
Standard Method of Test for

**Determining Air Content of
Hardened Portland Cement
Concrete by High-Pressure
Air Meter**

AASHTO Designation: T 356-22¹

Technically Revised: 2022

Technical Subcommittee: 3c, Hardened Concrete



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This test method covers laboratory determination of the air content of hardened portland cement concrete with the use of the high-pressure air meter. This determination is made from the observation of change in linear piston movement with a specimen in the test chamber from that of the linear piston movement with no specimen in the test chamber. This change is due to a replacement of specific volume of compressible air by a specific volume of incompressible water.
- 1.2. *This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this procedure to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitation prior to use.*
- 1.3. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- < M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - < R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - < T 121M/T 121, Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 - < T 152, Air Content of Freshly Mixed Concrete by the Pressure Method
- 2.2. *ASTM Standards:*
- < E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
 - < E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples

- E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard:*

- IEC 60584-1:2013 Thermocouples - Part 1: EMF Specifications and Tolerances

3. TERMINOLOGY

3.1. *Definitions:*

- 3.1.1. *linear piston movement (LPM)*—the travel of the hydraulic piston with a specimen in the test chamber.
- 3.1.2. *initial value (INIT)*—the stabilized travel of the hydraulic piston with no specimen in the test chamber.
- 3.1.3. *saturated surface-dry (SSD)*—the saturated surface-dry mass (weight) of the specimen.

4. SIGNIFICANCE AND USE

- 4.1. This test method covers determination of the air content of hardened concrete exclusive of any air that may be inside voids within aggregate particles. Therefore, determination of an aggregate correction factor, in accordance with the applicable requirements of T 152, is required.

5. APPARATUS

- 5.1. *High-Pressure Air Meter* (see Figure 1):
 - 5.1.1. *Hydraulic Pump and Hydraulic Cylinder*—A specially designed unit combining a hydraulic pump and a hydraulic cylinder employed to supply the 34 470 kPa (5000 psi) load required to force water into a concrete specimen in the test chamber. The unit is supplied hydraulic pressure, which is converted to water pressure by movement of the hydraulic piston.
 - 5.1.2. *Test Chamber* (Figures 2, 3, and 4)—A specially designed stainless steel seamless tube secured with a stainless steel plate at the bottom and a stainless steel lid at the top. This chamber is designed to contain water under pressure.
 - 5.1.3. *The System*—The cylinder, of known volume, is attached to the test chamber, of known volume, that is completely filled with deionized water. This is done in order to enable load from the hydraulic pump to be applied to the test chamber. The system is equipped with a dial gauge accurate to 0.0254 mm (0.001 in.), in order to measure the movement of the hydraulic piston. Volume displacement is determined by the measured movement of the hydraulic piston.

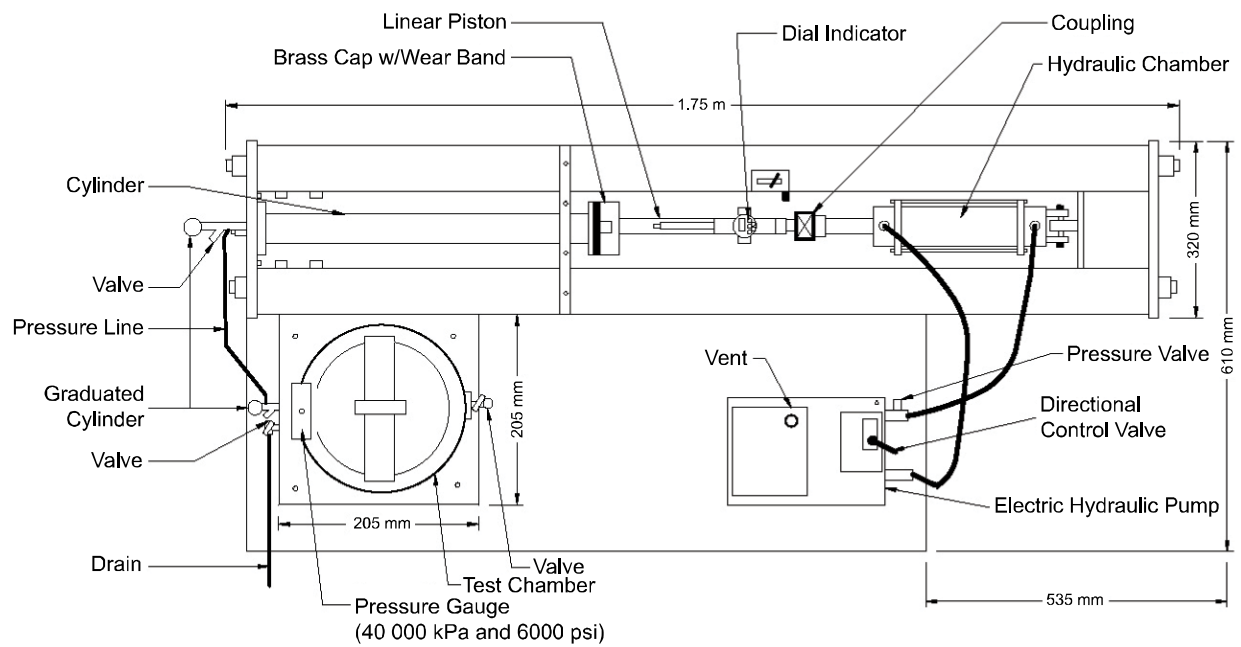


Figure 1—High-Pressure Air Meter (Plan View)