

## SECTION 1004 -- PORTLAND CEMENT

### 1004.01 -- Description

1. Portland cement is the binder in concrete, locking the aggregate into a solid structure. It is manufactured from lime, silica, and alumina (with a small amount of plaster of paris).
2. Equivalent alkali referred to herein is hereby defined as the sum of the sodium oxide ( $\text{Na}_2\text{O}$ ) and the potassium oxide ( $\text{K}_2\text{O}$ ) calculated as sodium oxide (equivalent alkali as  $\text{Na}_2\text{O} = \text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}$ ).

### 1004.02 -- Material Characteristics

1. Type I, Type II, and Type III portland cement shall conform to the requirements in ASTM C 150 and shall not contain more than 0.60 percent equivalent alkali.
2. Type IP (portland pozzolan) cement may be used in any application where fly ash modified concrete is allowed. Type IP cement shall conform to the requirements as prescribed in ASTM C 595M and the following requirements:
  - a. The pozzolan content shall be 15 to 25 percent of the cementitious materials by weight.
  - b. The pozzolan shall be Class F or Class C fly ash or Class N natural pozzolan.
  - c. Additional fly ash substitution shall not be allowed with Type IP containing Class C or F fly ash. If Class N natural pozzolan is used in the Type IP cement, fly ash substitution is allowed to a maximum pozzolan content of 25 percent.
  - d. A water-reducing admixture shall be used in concrete produced with Type IP cement.
  - e. Type IP cement shall not contain more than 0.80 percent equivalent alkali.

### 1004.03 -- Procedures

1. The Contractor shall provide adequate protection for the cement against dampness. Cement shall be stored in railroad cars or in suitable moisture-proof buildings. The use of tarpaulins for the protection of the cement will not be allowed.
2. No cement which has become caked or lumpy shall be used.
3. Cement which has been spilled shall not be used.
4. Accepted cement which has been held in storage at the concrete mix plant more than 90 days shall be retested.

#### **1004.04 -- Acceptance Requirements**

1. a. Approved cements are on the NDR Approved Products List.
  - b. Cements will be placed on the NDR Approved Products List based on conformance with the NDR Acceptance Policy for Portland Cement. This information is available upon request from the NDR Concrete Materials Section.
2. Portland cement having false set when tested in accordance with the method set forth in NDR T 517 will not be used. Portland cement will be considered to have false set when either the second or third penetration is less than 50 percent of the first penetration and the fourth penetration is 90 percent or more of the first penetration.
3. Cement coming directly from the manufacturer shall not be used until the temperature is 176°F or less.
4. Cement which is placed in storage or is received on the project at temperatures of over 203°F shall not be used until acceptable test results are obtained. Samples shall be taken when the temperature of the cement has decreased to 176°F.
5. a. Should any sample indicate noncompliance with the specifications, use of material from that source based on certification only may be withheld. It will be necessary that the cement be held in special silos or bins at the plant or some facility under control of the company furnishing the cement until such time that test results show compliance.
  - b. When it can be shown that continuing production from that plant has a high assurance of meeting specifications, material acceptance may once again be based on certification only.
6. a. If tests made on field samples taken by the Department fail to meet any of the specification requirements, all shipments from the supplier will be held until tests have been completed by the NDR Materials and Tests Division and approval for use is issued.
  - b. This procedure will be continued until it can reasonably be assured that the cement from the supplier will again continue to meet contract requirements.