

PHILIPPINE NATIONAL STANDARD

**PNS/BAFS 215:2023
ICS 65.060.99**

Green Coffee Bean (GCB) Roaster — Methods of Test



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Published by:

Bureau of Agriculture and Fisheries Standards
BAFS Building, BPI Compound, Visayas Avenue, Diliman, Quezon City
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(+632) 8928 8756 to 65 local 3301 – 3325

ISBN (*insert ISBN No.)

www.bafs.da.gov.ph

Foreword

In 2017, the Department of Agriculture (DA)-BAFS developed the Philippine National Standards (PNS) on Coffee Roaster — Specifications (PNS/BAFS 214:2017) and Methods of Test (PNS/BAFS 215:2017) with the objective of setting the minimum parameters of the machine to achieve quality roasted coffee. According to the Cavite State University (CvSU) in 2022, over the course of its implementation, there were issues with some of the major provisions on the PNS, such as performance criteria and its methods of test. In light of these concerns, CvSU proposed a thorough review and potential revisions to the existing standards. The suggestion aims to go beyond merely providing guidance to suppliers and manufacturers but primarily intends to ensure product safety and market equity, in the interest of protecting the end-users. The proposed amendment of the PNS was endorsed through the issuance of DA-Philippine Council for Agriculture and Fisheries (PCAF)-National Sectoral Committee on Agricultural and Fisheries Mechanization (CAFMech) Resolution No.12, series of 2022 (Recommending to the BAFS the Prioritization of the Revision of the Existing PNS on Coffee Roaster [PNS 214:2017 and PNS 215:2017]).

In response, the DA-BAFS officially created a Technical Working Group (TWG) to amend the PNS under Special Order (SO) No. 146, series of 2023 (Creation of TWG for the Development of PNS for Agricultural and Fishery Products, Machinery, and Infrastructures) and SO No. 532, series of 2023 (Addendum to SO No. 146 series of 2023 entitled, “Creation of TWG for the Development of PNS for Agricultural and Fishery Products, Machinery, and Infrastructures”). The TWG was composed of relevant stakeholders from the government sector, academe/research institutions, private sector organizations, and Civil Society Organizations (CSO). The draft PNS underwent a series of TWG meetings and stakeholder consultations, facilitated through physical and online platforms, from February to September 2023 prior to its endorsement to the DA Secretary for approval.

This standard includes the following significant changes compared to the PNS on Coffee Roaster — Methods of Test (PNS/BAFS 215:2017):

1. Modification of title from “Coffee Roaster” to “Green Coffee Bean (GCB) Roaster”;
2. Modification on the scope to include other types of heat and energy sources;
3. Modifications on the terms and definitions;
4. Inclusion of traceability information and GCB grade in the test instrument and materials;
5. Inclusion of the condition of the test and pre-test activities in the general considerations;
6. Inclusion of GCB operation without load;
7. Reduction of number of test trials from 3 to 2; and
8. Inclusion of the measurement of quality roasted coffee bean (RCB) with the following parameters;
 - a. defective GCB;
 - b. RCB coefficient of variation and moisture content;
 - c. RCB degree of roast;
 - d. defective RCB; and

e. damaged RCB

This document was written in accordance with the formatting and editorial rules of the Standardization Guide No. 1 (Writing the Philippine National Standards) developed by the BAFS-Standards Development Division (SDD) of the BAFS.

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1 Scope

This Standard specifies the methods of test for green coffee bean (GCB) roasters driven by an electric motor or an engine with liquefied petroleum gas (LPG), electric heating element or diesel as heat sources. GCB roasters utilizing renewable energy are also covered by this Standard. Specifically, it shall be used to:

- a) Verify the mechanism, main dimensions, materials, accessories of the GCB roaster, and the list of specifications submitted by the manufacturer;
- b) Determine the performance of the machine;
- c) Evaluate the ease of handling and safety features; and
- d) Report the results of the tests.

2 Normative References

The following documents are referred to in the text in such a way that some or all their contents constitute the requirements of this document. The latest edition of the referenced document (including any amendments) applies.

Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2000). Agricultural machinery – Methods of sampling (PAES 103:2000).
<https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2019/07/PAES-103-2000-Agricultural-Machinery-Method-of-Sampling.pdf>

Bureau of Agriculture and Fisheries Product Standards (BAFPS)-Department of Agriculture (DA). (2012). Green Coffee Beans – Specifications (PNS/BAFPS 01:2012)
https://bafs.da.gov.ph/bafs_admin/admin_page/pns_file/2022-10-20-Green%20Coffee%20Beans%20.pdf

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2022). Agricultural machinery – Coffee Bean Sorter – Methods of test (PNS/BAFS PAES 342:2022).
https://amtec.ceat.uplb.edu.ph/wpcontent/uploads/2023/02/PNS.BAFS-342.2022_PNS-Green-Coffee-Bean-Sorter-Methods-of-Test.pdf

BAFS-DA. (2023). GCB roaster — Specifications (PNS/BAFS 214:2023).

3 Terms and Definitions

For this Standard, the definitions given in PNS/BAFS 214:2023 (Green Coffee Bean (GCB) Roaster — Specifications) and the following shall apply:

3.1

coffee species

various botanical species within the *Coffea* (genus) that are cultivated for the production of coffee beans (Farah and dos Santos, 2015, *modified*)

3.2

moisture content (wet basis)

amount of moisture in the coffee beans expressed as percent of the total weight of the sample (BAFS-DA, 2017)

3.3

overall height

distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the roaster (BAFS-DA, 2021, *modified*)

3.4

overall length

distance between the vertical planes perpendicular to the median plane of the roaster, each plane touching the front and rear extremities of the machine (BAFS-DA, 2021, *modified*)

3.5

overall width

distance between the vertical planes parallel to the median plane of the roaster, each plane touching the outermost point of the machine on its left and right sides (BAFS-DA, 2021, *modified*)

3.6

pre-heating time

duration where the roaster is operated on a certain temperature prior to loading of GCB (Corena, 2022 *modified*)

3.7

prime mover

any device or mechanism that generates power to run the GCB roaster (BAFS-DA, 2018, *modified*)

3.8

roasting time

actual roasting period which takes place after pre-heating time (BAFS-DA, 2023)

3.9

running-in period

preliminary operation conducted before the actual testing of the machine to make various adjustments until the operation is stable (BAFS-DA, 2018, *modified*)

3.10

specific energy consumption

amount of energy consumed per unit of coffee beans roasted, expressed in kW-h/kg or kJ/kg (BAFS-DA, 2021, *modified*)

3.11

tipping

can be determined by the presence of marks on the edges of the beans (Ospina, 2017)

3.12

variety

genetically distinct variation of a single species of coffee (Farah and dos Santos, 2015, *modified*)

4 Principle of the Test

The test shall be carried out to verify the actual specifications of the GCB roaster. Its specifications shall be validated with PNS/BAFS 214:2023 (Green Coffee Bean roaster – Specifications).

5 Test Instruments and Materials

5.1 Test instruments

The suggested list of minimum field and laboratory test equipment and materials needed to carry out the GCB roaster test is shown in Annex A (Minimum list of field and laboratory test equipment and materials). The instruments to be used shall be calibrated regularly and physically checked before and after each test.

5.2 Test input materials

5.2.1 Grade 1 GCB, as specified in PNS/BAFPS 01:2012 (Green Coffee Beans – Specifications) Clause 6.1, should be used as test input material. Only one among the identified species shall be used for each testing.

5.2.2 The moisture content (wet basis) of the dried GCB shall be 9% to 12%. It should be sourced from a single farm with traceability information as shown in Annex B (Traceability information).

5.2.3 The amount of test input material to be supplied shall be sufficient for the required test trials, running-in, and laboratory tests.

5.2.4 If the test input materials are not conforming to the prescribed quality characteristics, the test engineer shall not pursue the test.

6 General Considerations

6.1 Conditions for the test

6.1.1 Selection of GCB roaster to be tested

The GCB roaster submitted for testing shall be sampled in accordance with PAES 103:2000 (Agricultural machinery – Methods of sampling).

6.1.2 Test site conditions

The GCB roaster shall be tested and installed for normal operation. The site should have ample provisions for material handling, temporary storage, workspace, and suitable for normal working condition. Adequate ventilation and lighting shall be provided in the test site.

6.1.3 Suspension/termination of test

During the test run, if the GCB roaster stops due to breakdown or malfunction affecting its performance, the test shall be suspended. If the GCB roaster will not be able to continue the operation, the test shall be terminated.

6.2 Pre-test activities

6.2.1 Running-in and preliminary adjustments

6.2.1.1 The GCB roaster shall have undergone a running-in period before starting the test. It shall be operated for sufficient duration with and without load at the test. During the running-in period, the various adjustments of the GCB roaster shall be made according to the recommendation of the manufacturer.

6.2.1.2 The GCB roaster should be operated with a load at the test site for a sufficient amount of time using the manufacturer's recommended settings. Same settings shall be maintained throughout the test run.

6.2.1.3 The testing agency is responsible for making all necessary measurements and taking the prescribed samples as part of the test. After the test run, the GCB roaster should be cleaned and cooled down to its initial temperature before starting the next test trial. This procedure should be repeated for each subsequent test trial.

6.2.2 Verification of specifications

The specifications claimed by the manufacturer and the physical details given in Annex C (Specifications of green coffee bean roaster) shall be verified by the testing agency. A stable and level surface shall be used as reference plane for verification of dimensional machine specifications when fully assembled and ready for use.

6.2.3 Preparation of the GCB roaster for testing

The GCB roaster shall be checked to ensure that the machine has been assembled and installed in accordance with the instruction of the manufacturer. It shall be tested according to the manufacturer's specifications.

6.2.4 Sampling of test materials

Random representative test samples shall be collected from the test material for the determination of moisture content, size, species, dimensions and bulk density. Sampling procedure is shown in Annex D (Sampling procedures and measurements).

7 Performance Test and Procedures

7.1 Performance test

7.1.1 Operation of the GCB roaster

The GCB roaster shall be operated with and without load by the official representative of the applicant using the manufacturer's recommended setting of its components. The same recommended setting shall be maintained during the test run. The testing agency shall make all measurements and take the prescribed samples. After the test run, the roaster shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials. No other adjustments shall be permitted during the test.

7.1.2 Test trial

There shall be a minimum of two test trials with duration depending on the degree of roast of the RCB. The GCB roaster shall be tested to attain at least dark roast profile (except for specialty roaster). The list of degree of roast at a certain temperature is shown in Annex E (Characteristics of RCB for various visual roast standards).

7.1.3 Sampling and measurements

Samples shall be collected during each test trial. Sampling procedures and measurements are shown in Annex D (Sampling procedures and measurements).

7.1.4 Data collection

7.1.4.1 Duration of test

The duration of test shall commence when heat is introduced and end when the desired degree of roast is achieved. This includes pre-heating, loading, actual roasting, and cooling operation.

7.1.4.2 Noise level

a) The noise emitted by the coffee roaster, with and without load, shall be measured using a sound level meter at the location of the operator/s. The noise level, expressed in dB (A), shall be measured 50 mm away from the ear level of the operator/s standing near the edge of the feeding hopper and the bagger/s.

b) There shall be a minimum of five observations for each data to be taken. It should be ensured that the feed rate, speed, and other functional characteristics have stabilized before taking data. The time of recording shall be properly spaced during the whole duration of the test trial.

7.1.4.3 Power requirement/fuel consumption

The power requirement and/or fuel consumption shall be measured using the procedure given in Annex D (Sampling procedures and measurements).

7.1.4.4 Speed of components

The speed of the rotating shafts of the GCB roaster expressed in revolutions per minute, with and without load, shall be measured using a tachometer. Requirements for each data to be taken shall conform to 7.1.4.2b.

7.1.5 Data recording and observations

Record sheet for all data and information during the test is given in Annex F (Performance test data sheet). Observations to be taken during the performance test shall be recorded in this sheet.

7.2 Laboratory analysis

Laboratory analysis shall be made to determine the GCB and RCB dimension, defective GCB, moisture content of GCB and RCB, scorched RCB, damaged GCB and RCB, and degree of roast. The laboratory procedure to be followed

in the analysis is given in Annex G (Laboratory analysis), while data sheets are given in Annex H (Laboratory analysis data sheet).

7.3 Measurement of the quality of coffee bean

7.3.1 Defective GCB

The sampling procedure for the determination of GCB defects shall be in accordance with PNS/BAFPS 01:2012 (Green Coffee Beans – Specifications). The broken GCB shall be considered in the computation of percent damaged GCB.

7.3.2 RCB

The quality of RCB shall be determined using the coefficient of variation, degree of roast, defective RCB and damaged RCB sampling procedures.

7.3.2.1 Coefficient of variation of moisture content

The moisture content of randomly selected 10 sets of 10 g RCB samples shall be determined for each test trial. The coefficient of variation shall be calculated using the formula indicated in Annex I (Formulas used during calculations and testing).

7.3.2.2 Degree of roast

The degree of roast after each test trial shall be measured using the Agtron roast color guide/Specialty Coffee Association (SCA) roast color guide, spectrophotometer, and colorimeter. The characteristics of RCB for various visual roast standards are given in Annex E.

7.3.2.3 Defective RCB

A 100-g RCB shall be sampled for the measurement of defects. For dark roast, scorched RCB shall be determined. In case for light to medium roast, tipping and scorched shall be determined.

7.3.2.4 Damaged RCB

A three set of 100-g RCB shall be sampled for the measurement of damaged RCB. The damaged GCB shall be considered in the computation of percent damaged RCB.

8 Formula

The formulas to be used are given in Annex I (Formulas used during calculations and testing).

9 Test Report

The test report shall include the following information in the order given:

- a) Name of testing agency;
- b) Test report number;
- c) Title;
- d) Name of the Manufacturer
- e) Summary of results;
- f) Purpose and scope of test;
- g) Methods of test;
- h) Description of the machine;
- i) Specifications;
- j) Results;
- k) Observations (include pictures); and
- l) Names, signatures, and designation of test engineers.

Annex A
(Informative)

Minimum list of field and laboratory test equipment and materials

No.	Equipment/material	Quantity
A.1	Field test	
A.1.1	Hand-held tachometer	1
A.1.2	Stopwatch Resolution: 0.1 s	2
A.1.3	Measuring tape	1
A.1.4	Sound level meter Range: 30 dB(A) to 130 dB(A)	1
A.1.5	Weighing scale Capacity: 100 kg Resolution: 0.1 kg	1
A.1.6	Clamp-on AC/DC Power Meter 1000 V	1
A.1.7	Camera	1
A.1.8	Thermocouple with data logger	1
A.1.9	Thermohygrometer	1
A.1.10	Sampling bag with labeling tags which include: Date of test Coffee roaster on Test Sample source Species Trial number	30
A.1.11	GCB moisture meter	1
A.1.12	Caliper Resolution: (0.05mm)	1
A.1.13	Graduated cylinder	1
A.2	Laboratory test	
A.2.1	Digital weighing scale Resolution: 0.01 g	1
A.2.2	Moisture meter	1
A.2.3	Agtron Coffee Roast Color Guide/ Spectrophotometer/Colorimeter	1
A.2.4	Labeling tags which include: Date of test Coffee roaster on Test Sample source Species Trial number	20

Annex B
(Informative)

Traceability Information

Name of Farmer/s: _____
Address/ Locations: _____
Telephone/Mobile No.: _____
Meters Above Sea Level (masl): _____
Process (Optional): _____
Certifying body: _____

Annex C
(Informative)

Specifications of GCB roaster

Name of Applicant : _____
Address : _____
Tel. No. : _____
Name of Manufacturer: _____
Address : _____
Tel. No. : _____

General Information:

Serial No.: _____ Brand/Model: _____
Classification: _____ Make: _____
Power Requirements (Electric Motor/ Engine): _____
Production date of the machine to be tested: _____

No.	Items ¹	Manufacturer's specification	Verification by the testing agency
1	Main structure		
1.1	Overall dimensions, mm		
1.1.1	Length		
1.1.2	Width		
1.1.3	Height		
1.2	Overall weight without prime mover, kg		
1.3	Type of Insulation		
2	Input per load, kg/load		
3	Heat source		
4	Input hopper		
4.1	Overall dimensions, mm		
4.1.1	Length		
4.1.2	Width		
4.1.3	Height		
4.2	Height from the ground, mm		
4.3	Material/s		
4.4	Location		
4.5	Means of attachment		
5	Output chute		
5.1	Overall dimensions, mm		
5.1.1	Length		
5.1.2	Width		
5.1.3	Height		

No.	Items ¹	Manufacturer's specification	Verification by the testing agency
5.2	Height from the ground, mm		
5.3	Material/s		
5.4	Location		
5.5	Means of attachment		
6	Roasting mechanism		
6.1.1	Type		
6.1.2	Dimensions, L x W x H, mm		
6.1.3	Material/s		
7	Cooling Mechanism		
7.1	Dimensions, L x W x H, mm		
7.2	Materials		
7.3	Capacity, kg		
8	Dust Collector Mechanism		
8.1	Dimensions, L x W x H, mm		
8.2	Materials		
8.3	Capacity, kg		
9	Speed of Shaft, rpm		
10	Safety devices		
11	Special feature		

¹The parameter will be checked upon availability

10 Photo of the transmission system

Annex D
(Normative)

Sampling procedures and measurements

D.1 Sampling Procedures for GCB Input

The conditions of the GCB input such as moisture content to be used in each test shall be taken using three “representative samples”, which represent the different conditions of GCB input in the bulk. This is done by randomly collecting samples at the top, middle, and bottom portions of the bulk. Half of the sample shall be used for laboratory analysis and the other half shall be used for reference purposes or for an eventual second check in case of review. Samples representing the materials for each test trial shall be placed in appropriate containers for laboratory analysis.

D.2 Sampling from the output chute of cooling tray

During each test trial, three samples, each weighing at least 100 g shall be collected. The minimum amount of sample to be taken from the outlet of the GCB roaster to be analyzed in the laboratory for the determination of moisture content, purity and degree of roast shall be twice as much as what is needed for a particular analysis.

D.3 Handling of samples

All samples to be used shall be properly labeled and kept in airtight, dry, and food grade containers.

D.4 Other measurements required during the test run

The speed of rotating components and noise level at operator’s location shall be taken. For each data, there shall be a minimum of five observations. Before taking the data, it should be ensured that the feed rate, speed, and other functional characteristics have stabilized.

D.5 Measurement of power requirement (electric motor)

A power meter shall be used to measure the voltage, current, and the total electric power requirement of the GCB roaster. There shall be three sets of data with a minimum of five observations per set each taken with and without load.

D.6 Measurement of energy consumption (heat source)**D.6.1 Using LPG**

To determine the fuel (LPG) used, the initial and final weight of the LPG tank shall be measured for each test trial. The duration of roasting shall be recorded.

D.6.2 Using diesel

To determine the amount of diesel consumed, the volume of fuel refilled after the test shall be measured. The tank shall be filled to full capacity before and after each trial. When filling up the tank, careful attention shall be paid to keep the tank horizontal and not to leave empty space in the tank.

D.6.3 Using electricity

The energy consumption shall be measured in conformance with C.5.

Annex E
(Normative)

Characteristics of RCB for various visual roast standards

Table E.1. Agtron/SCA Roast color standards (*HunterLab Coffee Color Index [HCCI], 2015*).

SCA Visual Roast Standards	Agtron/SCA Classification
Very Dark	R25
Dark	R35
Moderately Dark	R45
Medium	R55
Light Medium	R65
Moderately Light	R75
Light	R85
Very Light	R95

Table E.2. Agtron/SCA roast color standards based on spectral reflectance (*HCCI, 2015*).

SCA Visual Roast Standards	Spectral Reflectance (640nm)¹
Very Dark	2.54
Dark	2.43
Moderately Dark	3.66
Medium	6.58
Light Medium	8.19
Moderately Light	9.71
Light	11.28
Very Light	12.81

¹**NOTE** Measures the reflectance of ground coffee products at **640 nm**, which is optimal for defining the degree of roast.

Table E.3. Agtron/SCA roast color standards based on Hunter Lab Coffee Color Index (*HCCI, 2015*).

SCA Visual Roast Standards	HunterLab Coffee Color Index
Very Dark	1.7
Dark	1.4
Moderately Dark	3.8
Medium	9.6
Light Medium	12.7
Moderately Light	15.7
Light	18.8
Very Light	21.8

Table E.4. Agtron/SCA roast color guides according to CIELAB color space (*HCCL*, 2015).

SCAA Visual Roast Standards	L*a*b*		
	L*	a*	b*
Very Dark	14.70	4.31	2.54
Dark	14.85	6.15	2.43
Moderately Dark	18.23	8.77	3.66
Medium	22.07	10.94	6.58
Light Medium	25.45	12.31	8.19
Moderately Light	28.10	13.10	9.71
Light	30.15	13.55	11.28
Very Light	32.45	13.04	12.81

Table E.5. Roast color guide with its corresponding characteristics (*Dauids*, 2003).

Roast Color	Final Bean Temperature (°C)	Agtron Gourmet Scale	Agtron/SCA Classification
Very Dark (nearly black)	245-250	30-25	Tile No. 25
Very Dark Brown	240-245	35-30	Tile No. 35
Dark Brown	235-240	40-35	
Moderately Dark Brown	230-235	45-40	
Medium-dark Brown	225-230	50-45	Tile No. 45
Medium Brown	215-225	50-60	Tile No. 55
Light Medium Brown	205-215	70-60	Tile No. 65
Moderately Light Brown	Around 205	80-70	Tile No.75
Light Brown	Below 205	90-80	Tile No. 85
Very Light Brown	Around 195	95-90	Tile No. 95

Annex F
 (Normative)

Performance test data sheet

Test Trial No.: _____ Date: _____
 Test Engineers: _____ Location: _____
 Assistants: _____ Machine: _____
 Test Requested by: _____ Manufacturer: _____

No.	Items	Trial 1	Trial 2	Trial 3	Average
1	Green coffee beans (GCB)				
1.1	Species/Varieties				
1.2	Source				
1.3	Moisture content, %				
1.4	Size classification				
1.4.1	Dimension, mm (length, width and thickness)				
1.4.2	Weight, g				
1.4.3	Bulk density, g/cm ³				
2	Weight of input GCB, kg				
3	Weight of output RCB, kg				
4	Total operating time, h				
5	Roasting time, min				
6	Input capacity or input per load, kg/h				
7	Roasting losses, %				
8	Specific energy consumption				
9	Speed of prime mover, rev/min				
9.1	Without load				
9.2	With load				
10	Noise level, dB(A)				
10.1	Without load				
10.2	With load				
11	Power requirement				
11.1	Power, kW				
11.1.1	Without load				
11.1.2	With load				
11.2	Current, A				
11.2.1	Without load				
11.2.2	With load				
11.3	Voltage, V				

No.	Items	Trial 1	Trial 2	Trial 3	Average
11.3.1	Without load				
11.3.2	With load				
12	Fuel consumption, kg/h				
13	Moisture content reduction rate, %/h				
14	Defective GCB				
15	Roasted coffee beans (RCB)				
14.1	Species/Variety				
14.2	Source				
14.3	Moisture content, %				
14.4	Size classification				
14.4.1	Dimension, mm (length, width and thickness)				
14.5	Coefficient of variation				
14.6	Degree of roast				
14.7	Damaged RCB				
14.8	Defective RCB				
15	Maximum Temperature, °C				

16 Other observations

16.1 Ease of transporting the machine

16.2 Ease of adjusting and repairing of parts

16.3 Safety features

16.4 Ease of cleaning the machine and its components

16.5 Labor requirement

16.6 Failure or abnormalities observed on the roaster or its component parts during and after the sorting operation.

16.7 Ease of loading input and collecting output

16.8 Dynamic balance

16.9 Others

Annex G
(Informative)

Laboratory analysis

G.1 Measurement of GCB dimension

G.1.1 Randomly take at least 30 pieces of bean from the GCB samples.

G.1.2 For each sample, measure the length, width, and thickness using a caliper. Record the measurement to the nearest 0.01 mm. Calculate the average length, width, and thickness; and their coefficient of variation using the formula in Annex I (Formulas used during calculations and testing).

G.2 Coefficient of Variation

G.2.1 Randomly take 10 sets of 10 g beans from the RCB samples.

G.2.2 For each set, measure the moisture content using a moisture meter. Record the measurement to the nearest 0.01%. Calculate the average, standard deviation, and coefficient variation of the recorded moisture contents using the formula in Annex I (Formulas used during calculations and testing).

G.3 Determination of moisture reduction rate

Measure and record the moisture contents of the GCB (initial moisture content) and RCB (final moisture content) in clause 1 of Annex G (Laboratory analysis data sheet). Compute for the moisture reduction rate using the formula indicated in Annex I (Formulas used during calculations and testing).

G.4 Determination of defective and damaged RCB

Take three sets of 100-g sample each of the GCB from the input and RCB from the cooling tray. Manually separate the broken GCB and RCB and label them as initially broken and broken after operation, respectively. Weigh and record it to compute for the percent defective RCB. Repeat the procedure in determining the measurement of damage RCB.

G.5 Determination of degree of roast

Using the appropriate instrument or method (Agtron Roast Color Guide, spectrophotometer, colorimeter etc.) measure a three sets of 100-g sample of RCB after each test trial. Record the readings and refer to the description of roast profile corresponding to the color measurement as indicated in Annex E (Characteristics of RCB for various visual roast standards)

Annex H
(Informative)

Laboratory analysis data sheet

Machine Tested : _____
Date Tested : _____
Analyzed by : _____
Date Analyzed : _____

1 Moisture content reduction rate

	Trial 1	Trial 2	Trial 3	Average
GCB moisture content wet basis, %				
RCB moisture content wet basis, %				
Moisture reduction rate, %/h				

2 Determination of RCB Moisture Content Coefficient of Variation

Sample No.	Moisture Content
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Average, mm	
Standard deviation	
Coefficient of variation, %	

3 Determination of defective RCB and damaged RCB

Weight, g	Trial 1				Trial 2				Trial 3				Gen. Ave.
	a	b	c	Ave.	a	b	c	Ave.	a	b	c	Ave.	
GCB sample													
Broken GCB													
RCB sample													
Broken RCB													

4 Determination of RCB dimensions

Sample no.	Length, mm	Width	Thickness, mm
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
23			
30			
Average, mm			
Standard deviation			
Coefficient of variation, %			

Annex I
(Normative)

Formulas used during calculations and testing

H.1 Moisture content reduction rate

$$MC_R = \frac{MC_i - MC_o}{T_R}$$

where:

MC_R	is the moisture content reduction rate during roasting operation, %/h
MC_i	is the moisture content of GCB input, %
MC_o	is the moisture content of RCB output, %
T_R	is the total roasting time, h

H.2 Output capacity

$$C_R = \frac{W_R}{T_R}$$

where:

C_R	is the input per load, kg/h or kg/batch
W_R	is the total weight of GCB, kg
T_R	is the total roasting time, h

H.3 Defective RCB

$$B = \frac{W_{de}}{W_T} \times 100$$

where:

B	is the percent defective bean per 100-g sample, %
W_{de}	is the weight of defective RCB, g
W_T	is the total weight RCB sample, g

H.3 Damaged RCB

$$B = \frac{W_{da}}{W_T} \times 100$$

where:

B	is the percent damaged bean per 100-g sample, %
W_{da}	is the weight of damaged RCB, g
W_T	is the total weight RCB sample, g

H.4 Retained RCB

$$R = \frac{W_r}{W_f + W_r} \times 100$$

where:

R	is the retained RCB, %
W_r	is the weight of the remaining beans inside the roaster, g
W_f	is the final weight of RCB output, g

H.5 Coefficient of variation (Use generic formula to cover both for dimension and for moisture content)

$$CV = \frac{s}{\bar{x}} \times 100$$

$$s = \sqrt{s^2}$$

$$s^2 = \frac{\sum(x_j^2) - n(\bar{x}^2)}{n - 1}$$

where:

CV	is the coefficient of variation, %
s	is the standard deviation, mm,
s^2	is the variance of, mm^2
\bar{x}	is the mean size or dimension, mm
n	is the total number of samples
x_j	is the dimension (length, width, thickness) of individual sample, mm

H.5 Fuel and specific energy consumption

H.5.1 Fuel (LPG) consumption

$$F_{cr} = \frac{W_{Li} - W_{Lf}}{T_R}$$

where:

F_{cr}	is the fuel consumption rate, kg/h
W_{Li}	is the initial weight of LPG tank, kg
W_{Lf}	is the final weight of LPG tank, kg
T_R	is the total roasting time, h

H.5.2 Specific energy consumption (Electric)

$$E_s = \frac{P_{EC} \times T_R}{W_i}$$

where:

E_s	is the specific energy consumed, kW-h/kg
P_{EC}	is the electric power consumed, kW
T_R	is the total roasting time, h
W_i	is the total weight of GCB input, kg

H.5.3 Specific energy consumption (LPG/diesel)

$$E_s = \frac{(F_c \times T_R) HV}{W_i}$$

where:

E_s	is the specific energy consumed, kJ/kg
F_c	is the fuel consumed, kg/h
T_R	is the total roasting time, h
HV	is the heating value of the LPG or diesel (kJ/kg)
W_i	is the initial weight of GCB input, kg

Bibliography

- Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2000). Agricultural machinery – Methods of sampling (PAES 103:2000).
<https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2019/07/PAES-103-2000-Agricultural-Machinery-Method-of-Sampling.pdf>
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2017). Agricultural machinery – Coffee huller – Methods of test (PNS/BAFS PAES 213:2017).
http://www.bafs.da.gov.ph/bafs_admin/admin_page/pns_file/PNS%20BAFS%20PAES%20213_2017%20-%20Coffee%20Huller%20-%20Methods%20of%20Test.pdf
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2018). Agricultural machinery – Cacao grinder – Methods of test (PNS/BAFS PAES 191:2018).
https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2020/06/PNS-BAFS-PAES-191_2018-Cacao-Grinder-Methods-of-Test-converted.pdf
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2018). Agricultural machinery – Cacao roaster – Methods of test (PNS/BAFS PAES 256:2018).
https://bafs.da.gov.ph/bafs_admin/admin_page/pns_file/2022-09-29-PNS%20255.2018%20Cacao%20Roaster_Spec.pdf
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2022). Agricultural machinery – Coffee Bean Sorter – Methods of test (PNS/BAFS PAES 342:2022).
https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2023/02/PNS.BAFS-342.2022_PNS-Green-Coffee-Bean-Sorter-Methods-of-Test.pdf
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2022). Agricultural machinery – Corn Mill – Methods of test (PNS/BAFS PAES 252:2021).
<https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2022/01/PNS-BAFS-252-2021-Corn-Mill-Methods-of-Test.pdf>
- Bureau of Agriculture and Fisheries Product Standards (BAFPS)-Department of Agriculture (DA). (2012). Green Coffee Beans – Specifications (PNS/BAFPS 01:2012)
https://bafs.da.gov.ph/bafs_admin/admin_page/pns_file/2022-10-20-Green%20Coffee%20Beans%20.pdf
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (20XX). Green Coffee Bean roaster – Specifications (PNS/BAFS 214:20XX).

Department of Environment and Natural Resources (DENR). (2019). Updated NATIONAL List of Threatened Philippine Fauna and their Categories (Department Administrative Order No. 2019-19)
https://bmb.gov.ph/downloads/WRD/WC/WC2020/stat_and_lists_of_wildlife/fana/dao-2019-09.pdf

Farah, A., & dos Santos, T. F. (2015). The coffee plant and beans: An introduction. In Coffee in health and disease prevention (pp. 5-10). Academic Press.
<https://www.sciencedirect.com/science/article/pii/B9780124095175000012>

HunterLab (2015). What is HCCI – HunterLab Coffee Color Index?
Retrieved from: <https://support.hunterlab.com/hc/en-us/articles/202021815-What-is-HCCI-HunterLab-Coffee-Color-Index->

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