Designation: C1621/C1621M – 17

Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring[1]

This standard is issued under the fixed designation C1621/C1621M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers determination of the passing ability of self-consolidating concrete (SCC) by using the J-Ring in combination with a mold.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 The text of this standard references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* (**Warning—**Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.[2])

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C125 Terminology Relating to Concrete and Concrete Aggregates

C143/C143M Test Method for Slump of Hydraulic-Cement Concrete

C172 Practice for Sampling Freshly Mixed Concrete

C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C1611/C1611M Test Method for Slump Flow of Self-Consolidating Concrete

C1758/C1758M Practice for Fabricating Test Specimens with Self-Consolidating Concrete

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology C125.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *halo, n*—an observed cement paste or mortar ring that has clearly separated from the coarse aggregate, around the outside circumference of concrete after flowing from the mold.

3.2.2 *J-ring, n*—an apparatus consisting of a rigid ring supported on sixteen 16 mm [⅝ in.] diameter rods equally spaced on a 300 mm [12 in.] diameter circle 100 mm [4 in.] above a flat surface as shown in Fig. 1.

3.2.3 *J-ring flow, n*—the distance of lateral flow of concrete using the J-Ring in combination with a mold.

3.2.4 *passing ability, n*—the ability of self-consolidating concrete to flow under its own weight (without vibration) and fill completely all spaces within intricate formwork, containing obstacles, such as reinforcement.

4. Summary of Test Method

4.1 A sample of freshly mixed concrete is placed in a mold, either in the upright or inverted position, that is concentric with the J-Ring (Fig. 2). The concrete is placed in one lift without tamping or vibration. The mold is raised, and the concrete is allowed to spread through the J-Ring (Fig. 3). After spreading ceases, two diameters of the concrete mass are measured in approximately orthogonal directions. J-Ring flow is the average of the two diameters. The test is repeated without the J-Ring to obtain the slump flow. The difference between the slump flow and J-Ring flow is an indicator of the passing ability of the concrete.

[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.47 on Self-Consolidating Concrete.

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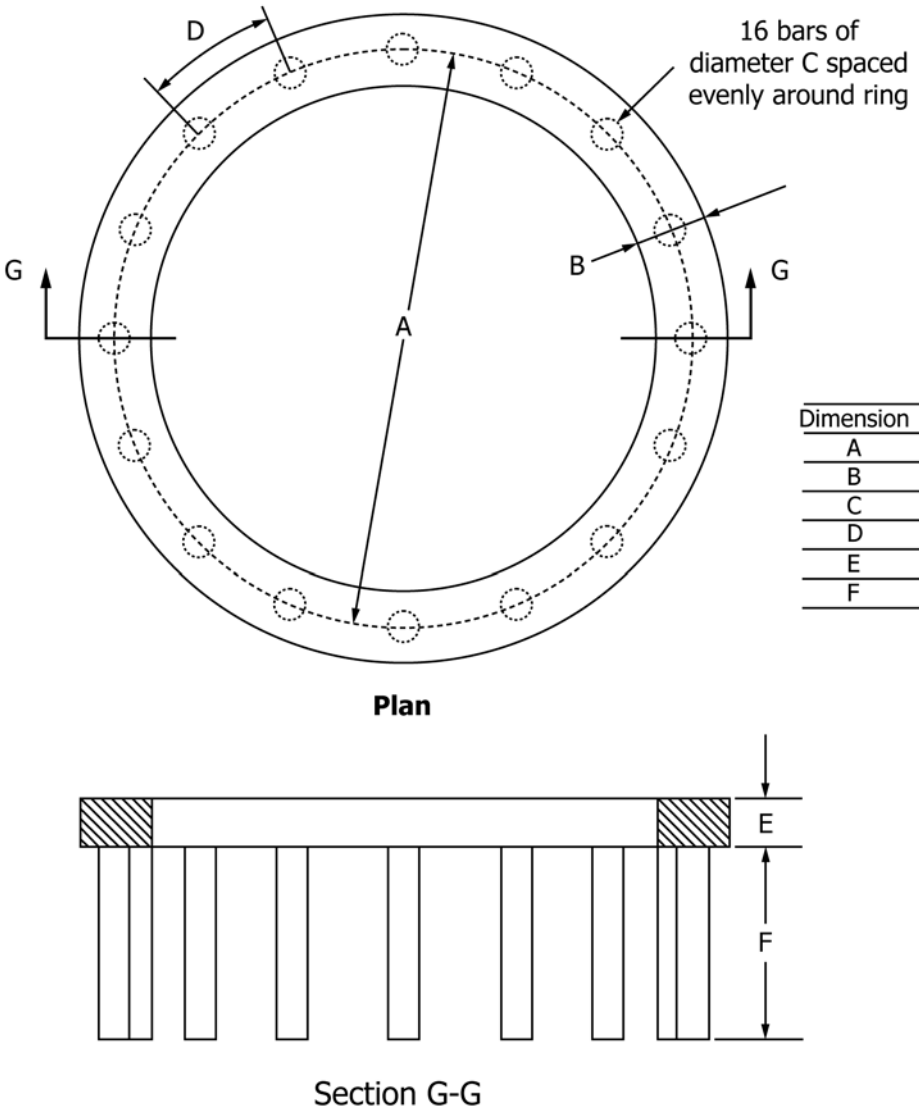
[2] Section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol 04.02.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**



Dimension	mm	in.
A	300 ± 3.3	12.0 ± 0.13
B	38 ± 1.5	1.5 ± 0.06
C	16 ± 3.3	0.625 ± 0.13
D	58.9 ± 1.5	2.36 ± 0.06
E	25 ± 1.5	1.0 ± 0.06
F	100 ± 1.5	4.0 ± 0.06

FIG. 1 J-Ring Apparatus

5. Significance and Use

5.1 This test method provides a procedure to determine the passing ability of self-consolidating concrete. This test method is applicable for laboratory use in comparing the passing ability of different concrete mixtures. It is also applicable in the field as a quality control test.

5.2 The difference between the slump flow and J-Ring flow is an indication of the passing ability of the concrete. A difference less than 25 mm [1 in.] indicates good passing ability and a difference greater than 50 mm [2 in.] indicates poor passing ability. The orientation of the mold for the J-Ring test and for the slump flow test without the J-Ring shall be the same.

5.3 This test method is limited to self-consolidating concrete with nominal maximum size of aggregate of up to 25 mm [1 in.].

6. Apparatus

6.1 *J-Ring*—The apparatus shall consist of a steel (or equivalent nonabsorbent, rigid material) ring measuring 300 mm [12 in.] in diameter at the center of the ring and 25 mm [1 in.] in thickness, and sixteen 16 mm [⅝ in.] diameter smooth steel rods spaced evenly around the ring measuring 100 mm [4 in.] in length (see Fig. 1).

6.2 *Mold*—The mold used in this test method shall conform to that described in Test Method C143/C143M, except that the foot pieces are removed when the test is performed with the mold in the upright position (Procedure A).

6.3 *Base Plate*—A nonabsorbent, smooth, rigid plate having a minimum diameter of 915 mm [36 in.].

NOTE 1—Field experience has shown that base plates made from sealed or laminated plywood, rigid plastic, or steel are suitable for performing this test.

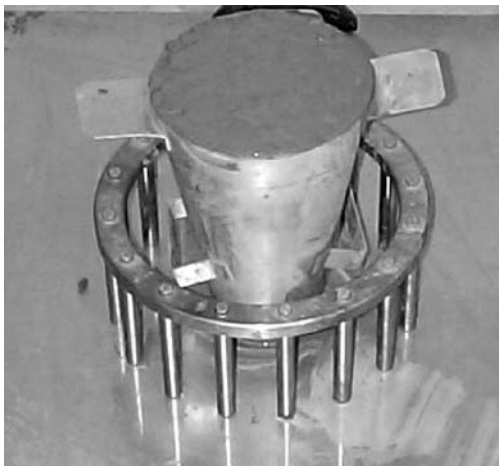


FIG. 2 J-Ring Setup with Inverted Mold Filled with Concrete

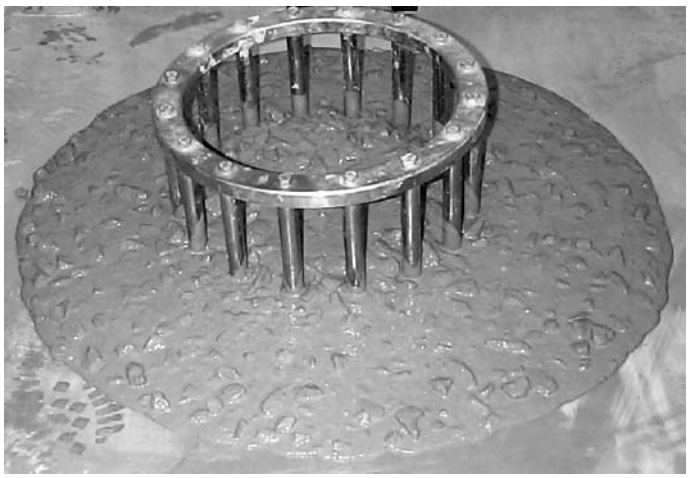


FIG. 3 J-Ring Flow

6.4 *Strike-off Bar*—As described in Test Method C173/C173M.

6.5 *Measuring Device*—A ruler, metal roll-up measuring tape, or similar rigid or semi-rigid measuring instrument marked in increments of 5 mm [¼ in.] or less.

6.6 *Sample Receptacle*—A pan or wheelbarrow that is water-tight, has a nonabsorbent surface, and is large enough to allow both remixing of the entire sample and retain a volume of concrete sufficient to fill the mold.

6.7 *Other Tools*—Items such as shovels and scoops capable of remixing the concrete in the sample receptacle, filling the pouring vessel, or both.

7. Sample

7.1 Obtain a sample of freshly-mixed self-consolidating concrete in accordance with Practice C172 and place it in the sample receptacle.

8. Procedure

8.1 Perform this test on a flat, level, nonabsorbent work surface such as a concrete floor or base plate. Use a base plate in conditions where a flat, level surface is not available, such as on a construction site. When the base plate is used, position and shim the base plate so that it is fully supported. Dampen the work surface, removing any standing water. Do not subject the work surface or mold to vibration or disturbance.

8.1.1 When performing the slump flow test for a given study or project, do not change the base plate type for the duration of the study or project.

8.1.2 Place the J-Ring on the work surface or at the center of the base plate.

8.2 Remixing of Sample. Remix the sample, obtained in accordance with 7.1, in the sample receptacle using a shovel or scoop so that the concrete is homogeneous.

8.3 *Filling the Mold*—Fill the mold by following either Procedure A or Procedure B.

8.3.1 *Filling Procedure A (Upright Mold)*—Dampen the interior of the mold and place it on the work surface or base plate with the larger opening facing down and concentric with the J-Ring. Hold the mold firmly in place during filling.

8.3.2 *Filling Procedure B (Inverted Mold)*—Dampen the interior of the mold and place it on the work surface or base plate with the smaller opening facing down and concentric with the J-Ring (see Note 2).

NOTE 2—As a precaution, when filling the mold in the inverted position, the mold may be supported to prevent accidental movement or tipping. Experienced users of this test method have found that it is not necessary to support the mold.

8.3.3 Fill the mold with SCC in accordance with the procedure in Practice C1758/C1758M.

8.4 Strike off the surface of the concrete level with the top of the mold by a sawing motion of the strike-off bar. Remove concrete from the area surrounding the base of the mold to preclude interference with the movement of the flowing concrete. Remove the mold from the concrete by raising it vertically. Raise the mold a distance of 225 ± 75 mm [9 ± 3 in.] in 3 ± 1 s by a steady upward lift with no lateral or torsional motion. Complete the entire test from the start of filling through removal of the mold without interruption within an elapsed time of 2 ½ min.

8.5 Wait for the concrete to stop flowing and then measure the largest diameter (j_1) of the resulting circular spread of concrete. When a halo is observed in the resulting circular spread of concrete, it shall be included as part of the diameter of the concrete. Measure a second diameter (j_2) of the circular spread at an angle approximately perpendicular to the first measured diameter (j_1). Measure the diameters to the nearest 5 mm [¼ in.]. Determine the J-Ring flow in accordance with Section 9.

8.6 If the measurement of the two diameters differs by more than 50 mm [2 in.], the test is invalid and shall be repeated.

8.7 Conduct a slump flow test without the J-Ring in accordance with Test Method C1611/C1611M. Use the same filling procedure as used with the J-Ring. Complete the tests with and without the J-Ring within 6 min.

9. Calculation

9.1 Calculate J-Ring flow according to the following equation:

$$\text{J} - \text{Ring flow} = \frac{(j_1 + j_2)}{2} \quad (1)$$

where:

j_1 = the largest diameter of the circular spread of the concrete from the J-Ring test, and

j_2 = the circular spread of the concrete at an angle approximately perpendicular to j_1.

9.2 Calculate the slump flow according to the following equation:

$$\text{Slump flow} = \frac{(d_1 + d_2)}{2} \quad (2)$$

where:

d_1 = the largest diameter of the circular spread of the concrete from the slump flow test, and

d_2 = the circular spread of the concrete at an angle approximately perpendicular to d_1.

9.3 Calculate the difference between slump flow and J-Ring flow to the nearest 10 mm [½ in.]. This number represents the passing ability of the concrete.

10. Blocking Assessment

10.1 Identify blocking assessment according to Table 1.

TABLE 1 Blocking Assessment

Difference Between Slump Flow and J-Ring Flow	Blocking Assessment
0 to 25 mm [0 to 1 in.]	No visible blocking
>25 to 50 mm [>1 to 2 in.]	Minimal to noticeable blocking
>50 mm [>2 in.]	Noticeable to extreme blocking

11. Report

11.1 Report the filling procedure (A or B) used.

11.2 Report the J-Ring flow to the nearest 10 mm [½ in.].

11.3 Report the slump flow (without the J-Ring) to the nearest 10 mm [½ in.].

11.4 Report the passing ability as the difference between the slump flow and J-Ring flow to the nearest 10 mm [½ in.]. Identify the blocking assessment.

12. Precision and Bias

12.1 *Precision*—An interlaboratory study of this test method has not been carried out. In a study involving two operators who performed three replicate tests on 30 batches of the same concrete mixture during normal production at a precast plant, the within-test standard deviation (repeatability) for passing ability was 5.8 mm [0.23 in.]. The average passing ability in these tests was 20.5 mm [0.81 in.] for slump-flow values ranging from about 480 to 740 mm [19 to 29 in.]. Measurements were done in the inch-pound system and the SI values are conversion of the inch-pound values.

12.2 *Bias*—The procedure used in this test method has no bias since passing ability based on the J-Ring flow is defined only in terms of this test method.

13. Keywords

13.1 halo; j-ring; j-ring flow; passing ability self-consolidating concrete; slump flow; spread

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this standard since the last issue (C1621/C1621M – 14) that may impact the use of this standard. (Approved Aug. 1, 2017.)

(1) Added Practice C1758/C1758M to list of referenced documents (Section 2).
(2) Removed previous 6.7 and Note 2.
(3) Removed previous 8.3.3 through 8.3.5.
(4) Added new 8.3.3.