

OPERATING INSTRUCTIONS

Heat of Hydration Apparatus

38-4600

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1 Introduction

- 1.1 The chemical reaction during the hydration of cement is exothermic, producing up to 500 joules per gram.
- Under certain conditions for the use of cement, this heat output, when related to the low conductivity of concrete, can have detrimental effects on the finished product.
- 1.2 Where the designer considers that the heat produced during hydration of the cement will cause a problem, the specification will call for the use of low heat cement.
- 1.3 The test for heat of hydration of cement is used to determine the output of heat from a specific sample of cement by testing prepared specimens before and after hydration.

2 Description

- 2.1 General
- 2.1.1 The heat output during the test is only sufficient to cause the test solution to rise a few degrees Celsius. It is therefore important for the apparatus to be well insulated.
- It is also preferred that the test will be carried out under conditions of constant temperature.
- 2.1.2 Later heat of hydration apparatus incorporates an in-line 2 amp fuse as protection against short circuit. This is situated behind the polystyrene insulation in the rear section of the wooden box.
- 2.2 The flask assembly
- 2.2.1 The flask assembly comprises a wooden box containing the Dewar flask set in insulation materials. The box is arranged for easy access for removal of the flask between tests.
- 2.2.2 The top of the flask is enclosed with a cork with three holes to accept:
- a) thistle funnel
 - b) stirrer
 - c) Beckmann Thermometer
- 2.3 The upper assembly
- 2.3.1 A support rod is provided to carry the stirrer drive motor and the thermometer.
- 2.3.2 The motor is geared to rotate the stirrer at 400 rpm.
- 2.3.3 The glass stirrer is assembled into the drive mechanism by placing the nut onto the stirrer. Next, position the nylon 'olive' on the stirrer and finally lock the nut into the drive shaft. (Wetting the shaft will assist assembly.)
- 2.3.4 The thermometer is graduated to 0.01°C and is supplied with a magnifier.
- 2.4 How to adjust Beckmann Thermometers with dropping traps
- 2.4.1 The auxiliary divisions on the upper scale are used for adjusting. The thermometer may have been tipped upside down in transport and the mercury may have run up, filling the main chamber and the antechamber. Should this be the case, place the instrument in a vertical position and tap gently between both hands, thus forcing the mercury to flow back.
- 2.4.2 Make sure that there is no mercury left in the antechamber. When the mercury is again in the proper position and you wish to adjust, or rather measure, a temperature between 20° and 25°C, heat the bulb containing the mercury by hand or in a warm water bath until the mercury column registers 20°C on the auxiliary scale.
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- 2.4.3 Then hold the thermometer on the middle part of the instrument. A shake of the wrist will make the mercury flow out of the auxiliary chamber and into the antechamber.
- 2.4.4 Alternatively, tip the thermometer and tap the mercury into the antechamber.
- 2.4.5 In most cases the mercury will separate at the drop trap, leaving the entire capillary filled with mercury from the trap down to the actual separation.
- 2.4.6 The previously warmed up mercury bulb will now cool off and, when placing the instrument vertically into a water bath of 20°C, the temperature on the main temperature scale should read about 0°C. If the reading shown is higher, eg $\pm 1^\circ\text{C}$ or $\pm 2^\circ\text{C}$, this indicates that not enough mercury was shaken out.
- 2.4.7 In this instance mercury can be taken out of the capillary by the drop trap system by heating the mercury bulb. The upper capillary end which tapers into the drop trap needs to be watched during this procedure. The mercury will drop out of this opening.
- 2.4.8 By counting the drops you can calculate exactly the amount of mercury which needs to be taken out of the capillary, as the scale of each thermometer shows the temperature value of this drop of mercury.
- 2.4.9 If too much mercury has been taken out, the previously described procedure must be repeated.

With very little effort the Beckmann Thermometer with dropping traps may be adjusted to any desired temperature value.

2.5 Protection from hydrofluoric acid

- 2.5.1 It is important to apply a protective coating of wax, or similar waterproof material not sensitive to hydrofluoric acid, to all surfaces exposed to the solution.
- 2.5.2 The coatings should be as thin as possible to minimise the heat capacity of the apparatus, which represents an important correct factor as part of the calculations.

Important: regularly check all protective coatings for any sign of damage. Where damage has occurred, the coating must be replaced immediately.

- 2.5.3 The wax supplied by ELE will melt at approximately 60°C. Experience will be required to achieve good results.

It is recommended that the components to be coated are warmed before treatment.

3 Installation

Safety

Whilst the test is in operation do not remove any covers or attempt to adjust any part of the machine.

Ensure all moving parts are thoroughly secured before attempting any maintenance.

Ensure all appropriate measures are taken to protect the operator from excessive noise.

See noise certificate (when supplied).

Power Supply

Electrical safety

Warning: Before removing any covers or performing maintenance repair and service, isolate from electrical supply by removing mains plug. Where mains supply is required during these activities, only competent persons should perform the work.

Check that the power supply is compatible with the requirements stated on the label and connect in accordance with IEE regulations or to local requirements.

This machine may be operated through a standard 13 amp socket outlet when fitted with an appropriate 3 pin plug fused in accordance with the label.

The power cable is coded as follows:

Brown wire	L	Live or power
Blue wire	N	Neutral
Green/Yellow wire	E	Earth or Ground

Portable Appliance Tests (PAT)

All ELE designed products are tested for electrical safety prior to sale.

An electrical safety test label is fitted (usually adjacent to the mains input socket).

Should no label be found, please contact ELE Service Department quoting the serial number of the equipment.

Organisations have an obligation to ensure equipment is maintained and is safe for use. Regular PAT testing is one means of ensuring equipment continues to be electrically safe.

Important: do not connect PAT leads to sensitive components such as PCBs, control switches and the like.

DO NOT FLASH TEST ELECTRONIC EQUIPMENT.

If in doubt as to the most suitable connection point (which will usually be an earth stud or an external earth connection) contact the ELE Service Department for assistance.

4 Operation

- 4.1 The test must be carried out under carefully controlled conditions, the data recorded accurately, and calculated to obtain reliable and repeatable results.
- 4.2 It is recommended that where possible comparative tests with other authorities are undertaken to check the accuracy and repeatability of the apparatus and personnel.
- 4.3 For a recognised and accepted method of procedure refer to the relevant Standard.
- 4.4 The technique should be examined carefully and the procedures followed in detail to achieve the required results.

5 Spares

Dewar Flask	38-4600/10
Filling Funnel	38-4600/11
Beckmann Thermometer	38-4600/12
Glass Paddle	38-4600/13
Paraffin Wax	82-7021
Fuse 2 amp	6003X0011