles on the roof in December so that the trusses would settle, crews from [Superior Roofing of Northern Arizona](#) returned to lay out the tiles including ridges and gable ends.



#### Coming in the Next Installment

Drywall Installation