SLOVENSKI STANDARD

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Testing fresh concrete - Part 12: Self-compacting concrete - J-ring test

Prüfung von Frischbeton - Teil 12: Selbstverdichtender Beton - Blockierring-Versuch

Essai pour béton frais - Partie 12 : Béton auto-plaçant - Essai d'écoulement a l'anneau

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Testing fresh concrete - Part 12: Self-compacting concrete - J-ring test

Essai pour béton frais - Partie 12 : Béton auto-plaçant - Essai d'écoulement à l'anneau

Prüfung von Frischbeton - Teil 12: Selbstverdichtender Beton - Blockierring-Versuch

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 104.

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Foreword

This document (prEN 12350-12:2007) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This standard is based on the results from the EU-project “Testing-SCC” under the 5th Frame Programme (GRD2-2000-30024/G6RD-CT-2001-00580).

Owing to its significant advantages in the improvement of construction quality and working environment, self-compacting concrete (SCC) has been more widely accepted by the construction owners. The use of SCC in practical concrete construction is stably increasing. Since SCC has to give satisfactory in-situ properties (perfect filling of the mould and embedment of the reinforcement, homogeneity and full compaction) without vibration, the proper methods for testing the workability of fresh SCC are very important. The workability of fresh SCC should basically include three key properties: filling ability, passing ability and resistance to segregation. It is desirable, especially in the case of new constituents or new concrete compositions, to test the workability of fresh SCC before casting in place.

A number of test methods are available for testing fresh SCC. Most of the commonly used test methods were evaluated in the recently closed EU-project “Testing-SCC” under the 5th Frame Programme (GRD2-2000-30024/G6RD-CT-2001-00580). According to the results from this EU project, it seems no single test method can completely cover all the three key properties. Nevertheless any test method should at least be correlated to the practical situation and give consistent results in order to provide reliable data for judgment of concrete workability.

This standard is one of a series concerned with testing fresh concrete.

This series EN 12350 includes the following parts.

EN 12350 *Testing fresh concrete*

- *Part 1: Sampling*;
- *Part 2: Slump test*;
- *Part 3: Vebe test*;
- *Part 4: Degree of compactability*;
- *Part 5: Flow table test*;
- *Part 6: Density*;
- *Part 7*: *Air content — Pressure methods*;
- *Part 8*: Self compacting concrete - *Slump-flow test;*
- *Part 9:* Self compacting concrete - *V-funnel test;*
- *Part 10:* Self compacting concrete - *L-box test;*
- *Part 11:* Self compacting concrete - *Sieve segregation test;*
- *Part 12:* Self compacting concrete - *J-ring test.*

Caution When cement is mixed with water, alkali is released. Take precautions to avoid dry cement entering the eyes, mouth and nose whilst mixing concrete. Prevent skin contact with wet cement or concrete by wearing suitable protective clothing. If cement or concrete enters the eye, immediately wash it out thoroughly with clean water and seek medical treatment without delay. Wash wet concrete off the skin immediately.

1 Scope

This document specifies the procedure for determining the passing ability (measured by the blocking step), the flow spread and t_{500J} flow time of self-compacting concrete as the concrete flows through the J-ring.

2 Normative references

The following referenced documents are indispensable for the application 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.

This document incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this document only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to (including any amendments) applies.

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

EN 12350-2, *Testing fresh concrete — Part 2: Slump test*

EN 12350-8, *Testing fresh concrete — Part 8: Slump flow test and t500 time for self-compacting concrete*

ISO 5725, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests*

3 Principle

The J-ring test is used to assess the passing ability of self-compacting concrete to flow through tight openings including spaces between reinforcing bars and other obstructions without segregation or blocking.

A narrow and wide bar spacing test is described. The narrow bar spacing simulates more congested reinforcement.

The J-ring test is an alternative to the L-box test EN 12350-10 although the result is not directly comparable.

The method follows the procedure detailed in EN 12350-8 Slump-flow and t_{500} time for self-compacting concrete except that, before filling the slump cone with concrete, the J-ring is placed concentrically over the cone. The J-ring consists of a ring of evenly spaced vertical, smooth bars.

In addition, the time when the concrete has flowed to a diameter of 500 mm t_{500J} may be measured.

4 Apparatus

The apparatus shall be in accordance with EN 12350-8 with the additional items as detailed below:

4.1 Narrow gap J-ring

(bar spacing approximately 41 mm) with the dimensions as shown in Figures 1 and 2.

4.2 Wide gap J-ring

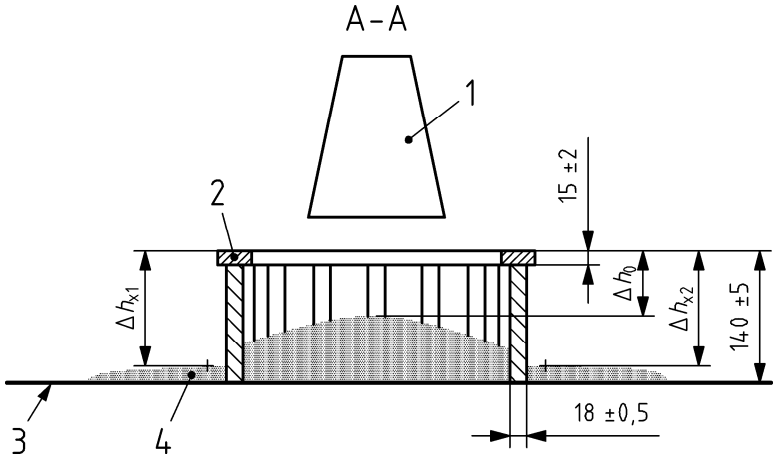
(bar spacing approximately 59 mm) with the dimensions as shown in Figures 1 and 3.

NOTE Other bar spacing J-rings may be used. Refer to national annex NA

4.3

Straight edge for aligning the reference line for the height measurements, with a length of about 400 mm and at least one straight edge having the flexure less than 1 mm.

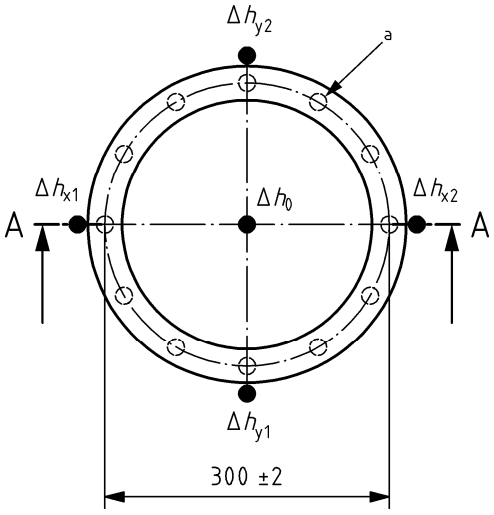
NOTE: Slump Cone may have the feet removed to fit inside the J-ring.



Key

1 Slump cone
2 J-ring
3 Baseplate
4 Concrete

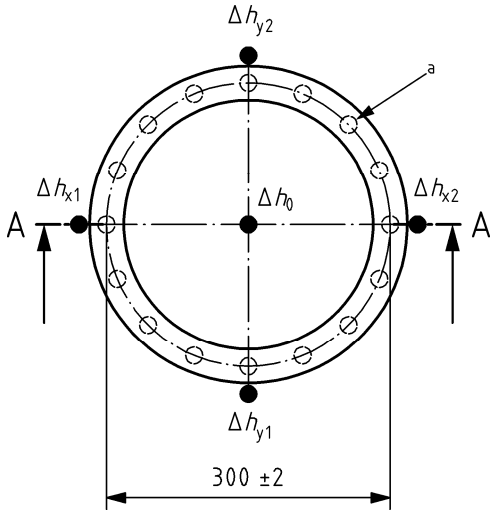
Figure 1 — Section A-A across J-ring



Key

a 16 X 18 mm Ø equally spaced ± 0,5mm smooth steel bars

Figure 2 — Narrow gap J-ring



Key

a 12 X 18 mm Ø equally spaced ± 0,5mm smooth steel bars

Figure 3 — Wide gap J-ring

5 Test sample

The sample shall be obtained in accordance with EN 12350-1.

6 Procedure

Prepare the cone and baseplate as described in EN 12350-8.

Place the cone centrally within the 210 mm circle on the baseplate and hold in position (or use the weighted collar), ensuring that no concrete can leak from under the cone.

Place the J-ring on the base plate, concentrically around the cone.

Fill the cone in one operation without any agitation or mechanical compaction, and strike off surplus from the top of the cone. Allow the filled cone to stand for not more than 30s; during this time remove any spilled concrete from the baseplate and ensure the baseplate is damp all over but without any surplus water.

Lift the cone vertically in one movement without interfering with the flow of concrete. If the t_{500J} time has been requested, start the stop watch immediately the cone ceases to be in contact with the baseplate and record the time taken to the nearest 0,1 s for the concrete to reach the 500 mm circle at any point.

Without disturbing the baseplate or concrete, measure the largest diameter of the flow spread and record as d_m to the nearest 10 mm. Then measure the diameter of the flow spread at right angles to d_m to the nearest 10 mm and record as d_r to the nearest 10 mm.

Lay the straight edge on the top side of the J-ring and measure the relative height differences between the lower edge of the straight edge and the concrete surface at the central position Δh_0 and at the four positions outside the J-ring, two Δh_{x1}, Δh_{x2} *in* the *x*-direction and the other two Δh_{y1}, Δh_{y2} in the *y*-direction (perpendicular to *x*), as shown in figure 1a measured to the nearest mm.

Check the concrete spread for segregation. The cement paste/mortar may segregate from the coarse aggregate to give a ring of paste/mortar. Segregated coarse aggregate may also be observed in the central area. Report if segregation has occurred.

7 Expression of results

7.1

The J-ring blocking step B_J is calculated using the equation below and expressed to the nearest 1 mm.

$$B_J = \frac{\left(\Delta h_{x1} + \Delta h_{x2} + \Delta h_{y1} + \Delta h_{y2}\right)}{4} - \Delta h_0$$

where:

B_J blocking step and

Δh measurement heights

7.2

The J-ring flow spread SF_J is the mean of d_m and d_r, expressed to the nearest 10 mm given by the following equation.

$$SF_J = \frac{(d_m + d_r)}{2}$$

where:

SF_J flow spread, in mm

d_m largest diameter of flow spread, in mm

d_r flow spread at 90° to d_m , in mm

7.3

The J-ring flow time t_{500J} is the period between the moment the cone leaves the base plate and SCC first touches the circle of diameter 500 mm. t_{500J} is expressed in seconds to the nearest 0,5 s.

8 Test report

The test report shall include:

a) identification of the test sample;

b) location where the test was performed;

c) date and time of test;

d) whether narrow or wide gap J-ring used;

e) blocking step B_J, to the nearest 1mm;

f) low spread SF_J, to the nearest 10 mm;

g) any indication of segregation of the concrete;

h) age of concrete at time of test (if known);

i) any deviation from the standard test method;

j) a declaration by the person technically responsible for the test that it was carried out in accordance wit this document, except as noted in item i)

The report may include:

k) t_{500J} time to the nearest 0,5 s;

l) temperature of the concrete at the time of test;

9 Precision

The repeatability *r* and the reproducibility *R* have been determined for the narrow gap J-ring by a programme including 8 laboratories, 16 operators and 2 replicates, and interpreted in accordance with ISO 5725: 1994

The resulting values for r and R when using the narrow gap J-ring are given in Table 1. No data exists for the wide gap J-ring

Table 1 — Precisions of the J-ring (narrow gap) flow spread SFJ, blocking step BJ and flow time t_{500J}

J-ring flow spread SF_J mm	< 600	600 - 750	> 750
Repeatability *r* mm	59	46	25
Reproducibility *R* mm	67	46	31
J-ring blocking step B_J mm	≤ 20		> 20
Repeatability *r* mm	4.6		7.8
Reproducibility *R* mm	4.9		7.8
J-ring flow time t_{500J} s	≤ 3.5	3.5 - 6	> 6
Repeatability *r* s	0.70	1.23	4.34
Reproducibility *R* s	0.90	1.32	4.34