



SCA Standard 310-2021

**Home Coffee Brewers:
Specifications and Test Methods**

Contents

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01. Preface

This SCA standard is derived from the SCA's Minimum Certification Requirements for Coffee Brewers and the Uniformity of Extraction Evaluation Procedure for SCA's Certified Home Brewer program, which have been adapted to current SCA Standards format and updated to include recent findings about coffee brewing and recent industry trends. This standard assumes the amounts of coffee and water used are parameters under the consumer's control, and therefore a good quality of brew shall be produced by complying brewers under typical conditions of household use.

02. Scope

This standard covers the specifications and test methods for filter coffee electrical brewers designed for home use at atmospheric pressure. Manual brewing devices (i.e., pour over devices), non-filter brewing devices (i.e., French press style), home espresso machines, pressurized brewing devices, and pod/capsule brewers are excluded from this standard.

03. Normative References

There are no normative references for this standard.

04. Terms and Definitions

Brew. The coffee beverage after extraction.

Brew basket. The basket holding the filter in a home coffee brewer. It may be conic or with a flat bottom.

Brew ratio. The ratio of coffee to water when preparing a brew. In this standard, brew ratio is expressed in grams of coffee per 1.000 kg of fresh water at $17\pm 3^{\circ}\text{C}$ (g/kg). The brew ratio used for testing in this standard is 55 g of coffee per 1.000 kg of fresh water unless stated otherwise.

Brew strength. The amount of total dissolved solids (TDS) in the brew, expressed in percentage or in parts per million, and usually estimated using a coffee refractometer.

Brew yield (percent extraction). This is defined as the percentage in mass of the fresh coffee grounds which is extracted into the brew after the cycle is completed.

Coffee Brewing Control Chart. Refers to the latest version of the SCA Brewing Control Chart, a chart that allows graphic calculation of brew yield, using brew strength and brew ratio as input.

Coffee refractometer. A refractometer especially designed to estimate the total dissolved solids (TDS) in the coffee brew from its refraction index.

Cycle. The operation of the coffee brewer which produces one batch of brew.

Filter. The filtering medium used in a home coffee brewer to separate the coffee grounds from the brew. For this standard, the filter used for tests shall be the one supplied by the manufacturer upon submission of the home brewer units for testing. If the manufacturer does not supply filters together with the brewer units, then the filters used for tests shall be "Melitta" brand, for conical brew baskets, and "Mr. Coffee" brand for flat-bottom brew baskets,

Fresh water reservoir. The reservoir designed to hold fresh water in a home coffee brewer. In most models, it is located at the back of the unit.

Full capacity. Defined as the amount of water the consumer would use when intending to obtain the maximum amount of brew per batch, using a home coffee brewer. For single-batch brewers, full capacity is the maximum fresh water capacity indicated in the product's documentation, intended for the fresh water reservoir. For multiple-batch or plumbed-in brewers, full capacity (in terms of fresh water) is calculated by multiplying the maximum brew capacity (stated in the product's documentation for the holding receptacle) by a factor of 1.15.

Holding receptacle (carafe). The reservoir that receives the coffee after brewing. The holding receptacle may be heated to keep the brew hot.

Home coffee brewer. An electrical device, intended for household use, designed to brew coffee by spraying or dripping hot water over a bed of coffee grounds and filtering the resulting brew under atmospheric pressure conditions. "Coffee brewer" or "brewer" always refer to a home coffee brewer in this standard.

Operation time. The time measured between starting the brewing cycle by the user (activating the brewing operation) and the moment when there is a visible interruption or break of the brew stream into the carafe.

Slurry. The dynamic mix of coffee grounds and water produced inside the filter during brewing.

Standard brew ratio. The brew ratio used for testing in this standard: 55 g of coffee per 1.000 kg of water.

Target extraction parameters. For this standard, target extraction parameters shall be a brew strength of 1.15-1.55% at the standard brew ratio.

TDS. Total dissolved solids.

Typical conditions of household use. The operation parameters typically used by consumers to brew their coffee. For the purpose of this standard, these conditions include the following: a 100% arabica coffee of roast level between #55 to #65 using SCA/Agtron Roast Color Tiles; coffee particle size distribution of $\geq 65\%$ in the 589 μm -1168 μm range; standard brew ratio; fresh water temperature of $17\pm 3^{\circ}\text{C}$; coffee temperature, brewer temperature and ambient temperature of $20\pm 3^{\circ}\text{C}$.

Uniformity of extraction rating. The numerical rating received by brewers based on the average uniformity of extraction factor as determined by the uniformity of extraction test (See 7.6), for the mass of coffee used for the full capacity of the brewer to the standard brew ratio. The rating number is calculated by comparing residual soluble solids in the outside, middle, and inside areas of the wet coffee grounds in the brew basket. The result is multiplied by 100 to convert the percentage to a whole number. The index rating is 0-100, with 100 indicating perfect uniformity of extraction. An average uniformity rating number of 60 would be considered "good," a rating number above 75 would be considered "excellent," and a rating number above 90 would be "outstanding." All ratings below 60 would be listed as "needs improvement."

05. Classification

5.1 By the Number of Mode Settings

Home coffee brewers may have one setting or multiple settings.

5.2 Based on the Shape of the Brew Basket

Home coffee brewers may have a conical brew basket or a flat-bottom brew basket.

06. Specifications

The specifications for home coffee brewers are summarized in Table 1. Brewers with multiple settings shall comply with specifications in at least one setting. See corresponding paragraphs for details.

6.1 Brew Basket Volume

The volume of the brew basket shall be sized in proportion to the full capacity. The brew basket shall have capacity to accommodate an amount of coffee to fill the holding receptacle at full capacity at the standard brew ratio without overflowing from the basket due to the swelling of the coffee grounds during the brew cycle.

6.2 Brewing Temperature

The coffee brewer shall be able to cycle the entire water volume through the coffee grounds within the prescribed temperature range. The slurry temperature (using a floating array of three thermocouples) shall reach a temperature in the 90 to 96°C range by the moment when 33% of the water mass has been sprayed onto the coffee. The temperature shall be maintained within the 90 to 96°C range for the remainder of the brew cycle.

6.3 Resulting Brew

The coffee brewer shall be able to produce a beverage within the target extraction parameters, under typical conditions of household use. Brewers shall be able to meet target extraction parameters at full capacity. Brewers larger than 1 kg water capacity shall also meet target parameters using 1 kg water.

Brewers with multiple extraction settings shall meet the target extraction parameters in at least one of the settings.

6.4 Uniformity of Performance

Three brewer units shall meet the brewing temperature and resulting brew specifications across five (5) cycles each at full capacity. The coffee brew resulting from these five (5) tests shall meet the target extraction parameters.

6.5 Uniformity of Extraction

Brewers shall achieve a uniformity of extraction rating of 60 or above, tested at full capacity. Brewers larger than 1 kg fresh water capacity shall also be tested at 1 kg capacity.

6.6 Holding Receptacle & Temperature

The holding receptacle shall accommodate the quantity of coffee for which the brewing equipment is designed at full capacity as designated by the manufacturer and, if heated, maintain the temperature of the brewed coffee at the correct holding temperature. If heated, the holding receptacle shall maintain the temperature of the coffee in the range of 80 to 85°C during the first thirty (30) minutes of the holding time. During this time, at no point should the temperature of the coffee increase above 85°C due to a heating element.

6.7 Operating Manuals and Other Instructional Materials

Proper brewing instructions shall be supplied with the brewer, specifically some recommendation of coffee grind, a coffee/water ratio of 55 g/kg (or its equivalent in other units) and cleaning instructions. The filter type recommended for optimal results shall also be indicated. In the case of brewers with multiple settings, the setting capable of achieving the target extraction parameters within the standard should be indicated.

Table 1: Specifications of home coffee brewers

Note: (a) for the resulting brew and uniformity of extraction requirements, besides testing all brewers at full capacity brewers larger than 1 kg fresh water capacity shall also be tested at 1 kg water.

| Item | Summary of Specifications | Test Method |
|---|---|-------------|
| 6.1 Brew basket volume | Enough volume to prepare full capacity at standard brew ratio without overflowing | 7.2 |
| 6.2 Brewing temperature | 90 to 96°C | 7.3 |
| 6.3 Resulting brew | Meet target extraction parameters at full capacity and at 1 kg water ^a | 7.4 |
| 6.4 Uniformity of performance | Brewing temperature and resulting brew consistency across three (3) brewer units, operating five (5) cycles each | 7.5 |
| 6.5 Uniformity of extraction | Uniformity of extraction rating of 60 or above | 7.6 |
| 6.6 Holding receptacle and temperature | If heated, should hold coffee brew at 80 to 85°C for 30 minutes | 7.7 |
| 6.7 Operating manuals and other instruction materials | Specify recommended coffee grind, a coffee/water ratio of 55 g/kg (or its equivalent in other units), recommended filter, and cleaning instructions | 7.8 |

07. Test Methods

7.1 General Testing Procedure

Three (3) brewer units of each tested model shall be tested for compliance with this standard. The general testing procedure should be as follows:

1. Testing shall be done at altitudes of 0-300 m above sea-level, to avoid high-altitude effects in brewers' operation. Ambient, brewer and coffee temperature shall be $20\pm 3^{\circ}\text{C}$. Whenever consecutive operation cycles are required on the same brewer, the brewer shall be allowed to cool down for 10 minutes after the end of the last cycle, to assure a more consistent operation.
2. As instructed in 7.1.7, using one of the brewer units, and operating at full capacity, determine the time at which 33% of the fresh water has been used.
3. Using one of the brewer units, test for brewing temperature as per 7.3, verifying compliance of brewing temperature specifications in 6.2. If brewing temperature specifications are not met using the first unit, repeat the operation using a second or a third brewer unit. If the brewing temperature specifications are not achieved after three units are tried, testing should be canceled, and brewers shall be considered as non-compliant with this standard.
4. Test the resulting brew (as per 7.4), as follows: using one of the brewer units, adjust the coffee grind as necessary within the parameters in Table 2 to achieve the target extraction parameters, using the operation parameters in 7.1.1 to 7.1.6. If this is not achievable using the first unit, repeat the operation using a second or a third brewer unit. If the target extraction parameters are not achieved after three units are tried, testing should be canceled, and brewers shall be considered as non-compliant with this standard.
5. Once the grind is adjusted, using one brewer unit, test for coffee volume (7.2), and holding receptacle and temperature (7.7). If applicable, test the resulting brew using a 1 kg fresh water batch size (7.4).

6. Using the same brewer unit, test uniformity of extraction (7.6) for two (2) different batch sizes, for three (3) brewing cycles each batch size.
7. Test uniformity of performance (7.5) using three (3) brewer units of each tested model at full capacity.
8. Verify documentation compliance (operating manuals and other instruction materials, see 7.8).

7.1.1 Test Batch Sizes

For brewers above 1 kg fresh water capacity, two batch sizes shall be tested for the resulting brew test (7.5) and for the uniformity of extraction test (7.7): full capacity and 1 kg fresh water mass. If the brewer's full capacity is 1 kg water or less, just the full capacity shall be tested for the resulting brew and uniformity of extraction tests. Other tests shall be done using full capacity.

7.1.2 Coffee

Compliance testing shall be made using 100% arabica coffees in the medium roast color range (#55 to #65, SCA roast color tile). Additional testing for informative purposes may be made using coffees in the dark roast color range (#35 to #45, SCA roast color tile). Coffees at least of 1-1.5 weeks off-roast shall be utilized to assure consistent brewing. Coffee temperature shall be $20\pm 3^{\circ}\text{C}$ at the time of brewing.

7.1.3 Grind

All testing shall commence with the coffees from 7.1.2 ground to a common particulate distribution chosen to systematize the testing process, depending on the shape of the brew basket. For conical brew baskets, the final grind distribution after adjustment shall have less than 12% (by mass) of the grinds above 850 μm in size, at least 68% of grinds falling between 425-850 μm , and 20% or less being smaller than 425 μm . For flat brew baskets, the final grind distribution after adjustment shall have less than 17% (by mass) of the grinds above 1168 μm in size, at least 65% of grinds falling between 589-1198 μm , and 18% or less being smaller than 589 μm (see Table 2).

Table 2: Particle distribution of grind for brewer testing

| Conical Brew Basket | | Flat Brew Basket | |
|------------------------------|---------------------|------------------------------|---------------------|
| Size Range (μm) | Percent (%) by mass | Size Range (μm) | Percent (%) by mass |
| >850 | ≤ 12 | >1168 | ≤ 17 |
| 425-850 | ≥ 68 | 589-1168 | ≥ 65 |
| <425 | ≤ 20 | <589 | ≤ 18 |

7.1.4 Water

Fresh, cold water at $17\pm 3^{\circ}\text{C}$, complying with the current SCA Water standard, shall be used in all the brew testing: this is summarized as odor-free, free of chlorine, calcium hardness equivalent to 50 to 175 ppm CaCO_3 , alkalinity equivalent to 40 to 70 ppm CaCO_3 , and pH of 6 to 8.

7.1.5 Coffee to Water Ratios

The standard brew ratio of 55 g of coffee per 1.000 kg of $17\pm 3^{\circ}\text{C}$ water shall be used for both batch sizes as per 7.1.1.

7.1.6 Water Supply

For plumbed-in units, the water pressure shall be controlled by a pressure regulator to maintain the minimum pressure designated by the manufacturer.

7.1.7 Determining Operation Time at 33% of Full Capacity

This determination shall be done at full capacity. Start by filling the fresh water reservoir with two thirds (67%) of the full capacity. Mark the two-thirds water level in the fresh water reservoir, using tape. Fill the fresh water reservoir to full capacity. Operate the brewer and measure the time required for the water level in the fresh water reservoir to reach the two-thirds mark, with initial time being the moment when the cycle is initiated (brewing is activated by the user).

In brewer models where the fresh water level cannot be easily measured, including plumbed-in models, the manufacturer shall be required to supply information to determine the time when 33% of fresh water has been sprayed, using full capacity.

7.2 Brew Basket Volume

Fill the brewer's filter with the corresponding amount of coffee to operate at full capacity, using the standard brew ratio. Operate the brewer at full capacity. Verify coffee does not overflow from the basket at any time of the cycle.

7.3 Brewing Temperature

Measurement of brewing temperatures shall be made by using an array of three (3) K-type thermocouples (of tolerance of $\pm 1.1^{\circ}\text{C}$ or $\pm 0.4\%$) either placed or fixed at the top and in the center of the bed of coffee in the brew basket. During the brew, due to the activity in the basket, the temperature sensor may float in the top section of the brew slurry. Additionally, a variety of other sensor configurations may be performed as necessary to troubleshoot unforeseen, brewer-specific issues though the details of the sensors used (brand, size, grade, precision, and response time) shall be reported in all cases. The temperature shall be recorded every second during the operation time (temporal resolution of one (1) second).

7.4 Resulting Brew Test

The brewer shall be evaluated at full capacity. In situations where the full capacity of the brewer is larger than 1 kg, the brewer shall also be tested using 1 kg fresh water. The grind of the coffee may be adjusted, within the parameters of Table 2, for the brewer to achieve the target extraction parameters. All samples' brew strength shall be measured using a coffee refractometer.

7.5 Uniformity of Performance

To assure the brewer model is both consistent and reliable, it shall be tested for uniformity of performance. For this test, three (3) coffee brewer units shall be evaluated. During testing, at least five (5) separate brew cycles shall be run at full capacity on each brewer to measure the brewing temperature (following 7.4) and to evaluate the extraction (following 7.5). Measurements where obvious artifacts due to thermocouple malfunction are found shall be discarded and measurement shall be repeated in an additional cycle.

7.6 Uniformity of Extraction

To evaluate uniformity of extraction, this procedure shall be replicated (on the same brewer unit) three times at full capacity and, for brewers larger than 1 kg fresh water full capacity, another three times at 1 kg fresh water batch size. The below steps describe the method for an individual brewer run (one (1) coffee filter with one (1) spent bed of coffee grounds), therefore shall be repeated three (3) or six (6) times on separate brew runs, depending on the brewer's capacity: In brewers larger than 1 kg fresh water capacity, in addition to the three (3) times using full capacity, the below steps shall be repeated another three (3) times using 1 kg fresh water batch size. All results are averaged.

1. Brew a batch of coffee to the target extraction parameters.
2. Remove the spent coffee bed in its paper filter and place it into a drying oven. Make sure the filter lies as flat as possible, unless it is a cone-shaped filter, in which case, allow the cone-shaped filter to sit upright, supported by an oven safe support or cup. It is best to elevate the filter using a rack or screen to maximize airflow and uniform drying.
3. Turn on oven to $103\pm 2^{\circ}\text{C}$.
4. Dry sample for two (2) hours, until the grounds and filter are thoroughly dry.
5. Prepare three sample cups and label them A, B, and C.

Refer to figure 1 for the following steps:

6. Remove 2 g of dried grounds from each of the four A sections (A1-A4) and put them in the sample cup, for a total mass of 8 g. Remove samples from the bed so that they represent the full bed depth of coffee.
7. Add 92 g of distilled water (15±5°C) to the sample cup with the grounds. Seal the lid of the sample cup and shake for 10 seconds.
8. Repeat this process for Sections B and sections C. For section C, simply remove 8 g of coffee and place in the sample cup.
9. Set the three sample cups aside for at least 12 hours at room temperature (18 to 24°C).
10. Open sample cup A and remove a sample of the liquid using a syringe or eye-dropper. Filter the liquid to make sure no coffee particulates are included and test the sample for TDS using a coffee refractometer. Test at least three times and average result. Record as Sample A residual TDS.
11. Rinse the sample well in the coffee refractometer with distilled water.
12. Repeat step #10 with B and C samples.

Evaluating the results:

13. Of the B and C residual TDS values, divide the smaller value by the larger value. Then, multiply that number by 100. This is the B/C uniformity factor.
14. Of the B and A residual TDS values, divide the smaller value by the larger value. Then, multiply that number by 100. This is the B/A uniformity factor.
15. Of the A and C residual TDS values, divide the smaller value by the larger value. Then, multiply that number by 100. This is the A/C uniformity factor.
16. Average the three (B/C, B/A, and A/C) uniformity factors. This is the brewer's average uniformity factor for this brew cycle.
17. Repeat steps 1-16 three (3) times on three (3) brew cycles (or six (6) times, using two (2) batch sizes, in brewers larger than 1 kg fresh water capacity).
18. Evaluate the three (3) or six (6) resulting average uniformity factors as follows:
 - a. The factors should range from 0 to 100, with 100 indicating perfect uniformity of extraction.
 - b. All values below 60 would be listed as "needs improvement" and would constitute the brewer failing the uniformity of extraction test. This would prevent the brewer from complying.

- c. An average uniformity of 60 would be considered "good." All three (3) or six (6) of the uniformity of extraction tests on a brewer model shall result in an average uniformity of extraction value of 60 or above.
- d. An average uniformity above 75 would be considered "excellent."
- e. An average uniformity above 90 would be "outstanding."

7.7 Holding Receptacle and Temperature

If the holding receptacle is heated, using "time 00:00" as the moment when the brewed coffee changes from a stream to a drip from the brew basket, measure the brew temperature in the holding receptacle every minute for 30 minutes.

7.8 Operating Materials and Other Instructional Materials

Locate all documentation in the form of package instruction, operating manuals, and online manuals or instructional videos, linked from the product documentation. Locate brewing instructions, specifically some suggestion of coffee grind, a coffee/water ratio of 55 g/kg (or its equivalent in other units), suggested filter type and cleaning instructions. In the case of brewers with multiple settings, verify the setting to achieve the target extraction parameters is correctly indicated in the product's documentation.

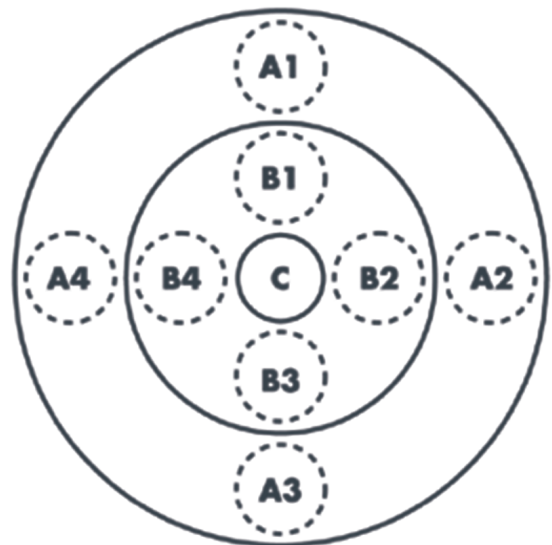


Figure 1



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