



BS 1881 : Part 112 : 1983

UDC 666972.017 : 691.32 : 620.1

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British Standard
Testing concrete

Part 112. Methods of accelerated
curing of test cubes

Essais du béton

Partie 112. Méthodes de conservation accélérée des cubes d'essai

Prüfverfahren für Beton

Teil 112. Schnellverfahren zur Nachbehandlung von Probewürfeln

Contents

	Page		Page
Foreword	Inside front cover	4. 55 °C method	1
Committees responsible	Back cover	5. 82 °C method	3
		6. Report	3
Methods			
1. Scope	1	Figure	
2. Definitions	1	1. Typical curing tank for 82 °C method	2
3. 35 °C method	1		

Foreword

This Part of this British Standard, prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee, is a revision of clause 6 of BS 1881 : Part 3 : 1970. Together with Parts 109, 109, 110, 111 and 113, this Part of BS 1881 supersedes BS 1881 : Part 3 : 1970, which is withdrawn.

Two of the methods given in this Part use relatively high curing temperatures, 55 °C and 82 °C, and the third a moderate temperature, 35 °C. All methods enable strengths to be determined the day after the specimens are made.

Of the three methods of curing given, those at 55 °C and 82 °C were previously included in BS 1881 : Part 3 : 1970; the method of curing at 35 °C has been introduced in this Part as it is simpler and more convenient than working at the higher temperatures.

Strength test results from cubes that have been subjected to accelerated curing can be used for control purposes and it is also possible to use a regime of accelerated strength testing to judge compliance. In addition, the strength of normally cured concrete at later ages can be predicted by the use of correlations appropriate to the method, materials and mix used. While the 35 °C method is the simplest and most convenient of the three the correlations for a range of different concretes may be somewhat more widely dispersed than for the 55 °C and 82 °C methods.

Experience of accelerated curing of concrete has largely been gained from cubes made with ordinary or rapid hardening Portland cement and without admixtures. If other mixes are used caution is required when interpreting accelerated strength test results.

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British Standard

Testing concrete

Part 112. Methods of accelerated curing of test cubes

1. Scope

This Part of this British Standard describes the methods of accelerated curing of concrete test cubes at 35 °C, 55 °C and 82 °C.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2. Definitions

For the purposes of this Part of this British Standard, the definitions given in BS 5328 and BS 1881 : Part 101 apply together with the following:

21 specimen. The test cube complete with its mould and cover plate.

3. 35 °C method

3.1 Apparatus

3.1.1 *Cover plate.* A rigid plate, such as a base plate, to cover each mould (see BS 1881 : Part 108) to isolate the concrete from the water of the curing tank (see 3.1.2). The material for this cover plate shall be such that it does not react with the concrete or the mould.

3.1.2 *Curing tank.* A curing tank constructed from any material which is of adequate strength and corrosion resistant, provided with a lid and instruments for continuous recording of the water temperature. The internal dimensions of the tank shall be appropriate for the number and size of the test specimens to be accommodated, shall permit adequate circulation of the water and shall be such that the specimens can be removed easily. In order to provide adequate circulation of the water there shall be at least 30 mm of water above, below and around each specimen and in addition the specimens shall be at least 30 mm above the heating element. The curing tank shall be capable of holding sufficient water and of being controlled so that the temperature of the water at any point within the tank is maintained at 35 ± 2 °C at all times.

NOTE 1. For a convection circulating tank a volume of water at least 15 times the volume of concrete to be cured has been found to be satisfactory. If the tank is provided with forced circulation a volume of water at least 10 times the volume of concrete to be cured has been found to be satisfactory.

NOTE 2. It is advantageous to provide the tank and its lid with suitable thermal insulation.

NOTE 3. The power input required will be dependent on various factors including:

- (a) the surrounding air temperature;
- (b) the degree of tank insulation;
- (c) the volume of concrete placed in the tank;
- (d) the volume of water in the tank.

NOTE 4. Attention is drawn to the need for electrical safety both in the construction of the tank and in its installation and use (see CP 1017).

3.1.3 Thermometer, suitable for measuring maximum and minimum curing temperatures.

3.1.4 *Temperature recorder* (optional see 6.2.2(f)).

Recording thermograph and probe or similar arrangement fitted in the curing tank to provide a continuous record of the temperature in the curing tank for the whole of the curing cycle (see figure 1).

3.2 Making test cubes. Make the test cubes by the method described in BS 1881 : Part 108. Finish the upper surface of the concrete level with the top of the mould and then wipe the mould clean.

3.3 Procedure Thinly coat the *cover plate* with release agent to prevent adhesion of the concrete and place it in position to form a watertight seal: then immediately lower the specimens gently into the filled curing tank, ensuring that they are spaced in accordance with 3.12. Totally immerse the specimens for a period of $24 \text{ h} \pm 15 \text{ min}$, continuously recording the water temperature which shall be maintained at 35 ± 2 °C at all times except for a period not exceeding 15 min immediately after immersion of the specimens. Remove the specimens from the curing tank, demould the cubes and clearly and indelibly mark each one with an identification number or code. Test the cubes (see BS 1881 : Part 116) as soon as possible after removal from the curing tank.

4. 55 °C method

4.1 Apparatus

4.1.1 *Cover plate*, as described in 3.1.1.

4.1.2 *Curing tank*, as described in 3.1.2 but maintains a 55 ± 2 °C.

4.1.3 *Cooling tank.* A cooling tank constructed from any material which is of adequate strength and corrosion resistant. The internal dimensions of the tank shall be appropriate for the number and size of cubes to be accommodated, shall permit adequate circulation of water and shall be such that the cubes can be removed easily. The tank shall contain clean water which shall be renewed at *least once* a month and be controlled so that the temperature of the water at any point in the tank shall be maintained at 20 ± 5 °C during the period that cubes are being cooled.

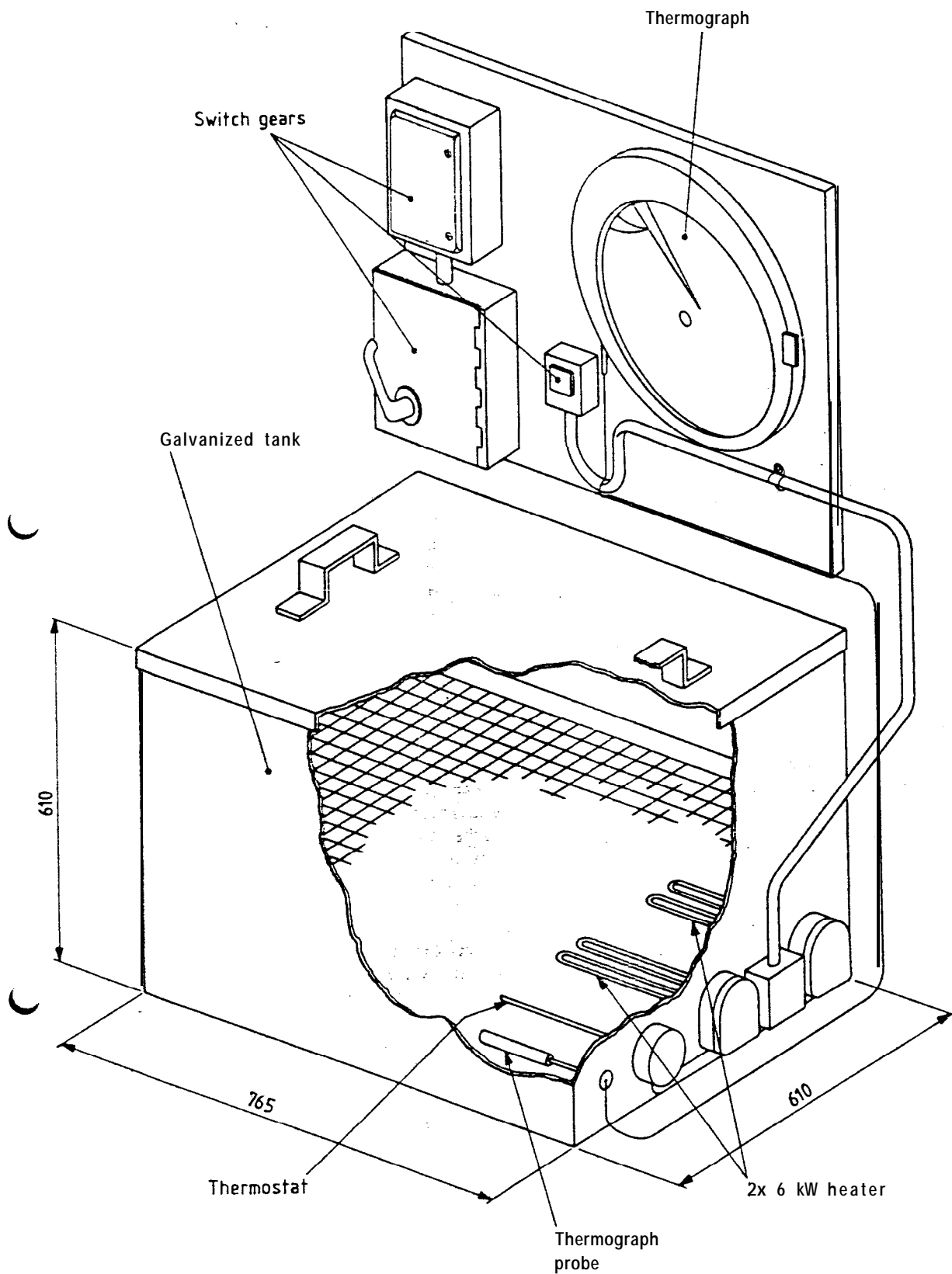


Figure 1. Typical curing tank for 82 °C method

4.1.4 *Thermometer*, as described in 3.1.3.

4.1.5 *Temperature recorder* (optional, see 6.2.2(f)), as described in 3.1.4.

4.2 Making test cubes. Test cubes shall be made in accordance with 3.2.

4.3 Procedure. Place the cover plate in position after being thinly coated with release agent to prevent adhesion of the concrete and leave the specimens to stand undisturbed in a place free from vibration at a temperature of 20 ± 5 °C for at least 1 h. Lower the specimens gently into the filled curing tank not less than 1 h 30 min or more than 3 h 30 min after the addition of the water to the other materials in the concrete mix, ensuring that the specimens are spaced in accordance with 3.1.2.

Totally immerse the specimens for a period of not less than 19 h 50 min, continuously recording the water temperature which shall be maintained at 55 ± 2 °C at all times except for a period not exceeding 15 min immediately after immersion of the specimens. Remove the specimens from the water, demould the cubes and clearly and indelibly mark each one with an identification number or code. Immerse the cubes in the cooling tank not more than 20 h 10 min after their time of immersion in the curing tank. Leave the cubes in the cooling tank for a period of between 1 h and 2 h and then test (see BS 1881 : Part 116) as soon as possible after removal from the cooling tank.

NOTE. To minimize the difficulties in handling and the risk of injury to the operator, it is recommended that suitable gloves or other aids should be used.

5. 82 °C method

5.1 Apparatus

5.1.1 *Cover plate*, as described in 3.1.1.

5.1.2 *Curing tank*, as described in 3.1.2 but maintained at 82 ± 2 °C. Additionally, the tank shall be fitted with a tap to enable the tank to be drained at the end of the curing period.

NOTE 1. A typical tank is shown in figure 1.

NOTE 2. For the tank shown in figure 1, two 6 kW electric immersion heaters have been found to be adequate.

5.1.3 *Temperature recorder*, as described in 3.1.4.

5.2 Making test cubes. Test cubes shall be made in accordance with 3.2

5.3 Procedure. Place the cover plate in position after being thinly coated with release agent to prevent adhesion of the concrete and then leave the specimens to stand undisturbed in a place free from vibration at a temperature of 20 ± 5 °C for at least 1 h. Place the specimens in the empty curing tank and fill with water at a temperature of between 5 °C and 20 °C until the specimens are totally immersed. Ensure that the specimens are spaced in accordance with 3.1.2. Raise the temperature of the water to 82 ± 2 °C in 2 h \pm 15 min and maintain it for a further 14 h \pm 15 min. Discharge the water from the tank within 5 min and remove the specimens from the tank. Demould the cubes and mark clearly and indelibly with an identification number or code. Test the cubes (see BS 1881 : Part 116) whilst they are still hot, as soon as possible after removal from their moulds and not later than 1 h after the discharge of the curing water.

NOTE. To minimize the difficulties in handling and the risk of injury to the operator, it is recommended that suitable gloves or other aids should be used.

6. Report

6.1 General. The report shall affirm that the cubes were cured in accordance with this Part of this British Standard. The report shall state whether or not a certificate of sampling and specimen preparation is available. If available, a copy of the certificate shall be provided.

6.2 Information to be included in the report

6.2.1 *Mandatory information*. The following information shall be included in the test report:

- (a) identification number or codes of specimens;
- (b) method of curing (35 °C, 55 °C or 82 °C method);
- (c) maximum and minimum curing temperatures;
- (d) certificate that curing has been carried out in accordance with this Part of this standard.

6.2.2 *Optional information*. If requested the following information shall be included in the test report:

- (a) time of adding water to the other materials in the concrete mix;
- (b) time of making cubes;
- (c) time of immersion of cubes into curing tank;
- (d) time of removal of cubes from curing tank;
- (e) time when cubes placed in and removed from cooling tank (55 °C method only);
- (f) temperature record during curing.

Publications referred to

- BS 1881 Testing concrete**
 - Part 101 Method of sampling fresh concrete on site**
 - Part 108 Method for making test cubes from fresh concrete**
 - Part 109' Method for making test beams from fresh concrete**
 - Part 110' Method for making test cylinders from fresh concrete**
 - Part 111 * Method of normal curing of test specimens (20 °C method)**
 - Part 113' Method for making and curing no-fines test cubes**
 - Part 116 Method for determination of compressive strength of concrete cubes**
- BS 5328 Methods for specifying concrete, including readymixed concrete**
- CP 1017 Distribution of electricity on construction and building sites**

*** Referred to in the foreword only.**

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This British Standard, having been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee, was published under the authority of the Board of BSI and comes into effect on 29 July 1983.

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ISBN 0 580 13333 8

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The following BSI references relate to the work on this standard: Committee reference CAB/4 Draft for comment 81/12319 DC

Committees responsible for this British Standard

This British Standard was published under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee CAB/-. Its preparation was entrusted to Technical Committee CAB/4 upon which the following bodies were represented:

- British Aggregate Construction Materials Industries
- British Precast Concrete Federation Ltd.
- British Ready Mixed Concrete Association
- Cement Admixtures Association
- Cement and Concrete Association
- Cement Makers' Federation
- Concrete Society Limited
- County Surveyors' Society
- Department of the Environment (Building Research Establishment)
- Department of the Environment (PSA)
- Department of the Environment (Transport and Road Research Laboratory)
- Department of Transport
- Electricity Supply Industry in England and Wales

- Federation of Civil Engineering Contractors
- Greater London Council
- Institute of Concrete Technology
- Institution of Civil Engineers
- Institution of Highway Engineers
- Institution of Municipal Engineers
- Institution of Structural Engineers
- Institution of Water Engineers and Scientists
- National Federation of Building Trades Employers
- Royal Institute of British Architects
- Royal Institution of Chattered Surveyors
- Sand and Gravel Association Limited
- Society of Chemical Industry

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- British Civil Engineering Test Equipment Manufacturers' Association
- Coopted members

Amendments issued since publication

Amd. No.	Date of issue	Text affected