

Construction Management

Subcontractor Scopes of Work

Jason G. Smith
Jimmie Hinze



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20 Roofing*

A watertight roof is one of the most important milestones to reach on a project. Once the ability to deflect water from the building is realized, the interior work can proceed. This includes the installation of wall insulation, gypsum board, duct insulation, and acoustical ceilings. These are all materials that can only be considered for installation after the building is dried in. Since so many critical path activities can begin after a building is dried in, completion of the roof is a major milestone on a project.

Though there are many types of roofing systems, they are all similar in terms of bidding and requirements for coordinating with other subcontractors.

SCOPE OF WORK ISSUES RELATED TO ROOFING

1. Tapered roof insulation is used on most flat roof construction projects (despite the terminology, flat roofs do have a slight slope, commonly 1/4"–1/2" per foot). Roof insulation serves a dual purpose by creating the drainage slope for the roof and by providing thermal roof insulation. Thermal insulating properties of insulation are commonly expressed in terms of an R-value. Roofs are required by code to be constructed with a value of R-30. The R-value may be given as an average of 30 or a minimum of 30 (Figure 20.1). This distinction must be recognized and understood, as it carries a substantial cost impact.

- (a) There is a significant difference between a minimum and an average R-value in the thickness of roof insulation. To begin, note that all roof slopes begin at the roof drains. Roof insulation R-values vary among roof insulation products.

For example, assume that a minimum R-value of 30 is specified. Also, assume that a thickness of five inches of a particular insulation yields an R-value of 30 (R-values are given per inch of thickness; therefore the roof insulation for this example has an R-value of 6 per one inch of insulation). To meet the specification, the entire roof would need to have a thickness of five inches or greater, meaning the thickness of the insulation will start at five inches at the roof drain and rise from there.

On the contrary, if an average R-value of 30 is specified, this means the insulation will have no minimum thickness as long as the average thickness across the entire roof is five inches or greater. In this case, the insulation taper could begin at zero at the roof drain, as long as the

* MasterFormat Specifications Division 7

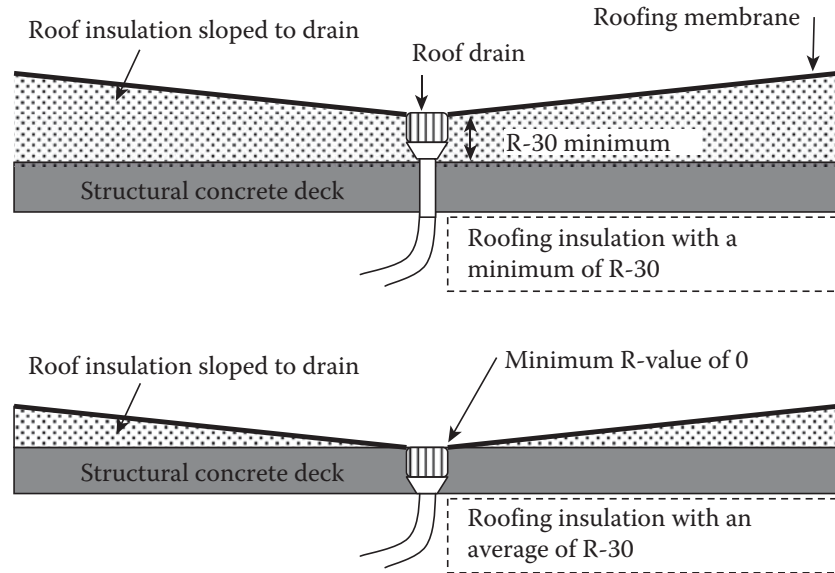


FIGURE 20.1 Average vs minimum of R-30.

overall average thickness is five inches or more. The latter provides a savings of up to five inches of insulation across the entire roof, which is a sizable monetary figure.

- (b) If the R-value of the roofing insulation is given without stating that this is a minimum or an average value, the roofing bidders will generally assume only an average R-value of 30 is required. If a minimum R-value of 30 is required, a sizable change order request can be expected to cover the cost of the additional insulation. This distinction should be provided in the contract documents.
2. An important distinction must be made regarding the responsibility for furnishing and installing the pipe boots, commonly called roof jacks (Figure 20.2). For asphaltic roofing, the pipe boots are typically lead or copper and are provided by either the MEP subcontractor who is penetrating the roof or by the roofing subcontractor for non-MEP penetrations. For PVC roofing, the pipe boots are a prefabricated PVC roofing product provided by the roofing subcontractor for all penetrations.

Compatibility between the pipe boot and asphaltic roofing is important, as asphaltic roofing will not adhere to galvanized materials. It is important to clarify this in the bid instructions and to monitor the products put in place to ensure that this common error does not occur. Since galvanized material is commonly used for MEP sleeves, conduit, and ductwork, the MEP subcontractors get accustomed to using this material. They regularly send galvanized roof jacks to the project for installation not realizing that asphaltic roofing will not adhere to this material.

3. Cold-applied roofing is most commonly specified for re-roofing wood framed structures. This is preferred by many owners because of the potential fire hazard posed by hot-mopped asphaltic roof operations. Cold-applied roofing is also preferred by some owners for minor roof



FIGURE 20.2 Lead roof jack. (Photo by author, courtesy of Hathaway Dinwiddie Construction Company and California State University Northridge.)

patching on occupied buildings due to the lower cost and to avoid the pungent odors from a hot asphalt kettle. This type of roofing is rarely used for other conditions because the application of a cold-applied asphaltic roofing system creates a considerable mess which requires the use of significant protection and quality control measures. The roof membrane is laid in full beds of cold asphalt and goop runs out around the edges. This goop never dries completely and takes weeks before it is no longer sticky to the touch. When using a cold-applied asphaltic roofing system, vigilance will be required for several months after the application to keep workers off the roof. Otherwise, they will step into the asphaltic goop and then track it throughout the building because it is impossible to properly clean this gummy mastic off shoes and clothing. This is a common cause of ruined carpets.

4. When a hot-mopped asphalt roofing system is specified on an occupied building, or adjacent to an occupied building, the air handling units will need to be shut down to avoid drawing the pungent odors from the hot asphalt kettle into the building. It is most common for owners to require, via the contract documents, that roofing activities of this type be scheduled over a weekend to avoid disturbing the building occupants. This requirement may only be identified in Division 1 (the general conditions for the project, where most protocol and administrative requirements are addressed) of the specifications, which is not commonly read by roofing bidders because the roofing work is specified in Division 7. The overtime costs for the roofing crew must be taken into consideration, as well as the general contractor's weekend supervision costs. This premium time work should be clearly shown in the project schedule and reflected in the general contractor's bid instructions to ensure that it is properly accounted for by all roofing bidders.

5. An apparent disparity exists between the roofing subcontractor and the various subcontractors who perform vertical building envelope systems (such as metal panels, plaster, glass, glass fiber reinforced concrete, etc.) in regard to the roof flashings. This is because the roof flashings are not provided by the roofing subcontractor, but the flashings for vertical systems are provided by the subcontractors who install the respective vertical building envelope systems. Copings, reglets, and cap flashings at the roof will traditionally be furnished and installed by the flashing subcontractor.

There are many exceptions to this rule. It is important to identify and properly allocate all of the flashings on a project prior to bidding. This is discussed in greater detail in the chapter on flashings.

For example, a roof penthouse with plaster walls will have flashing from the plaster to the roofing provided by the plaster subcontractor. A parapet with plaster on the exterior side and roofing on the interior side will have a cap flashing spanning over the top of the parapet connecting these two systems and this cap flashing will actually be fabricated and installed by the flashing subcontractor (Figure 20.3).

6. The roof will be installed as early in the construction schedule as possible, because of the need to have the building dried in as early as possible. Protection of the completed roofing until the project is complete and turned over to the owner is extremely important. Since the roofing subcontractor will be off the project once the roof is completed, it is best

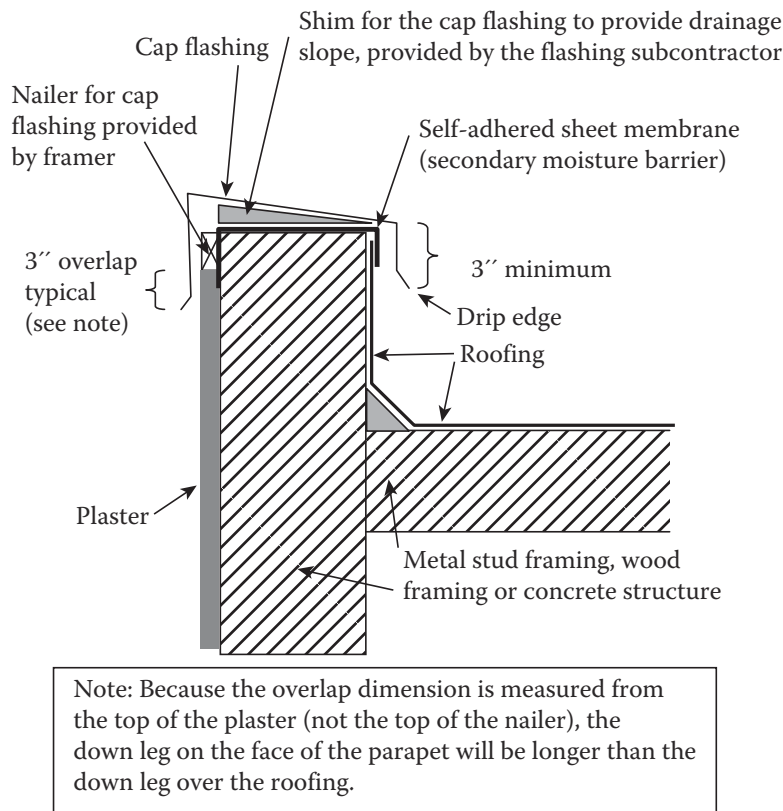


FIGURE 20.3 Roof parapet.

for the general contractor to maintain responsibility for protecting the roof membrane.

In addition to a protection budget, an allowance for minor roof repairs should be included, preferably in the subcontractor's base bid. Even with good protection measures in place, minor damage is inevitable during the fast-paced construction process.

7. Due to the importance of roof protection and the fact that finding leaks is extremely difficult, it is recommended that a protocol of no backcharges be implemented for accidental damage to the roofing. Roof damage is extremely difficult to see with the naked eye and this will help ensure that roof damage will not be left unnoticed. The general contractor should provide several cans of orange upside-down marking paint on the roof for this purpose. Posted signage should notify workers that all they are asked to do when accidentally damaging the roof is to circle the damage with orange paint. The workers will not need to tell their foreman, the general contractor's superintendent or anyone else. This "no name no blame" approach encourages workers to participate. The roofing subcontractor can then send a worker to patch the roof where orange circles mark the damage. This approach is cost-effective and helps ensure that multiple people will not be subsequently required to spend many hours trying to find small leaks.

The term accidental damage is used for a very important reason, implying that this program is not applicable to intentional damage or damage occurring from negligent work practices. Damage that is caused intentionally or through negligence must remain the responsibility of the guilty party. This qualification should be clarified in the roof damage program.

8. Once the project is complete and the building is occupied, maintenance workers will be required to have access to air handling units, roof mounted fans, and other components on the roof. To prevent damaging the roof, walking pads adhered to the roofing membrane will be placed at strategic locations around the roof to provide an appropriate and durable walking surface (Figure 20.4). Walking pads necessary for maintenance workers are typically shown on the architectural drawings where it is necessary to gain access to items such as valves, filters, and other components which require routine maintenance. It is suggested that additional walking pads be added where necessary for construction traffic as well. These walking pads should be considered for placement around all sides of the equipment located on the roof, along large pipe racks, around roof screens, and at other areas where there will be considerable foot traffic during various construction activities. Walking pads are relatively inexpensive and they provide effective roof protection.
9. Condensate drains and small conduits are strewn across roofs. They are traditionally run across the roof on 4" × 4" pressure treated wood blocks that are adhered to a small piece of walking pad material, which is in turn adhered to the roof membrane. If this method is used, the roofing subcontractor should include delivery of additional walking pads, FOB jobsite, for use by the MEP subcontractors to create these supports.



FIGURE 20.4 Walking pads. (Photo by author, courtesy of Hathaway Dinwiddie Construction Company and The California Institute of Technology.)

10. For PVC roofing systems there is commonly a 1/4" underlayment board, such as DensGlass, below the membrane and above the roof insulation. Confusion sometimes occurs because DensGlass is commonly the same product being used for the vertical sheathing at the parapet and penthouses. Clarification to the bidders that the roofer is responsible for all horizontal DensGlass (or similar material) and the framer is responsible for all vertical DensGlass is a good practice, though the majority of subcontractors will understand this distinction without clarification.
11. With high parapets, mechanical supports will usually be required to support the roofing run the full height of the parapet wall. This means backing will be required in the wall to receive the nail or screw fasteners. The framing subcontractor must be alerted of this work prior to bidding, because the backing is considered a contractor's means and methods issue and as such will not be shown on the contract drawings. This backing is considered atypical and will not be included in the framing subcontractor's proposal unless they are specifically directed to do so in the general contractor's bid instructions.
12. The roofing subcontractor should be responsible for all costs associated with water testing the roof; especially standing water tests which commonly last 24 hours. It must be recognized that roofs are not designed to hold a significant amount of water weight (except in harsh climates where roofs are actually designed to withstand heavy snow loads). In order to get standing water on a sloped roof water dams must be constructed intermittently up the slope. This is an elaborate and costly means of testing a roof. Make sure that the roofing subcontractor includes the costs for constructing and removing these water dams, as the cost is significant and they will likely exclude this work.

Make special note that this method of testing is expensive and the process can cause damage to the roof when the dams are removed. Through a value engineering study, owners may agree to a modified test that is significantly easier and less expensive, such as continuous sprinklers set on the roof for 24–48 hours. If a standing water test is specified, it is advised that this value engineering suggestion be presented to the owner, as experience has shown that most owners are willing to eliminate the standing water type testing because they agree the added cost and potential damage outweighs the benefit of the elaborate testing itself. It is imperative that this suggestion be made prior to bidding. Otherwise, this becomes a deductive change order issue that is generally not too favorable for the owner. Once the work has been bid and awarded, the subcontractors will be less inclined to make a full reduction for the cost of the test. Just as additive change order pricing has a reputation of being inflated, deductive change order pricing has a reputation of being deflated.