

# OPERATING INSTRUCTIONS

## Vicat Apparatus

### 38-4010

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<p><i>In the interests of improving and updating its equipment, ELE reserves the right to alter specifications to equipment at any time.</i></p> <p><b>ELE International 2018 ©</b></p>		

## Contents

<b>Section</b>		<b>Page</b>
<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Description</b>	<b>4</b>
<b>3</b>	<b>Temperature for Testing</b>	<b>6</b>
<b>4</b>	<b>Spares</b>	<b>8</b>

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**The equipment comprises of:**

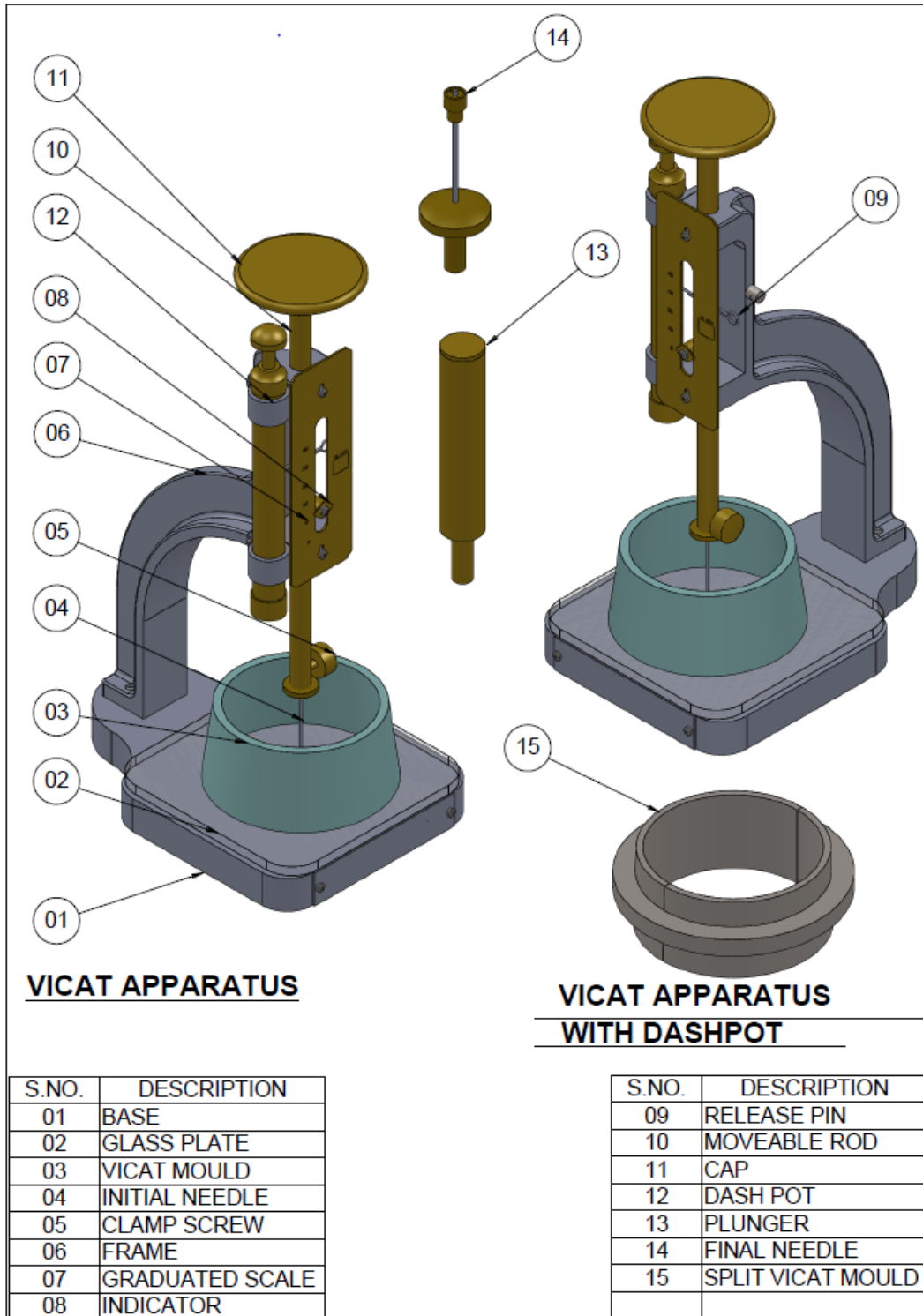
- |  |       |
|--|-------|
| 1. Metallic frame bearing a moveable rod with a cap at the top | 1 No. |
| 2. Glass Base Plate  | 1 No. |
| 3. Consistency Plunger, in plastic container                   | 1 No. |

**1 Introduction**

The Vicat Apparatus meets the requirements of EN 196-3. These are used for the determination of Standard Consistency, Initial Setting Time and Final Setting Time of cement paste of Ordinary Portland Cement, Rapid Hardening Portland Cement, Low Heat Portland Cement and other Hydraulic Cements as per the procedures described in EN 196-3, EN 480-2, EN 13454-2, ASTM C187, ASTM C191, AASHTO T129, AASHTO T131.

## 2 Description

The equipment is illustrated in the General Assembly Drawing below. The numbers given against the components in the descriptions below relate to this General Assembly Drawing.



The instrument consists of a base (1) connected to a metallic frame (6) bearing a moveable rod (10) with a cap (11) at one end. At the other end, any one of the following attachments which are interchangeable may be attached:

1. Initial Needle (4) : not supplied with Vicat Apparatus (see Spares section)
2. Final Needle (14) : not supplied with Vicat Apparatus (see Spares section)
3. Plunger (13) : supplied with Vicat Apparatus

The moveable bearing rod (10) carries an indicator (8) which moves over a graduated scale (7) attached to the frame (6). A release pin (9) is provided for holding the moveable rod whilst fixing the needle or plunger.

A dash pot is fitted to the frame. The dash pot (12) is filled with oil of low viscosity (oil is not supplied) and helps in slowly lowering the moveable rod. The use of 3-in-1, Singer oil or any equivalent oil of low viscosity is recommended.

### **2.1 Vicat Mould** : not supplied with Vicat Apparatus (see Spares section)

The mould (3) is in the form of a frustum of a cone with an internal diameter of 70 mm at the lower end and 80 mm at the upper end, with a height of  $40 \pm 0.2$  mm. The mould is kept on a glass plate (2) which is placed on the base (1) of the Vicat Apparatus.

### **2.2 Initial Needle** : not supplied with Vicat Apparatus (see Spares section)

The initial needle (4) is circular in cross-section and has a cross sectional area of 1 mm<sup>2</sup>. The end of the needle is flat. This is used for the determination of the initial setting time of the cement sample. (An ASTM needle is also available – see Spares section.)

### **2.3 Final Needle** : not supplied with Vicat Apparatus (see Spares section)

The final needle (14) is circular in cross-section and has a cross sectional area of 1 mm<sup>2</sup>. The needle is fitted in a metal attachment (hollowed out). The end of the needle projects beyond the cutting edge of the hollowed-out metal attachment. This is used for determining the final setting time of cement.

### **2.4 Plunger**

The Plunger (13) is known as the consistency plunger. It is made of polished brass with a projection at the upper end for insertion into the moveable rod. The lower end is flat.

### **2.5 Setting Up**

Keep the Vicat Apparatus on a level base. Keep the moveable rod at its highest position and hold it with the pin. Unscrew the top of the dash pot and half fill it with suitable oil of low viscosity and screw the top back on. Work the plunger a couple of times.

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### **3 Temperature for Testing**

#### **3.1 Determination of Consistency of Standard Cement Paste**

##### **3.1.1 Definition**

The standard consistency of a cement paste is that which will permit the Vicat Plunger to penetrate to a point 5 to 7 mm from the bottom of the Vicat Mould when cement is tested as described below.

##### **3.1.2 Specimen preparation**

Place 400 g of weighed cement in a dish. Run down a known quantity of water from the burette into the dish and mix it thoroughly, taking care that the time of gauging is not less than 3 minutes or more than 5 minutes and that gauging is completed before any sign of setting occurs. The gauging time is the time elapsed from the time of adding water to the dry material until the time the user starts to fill the mould. Clean appliances must be used for gauging. Only the gauging trowel (supplied as an accessory – see Spares section) and the operator's hand must be used.

##### **3.1.3 Test procedure**

Apply petroleum jelly to the inner surface of the Vicat Mould and the Base Plate so that there is no water leakage. Fit the plunger to the moveable rod, prepare the cement paste as described above and fill the mould using only the operator's hand and the blade of the gauging trowel. Level-off the surface of the mould and place the whole assembly on the base of the Vicat Apparatus. Place the mould filled with cement paste and the non-absorbent plate on the base plate of the Vicat Apparatus. Raise the plunger of the dash pot, bring it into contact with the top cap of the moveable bearing rod, remove the pin holding the moveable bearing rod to the surface of the cement paste and quickly release by pushing the plunger of the dash pot down by hand. The above must be carried out within the minimum possible time after filling the mould to avoid any setting. If signs of setting are observed, reject the paste and start with a fresh specimen.

Prepare the trial paste with varying percentages of water until the plunger penetrates to a point 5 to 7 mm from the bottom of the Vicat Mould, which is read on the scale. Express the water required as percentage by weight of the dry cement. The apparatus shall be free from vibration during the test.

#### **3.2 Determination of Initial Setting Time**

##### **3.2.1 Specimen preparation**

Prepare a neat cement paste by gauging the cement with 0.85 times the water required to give a paste of a standard consistency as detailed above, preferably in an atmosphere of 90% relative humidity. Remove the grease on the initial needle and start a stop watch at the time that water is added to the cement.

### 3.2.2 Test procedure

Attach a needle for the determination of initial setting time to the moveable bearing rod of the Vicat Apparatus and place the glass plate on the base. Lower the moveable rod and rest the needle on the plate. Raise the rod and pin it. Note the reading (A) on the scale. Fill the mould, positioned on the glass plate, with cement paste.

Whilst filling the mould, only the operator's hands and the gauging trowel must be used. Place the mould filled with cement paste and the test block on the glass plate on the base of the Vicat Apparatus under the bearing rod to which the initial needle is attached. Slowly bring down the needle to the surface of the cement paste and quickly release.

Raise the plunger of the dash pot, bring it into contact with the top cap of the moveable rod, remove the pin holding the moveable bearing rod and bring down the initial needle, attached to the moveable bearing rod, to the surface of the cement paste. Quickly release it by pushing the plunger of the dash pot down by hand.

Make a note of the reading on the scale. Similarly, take the penetration reading at regular intervals, say every 10 minutes. Be vigilant as the setting time approaches and observe the penetration at smaller intervals. Clean the needle from the sticking cement paste soon after it is withdrawn. Note the time when the needle rests, about a point  $5 \pm 0.5$  mm from the original reading (A) which corresponds to the bottom of the Vicat Mould. This gives the initial setting time.

### 3.3 Determination of Final Setting Time

#### 3.3.1 Test procedure

Remove the initial needle and fit in the final needle with the hollowed out metallic attachment to the bearing rod. Slowly lower the needle into contact with the surface of the paste and apply the needle gently to the surface. Use the plunger of the dash pot and set up the needle as described under the 'Determination of Initial Setting Time Test Procedure' in section 3.2.2). Repeat the same operation at regular intervals until the needle makes a mark on the surface of the test block while the metallic attachment fails to do so. Make a note of the time.

The time elapsed between when water is added to the dry material and the time at which the needle makes an impression on the surface, and the time at which the needle fails to make an impression when applied gently to the surface, gives the final setting time.

In the event of cement foam forming on the surface of the test block, the under-side of the test block may be used for determining the final test.

Take at least three specimens, the mean of these specimens is the final setting time.

### 3.4 Specifications for Setting Times of Various Types of Cement

S.No	Type of Cement	Initial setting time not less than	Final setting time not more than
1.	Ordinary Portland	30 minutes	600 minutes
2.	Rapid Hardening Portland	30 minutes	600 minutes
3.	Low Heat Portland	60 minutes	600 minutes

### 3.5 Precautions

- a. The apparatus should remain free from vibration during the test.
- b. Care should be taken to ensure that the initial needle is not bent and is fixed vertically straight into the moveable rod.
- c. The needles and the plunger should be kept free from the adhering cement, as the cement adhering on the sides may delay penetration and cement at the bottom may increase.
- d. All the tests should be carried out at  $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and 90% relative humidity.
- e. Petroleum Jelly should be applied to the mould.

### 3.6 Maintenance

- a. The bearing rod should be oiled periodically.
- b. All needles should be kept in their respective cases after they are cleaned and greased.

## 4 Spares

Product No.	Description
38-2200	Vicat Mould
38-2300	Vicat Mould and Glass Plate
38-4010/10	ASTM Initial Needle
38-4010/11	EN Initial Needle
38-4010/12	EN Final Needle
38-4010/13	EN Set of Needles
38-4010/14	Consistency Plunger
81-0335	Gauging Trowel