

BS 1881-130:2013



BSI Standards Publication

# Testing concrete – Part 130: Method for temperature-matched curing of concrete specimens

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### **Summary of pages**

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## Foreword

### Publishing information

This part of BS 1881 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 January 2013. It was prepared by Subcommittee B/517/1, *Concrete production and testing*, under the authority of Technical Committee B/517, *Concrete*. A list of organizations represented on this committee can be obtained on request to its secretary.

### Supersession

This part of BS 1881 supersedes BS 1881-130:1996, which is withdrawn.

### Relationship with other publications

BS 1881 is published in the following parts:

- BS 1881-113, *Method for making and curing no-fines cubes*;
- BS 1881-119, *Method for determination of compressive strength using portions of beams broken in flexure (equivalent cube method)*;
- BS 1881-122, *Method for determination of water absorption*;
- BS 1881-124, *Methods for analysis of hardened concrete*;
- BS 1881-125, *Method for mixing and sampling fresh concrete in the laboratory*;
- BS 1881-128, *Method for analysis of fresh concrete*;
- BS 1881-129, *Method for the determination of density of partially compacted semi-dry fresh concrete*;
- BS 1881-130, *Method for temperature matched curing of concrete specimens*;
- BS 1881-131, *Methods for testing cement in a reference concrete*;
- BS 1881-201, *Guide to the use of non-destructive methods of test for hardened concrete*;
- BS 1881-204, *Recommendations on the use of electromagnetic covermeters*;
- BS 1881-206, *Recommendations for determination of strain in concrete*;
- BS 1881-207, *Recommendations for the assessment of concrete strength by near-to-surface tests*;
- BS 1881-208, *Recommendations for the initial surface absorption of concrete*;
- BS 1881-209, *Recommendations for the measurement of dynamic modulus of elasticity of concrete*;
- DD 216, *Determination of chloride content of fresh concrete*.

### Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is "shall".

*Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.*

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This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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## Introduction

During the period between fresh concrete in an element hardening, and it being subjected to working loads, an estimate of the in-situ strength might be required for a number of reasons, these include:

- to provide information on the gain of concrete strength in cold conditions;
- to determine the striking time for vertical and soffit formwork;
- to determine the time at which pre-stressing operations may be started
- to determine the time at which a member may be subjected to all or part of the working load; and
- to provide information on the effects of temperature on the long term strength of the concrete.

The in-situ cube or cylinder strength (as defined in BS 6089) differs from the standard strength of water-stored cubes or cylinders cured at 20 °C (as defined in BS EN 12390-2) for a number of reasons, including:

- variations in mix proportions within or between batches;
- differences in compaction;
- differences in moisture conditions during curing; and
- differences in temperature history.

This test procedure only addresses the difference in temperature history.

The temperature history of concrete in an element depends on the types and quantities of cement, the thermal properties of the concrete, the size and shape of the section, the insulating properties of the formwork, the ambient temperature conditions and the concrete placing temperature. Because of this, standard cubes or cylinders might not give a reliable indication of the concrete strength in the element, particularly at early ages, where large differences in temperature history can occur between cubes or cylinders stored at 20 °C, and the concrete in the element. An alternative method is therefore needed for estimating the early-age strength of the concrete in the element under consideration.

Several methods are in use, but these vary considerably in accuracy and appropriateness for the following reasons.

- Tests conforming to BS EN 12504-2 and BS EN 12504-3 are only suitable for estimating the concrete strength near to the surface as they are dependent on impact, resistance, or rupture of the concrete surface. However, as this is the concrete that protects the reinforcement, it is often the most highly stressed part of the cast section.
- Specimens cured alongside the cast section provide a safe and reasonable means by which the strength of the cast section can be estimated only if the cast section is thin and not insulated. In larger cast sections, specimens cured alongside substantially underestimate the early-age strength of the cast section.
- By matching the temperature of water in a curing bath to the rise and fall of temperature in a concrete element, specimens cured in the bath are subjected to the same temperature history as the concrete at a selected point in the element. When tested for strength, these specimens give a more accurate estimate of the concrete strength at a selected point in the element at the time of testing. This method of curing specimens is termed temperature-matched curing.

A feature of using temperature-matched curing is that a record is obtained of the rise and fall in concrete temperature due to the hydration of the cement. Depending on the particular conditions, the control of early-age thermal cracking might require conformity to a maximum peak temperature, a maximum fall from peak temperature to mean ambient temperature and/or a maximum temperature difference. Where the heat of hydration of the concrete causes the temperature to exceed 70 °C, the properties of the concrete might be affected. In order to assess the possibility of damage to concrete by any of the above phenomena, recording the temperature at various locations in the structure is often advantageous. Such an investigation may be undertaken either in conjunction with, or independently of temperature-matched curing. Annex A describes how such temperature histories can be recorded.

## 1 Scope

This part of BS 1881 describes the method for curing concrete cubes or cylinders so that they follow the concrete temperature at a pre-selected position in a concrete element.

Guidance on recording the temperature history at other positions in a concrete element is also given.

## 2 Normative References

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 12350-1, *Testing fresh concrete – Part 1: Sampling*

BS EN 12390-1, *Testing hardened concrete – Part 1: Shape, dimensions and other requirements for specimens and moulds*

BS EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests*

BS EN 12390-3, *Testing hardened concrete – Part 3: Compressive strength of test specimens*

## 3 Terms and definitions

For the purposes of this part of BS 1881, the terms and definitions given in BS EN 12350-1 apply.

## 4 Apparatus

**4.1** *Cube or cylinder moulds*, conforming to BS EN 12390-1 (as appropriate to the maximum aggregate size in use) together with a cover plate.

*NOTE* The function of the cover plate is to prevent concrete being washed from the specimen surface by the circulating water, but not necessarily to provide a complete seal. Mould bases make suitable cover plates.

**4.2** *Water bath (or curing tank)*, of sufficient capacity to contain at least four specimen moulds.

**4.3** *Water heater*, capable of raising the temperature of the water in the filled bath at a rate of 10 °C/h.