

PHILIPPINE NATIONAL STANDARD

PNS/BAFS/PAES 214:2017

Agricultural Machinery – Coffee Roaster – Specifications



DEPARTMENT OF
AGRICULTURE

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Foreword

The implementation of Republic Act 10601 also known as the Agricultural and Fisheries Mechanization (AFMech) Law of 2013 mandated the Bureau of Agriculture and Fisheries Standards (BAFS) to develop standard specifications and test procedures for agricultural and fisheries machinery and equipment.

The Bureau, in collaboration with the Bureau of Agricultural and Fisheries Engineering (BAFE), concerned Department of Agriculture (DA) Bureaus, and attached agencies, Professional Regulatory Board of Agricultural and Biosystems Engineering (PRB-ABE), and University of the Philippines Los Baños – Agricultural Machinery Testing and Evaluation Center (UPLB-AMTEC), embarked on a project entitled “**Development of Philippine National Standard/ Philippine Agricultural Engineering Standard for Various Agricultural Machinery**”. This project covers the development of PNS for Coffee Roaster.

In the Philippines, coffee is considered as one of the most highly demanded crops. Arabica, Robusta, Excelsa and Liberica are four of the coffee varieties that can be grown in the country because of its climatic and soil condition. Currently, the country is involved in trading various coffee products such as green coffee bean (GCB), ground coffee, unground coffee, roasted coffee and coffee extracts. All these products except GCB underwent roasting process.

Roasting of coffee beans has an effect on its taste and aroma. The development of specifications and test procedures for coffee roaster is therefore essential to ensure the quality of roasted coffee beans by establishing minimum requirements of the roaster.

This standard will serve as reference for Agricultural and Biosystems Engineers (ABEs) in the preparation and evaluation of specifications and test reports for coffee roasters pursuant to Republic Act No. 10915 otherwise known as the Philippine Agricultural and Biosystems Engineering Act of 2016.

This standard has been technically prepared in accordance with Bureau of Philippine Standards (BPS) Directives Part 3:2003 – Rules for the Structure and Drafting of International Standards.

The word “shall” is used to indicate mandatory requirements to conform to the standard.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable without mentioning or excluding others.

1 Scope

This standard specifies the fabrication and performance requirements for coffee roasters particularly those driven by electric motors.

2 References

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this National Standard:

PAES 101:2000	Agricultural Machinery – Technical Means for Ensuring Safety - General
PAES 102:2000	Agricultural Machinery – Operator’s Manual – Content and Presentation
PAES 103:2000	Agricultural Machinery – Method of Sampling
PNS/BAFS/PAES 192:2016	Agricultural Machinery – Guidelines on After-Sales Service
PNS/BAFS/PAES 215:2017	Agricultural Machinery – Coffee Roaster – Methods of Test
OSHS Rule 1074:01	Threshold Limit Values for Noise - Occupational Safety and Health Center, Department of Labor and Employment (2013)

3 Definitions

For the purpose of this standard, the following terms shall apply:

3.1

air quench

rapid airflow is used to stop the roast and cool the coffee upon completion of roasting

3.2

air roaster

roaster that utilizes forced hot air to simultaneously agitate and roast green coffee beans (GCB) through convection

3.3

chaff

silver skin

waste product of coffee roasting

3.4

coffee roaster

machine used to roast GCB

3.5

coffee trier

trier, tryer

metal scoop used to sample small portion of GCB for examination during roasting

3.6 degree of roast

color-based roast classification

(a) light roast

light brown in color, no oil on the surface of the roasted coffee bean (RCB)
with internal temperature of 180 °C – 205 °C

(b) medium roast

city roast

medium brown in color, no oil on the surface of the RCB
with internal temperature of 210 °C to 220 °C

(c) medium-dark roast

full-city roast

with richer, darker color having some oil beginning to show on the surface of the RCB. The beans are roasted to the beginning or in the middle of the second crack
– around 225 °C or 230 °C

(d) dark roast

French roast

dark brown in color with RCB covered in oil; The beans are roasted with internal
temperature of 240 °C up to 250 °C, at about the end of second crack

3.7

drum roaster

roaster where the beans are agitated inside a metal drum; heat is provided by a flow of hot air through the drum and/or by the hot metal of the drum

3.8

first crack

stage of coffee roasting where complex chemical reactions occur as the GCB reach 160 °C that causes an audible cracking sound

3.9

fresh roast

recently roasted GCB, characterized by pleasing aroma

3.10

green coffee bean (GCB)

commercial term designating the dried seed of the coffee plant, disengaged from their external envelopes

3.11

heat source

supplies heat to the roasting chamber

3.12

roasting

process used to produce chemical and physical changes in the structure and composition of GCB by heat treatment; it results to the darkening of GCB and development of the characteristic flavor and aroma

3.13

roasting capacity

total amount of roasted coffee beans over the total time the machine is in operation, expressed in kilogram per hour (kg/h)

3.14

roasting recovery

ratio between the total weight of RCB collected at the outlet and the total weight of input GCB to the machine, expressed in percent (%)

3.15

roasting temperature

temperature in roasting chamber during roasting

3.16

roasted coffee bean (RCB)

palatable coffee beans derived by subjecting GCB to dry heat, whether from an open flame, oven, or other heating source, to achieve desired physico – chemical changes such as brewing, caramelization, flavor development and moisture reduction

3.17

second crack

stage of roasting where GCB are dehydrated and becomes brittle resulting to cracking and carbonization; produces burnt characteristics of dark roasts

3.18

water quench

water is used rapidly to cool RCB to prevent over roasting and loss of aroma

4 Classification

The classification of coffee roaster should be according to the following:

4.1 Heating Method

4.1.1 Conduction

Transfer of heat to the GCB occurs through the surface of a hot metal drum or container. Conduction is a one of the heating methods employed by drum roasters.

4.1.2 Convection

Transfer of heat to the GCB occurs through heated air. Convection is the heating method employed by air roasters.

4.2 Roasting Mechanism

4.2.1 Horizontal drum roaster

GCB are axially mixed along the horizontal by spiral flights.

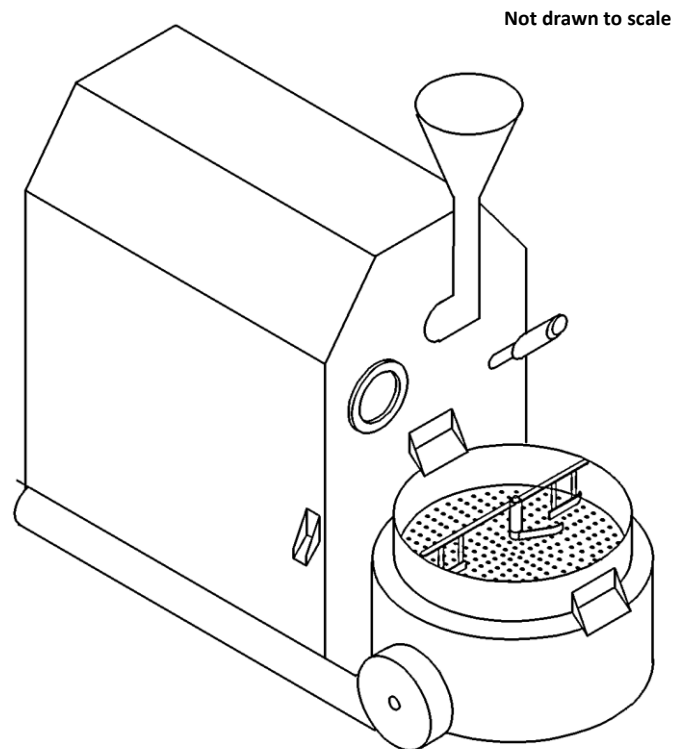


Figure 1. Horizontal drum-type coffee roaster

4.2.2 Vertical drum roaster

Movement of the GCB inside the chamber is facilitated by paddles or auger.

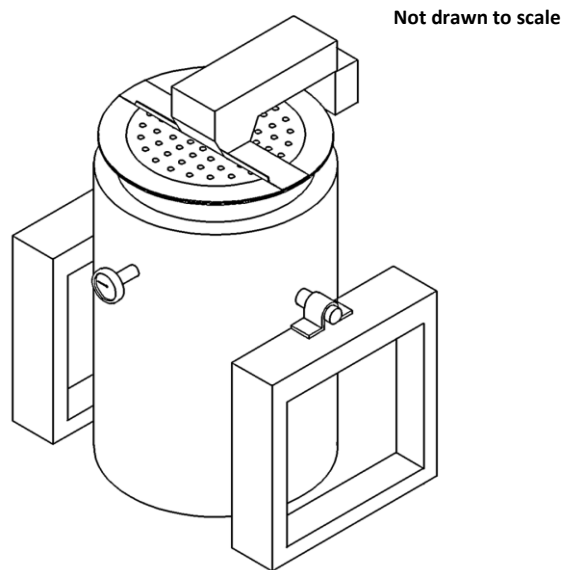


Figure 2. Vertical drum-type coffee roaster

4.2.3 Rotating bowl

GCB are fed into the center of the rotating horizontal bowl with a vertical shaft and are carried to the sides of the bowl by centrifugal force supported by high-temperature air.

4.3 System of Operation

4.3.1 Batch roaster

Definite amount of GCB are roasted at a time. Batch roasters have a specified start and stop time for each roast. Bean temperatures change with time. Likewise, the roasting time per batch varies depending on the degree of roast and the amount of GCB.

4.3.2 Continuous roaster

GCB are roasted continuously instead of batches. Bean temperature changes with axial position.

4.4 Heat Source

4.4.1 Liquefied petroleum gas (LPG)

4.4.2 Electricity

4.4.3 Diesel

5 Fabrication Requirements

5.1 Steel bars, metal sheet or plate and mild steel shall be generally used for the manufacture of the different components of the coffee roaster. Parts that are in direct contact to the coffee beans shall be made of corrosion resistant and food grade materials in compliance to the food safety standards.

5.2 The coffee roasters shall be provided with appropriate temperature gauge, cooling tray with stirrer, and inspection window. If built in, the temperature gauge shall be calibrated. The cooling tray shall have the capacity according to the capacity of the drum roaster. For drum roasters, a trier shall be provided.

5.3 Coffee roaster should use either liquefied petroleum gas (LPG), electricity, or diesel. A heat exchanger shall be provided if diesel will be used.

5.4 Frame and stand shall be able to support the whole coffee roaster assembly during operation.

5.5 Coffee roaster shall have a mechanism for adjustment of heat and should have a mechanism of adjustment of airflow and drum speed, as applicable.

5.6 Bolts and nuts, screws, bearings, bushing and seals to be used shall conform to the food safety requirements, PAES or other international standards.

6 Performance and Other Requirements

The coffee roaster, when tested, shall conform the following requirements:

6.1 Roasting capacity shall meet the manufacturer’s specification.

6.2 The performance criteria for coffee roaster shall be specified in Table 1.

Table 1. Performance Criteria for Coffee Roaster

Criteria	Performance Data
Roasting Recovery, percent, minimum	80
Broken Beans, percent, maximum	1

6.2 The noise level (Table 2) shall comply with the requirements of Occupational Safety and Health Center, Department of Labor and Employment depending on the daily duration of operation. (OSHS Rule 1074:01)

Table 2. Permissible Noise Exposure*

Duration Per Day, Hours	Sound Levels [db(A)], Slow Response
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼	115

* Occupational Safety and Health Center, Department of Labor and Employment (2013)

6.3 The roasted coffee beans should not exhibit tipping.

6.4 The roasted coffee beans should be uniformly roasted.

7 Safety, Workmanship and Finish

7.1 Coffee roaster shall be free from any manufacturing defects that may be detrimental to its operation.

7.2 All metal surfaces shall be free from rust.

7.3 The external parts of the coffee roaster shall be free from sharp edges and rough surfaces.

7.4 Mechanism for immediate load disengagement of power or emergency stop shall be provided.

7.5 All moving parts shall be provided with safety features.

7.6 The coffee roaster shall be compliant with the Good Manufacturing Practices (GMP).

8 Warranty for Fabrication and Services

Warranty shall be provided for parts and services except for normal wear and tear of expendable or consumable maintenance parts for at least one (1) year upon the acceptance of procuring entity of the coffee roaster. General requirements of the warranty shall conform to PNS/BAFS/PAES 192:2016 – Agricultural Machinery – Guidelines on After-Sales Service.

9 Maintenance and Operation

9.1 Each unit of coffee roaster shall be provided with a set of manufacturer's standard tools required for maintenance.

9.2 Operator's manual shall be provided (PAES 102:2000 Agricultural Machinery – Operator's Manual – Content and Presentation) including maintenance schedule and a list of the warrantable parts of the coffee roaster shall be provided.

9.3 The coffee roaster shall be easy to clean and operate

10 Sampling

Coffee roaster shall be sampled for testing in accordance with PAES 103:2000 Agricultural Machinery – Method of Sampling.

11 Testing

Coffee roaster shall be tested in accordance with PNS/BAFS/PAES 215:2017 Agricultural Machinery – Coffee Roaster – Methods of Test.

12 Marking and Labelling

12.1 Each unit of coffee roaster shall be marked at the most visible place with the following information:

12.1.1 Registered trademark of the manufacturer

12.1.2 Brand

12.1.3 Model

12.1.4 Serial Number

12.1.5 Name, address and contact number of the manufacturer/importer/distributor

12.1.6 Country of manufacture/origin (if imported) / “Made in the Philippines” (if manufactured in the country)

12.1.7 Roasting capacity, kg/h

12.1.8 Recommended roasting temperature, °C

12.2 Safety/Precautionary markings shall be provided. It shall be stated in English and Filipino and printed in red color with a white background.

12.3 The markings shall be durably bonded to the base surface material. The markings shall be all weather resistant and under normal cleaning procedures. It shall not fade, discolor, peel, crack or blister and shall remain legible.

13 Bibliography

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