

The Answer According to ACI – Simple But Requires Thinking!

Seems like a simple question: Does ACI require elevated deck formwork to be heated prior to placing concrete in cold weather? But the ACI answer may not be so simple because it depends on which ACI document is used to answer the question. Let's start with ACI 306.1-90 (reapproved 2002) "Standard Specification for Cold Weather Concreting". This document does not require the formwork to be heated to any temperature. Rather, it requires the concrete to be at a minimum temperature as placed and maintained for the protection period, usually two to three days. If the concrete falls below this minimum temperature, the concrete must be protected for a longer period.

Warm concrete placed on a colder form heats up the form while the concrete temperature decreases during the form-heating process until the concrete and forms reach the same temperature, called the equilibrium temperature. For example, if 6 inches of concrete with a temperature of 58F is placed on 1-inch-thick plywood deck forms at a temperature of 35F, the concrete and form would approach an equilibrium temperature of about 56F. If this concrete is maintained, by insulation blankets or heating for two or three days, ACI 306.1-90 requirements are met.

What if the forms are at 10F? In that case, the concrete and form equilibrium temperature is about 55F. Again if that temperature is maintained for two or three days, ACI 306.1-90 requirements are met. If the equilibrium temperature were to fall below 55F, ACI 306.1-90 would require an extended protection time period. For instance, if the maintained concrete temperature were to fall to 50F, the protection would be extended an extra day. In ACI 306.1-90, the Contractor decides whether to heat the forms and thus protect for two or three days or to let the concrete heat the forms and perhaps opt for an extra protection day.

ACI 301-10, "Specifications for Structural Concrete," contains a different requirement by stating the following: "Unless otherwise permitted, do not place concrete in contact with surfaces less than 35F." This is a provision that was not included in ACI 301-05 or any other previous revisions. Thus if ACI 301-10 is cited in the specification, the Contractor is required to heat all surfaces to 35F.

But what if both ACI 306.1-90 and ACI 301-10 are specified? There are three separate, logical approaches to handling such a dual specification reference. First, it is the legal argument that as a basic rule of contract interpretation, general terms and provisions in a contract yield to specific ones. ACI 306.1-90 is more specific to cold weather concreting than ACI 301-10. Second, ACI 301-10 prefaces the 35F requirement with "Unless otherwise permitted..." thus negating its requirement in preference for another stated requirement. ACI 306.1-90 permits concrete to be in contact with surfaces with temperatures less than 35F. Third, the Optional Requirements Checklist in ACI 301-10 indicates that provisions in the document can be replaced by referring to ACI 306. Thus when both specification documents are referenced ACI 306.1-90 should apply.

It is not uncommon for ACI documents to differ. When multiple ACI documents are cited in the contract document, a fundamental principle of contract interpretation is that the contract must be considered as a whole, giving weight to all parts. Typical practice in the industry is also used as a legal concept in contract interpretation. For instance in the cold weather concreting situation it is not typical practice to heat all surfaces to 35F prior to placing concrete. And finally, the risk of ambiguous contract language is generally allocated to the party responsible for drafting the ambiguity.

Weaving between ACI 301-10 and ACI 306.1-90 is not that difficult because ACI 301-10 contains very few cold-weather concreting requirements. Based on rational concepts for contract interpretation, it's easy to see why ACI 306.1 is the controlling document when both it and ACI 301-10 are specified. **To learn more about how ACI documents differ and how to interpret them attend "Managing ACI Specifications on the Job Site" presented at the ASCC Annual Conference in Columbus, Ohio, September 12-15.**