Designation: C 1621/C 1621M – 08

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

This standard is issued under the fixed designation C 1621/C 1621M; 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 by using the J-Ring in combination with a slump cone mold. The test method is limited to concrete with nominal maximum size of aggregate of up to 1 in [25 mm].

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

1.3 The text of this standard references notes that provide explanatory material. These notes (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]

2. Referenced Documents

2.1 *ASTM Standards:* [3]

C 125 Terminology Relating to Concrete and Concrete Aggregates

C 143/C 143M Test Method for Slump of Hydraulic-Cement Concrete

C 172 Practice for Sampling Freshly Mixed Concrete

C 173/C 173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C 1611/C 1611M Test Method for Slump Flow of Self-Consolidating Concrete

3. Terminology

3.1 *Definitions*:

3.1.1 For definitions of terms used in this test method, refer to Terminology C 125.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *halo*—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 slump cone.

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

3.2.3 *J-ring flow*—the distance of lateral flow of concrete using the J-Ring in combination with a slump cone.

3.2.4 *passing ability*—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 slump mold (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 pass through J-Ring and subside (Fig. 3). The diameters of the concrete, in two directions approximately perpendicular to each other, are measured and averaged to obtain the J-Ring flow. 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.

5. Significance and Use

5.1 This test method provides a procedure to determine the passing ability of self-consolidating concrete mixtures. The difference between the slump flow and J-Ring flow is an

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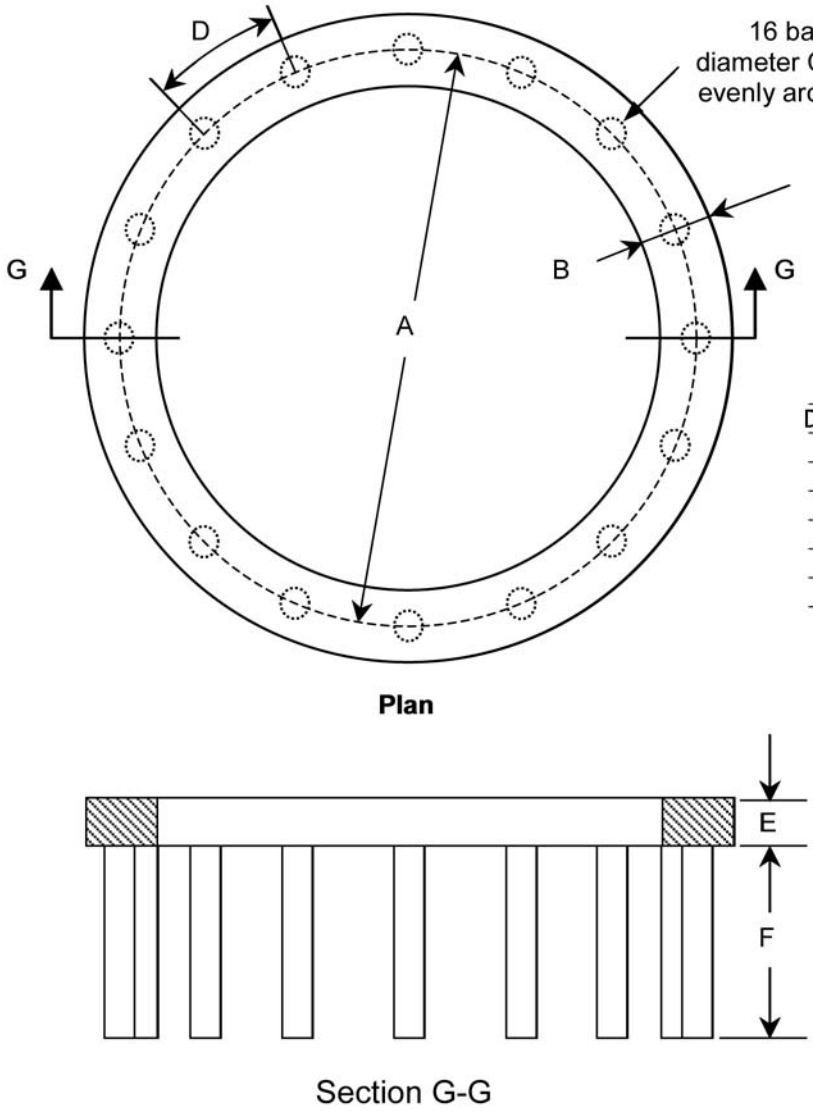
[2] Section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol. 04.02.

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

FIG. 1 J-Ring Apparatus

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

5.2 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.

6. Apparatus

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

6.2 *Mold*—The mold (slump cone) used in this test method is as described in Test Method C 143/C 143M, 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, rigid plate having a diameter of at least 36 in. [915 mm].

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.

6.4 *Strike Off Bar*—As described in Test Method C 173/C 173M.

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

7. Sample

7.1 The sample of concrete from which test specimens are made shall be representative of the entire batch. It shall be obtained in accordance with Practice C 172.

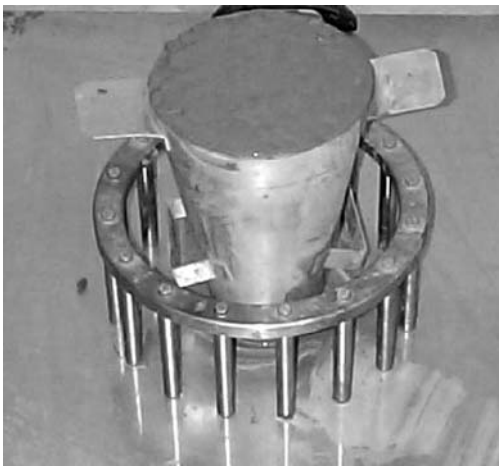


FIG. 2 J-Ring Setup with Inverted Mold Filled with Concrete

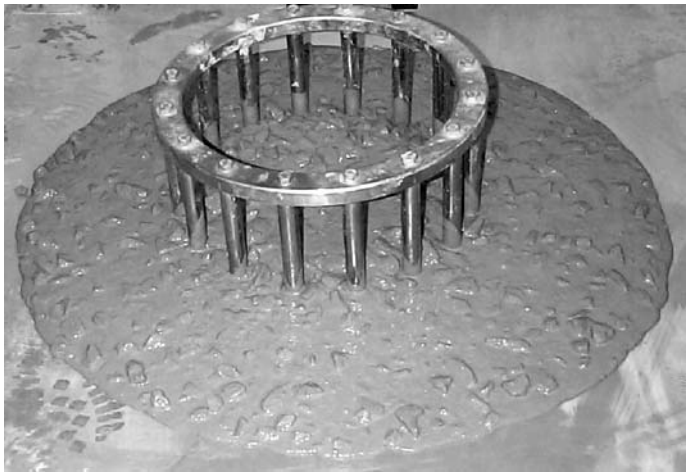


FIG. 3 J-Ring Flow

8. Procedure

8.1 Perform the test on a flat, level, and nonabsorbent surface such as a concrete floor or a base plate. Use the 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 and level. Pre-moisten the surface or base-plate with a damp towel, rag, or sponge. Rest the J-Ring on the surface or at the center of the base plate.

8.2 *Filling the Mold*—The operator has the option of filling the mold by following either Procedure A or Procedure B.

8.2.1 *Filling Procedure A (Upright Mold)*—Dampen the mold, and place it on the surface or base plate with the larger opening facing down and concentric with the J-Ring. Hold the mold firmly in place during filling. Fill the mold in one lift. Heap the concrete above the top of the mold.

8.2.2 *Filling Procedure B (Inverted Mold)*—Dampen the mold, and place it on the surface or base plate with the smaller opening facing down and concentric with the J-Ring. Support the mold and fill the mold in one lift. Heap the concrete above the top of the mold.

8.3 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 mold to preclude interference with the movement of the flowing concrete. Raise the mold a distance of 9 ± 3 in. [230 ± 75 mm] in 3 ± 1 s by a steady vertical lift with no lateral or torsional motion. Complete the entire procedure from start of the filling through removal of the mold without interruption within an elapsed time of 2½ min.

8.4 Wait for the concrete to stop flowing and then measure the largest diameter (d_1) of the resulting circular flow of concrete. When a halo is observed in the resulting circular flow of concrete, it shall be included as part of the diameter of the concrete. Measure a second diameter (d_2) of the circular flow at approximately perpendicular to the first measured diameter (d_1). Measure the diameters to the nearest ¼ in. [5 mm]. Determine the J-Ring flow in accordance with Section 9 of this test method.

8.5 Conduct a slump flow test without the J-Ring in accordance with Test Method C 1611/C 1611M. 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:

$$\text{J}-\text{Ring flow} = \frac{(d_1 + d_2)}{2} \quad (1)$$

9.2 Calculate the slump flow according to the following equation:

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

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

10. Blocking Assessment

10.1 Identify blocking assessment according to Table 1.

11. Report

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

11.2 Report the J-Ring flow as the average of the two measured diameters to the nearest ½ in. [10 mm].

11.3 Report the slump flow (without the J-Ring) as the average of the two measured diameters to the nearest ½ in. [10mm].

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

TABLE 1 Blocking Assessment

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

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 0.23 in. [5.8 mm]. The average passing ability in these tests was 0.81 in. [20.5 mm] for slump-flow values ranging from about 19 to 29 in. [480 to 740 mm]. 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.

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this test method since the last issue, C 1621/C 1621M – 06, that may impact the use of this test method. (Approved June 1, 2008)

(*1*) Revised 1.1 to clarify the scope of this test method.

(*2*) Corrected a value in the dimension table of Fig. 1.