

51-6 MASS CONCRETE

51-6.01 GENERAL**51-6.01A Summary**

Section 51-6 includes specifications for placing mass concrete elements.

51-6.01B Definitions

Reserved

51-6.01C Submittals

Submit a thermal control plan with design calculations for each mass concrete element. The thermal control plan and the calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State. Submit 6 copies of the control plan and 2 copies of the design calculations. Include the following:

1. Mix design
2. Duration and method of curing
3. Maximum allowable temperature differentials between the hottest point of the concrete and the exterior concrete faces
4. Procedures to control concrete temperature differentials at time of placement
5. Methods of controlling temperature differentials
6. Temperature differential monitoring and recording system details
7. Temperature sensor types and locations
8. Measures to ensure compliance with maximum temperature and temperature differential requirements

Determine the maximum allowable temperature differential assuming cracking due to heat of hydration does not occur.

Submit temperature data daily as an informational submittal.

Submit a daily progress report as an informational submittal. A copy of the daily report must be available at the job site.

Submit a modified thermal control plan to correct deficiencies for replacement mass concrete. Include supporting calculations.

51-6.01D Quality Assurance**51-6.01D(1) General**

An engineer who is registered as a civil engineer in the State must:

1. Inspect and test the temperature monitoring and recording systems before concrete placement
2. Be present during mass concrete activities
3. Provide daily progress reports

51-6.01D(2) Quality Control**51-6.01D(2)(a) General**

Reserved

51-6.01D(2)(b) Temperature Monitoring

Provide a temperature monitoring and recording system for mass concrete elements. The system must consist of temperature sensors connected to a data acquisition system. The system must be capable of recording, printing, and downloading temperature data to a computer.

Locate temperature sensors within mass concrete elements such that the maximum temperature difference within the element is monitored. At a minimum, monitor temperatures at the following locations:

1. Calculated hottest location
2. 2 outer faces
3. 2 corners except for CIP piling elements
4. Top surfaces

Record temperature readings automatically at least every hour. Install a redundant set of sensors on the primary set with recording capability. Make records using the redundant set if the primary sensors fail.

You may discontinue hourly temperature recording under the following conditions:

1. Maximum internal temperature is falling
2. Difference between the interior concrete temperature and the average daily air temperature is less than the allowable temperature differential for 3 consecutive days
3. There are no mass concrete elements to be cast adjacent

Protect the temperature sensor wiring to prevent movement during concrete placement. Keep wires as short as possible. Do not let the ends of temperature sensors come into contact with concrete supports, forms, or reinforcement.

Do not damage the monitoring and recording system when placing and consolidating concrete.

Correct equipment failures in temperature control and monitoring and recording systems immediately.

The temperature acceptance criteria for mass concrete elements are as follows:

1. Maximum allowable temperature must not exceed 160 degrees F.
2. Maximum temperature differential must not exceed that listed in the thermal control plan.

51-6.02 MATERIALS

Grout for cooling pipes must be a nonshrink grout mix complying with ASTM C1107/C1107M or ASTM C827/C827M for 0.0 percent shrinkage and 0.0 percent minimum and 4.0 percent maximum expansion.

51-6.03 CONSTRUCTION

You may use mechanical cooling systems to control internal concrete temperatures during curing. Mechanical cooling systems must comply with the thermal control plan.

Embed the cooling system within the mass concrete element. Surface connections to cooling pipes must be removable to 4 inches below the concrete surface.

Design the forms such that cooling or temperature monitoring is not disturbed during form removal.

Secure the cooling pipes to prevent movement during concrete placement. Replace damaged cooling pipes immediately.

Pressure test the cooling system for leaks at 30 psi for 30 minutes before placing concrete. Cooling pipes must be circulating when concrete placement starts.

Pressure grout the cooling pipes after cooling is complete. Place the grout under the manufacturer's instructions.

After the surface connections are removed, the holes must be reamed and filled with mortar.

Remove mass concrete elements that do not comply with the temperature acceptance criteria.