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## CHEMICAL ADMIXTURES FOR CONCRETE

### **GENERAL**

Air entraining admixtures shall meet the requirements of AASHTO M 154. Water reducing and retarding, water-reducing, high range water reducing, and non-chloride accelerating admixtures shall meet the requirements of AASHTO M 194. All chemical admixtures used for Portland Cement Concrete shall meet the requirements outlined in [Section 4103](#) and other applicable Iowa Department of Transportation Standard Specifications.

For all types of admixtures, the source, brand name, and lot/batch number must be identifiable by markings on the container and by description on the invoice. The manufacturer and supplier shall maintain a record of shipment, which identifies the brand, lot/batch number and certified test data for each shipment. This data shall be made available to the contracting authority when requested.

Material that (i) is suspected of being frozen, or (ii) exceeds its shelf life, or (iii) has been stored at plant site for more than 6 months shall be sampled and tested prior to use.

### **MANUFACTURER, BRAND NAME APPROVAL, USAGE GUIDELINES**

To obtain approval for any admixture type, the manufacturer shall submit the following items to the Office of Materials in Ames:

1. Product identification including brand name and product number
2. Complete manufacturer's recommendation for usage
3. Independent test data on admixture showing compliance with appropriate AASHTO specification
4. A current Materials Safety Data Sheet (MSDS)
5. A one-quart (one-liter) representative sample may be required upon request

Specific requirements for each type of admixture are as follows:

#### A. Air Entraining Admixtures

Air entraining admixtures shall meet the requirements of Iowa Department of Transportation Standard Specifications [Section 4103](#) and AASHTO M 154.

Approved brands of air entraining admixtures are listed in [Appendix A](#) of this IM.

#### B. Retarding, and Water-Reducing & Retarding Admixtures for Bridge Deck and Drilled Shaft Concrete Required Extended Working Time

Retarding, and water-reducing & retarding admixtures shall meet the requirements of AASHTO M 194, Type B or Type D. These admixtures can be used for water reduction, retardation, or water reduction and retardation for bridge deck and drilled shaft concrete when extended

working time is required.

Approved brands of retarding, and water-reducing & retarding admixtures for bridge deck and drilled shaft concrete required extended working time are listed in [Appendix B](#) of this IM. [Appendix B](#) also contains a guideline for dosage rates and working time limits based on an estimated maximum temperature of the concrete during placement at the point of discharge. Working time limits have been determined by AASHTO T 197 using 200 psi (1.38 MPa) penetration resistance and shall be provided by manufacturer. In addition to the AASHTO M194 requirements, a minimum working time of 4.5 hours is required for the Type I/II cement mix used the maximum normal recommended dosage of an admixture and tested at the normal temperature (between 70 °F and 75 °F).

#### C. Water-Reducing Admixtures

Water-reducing admixtures shall meet the requirements of AASHTO M 194, Type A.

Approved brands of water-reducing admixtures with their proper dosage rates are listed in [Appendix C](#) of this IM.

Mid-range water reducers used for bridge overlay concrete (Class HPC-O Mixture) are noted in [Appendix C](#). In additional to the AASHTO M 194 requirements, the use of these admixtures shall provide a maximum water content of 90% of the control at a normal dosage, and shall not result in a less initial set time as compared to the control. The intent of these mid-range water reducers is to achieve a workable, dense, low water to cementitious material ratio concrete for bridge overlay as described in Article 2413.02 of Standard Specifications.

A combination of a water-reducing admixture and a retarding admixture may be used to aid in air entrainment and slump retention.

#### D. High Range Water-Reducing Admixtures

High Range water-reducing admixtures shall meet the requirements of AASHTO M 194, Type F.

Approved brands of high range water-reducing admixtures with their recommended dosage rates are listed in [Appendix D](#) of this IM. As indicated, some of these high range water reducers listed can be used to cast self-consolidated concrete. If needed, a viscosity-modified admixture produced by the same manufacturer is allowed to cast self-consolidated concrete.

#### E. Non-Chloride Accelerating Admixtures

Non-Chloride Accelerating Admixtures shall meet the requirements of AASHTO M 194, Type C or E. Total chloride content, which may come from some indirect sources, shall not exceed 0.1% in the admixtures.

Approved brands of non-Chloride accelerating admixtures with their recommended dosage rates are listed in [Appendix E](#) of this IM.

#### F. Admixtures for Prestressed & Precast Concrete

In addition to the admixtures listed in other Appendixes of this IM, the admixtures listed in [Appendix F](#) can also be used in prestressed and precast concrete. Benefits of those admixtures in [Appendix F](#) include increasing production rate, improvement of visual appeal, greater strength, more durable, better compactability, and extension of life of molds and machines parts for dry-cast concrete. In order to get an admixture approval, its producer shall prove that the use of the admixture will not reduce strength of concrete, and provide evidence of the above-mentioned benefits.

#### G. Retarding, Water-Reducing & Retarding Admixtures for Concrete with Normal Working Times

Retarding, water-reducing and retarding admixtures shall meet the requirements of AASHTO M 194, Type B or Type D. These admixtures can be used for water reduction, retardation, or water reduction and retardation for concrete.

When use as a retarder is specified or authorized by the engineer, the contractor shall be responsible for its use and application of the proper dosage rate. It may also be necessary to adjust the quantity of air entraining agent. When fly ash is used in the concrete, the dosage rate shall be applied to both the cement and fly ash combined.

Approved brands of water-reducing and retarding admixtures with their recommended dosage rates are listed in [Appendix G](#) of this IM.

A hydration stabilizer/controller will be evaluated for approval as a retarder (Type B) or a water reducing & retarding admixture (Type D), and listed and identified in [Appendix B](#) or [Appendix G](#) after approved.

If alternative requirements specified in AASHTO M 194 are met, an admixture may be provisionally approved based on six-month test results. Producer shall submit one-year test results from an independent laboratory for final approval as soon as they become available. The failure or delay in submitting one-year results may lead to revoking of provisional approval.

Satisfactory evaluation of [product](#) reports by the National Transportation Product Evaluation Program (NTPEP) may be accepted for approval.

Approval of admixtures may be withdrawn because of deficient test results; product changes made after original approval, or unsatisfactory field performance.

### **AGITATION OF ADMIXTURES**

Provision shall be made to stir, agitate, or circulate air-entraining admixtures prior to use so as to ensure a uniform and homogeneous mixture of solids and solution. It is the admixture supplier's responsibility to the contractor to provide a quality product. Therefore the admixture suppliers shall be responsible for the system used to maintain the quality product described above.

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Retarding, water-reducing, and high range water-reducing admixtures shall be stirred, circulated, or agitated thoroughly once a day prior to operation of the proportioning plant to maintain the solids in suspension. The agitating shall be done in such a way that the solution in the holding or storage tank is circulated for a minimum of five minutes each day per 100 gallons (380 liters) of solution or any fraction thereof. A circulating pump with a 250-watt (1/3 hp) pump motor and a 5/8-inch (16 mm) inside diameter hose will be considered as a minimum requirement. The engineer shall approve the method of agitation. **NOTE:** Introducing air into a tank will not be acceptable.

## **CERTIFICATION**

### **A. FOR MANUFACTURER**

At the beginning of each calendar year, a certification form will be sent to each manufacturer. If the admixture to be supplied during that year is identical with the formulation previously tested and approved, then the manufacturer shall complete the quality control limits to be followed and return it to the Office of Materials in Ames, Iowa.

### **B. FOR DISTRIBUTOR**

At the beginning of each calendar year, a certification form will be sent to each distributor. The distributor shall certify that admixtures to be supplied are not altered and will be distributed as received from the manufacturer.

## **MONITOR SAMPLING & TESTING, AND REJECTION OF MATERIAL**

Monitor samples will be obtained and sent to Central Materials for testing. Sampling frequency shall be according to [IM 204](#). The sample size shall be one 1 pint (0.5 liter).

For all admixtures, only one acceptance sample per lot/batch is necessary. No project assurance samples are needed.

Samples will be tested for variation from the manufacturer target for solids, specific gravity and chloride content **if needed**.

If the test result of a monitor sample is outside the quality control limits specified by AASHTO M 154 or M 194 and provided by the manufacturer, all material in the storage tank shall be rejected. The admixture company is not allowed to mix new replacement material with the non-compliance material. The admixture manufacturer is responsible for the condition of storage tanks and should determine if the tanks should be cleaned to prevent cross contamination and further product failures.