DMS - 4600

HYDRAULIC CEMENT

EFFECTIVE DATE: JUNE 2011

4600.1. Description. This Specification establishes requirements and test methods for hydraulic cement and the Hydraulic Cement Quality Monitoring Program (HCQMP). Hydraulic cement is cement that sets and hardens by chemical interaction with water and that is capable of doing so under water. (Formerly DMS-4600, “Hydraulic Cement Quality Monitoring Program”.)

4600.2. Units of Measurements. The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

4600.3. Material Producer List. The Materials and Pavements Section of the Construction Division (CST/M&P) maintains the material producer list (MPL) of all materials conforming to the requirements of this Specification. Materials appearing on the MPL, entitled “Hydraulic Cement,” require no further testing, unless deemed necessary by the Project Engineer or CST/M&P.

4600.4. Bidders’ and Suppliers’ Requirements. In most cases, hydraulic cement must be pre-qualified and accepted into the Hydraulic Cement Quality Monitoring Program (HCQMP) in accordance with the requirements listed in Articles 4600.5 and 4600.6 of this Specification.

In cases when using cement not on the HCQMP for a specific project, the Department will test the cement for compliance with Article 4600.6 of this Specification before allowing the material on the project. Submit two samples of at least 1 kg in size, corresponding mill certificates, and Material Safety Data Sheets to the Texas Department of Transportation, Construction Division, Materials and Pavements Section–Cement Laboratory (CP51), 9500 North Lake Creek Parkway, Austin, Texas 78717.

4600.5. Pre-Qualification Procedure.

A. Pre-Qualification Request. Submit a written request to participate in the HCQMP to the Texas Department of Transportation, Construction Division, Materials and Pavements Section (CP51), 125 East 11th Street, Austin, Texas 78701-2483.

Include 6 months of physical and chemical producer test data meeting ASTM C 150 or AASHTO M 85 requirements and a copy of the producer's Quality Control Program with the request.

B. Criteria for Acceptance. The producer or supplier must have a facility with a minimum storage capacity of 1,000 tons. The producer or supplier must have a laboratory of its own, or one contracted, that the Cement and Concrete Reference Laboratory (CCRL) inspects and approves to perform all tests required in Article 4600.6.
Meet one of the following criteria:

- Located within the State of Texas
- Located outside the State of Texas, but maintain an established terminal within Texas, through which all cement must pass
- Located outside the State of Texas and agree to reimburse the Department for all sampling expenses based on mileage and per diem costs for the Department personnel traveling outside the state, or direct costs of sampling and shipping when sampling is accomplished through third party agreements

C. Sampling and Testing. Sampling will be in accordance with Tex-300-D. Testing will be in accordance with the requirements of ASTM C 150 or ASTM C 595. Sampling is at the mutual convenience of the Department and the supplier.

The Department or a designated Department representative will take pre-qualification samples to place cements on the HCQMP. For cement not on the HCQMP, the Department will sample the hydraulic cement during the course of a project to ensure continued specification compliance. For cement on the HCQMP or approved for a specific project, producers will submit monthly samples at the beginning of each month for all certified cements. Monthly QM samples should be received by the 15th of each month.

The Department reserves the right to conduct random sampling of materials for testing and to perform random audits of test reports.

Department representatives may sample material from the plant, terminal, transportation containers, and concrete plants to verify compliance with Article 4600.6.

D. Evaluation. CST/M&P will notify prospective bidders and suppliers after completion of material evaluation.

1. Qualification. If approved for use by the Department, CST/M&P will accept the material to the HCQMP and add to the MPL.

2. Failure. Producers not qualified under this Specification may not furnish materials for Department projects and must show evidence of correction of all deficiencies before reconsideration for qualification.

Costs of sampling and testing are normally borne by the Department; however, the costs to sample and test materials failing to conform to the requirements of this Specification are borne by the Contractor or supplier. The Director of CST/M&P will assess this cost at the time of testing.

Amounts due the Department will be deducted from monthly or final estimates on contracts or from partial or final payments on direct purchases by the State.
E. **Reporting Requirements.** For each type of cement on the HCQMP, submit:

- Monthly mill certificate that shows:
  - the cement meets the requirements of this Specification;
  - the minimum, maximum, and average values for equivalent alkalis obtained from quality control tests or a calculated value for maximum total alkali, based on a 95% confidence level; and
  - the average tricalcium aluminate (C₃A) content for Type III(MS) cement meets the requirements of ASTM C 150 Table 2.

- Written notification of changes in clinker source or other major production changes

- Annual test reports, if applicable, for:
  - ASTM C 563
  - ASTM C 1038
  - ASTM C 265

- Test reports, if applicable, for processing additions using ASTM C 465

F. **Periodic Evaluation.** The Department reserves the right to conduct random sampling of pre-qualified, certified materials for testing and to perform random audits of test reports. Department representatives may sample material from the manufacturing plant, the project site, and the warehouse. CST/M&P reserves the right to test samples to verify compliance with this Specification. In case of variance, the Department’s tests will govern.

G. **Disqualification.** The Department may remove the producer or supplier from the HCQMP for any of the following reasons:

- Failure to supply cement to a Department project for a period of 1 year
- Failure to meet the reporting requirements of the HCQMP
- Failure of two consecutive samples to meet the material requirements of this Specification

H. **Re-Qualification.** To re-qualify to the HCQMP, submit a written request for re-qualification to the address in Sub Article 4600.5.A. Detail the corrections or changes made that warrant reinstatement. If approved, all costs of pre-qualification sampling must be borne by the supplier.

4600.6. **Material Requirements.** All types of cement must meet the requirements of ASTM C 150 or ASTM C 595, with the following additions and exceptions:

A. **Additions to ASTM C 150.** ASTM C 465 is required when:

- Adding 1% to 5% of an inorganic processing addition or an inorganic processing addition, such as fly ash or ground-granulated blast furnace slag. The control cement should be composed of either:
  - Clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum, or
Clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum + limestone (with prior ASTM C 465 full or mortar/paste only – fineness tolerances not required)

- Adding 1% to 5% inorganic processing addition AND 1% to 5% limestone addition. The control cement should be composed of clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum

A modified ASTM C 465 including the mortar/paste testing only (fineness tolerances not required) will be required when adding 1% to 5% limestone to a cement already containing an inorganic processing addition (with prior passing ASTM C 465). The control cement should be composed of either:

- Clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum, or
- Clinker + organic grinding aid (with prior passing ASTM C 465) + gypsum + inorganic processing addition (with prior passing ASTM C 465 submitted prior to the effective date of this Specification)

For cements with limestone additions, report a corrected percent limestone to accurately reflect the total amount of limestone added. Report the difference between background/baseline loss on ignition (pre-limestone addition) and the total loss on ignition (after limestone addition) as the corrected percent limestone.

B. Additions to ASTM C 595.

1. **Type IP.** Type IP Portland-pozzolan cements must have a Class F fly ash pozzolan constituent between 20 and 40% by mass.

2. **Type IIIP.** Type IIIP Portland-pozzolan cements must meet all the requirements of a Type IP, with the following additions:
   - Type IIIP Portland-pozzolan cements must have a Class F fly ash pozzolan constituent between 25 and 40% by mass.
   - Type IIIP Portland-pozzolan cements must meet the requirements listed in Table 1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day Compressive Strength, minimum psi</td>
<td>1890</td>
</tr>
<tr>
<td>3 day Compressive Strength, minimum psi</td>
<td>3780</td>
</tr>
</tbody>
</table>

3. **Type IS.** Type IS Portland blast-furnace slag cements must be Type IS (>35).

4600.7. **Archived Versions.** Archived versions are available.