BS EN 12350-12:2010

BSI Standards Publication

Testing fresh concrete

Part 12: Self-compacting concrete — J-ring test

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/517/1, Concrete production and testing.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

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

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

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Foreword

This document (EN 12350-12:2010) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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 widely accepted by the construction owners. The use of SCC in practical concrete construction is steadily 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 fresh SCC are very important. The consistence 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 consistence of fresh SCC before casting in place.

A number of test methods including this test 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.

EN 12350, *Testing fresh concrete*, consists of the following parts:

— *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*

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— *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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard 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.

The test is not suitable when the maximum size of aggregate exceeds 40 mm.

NOTE In respect to the relationship between aggregate size and bar spacing, the test is intended to assess the passing ability of the concrete proposed with the bar spacing typically in the works. If the concrete blocks then the aggregate size could be too large for the particular application.

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.

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

EN 12350-8, *Testing fresh concrete — Part 8: Self-compacting concrete — Slump-flow test*

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 except that, before filling the slump cone with concrete, the J-ring, consisting of a ring of evenly spaced vertical smooth bars, is placed over the cone.

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

4 Apparatus

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

NOTE The feet to the slump cone may be removed to fit inside the J-ring or if their presence prevents free upward movement from within the J-ring.

4.1 Narrow gap J-ring.

Smooth steel bars, (18 ± 0,5) mm ∅, secured to a ring (300 ± 2) mm diameter (bar spacing of (41 ± 1) mm) with the dimensions as shown in Figures 1 and 2.

4.2 Wide gap J-ring.

Smooth steel bars, (18 ± 0,5) mm ∅, secured to a ring (300 ± 2) mm diameter (bar spacing of (59 ± 1) mm) with the dimensions as shown in Figures 1 and 3.

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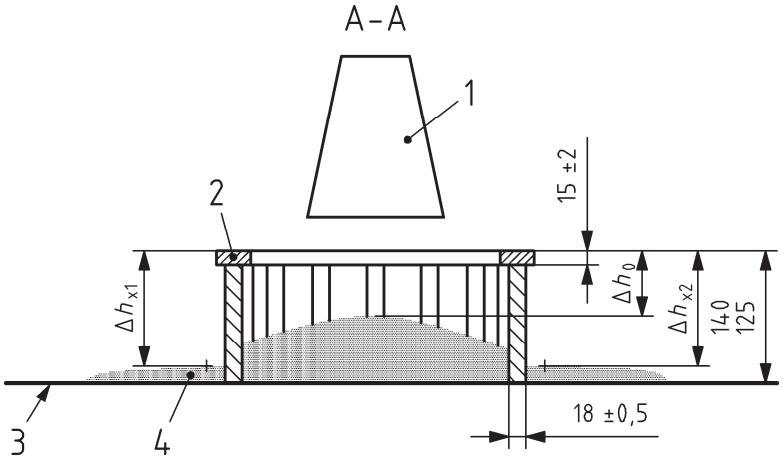
4.3 Straight edge.

Straight edge for aligning the reference line for the height measurements, with a length of about 400 mm.

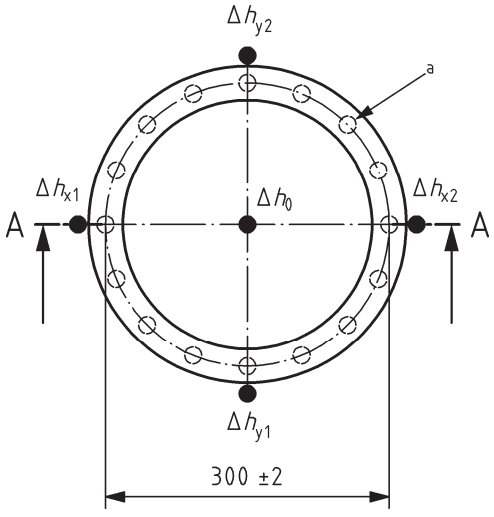
Dimensions in millimetres



Key
1 Slump cone
2 J-ring
3 Baseplate
4 Concrete
Δ*h* Difference in height between top of J-ring and top of the concrete at points referenced

Figure 1 — Section A-A across J-ring

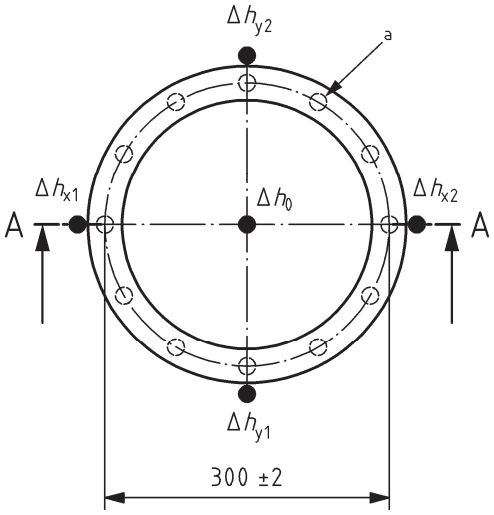
Dimensions in millimetres



Key
a 16 equally spaced smooth steel bars (± 0,5 mm)
Δ*h* Difference in height between top of J-ring and top of the concrete at points referenced

Figure 2 — Narrow gap J-ring

Dimensions in millimetres



Key
a 12 equally spaced smooth steel bars (± 0,5 mm)
Δ*h* Difference in height between top of J-ring and top of the concrete at points referenced

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 30 s; 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 1 s to 3 s 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_1 to the nearest 10 mm. Then measure the diameter of the flow spread at right angles to d_1 to the nearest 10 mm and record as d_2 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 Figures 2 and 3, measured to the nearest 1 mm.

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Check the concrete spread for signs of segregation and report under item 8, h) in a qualitative way, e.g. no indication of segregation, strong indication of segregation.

NOTE Signs of segregation include a ring of cement paste/mortar and segregated coarse aggregate in the central area.

7 Expression of results

7.1 Passing ability *PJ*

The J-ring passing ability PJ, measured by the blocking step, is calculated using the equation below and expressed to the nearest 1 mm.

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

where

PJ is the passing ability, measured by the blocking step, in millimetres;

Δh are the measurement heights, in millimetres.

7.2 Flow spread SF_J

The J-ring flow spread SF_J is the mean of d_1 and d_2, expressed to the nearest 10 mm given by the following equation:

$$SF_J = \frac{(d_1 + d_2)}{2}$$

where

SF_J is the flow spread, in millimetres;

d_1 is the largest diameter of flow spread, in millimetres;

d_2 is the flow spread at 90° to d_1, in millimetres.

7.3 Flow time t_{500J}

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. The time 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) passing ability PJ, measured by the blocking step, to the nearest 1 mm;

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

g) t_{500J} time, to the nearest 0,5 s (when requested);

h) any indication of segregation of the concrete;

i) any deviation from the standard test method;

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

The report may include:

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

l) age of concrete at time of test (if known).

9 Repeatability and reproducibility

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

The resulting values for r and R when using the narrow gap J-ring are given in Tables 1, 2 and 3. No data exists for the wide gap J-ring.

Table 1 — Repeatability and reproducibility for typical values of the narrow gap J-ring passing ability PJ, measured by the blocking step

J-ring passing ability PJ, measured by the blocking step, in millimetres	≤ 20	> 20
Repeatability r in millimetres	4,6	7,8
Reproducibility R in millimetres	4,9	7,8

Table 2 — Repeatability and reproducibility for typical values of the narrow gap J-ring flow spread SF_J

J-ring flow spread SF_J in millimetres	< 600	600 − 750	> 750
Repeatability r in millimetres	59	46	25
Reproducibility R in millimetres	67	46	31

Table 3 — Repeatability and reproducibility for typical values of the narrow gap J-ring flow time t_{500J}

J-ring flow time t_{500J} in seconds	≤ 3,5	3,5 − 6	> 6
Repeatability r in seconds	0,70	1,23	4,34
Reproducibility R in seconds	0,90	1,32	4,34

Bibliography

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

[2] EN 12350-10, *Testing fresh concrete — Part 10: Self-compacting concrete — L box test*

[3] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

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