Understanding Your Mill Test Report

The Cement Mill Test Report is a document that provides information about the physical and chemical properties of cement. It is produced by cement manufacturers to certify that the cement product meets the requirements of the CSA A3001 Standard. The List of Tables below identifies the CSA A3001 reference tables identifying chemical, physical and other requirements.

Product	Chemical requirements	Physical requirements	Requirements
Portland cement	Table 1	Table 4	—
Blended hydraulic cement	Table 2	Table 5	Table 9
Portland-limestone cement	Table 3	Table 6	—
Supplementary cementitious materials and blended supplementary cementitious materials	Table 7	Table 8	—

It is important to understand that this document is not an analysis of a particular shipment of cement. The mill test report represents the results of a single sample or an average of one or more composite samples taken of the final product, normally at the manufacturer's plant point of shipment or delivery. Frequency of testing is done at regular intervals as defined by A3004-A1 Table 1, but it may be modified if adequate quality assurance is demonstrated. This information is in addition to the process control samples that are tested at higher intervals.

Mill Test Report information can be used by concrete producers, engineers, architects, and construction professionals as a tool to assess quality and consistency of cement and its suitability for the intended application. CSA A23.1 contains the concrete production and construction practice requirements which must be met to ensure expected concrete performance is achieved. These include quality of all raw materials, batching control and limits, proper mixing, concrete properties, and placing, finishing and curing operations.

Specific additional information and testing may be supplied upon agreement between the cement manufacturer and the purchaser. For any additional questions please contact your cement Technical Service Representative.

Typical information provided in a Mill Test Report (depends on cement type – refer to CSA table requirements):

- Manufacturer's name and address
- Sample Period
- Test results for chemical composition Chemical Requirements such as:
  - SO3
  - MgO
  - C3A
  - Loss on Ignition
- Manufacturing Period
- Type of cement and the cement specification or standard it conforms to
- Test results for Physical Requirements such as:
  - Fineness +45 µm (No. 325) Sieve (%)
  - Setting time - Initial Set (minutes)
  - Compressive strength at different ages
  - Mortar Bar Expansion, A3004-C5, %

Note: If you would like to understand how the data on your Mill Test Report can affect your plastic and hardened concrete parameters, please reach out to your local cement Technical Service Representative.

Useful Definitions

Calcium, Silica, Aluminum, Iron, Magnesium (oxides): Typically measured by x-ray fluorescence. The main chemical constituents of the cement which will combine to form the main crystal compounds of the cement. Depending on the type of cement the compounds of interest are calculated by theoretical stoichiometric formulae (Bogue Calculations).

Sulphur Trioxide (SO3): This value provides the total sulphur content of the cement (compounds within the clinker plus the sulphur from the gypsum). The main use of gypsum in cement is to control the speed at which the cement sets. The gypsum is optimized for the ultimate strength properties provided adequate set time control is maintainable. The quantity of gypsum required varies with the fineness of the cement and the chemical reactivity.

Magnesium Oxide (MgO): A maximum Magnesium Oxide value is specified for some cements in CSA A3001

C3A, Tri-Calcium Aluminate: Primarily hydrates extremely quickly. Within the first day most of this compound will be hydrated. Large quantities of heat will be evolved with the hydration of this compound. This compound is not conducive to resistance to sulphate attack.

Loss on Ignition (LOI): This is the loss of mass, expressed as a percent, that occurs in a sample held at 950°C. This indicates how much combined moisture, gypsum, and limestone is in the cement (although it is only a certain chemical portion of the limestone and gypsum that burns off).

Blaine Surface Area (BSA): This number represents the specific surface area of a cement sample which gives another indication of fineness. The test involves measuring the time involved for air to permeate through the void space in a sample of cement. The higher this number is, the finer the cement is (for a given residue).

% Retained 45µm (No. 325): This number represents the percentage retained on the 45um mesh. Generally, the lower this number the finer the cement. % retained 45 um and Blaine provide different information about the fineness. For example: A sample that is high-Blaine & high-residue has a wide particle size distribution, while a sample that is low-Blaine and low-residue has a very narrow particle size distribution. Two cements with the same Blaine, but different residues will hydrate and react differently.

Strength: Measurement of the compressive strength of cement mortar cubes at different ages. Typically, 1-day, 3-day, 7-day and 28-day

Initial time of set, minutes: This is a measure of the time required in minutes for a mortar to achieve a standard stiffness.

Mortar Bar Expansion: Measure of the expansion of a mortar bar stored under water for 14 days. It is necessary for all Types of cements with a SO3 greater than their corresponding SO3 limit.