International Standard

ISO 18650-2

Third edition
2025-03

Building construction machinery and equipment — Concrete mixers —

Part 2: Procedure for examination of mixing efficiency

Machines et matériels pour la construction des bâtiments — Malaxeurs de béton —

Partie 2: Mode opératoire pour la détermination de l'efficacité de malaxage

Reference number
ISO 18650-2:2025(en)

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Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*, Subcommittee SC 1, *Machinery and equipment for concrete work*.

This third edition cancels and replaces the second edition (ISO 18650-2:2014), which has been technically revised.

The main changes are as follows:

— changed the Scope to be applicable to concrete mixers having a rated capacity greater than or equal to 0,5 m^3;

— modified Figure 1;

— modified Figure 2 and key;

— modified Figure 3 b) and key;

— modified the number of specimens in 5.4.1.1;

— modified the drawing of mixer in Figure 7 and corrected water temperature to (20 ± 2) °C

— modified Table 4;

— corrected keys marks for T_1 to T_3 in Figure 8.

A list of all parts in the ISO 18650 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document deals with the testing of the mixing capabilities of concrete mixers, characterized as the recommended mixing time.

The test consists of the determination of the variance of the mortar, coarse aggregate and air content, and the consistency of concrete mix samples, drawn after an assumed mixing time.

Compressive strength is also tested.

The measure of a concrete mixer's efficiency is the value of the variance of the above parameters, after the assumed mixing time.

This document provides for the preparation of concrete mix, sampling, execution of particular tests, criteria of test result evaluation and the test report.

Building construction machinery and equipment — Concrete mixers —

Part 2: Procedure for examination of mixing efficiency

1 Scope

This document specifies the procedure and requirements for examination of the mixing efficiency of batch-type and continuous-type concrete mixers as defined in ISO 18650-1. It is applicable to concrete mixers having a rated capacity greater than or equal to 0,5 m^3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1920-1, *Testing of concrete — Part 1: Sampling of fresh concrete*

ISO 1920-2, *Testing of concrete — Part 2: Properties of fresh concrete*

ISO 1920-3, *Testing of concrete — Part 3: Making and curing test specimens*

ISO 1920-4, *Testing of concrete — Part 4: Strength of hardened concrete*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 11375, *Building construction machinery and equipment — Terms and definitions*

ISO 18650-1, *Building construction machinery and equipment — Concrete mixers — Part 1: Commercial specifications*

ISO 20290-1, *Aggregates for concrete — Test methods for mechanical and physical properties — Part 1: Determination of bulk density, particle density, particle mass-per-volume and water absorption*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18650-1 and ISO 11375 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Requirements for mixer verified

The design and execution of the whole structure of the mixer and its components, such as the mixing chamber (drum, pan or trough), rotor with blades or paddle agitator(s), their directions of rotation, charging and discharging devices (if any), should be verified according to the manufacturer's instructions.

It shall be determined that the number of revolutions per minute of a drum or mixing tools conforms to the manufacturer's specification.

The drive system should be able to restart 5 min after being stopped when the mixer has completed the mixing of the test batch as specified in 5.2.

NOTE 1 The "restart" is for the additional mixing and does not warrant a series of restarts for the next batches.

The mixer shall be discharged according to its design or as specified by the manufacturer. The closure of the mixing chamber shall be so designed that the loss of the mix before discharge, i.e. during charging and mixing, remains below 0,5 %.

NOTE 2 The "below 0,5 %" requirement does not apply to the 1st batch which has more adhesion of mortar to the inner wall of drum.

5 Mixing performance test

5.1 General

The mixing efficiency is determined by the uniformity of the concrete mix and the compressive strength of the concrete cubes or cylinders, sampled after mixing time. The determination of the uniformity of the concrete mix includes the following variance tests on the sampled specimens:

a) air content;

b) content of mortar per unit volume;

c) content of coarse aggregate per unit volume;

d) consistency (slump).

The values of the concrete-mix component content (air, mortar, coarse aggregate), determined as the test results, as well as the consistency and compressive strength, are subsequently used for calculation of their variances.

For calculating the variance, ΔX, of the considered components' content and other features, expressed as a percentage, Formula (1) is applied:

$$\Delta X = \frac{X_1 - X_2}{X_1 + X_2} \times 100 \quad (1)$$

where

X_1 is the value of component content, slump and compressive strength received from portion 1 or 2 — larger value of X_1 and X_2;

X_2 is the value of component content, slump and compressive strength received from portion 1 or 2 — smaller value of X_1 and X_2.

To explain the physical sense of Formula (1), it can be transformed to Formula (2):

$$\Delta X = \frac{X_1 - X_2}{X_1 + X_2} = \frac{\frac{X_1 + X_2}{2} - X_2}{\frac{X_1 + X_2}{2}} \quad (2)$$

In this form it represents the variance of a subject parameter in two portions against its average value.

For evaluation of the test results, the particular variance values are compared with the acceptable results according to Clause 6.

5.2 Concrete mix preparation

The test concrete to be used for the mixing performance test should be specified by the concrete manufacturer or testing laboratory with the following conditions: coarse aggregates size up to 20 mm or 25 mm, slump (80 ± 30) mm, air content (4,5 ± 1,5) % and nominal compressive strength (25 ± 5) N/mm^2. In case of difficulty in obtaining of the assumed air content, an appropriate admixture may be used.

The quantity of components usually corresponds to the rating capacity declared by the mixer's manufacturer.

The constituent materials are to be weighed with measuring incertitude limits of ±3 %.

The sequence of a mixer charging with particular components should be as specified in the manufacturer's instruction. If there is no such instruction, the method of charging should be noted in the test report.

The charging of a mixer with constituent materials shall be carried out with a minimum loss of materials.

The mixing time shall be as specified by the manufacturer. If no such specification is available, the following approximate values — depending on the mixer type and its capacity — are recommended:

a) For batch-type gravity mixers:

   — rated capacity 1,0 m^3 and less, 60 s;

   — rated capacity above 1,0 m^3, 5 s added to 60 s for every 0,5 m^3 increase.

b) For batch-type compulsory mixers:

   — rated capacity 3,0 m^3 and less, 30 s;

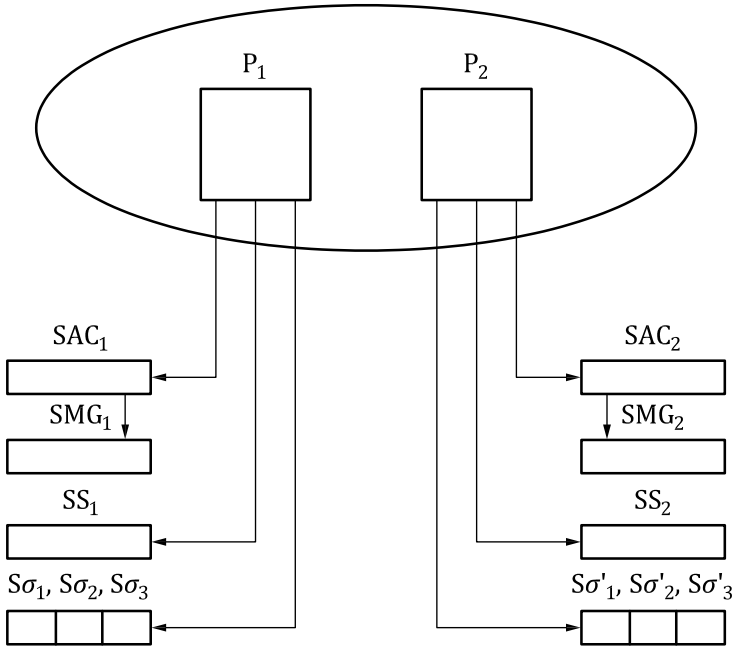
   — rated capacity above 3,0 m^3, 15 s added to 30 s for every 1,5 m^3 increase.

c) For continuous mixers: a mixing time corresponding to the duration of the concrete mix in the mixing chamber, which should be at least 10 s.

5.3 Sampling

5.3.1 General

Two portions of the concrete mix are sampled directly from the mixing chamber immediately after ensured mixing time (see Figures 2, 3, 4 and 5). Where the direct sampling from inside the mixing chamber is difficult, the sampling may be done from the concrete mix discharged to the hopper (see Figures 6 and 7). The volume of the sample (portion) should be a minimum of 20 l for batch mixers and 100 l for continuous mixers (see 5.3.4). Afterwards, the specimens for particular variance tests are prepared.



Key

P_1, P_2	concrete mix portion sampled from the mixer
SAC_1, SAC_2	specimens for air content test
SMG_1, SMG_2	specimens for air content test used for coarse aggregate and mortar content testing in further sequence
SS_1, SS_2	specimens for consistency (slump) test
$S\sigma_1$, $S\sigma_2$, $S\sigma_3$	specimens for compressive strength test (three cubes or cylinders from P_1 portion)
$S\sigma'_1$, $S\sigma'_2$, $S\sigma'_3$	specimens for compressive strength test (three cubes or cylinders from P_2 portion)

Figure 1 — General scheme of sampling

5.3.2 Batch-type compulsory mixers

5.3.2.1 Pan-type mixers

In pan-type mixers the samples (portions) are taken from concentric circles. Figure 2 shows an example of sampling in a turbo mixer.