DESCRIPTION OF INSPECTION

The inspection was designed to include a review of the laboratory's quality assurance system, an examination of the apparatus, and an observation of the test procedures used in determining the physical properties of portland and masonry cements as set forth in ASTM Specifications C150 and C91.

The ASTM Standards on which the work was based are as follows: C91, C109/C109M, C114, C115, C150, C151, C183, C185, C187, C191, C204, C230/C230M, C266, C305, C430, C451, C490/C490M, C511, C778, C1005, C1222, C1437, C1506, and E11.

Quality System

The inspection was designed to include those sections of ASTM Standard Practice C1222 which comprise the quality system of the laboratory. The quality system is defined in C1222 as those internal procedures and practices that a laboratory utilizes to ensure continued compliance with applicable testing standards. The inspection is a review of the laboratory's written procedures which document that the quality system has been established and the records which confirm on-going compliance are maintained.

Organization

A review of the laboratory's records was made to ascertain if a complete description of the organization of the laboratory was available. This description includes the following: the complete legal name and address of the laboratory, the principal officers, the management structure, other laboratories under the technical direction of this laboratory and a listing of technical services offered.

Human Resources

The resume of the laboratory manager was reviewed to see that the education and experience requirements of C1222 were met. The laboratory's written documents were reviewed to verify that training and performance evaluation procedures were properly established. Personnel records were reviewed to determine if training, performance evaluations, education and experience of laboratory technicians were documented.

Operations

Standard operating procedures were examined for descriptions of the sampling, handling and testing of cement samples required by C1222. The final test report and records used to generate the report were reviewed to ensure that they contained the minimum required information.

Quality

Laboratory documentation was reviewed to determine if written procedures were available for handling technical complaints and to ensure the quality of external technical services utilized. The laboratory's latest CCRL Cement Proficiency Sample Report was examined to verify the laboratory's participation in the applicable proficiency sample program. A review of the available ASTM standards was made to determine that the laboratory possessed the latest copies of the appropriate standards.

Equipment

Laboratory records were reviewed to establish that the laboratory has a complete inventory list of the required testing equipment. Written calibration and verification procedures were reviewed with the associated records to determine if the frequency and depth of review met prescribed criteria.

Qualification of Chemical Analysis

If the scope of the laboratory included the chemical analysis of hydraulic cement, data and procedures were reviewed to determine that the test methods used by the laboratory have met the qualification requirements described in ASTM Test Method C114.

Apparatus

Storage Facilities for Test Specimens (C511)

The physical condition and the functioning of the various mechanical features of the moist air storage facilities for cement test specimens were observed, and where possible, the temperature and humidity of the storage atmosphere were checked for conformance to the requirements of C511. In addition, it was determined whether or not the unit was equipped with automatic temperature control and with a temperature recording device.

The cleanliness and physical condition of all water storage tanks presented for inspection were observed, and it was noted whether or not the water was lime saturated. Where possible, the temperature of the water was checked for conformance to the requirements of the various methods of test for cements for which such facilities are required.

Wagner Turbidimeter (C115)

Each Wagner turbidimeter, stirring apparatus, timing buret, and sedimentation tank presented for inspection was checked for conformance to the design and dimensional requirements of C115. Each microammeter presented was checked for conformance to the design and accuracy of indication requirements of the specification, and the physical condition was observed.

Wet Sieving Apparatus (C430)

Each No. 325 sieve, spray nozzle, and pressure gage presented for inspection was checked for conformance to the requirements of C430, and the physical condition was observed. A check was made of the nozzle in use to determine if the flow rate was within the limits set forth in C430.

Autoclave Soundness Apparatus (C151)

The operating characteristics of each autoclave presented for inspection were observed to determine if the autoclave was operating in general conformance to the requirements of C151. Particular attention was given to rate of heating, maintenance of test pressure, and rate of cooling; and each pressure gage was checked for conformance to the design and accuracy requirements of C151. Each length comparator and bar mold presented was checked for conformance to the design and dimensional requirements of the specification and the accuracy of indication of each comparator was checked.

Graduates (C1005)

One or more glass graduates typical of those used by the laboratory in the testing of cements were checked for conformance to the marking and volumetric requirements of C1005.

Flow Table (C230)

Each ten-inch flow table and accompanying concrete pedestal, and each flow caliper and flow mold presented for inspection were checked for conformance to the design and dimensional requirements of C230. In addition, the performance of each table was tested with a sample of the CCRL flow table material.

Compression Test Apparatus (C109 and E4)

Compression Machine - Unless otherwise noted, only one testing machine was inspected. During this inspection, several of the more important mechanical features of the machine were examined, the bearing blocks were checked for conformance to the design and dimensional requirements of C109, and the accuracy of load indication was verified.

The verification tests were made using force measuring instruments (load cells) calibrated at the National Institute of Standards and Technology. The selection of test points was made based on loads consistent with the range of use of the material being inspected. In all tests, the test loads were approached by increasing the load from a lower load as specified in Method E4.

Cube Molds and Tampers - The cube molds and tampers presented for inspection were checked for conformance to the design and dimensional requirements of C109.

Mix Balances (C1005)

Each mix balance presented for inspection was tested for accuracy and sensitivity at 1000 grams and 2000 grams as specified in the various methods of test. Any balance which could be read directly over its entire capacity was tested for accuracy of indication at five test points over its capacity. Any balance which used a dial or beam in addition to equal arms, was tested for accuracy at five points across its range of use. Accuracy and sensitivity tolerances for the tests listed above were obtained from C1005. When a balance met all the requirements of the tests, and no obvious operational difficulty was present, it was assigned a CCRL identification number.

Testing Weights (Masses)(C1005)

All SI unit weights (masses), if used in the normal weighing operation, were checked for conformance to the maintenance tolerances of C1005. Frequency of verification was determined. When all the weights (masses) in a set were within the accuracy tolerances and were suitably stored, the storage container was assigned a CCRL identification number. In the event that mix weights (masses) were not required for balance operation, the reporting of balance weights will be omitted.

Vicat Apparatus (C187, C191, and C451)

Each Vicat apparatus and Vicat ring presented for inspection was checked for conformance to the requirements of the various methods of test for cement for which such equipment is required.

Gillmore Needles (C266)

Each initial and final Gillmore needle presented for inspection was checked for conformance to the weight and dimensional requirements of C266, and a check was made to determine that at least one set of needles was properly mounted.

Mechanical Mixing Apparatus (C305)

Each mechanical mixer presented for inspection was checked for conformance to the requirements of C305, and the physical condition was observed. A check was made to determine if a lid or lids and one or more scrapers conforming to specification requirements were available.

Air Content of Mortar Apparatus (C185)

Each of the 400-ml measures, steel straightedges, tapping sticks, and spoons presented for inspection was checked for conformance to the applicable requirements of C185. Apparatus not listed, but also needed for use in this test, is covered elsewhere in this report.

Air Permeability Apparatus (C204)

Each complete air permeability apparatus, and related accessory equipment, presented for inspection was checked for conformance to the requirements of C204.

Water Retention Apparatus (C1506)

Each water retention apparatus and each piece of related equipment presented for inspection was checked for conformance to the requirements of C1506.

Miscellaneous

The temperature and relative humidity of the air in the laboratory and the temperature of the mixing water were checked for conformance to the requirements of the various methods of test for cement. Observations were made to determine if the necessary sample splitter and sieves were available for checking the standard sand and graded standard sand for conformance to C778. The trowel required by various tests was examined for design and edge condition. The suitability of the rubber gloves furnished testing personnel was considered. A check was made to determine if the laboratory had been supplied with a copy of the latest edition of the ASTM Book of Standards pertaining to the testing of cement.

Procedures

The standard test methods which were observed and discussed during the inspection were as follows: Water Retention Test; Normal Consistency Test; Vicat Time of Set Test; Preparation of Gillmore Pats, Autoclave Bars, and Mortar Cubes; Testing of Autoclave Bars; Testing of Mortar Cubes; Air Content Determination; No. 325 Sieve Fineness Test; Turbidimeter Fineness Test; Air Permeability Fineness Test; and Early Stiffening Test (Paste Method). The laboratory's conformance to specified procedures was as indicated in the Summary of Findings.

The procedures used in transporting, processing, and storing test samples were also discussed, and the handling and storage of molded specimens were observed. The laboratory's conformance to standard practice was as indicated in the Summary Section.

All departures from specified procedures or standard practices noted by the CCRL representative were reviewed in detail with the operator, with particular attention being given to those matters described in the Footnote Section.