PCI MIDWEST
A Chapter of Precast/Prestressed Concrete Institute

PRECAST FOCUS

PRECAST CONCRETE INSTALLATION IN COLD WEATHER

One of the many attributes and benefits of high-performance precast concrete is accelerated year-round construction in almost any weather conditions. However, certain precautions need to be considered in severe cold weather for welding of connection hardware plates, structural grouting, and field-placed concrete topping operations.

Welded connections are the most common and typical connection used in the erection of precast concrete. They are structurally efficient and adjust easily to varying field conditions. The connections are usually made by placing a loose plate between two structural steel plates that are embedded in either the cast-in-place or precast concrete and welded together. Welding at temperatures below 32 degrees F may require preheating of materials to be joined because of the possibility of fractured welds. When welding in cold temperatures, preheating or special welding techniques should be used to prevent expansion of embedded steel that could result in spalling of the adjacent concrete. AWS D1.1 requires that when the insert plate temperature is below 32 degrees F, the plate should be preheated to a temperature of at least 70 degrees F and this minimum temperature maintained throughout the entire welding process. There are four primary reasons to utilize preheat for welding:

- It slows the cooling rate in the weld metal and base metal.
- The slower cooling rate provides any hydrogen present to be diffused out harmlessly.
- It reduces the shrinkage stresses in the weld and adjacent base metal.
- It raises some steels above the temperature at which brittle fracture could occur in fabrication.

The cold weather grouting of column base plates, splice sleeve connections, hollow-core slab shear keys and butt joints, and field-placed concrete topping on double tees and hollow-core slabs are critical due to the possibility of the grout or concrete freezing before reaching its initial set. Grouting and concrete operations are generally permitted when the ambient temperature is 40 degrees F and rising. Concrete or grout strength increases very slowly if exposed to low temperatures. Cold weather protection such as insulated curing blankets and additional curing are necessary if ambient temperatures are below 40 degrees F. Temporary enclosures and large industrial heaters should be utilized if early strength is required. The use of chemical accelerating admixtures to increase early set and strength are recommended but must be carefully monitored. Grouts should not be placed against concrete with a temperature at or below freezing. Calcium chloride must not be used as an accelerating additive in grout if the grout comes into contact with metal parts or reinforcing steel in a connection.

With a few simple precautions, precast concrete installation can be successfully and safely performed year-round in virtually any weather conditions, making it one of the most versatile and efficient construction delivery methods available.

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