

III. JSCE STANDARD

III-1. JSCE-STI SPECIFICATION OF STEEL FIBERS FOR CONCRETE

1. SCOPE OF APPLICATION

This standard specifies quality of steel fibers to be used for concrete.

Remarks: This standard shall not be applied to zinc or brass plated steel fibers which will lower the adhesion between steel fibers and matrix reacting with alkali in cement.

2. TYPE AND SYMBOL

Type of steel fibers and symbols shall be as shown in Table-1:

Table-1 Type and symbols

Type		Symbol
Type 1	With square section	SFR 1
Type 2	With circle section	SFR 2
Type 3	With crescent section	SFR 3

3. MATERIALS

Steel fibers shall be produced by cutting from steel materials such as steel sheet in conformity with JIS G3141 cold rolled steel sheet, or steel wires in conformity with JIS G3101 (rolled steel material for general structure) or steel material equivalent or better than these.

4. SHAPE, SIZE AND TOLERANCE

4.1 Standard size and weight of steel fibers shall be in accordance with Table-2, Table-3 and Table-4.

Table-2 Standard Size and Weight of Type 1 Steel Fibers

Size			Weight per Fiber (mg)
Nominal length l_f (mm)	Thickness x Width (mm)	Nominal cross section A (mm ²)	
25	0.25 x 0.50	0.125	25
	0.35 x 0.70	0.245	48
	0.50 x 0.50	0.250	49
30	0.30 x 0.50	0.150	35
	0.50 x 0.50	0.250	59
	0.50 x 0.70	0.350	82
*40	0.50 x 0.70	0.350	110

Table-3 Standard Size and Weight of Type 2 Steel Fibers

Size			Weight per Fiber (mg)
Nominal length l_f (mm)	Diameter d (mm)	Nominal cross section A (mm ²)	
25	0.45	0.159	31
	0.50	0.196	38
	0.55	0.237	47
30	0.50	0.196	46
	0.55	0.237	56
	0.60	0.283	67
*40	0.60	0.283	89

Remarks: * shall not be used for shotcreting concrete.

Table-4 Standard Size and Weight of Type 3 Steel Fibers

Size			Weight per Fiber (mg)
Nominal length l_f (mm)	Nominal converted diameter d (mm)	Nominal cross section A (mm ²)	
25	0.55	0.237	47
30	0.55	0.237	56
	0.60	0.283	67

Remarks 1) Weight of steel fibers (mg/fiber) shall be calculated weight.
Calculated weight W shall be obtained from the formula below:

$$A = A \times l_f \times 7.85$$

- 2) Nominal converted diameter shall be calculated from the diameter of circular cross section equivalent to the area of nominal cross section.

4.2 The steel fiber length shall be within the tolerance as shown in Table-5.

Table 5 Length Tolerance of Steel Fiber

Nominal length l_f (mm)	Tolerance (mm)
25	±1
30 40	±2

Remarks: On hundred steel fibers shall be taken randomly for every 3 tons. The tolerance for length M shall be calculated as follows:

$$i = 100$$

$$M = \frac{\sum_{i=1}^{100} l_i}{100} - l_f$$

Where l_i = length of each steel fiber ($i = 1 \sim 100$)

4.3 Allowable difference of weight shall be within the tolerance as shown in Table-6 below:

Table 6 Weight Tolerance of Steel Fibers

Type	Tolerance (%)
1	±15
2	
3	

Remarks: One hundred steel fibers shall be taken randomly for every 3 tons. The weight N shall be calculated as follows:

$$N = \frac{W_1 - W}{W} \times 100$$

Where, W_1 = Weight of 100 steel fibers
 W = Calculated weight

5. TENSILE STRENGTH OF STEEL FIBERS

5.1 Tensile strength of steel fibers shall be more than 60 kg/mm².

Remarks: Tensile strength shall be calculated as follows:

$$\sigma_t = \frac{P}{A}$$

Where, P: Maximum tensile load (kg) A: Nominal cross-section (mm²)

5.2 Tensile strength test shall be in accordance with the attached appendix.

6. EXTERNAL APPEARANCE

Steel fibers shall not have harmful amount of rust on their surface.

7. INSPECTION

Weight, shape, size and allowable difference of steel fibers shall be in conformity with sections 4, 5 and 6.

Appendix: Methods of Tensile Strength Tests of Steel Fibers

1. Scope of Application

This appendix specifies methods of tensile strength tests.

2. Testing Machine and Apparatus

2.1 Tensile testing machine

The standard tensile testing machine shall be of the displacement control type capable of measuring load to an accuracy of 1 kgf.

2.2 Chuck for installation

Chuck to be used for installation of specimen shall be a plane chuck.

3. Test

3.1 Installation of Specimen

Installation of specimen on the upper and lower chucks shall be with biting length of 1/3 of steel fibers, respectively, as shown in Figure-10:

Note 1) In general, as both ends of the chuck are completely fixed, care must be taken to fit correctly the axis of specimen to the axis of testing machine, so that rupture shall not occur near the upper and lower chucks.

3.2 Speed of loading

Speed of loading shall be controlled by the cross head speed of the testing machine, which is 0.3 mm/min as a standard.

3.3 Number of specimens

Number of specimens shall be more than 5.

3.4 Calculation of strength

Tensile strength (σ_t) shall be calculated from the following formula 2):

$$\sigma_t = \frac{P}{A}$$

Where P: Rupture load (kgf[N])

A: Nominal Cross-Section (mm²)

Note 2) Values when rupture occurred at the upper and lower chucks must be discarded.