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(JCMA/JSA)

**Concrete mixers—Part 2: Procedure
for examination of mixing efficiency**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Japan Construction Mechanization Association (JCMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

Consequently, **JIS A 8603**:1994 has been withdrawn and partly replaced with this Standard which has been established by dividing a part of the former standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS A 8603 series consists of the following 2 parts under the general title “Concrete mixers”:

Part 1: Terms and commercial specifications;

Part 2: Procedure for examination of mixing efficiency

Concrete mixers—Part 2: Procedure for examination of mixing efficiency

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 18650-2** published in 2006 with some modifications of the technical contents based on considerations of the history of usage of mixers in Japan and availability of related materials.

The portions with dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the procedure and requirements for examination of the mixing efficiency of batch-type and continuous-type concrete mixers as defined in **JIS A 8603-1**. It is applicable to concrete mixers having a rated capacity greater than or equal to 0.05 m³ (0.5 m³ for compulsory mixers).

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 18650-2:2006 *Building construction machinery and equipment—Concrete mixers—Part 2: Procedure for examination of mixing efficiency* (MOD)

The symbols which denote the degree of correspondence in the contents in the corresponding International Standard and **JIS** are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 1101 *Method of test for slump of concrete*

JIS A 1108 *Method of test for compressive strength of concrete*

JIS A 1109 *Methods of test for density and water absorption of fine aggregates*

NOTE : Corresponding International Standard: ISO 7033 *Fine and coarse aggregates for concrete—Determination of the particle mass-per-volume and water absorption—Pycnometer method* (MOD)

JIS A 1110 *Methods of test for density and water absorption of coarse aggregates*

NOTE : Corresponding International Standard: ISO 6783 *Coarse aggregates for concrete—Determination of particle density and water absorption—Hydrostatic balance method* (MOD)

JIS A 1115 *Method of sampling fresh concrete*

JIS A 1128 *Method of test for air content of fresh concrete by pressure method*

JIS A 1132 *Method of making and curing concrete specimens*

NOTE : Corresponding International Standard: ISO 1920-3 *Testing of concrete—Part 3: Making and curing test specimens* (MOD)

JIS A 8603-1 *Concrete mixers—Part 1: Terms and commercial specifications*

NOTE : Corresponding International Standard: ISO 18650-1 *Building construction machinery and equipment—Concrete mixers—Part 1: Vocabulary and general specifications* (MOD)

JIS Z 8801-1 *Test sieves—Part 1: Test sieves of metal wire cloth*

NOTE : Corresponding International Standard: ISO 3310-1 *Test sieves—Technical requirements and testing—Part 1: Test sieves of metal wire cloth* (MOD)

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS A 8603-1** apply.

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, number of revolution, charging and discharging devices (if any), should be verified according to the manufacturer's instructions.

The drive system shall be able to restart¹⁾ 5 min after being stopped when the mixer has completed the mixing of the test batch as specified in **5.2**.

The mixer shall be discharged according to its design. 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 %²⁾.

Notes ¹⁾ To “restart”, as referred to in this clause, is to carry out the additional mixing in case of emergency and is not to guarantee the repeated re-starting operation.

²⁾ This requirement does not apply to the first batch in which the amount of adherence of mortar to the inside of the mixing tank is usually greater.

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 (slump) 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, the following formula is applied.

$$\Delta X = \frac{X_1 - X_2}{X_1 + X_2} \times 100$$

where, X_1 : 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 : 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 this formula, it can be transformed as follows:

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

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 proportion

The test concrete to be used for the mixing performance test should be specified with the following conditions.

Coarse aggregates up to 20 mm or 25 mm, slump $8 \text{ cm} \pm 3 \text{ cm}$, air content $4.5 \% \pm 1.5 \%$, and nominal compressive strength 24. In case of difficulty in obtaining of the assumed air content, an appropriate admixture may be used.

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

The constituent materials shall be weighed within measuring accuracy limits of $\pm 3 \%$.

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 m³ and less, 60 s;
 - rated capacity above 1.0 m³, 5 s added to 60 s for every 0.5 m³ increase.
- b) For batch-type compulsory mixers:
 - rated capacity 3.0 m³ and less, 30 s;
 - rated capacity above 3.0 m³, 15 s added to 30 s for every 1.5 m³ increase.
- c) For continuous mixers: a mixing time corresponding to the duration of the concrete mix in the mixing chamber, which shall 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 assured mixing time (see figures 2 to 5 and figure 7). 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 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 (see figure 1).