

PHILIPPINE NATIONAL STANDARD

**PNS/BAFS PAES 248:2018
ICS 65.060.99**

Agricultural Machinery – Multicrop Pulverizer – Methods of Test



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines

Trunkline: **(632) 928-8741 to 64 loc. 3301-3319**

E-mail: **info.dabafs@gmail.com**

Website: **www.bafs.da.gov.ph**

Contents

Foreword.....	iii
1 Scope.....	1
2 Normative References.....	1
3 Terms and Definitions.....	1
4 General Conditions for Test.....	3
5 Test Preparation.....	4
6 Pre-test Observation.....	4
7 Performance Test.....	5
8 Laboratory Analysis.....	6
9 Presentation of Results.....	6
10 Formula.....	7
11 Test Report.....	7
Annex A.....	8
Annex B.....	9
Annex C.....	12
Annex D.....	13
Annex E.....	15
Annex F.....	16
Annex G.....	17

Foreword

The Philippine National Standard (PNS) for Agricultural Machinery – Multicrop Pulverizer – Methods of Test (PNS/BAFS PAES 248:2018) has been prepared by the Technical Working Group (TWG) for Various Agricultural Machinery as per approved Department of Agriculture Special Order No. 1045 series of 2016.

This Standard cancels and replaces the provisions recommended by PAES 239:2008 edition.

This edition includes the following significant changes compared to the previous edition:

- Modification of format in accordance with ISO/IEC Directives Part 2 eighth edition;
- Change of name of the machine from “Multicrop Micromill” to “Multicrop Pulverizer”;
- Revision of the scope such that both dried commodities for food and feed purposes were included;
- Revision of terms “requesting party” and “manufacturer/distributor/dealer to “test applicant”;
- Addition of “test applicant” in the terms and definition;
- Revision of the provision for the termination of test;
- Addition of provision on the duration of loading, operating, and output time;
- Addition of Clause 9 “Presentation of Results”;
- Revision of the Annexes;
- Addition of the determination of the size of the input material in the laboratory analysis;

This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2.

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 methods of test for multicrop pulverizer used in pulverizing dried agricultural commodities both for foods and feeds. Specifically, it shall be used to:

- 1.1 verify the mechanisms, dimensions, materials and accessories of the multicrop pulverizer and the list of specifications submitted by the manufacturer;
- 1.2 determine the performance of the machine;
- 1.3 evaluate the ease of handling and safety features; and
- 1.4 report the result of the tests.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM E11, *Specifications for Wire-Cloth Sieves for Testing Purposes*

PAES 103:2000, *Agricultural Machinery – Method of Sampling*

PNS/BAFS PAES 248:2018, *Agricultural Machinery – Multicrop Pulverizer – Specifications*

3 Terms and Definitions

For the purpose of this standard, the following terms and definitions shall apply.

3.1

dried agricultural commodities

includes the edible parts of crops with moisture content of 12-15% and is prepared for pulverizing

3.2

fineness

indicates the uniformity of size of the pulverized product

3.3

input capacity

weight of input dried agricultural commodity per input time into the hopper, expressed in kilogram per hour

3.4

labor requirement

number of man-day needed in the operation of the multicrop pulverizer

3.5

pulverizing capacity

total weight of pulverized product over the total operating time, expressed in kilogram per hour

3.6

pulverizing chamber

part of the machine where pulverizing takes place

3.7

pulverizing efficiency

ratio between the amount of acceptable pulverized products and the total pulverizing recovery, expressed in percentage

3.8

pulverizing recovery

ratio between the pulverized products and the total weight of dried agricultural commodity loaded in the hopper, expressed in percent

3.9

prime mover

electric motor or internal combustion engine used to drive the multicrop pulverizer

3.10

overall height

distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the multicrop pulverizer

NOTE All parts of the cassava mechanical dryer projecting upwards are contained between these two planes.

3.11

overall length

distance between the vertical planes at the right angles to the median plane of the multicrop pulverizer and touching its front and rear extremities

3.12

overall width

distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of the grater on its respective side

3.13

running-in period

preliminary operation of the machine to make final adjustments prior to the conduct of test

3.14

test applicant

manufacturer, direct importer, or any legitimate distributor, dealer, or end-user of the machine

4 General Conditions for Test and Inspection

4.1 Selection of multicrop pulverizer to be tested

Multicrop pulverizer submitted for testing shall be sampled in accordance with PAES 103:2000 or any other suitable method of selection.

4.2 Role of the test applicant

The test applicant shall submit specifications and other relevant information about the multicrop pulverizer. They shall abide with the terms and conditions set forth by the official testing agency, provide testing materials and shoulder other variable costs to carry out the test.

4.3 Role of the representative of the test applicant

An officially designated representative of the test applicant shall operate, demonstrate, adjust, repair as the case maybe and decide on matters related to the operation of the machine.

4.4 Test site conditions

The multicrop pulverizer 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 area.

4.5 Suspension/Termination of test

If during the test run, the machine stops due to breakdown or malfunction so as to affect the performance of the machine, the test may be suspended. If the machine will not be able to continue operation, the test shall be terminated.

5 Test Preparation

5.1 Preparation of the multicrop pulverizer for testing

The representative of the test applicant and testing agency shall check the multicrop pulverizer so as to ensure that the machine has been assembled and installed in accordance with the instruction of the manufacturer. The official testing agency will test the multicrop pulverizer according to the desired output of the manufacturer.

5.2 Test instruments and other materials

The suggested list of minimum field and laboratory test equipment and materials needed to carry out the multicrop pulverizer test is shown on Annex A. These instruments shall be calibrated regularly. It shall be physically checked and cleaned for operation before and after each test. A checklist of instruments and materials to be used before departure to and from the testing area shall be prepared.

5.3 Test materials

The dried agricultural commodity to be used shall be commonly and locally grown with moisture content (wet basis) of 12%-15%. The test material shall be of single variety and should be of uniform sizes.

The amount of test material to be supplied shall be sufficient for the required test trials, running-in, and laboratory tests. However, if the test materials are not conforming to the recommended quantity and characteristics, the test engineer has the option not to pursue the test concurred by the representative of the test applicant.

5.4 Running-in and preliminary adjustment

The multicrop pulverizer shall have undergone a running-in period before starting the test. During the running-in period, the various adjustments of the machine shall be made according to the recommendation of the manufacturer.

6 Pre-test Observation

6.1 Verification of specifications

The specifications claimed by the manufacturer and the physical details given in Annex B shall be verified by the testing agency. A stable and level surface shall be used as reference plane for verification of dimensional machine specifications.

6.2 Test Samples

Representative test samples shall be collected by the testing agency from the test material for analysis. Sampling procedure is shown in Annex C.

7 Performance Test

7.1 Operation of the multicrop pulverizer

The multicrop pulverizer shall be operated for sufficient duration with load at the test site by the official representative of the test applicant using the recommended setting of the manufacturer. The testing agency shall make all measurements, which form part of the test and take the prescribed samples. After the test run, the area shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials.

NOTE No other adjustments shall be permitted during the test.

7.2 Test Trials

A minimum of three (3) test trials, with duration of at least fifteen (15) minutes per trial, shall be adopted.

7.3 Sampling

Samples shall be collected at the product outlet during each test trail. Sampling procedure is shown in Annex C.

7.4 Data Collection

7.4.1 Duration of test

The loading/input time shall start at the feeding of the dried commodity from the intake hopper and ends when there is no more dried commodity in the hopper.

The total operating time shall start at the feeding of the dried commodity from the intake hopper and ends after the last discharge of the pulverized product at the product outlet.

The output time shall start from the first discharge of the pulverized product at the product outlet and ends after the last discharge of the pulverized product at the product outlet.

7.4.2 Noise level

7.4.2.1 The sound emitted by the machine, with and without load, shall be measured using a sound level meter at the location of the operator/s. The noise level, expressed in decibel [dB (A)], shall be measured 50 mm away from the ear level of the operator/s.

7.4.2.2 For each data to be taken, there shall be a minimum of five (5) observations. Before taking data, it should be ensured that the feed rate, speed, and other functional characteristics have stabilized. The time of recording shall be properly spaced during the whole duration of the test trial.

7.4.3 Power requirement/Fuel consumption

7.4.3.1 Using electric motor as prime mover

Use a power meter to measure the voltage, current, and the total electric power requirement of the multicrop pulverizer. There shall be three (3) sets of data with a minimum of five (5) observations per set taken with and without load.

7.4.3.2 Using engine as prime mover

To get the amount of fuel consumed, the tank shall be filled to full capacity before the test. After the test, fill the tank with measured fuel to the same level before the test. When filling up the tank, careful attention shall be paid to keep the tank horizontal and not to leave empty space in the tank. There shall be three (3) sets of data with a minimum of five (5) observations per set taken with and without load.

7.4.4 Speed of components

The speed of the rotating shafts of the major components of the multicrop pulverizer shall be taken using a tachometer with and without load. For each data to be collected, there shall be a minimum of five (5) observations.

Requirements for each data to be taken shall conform to Clause 7.4.2.2.

7.5 Data recording and observations

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

8 Laboratory Analysis

Laboratory analysis shall be made to determine the moisture content and fineness of the ground/pulverized product. The laboratory procedure to be followed in the analysis is given in Annex E while the data sheet is given in Annex F.

For the determination of fineness, the recommended sizes shall be based on relevant local and international standards, as prescribed by the market or based on the provisions prescribed in the PNS/BAFS PAES 247:2018.

9 Presentation of results

Machine specifications and the result of the tests shall be presented in tabular form in which data shall be taken from Annexes B and D. A schematic diagram of the

power transmission system shall also be included. Observations made on the machine while in operation shall be supported with photographs.

10 Formula

The formulas to be used during calculations and testing are given in Annex G.

11 Test Report

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

11.1 Name of testing agency

11.2 Test report number

11.3 Title

11.4 Summary of Results

11.5 Purpose and scope of test

11.6 Methods of test

11.7 Conditions of the Machine

11.8 Description of the Machine

11.9 Results and Discussions

11.10 Observations (include pictures)

11.11 Name, signature and designation of test engineers

Annex A
(informative)

**Minimum List of Field and Laboratory
Test Equipment and Materials**

A.1 Field test equipment and materials

	Equipment/Material	Quantity
A.1.1	Hand-held Tachometer	1
A.1.2	Stop Watch	2
A.1.3	Measuring Tape	1
A.1.4	Sound Level Meter	1
A.1.5	Weighing Scale Capacity: 100 kg Resolution: 0.1 kg	1
A.1.6	Clamp-on AC/DC Power Meter (for electric motors) Maximum: 1000 V	1
A.1.7	Graduated Cylinder (for engines) Capacity: 500 mL	1
A.1.8	Camera	1
A.1.9	Vernier Caliper Accuracy: 0.1mm	1

A.2 Laboratory test equipment and materials

	Equipment/Material	Quantity
A.2.1	Digital Weighing Scale Resolution: 0.01 g Capacity: 2500 g	1
A.2.2	Sieve Shaker	1
A.2.3	Sieves Screen ASTM E-11 #12, #16, #20, #30, #40, #50, Pan	1
A.2.4	Laboratory oven	1
A.2.5	Desiccator with desiccants	1
A.2.6	Aluminum Moisture Cans	9
A.2.7	Sample Bags (Resealable bags)	20
A.2.8	Labeling Tags which include: Date of Test Multicrop Pulverizer on Test Sample Source Variety Trial Number	20

Annex B
(informative)

Specifications of Multicrop Pulverizer

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

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

GENERAL INFORMATION

Make : _____ Type : _____
 Serial No. : _____ Brand/Model : _____
 Year of Manufacture : _____
 Testing Agency : _____ Test Engineer : _____
 Location of Test : _____ Date of Test : _____

No.	Items*	Specification of the Manufacturer	Verification by the Testing Agency
B.1	Main structure		
B.1.1	Overall dimensions (mm)		
B.1.1.1	Length		
B.1.1.2	Width		
B.1.1.3	Height		
B.1.2	Weight (kg), if applicable without the prime mover		
B.2	Pulverizing capacity (kg/h)		
B.3	Prime Mover		
B.3.1	Electric motor		
B.3.1.1	Brand		
B.3.1.2	Model		
B.3.1.3	Serial Number		
B.3.1.4	Type		
B.3.1.5	Rated power (kW)		
B.3.1.6	Rated speed (rpm)		
B.3.1.7	Electric service required (single phase or 3- phase)		

*The parameter will be checked upon availability

No.	Items*	Specification of the Manufacturer	Verification by the Testing Agency
B.3.1.8	Voltage (V)		
B.3.1.9	Current (A)		
B.3.1.10	Frequency (Hz)		
B.3.1.12)	Weight (kg)		
B.3.2	Engine		
B.3.2.1	Brand		
B.3.2.2	Make or manufacturer		
B.3.2.3	Model		
B.3.2.4	Serial Number		
B.3.2.5	Type		
B.3.2.6	Rated Power (kW)		
B.3.2.7	Rated Speed (rpm)		
B.3.2.8	Displacement (cm ³)		
B.3.2.9	Cooling system		
B.3.2.10	Starting system		
B.3.2.11	Weight (kg)		
B.4	Hopper		
B.4.1	Material		
B.4.2	Thickness (mm)		
B.4.3	Height from the ground (mm)		
B.4.4	Location		
B.4.5	Means of attachment		
B.5	Pulverizing Chamber		
B.5.1	Type		
B.5.2	Material		
B.5.3	Dimensions, if applicable		
B.5.3.1	Diameter (mm)		
B.5.3.2	Thickness (mm)		
B.5.3.3	Length (mm)		
B.5.4	Other Specifications		
B.6	Screen		
B.6.1	Mesh Number		
B.6.1	Material		
B.6.1	Dimensions on (mm)		
B.7	Cyclone collector		
B.7.1	Material		
B.7.2	Thickness (mm)		

*The parameter will be checked upon availability

No.	Items*	Specification of the Manufacturer	Verification by the Testing Agency
B.7.3	Height from the ground (mm)		
B.7.4	Location		
B.7.5	Means of attachment		
B.8	Safety Devices		
B.9	Special Features		

*The parameter will be checked upon availability

B.10 Illustration of transmission system and sieve arrangement

Annex C
(normative)

Sampling Procedures

C.1 Sampling procedures for test material input

The conditions of the dried commodity input, to be used in each test, such as the moisture content and the dimensions shall be taken using three (3) “representative samples,” which represent the different conditions of the dried agricultural commodity input in the bulk. This is done by randomly taking 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.

C.2 Sampling from the cyclone collector

During each test trial, three (3) samples, each weighing at least 100 g, shall be collected from the cyclone collector of the multicrop pulverizer to be analyzed in the laboratory for the determination of the fineness of pulverized product. The minimum amount of sample to be taken shall be twice as much as what is needed.

C.3 Handling of samples

All samples to be taken to the laboratory shall be placed in appropriate containers and properly labeled. If the sample is to be used for determining moisture content, it must be kept in dry and airtight containers. Care should be taken so as to prevent alterations of the conditions of the test samples.

Annex D
(informative)

Performance Test Data Sheet

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

No.	Item	Data
D.1	Conditions of the test materials	
D.1.1	Crop	
D.1.2	Source	
D.1.3	Variety	

No.	Items	Trial 1	Trial 2	Trial 3	Average
D.2	Weight of input (kg)				
D.3	Output capacity (kg/h)				
D.4	Input capacity (kg/h)				
D.5	Operating time (h)				
D.6	Pulverizing capacity (kg/h)				
D.7	Pulverized products (kg)				
D.8	Pulverizing recovery (%)				
D.9	Speed of components (rpm)				
D.9.1	Prime Mover				
D.9.2	Without load				
D.9.3	With load				
D.9.2	Pulverizer shaft				
D.9.2.1	Without load				
D.9.2.2	With load				
D.10	Noise level [dB (A)]				
D.10.1	Feeder				
D.10.1.1	Without load				
D.10.1.2	With load				
D.10.2	Collector				
D.10.2.1	Without load				
D.10.2.2	With load				
D.11	Power requirement				
D.11.1	Power (kW)				
D.11.1.1	Without load				
D.11.1.2	With load				

No.	Items	Trial 1	Trial 2	Trial 3	Average
D.11.2	Current (A)				
D.11.2.1	Without load				
D.11.2.2	With load				
D.11.3	Voltage (V)				
D.11.3.1	Without load				
D.11.3.2	With load				
D.12	Fuel Consumption				
D.12.1	Fuel time (h)				
D.12.2	Fuel consumed (L)				

D.12 Other Observations

D.12.1 Ease of loading

D.12.2 Ease of cleaning parts

D.12.3 Ease of adjusting and repair of parts

D.12.4 Ease of collecting output

D.12.5 Ease of transporting the machine

D.12.6 Failure or abnormalities that may be observed on the implement or its component parts during and after the operation.

D.12.7 Safety

D.12.8 Labor Requirements

D.12.9 Others

Annex E
(normative)

Laboratory Analysis

E.1 Determination of the size of the dried agricultural commodity

The length, width and height of the obtained representative samples of the test material shall be measured using a Vernier caliper. The measurements obtained shall be recorded in Annex F.

E.2 Moisture content determination of the dried agricultural commodity

At least five (5) representative samples of 25 g each shall be taken randomly for moisture content determination, preferably using the Air-Oven Drying Method

E.3 Determination of the fineness of the Pulverized Product

This shall be taken using Sieve Shaker Testing. A set of sieves as specified in ASTM E11 - Specifications for Wire-Cloth Sieves for Testing Purposes shall be used.

E.3.1 For each test trial, place the 100g samples in a testing sieve shaker with a series of sieves screen.

E.3.2 Shake the samples for at least 5 minutes.

E.3.3 After shaking, remove the samples from each sieve screen. Weigh and record each sample on the data sheet (Annex F). Repeat this for a total of 3 trials.

E.3.4 Calculate the percent of pulverized materials retained on each sieve screen.

E.3.5 Calculate the pulverizing efficiency depending on the purpose. The percent of material retained within the mesh sieve screen recommended for the specific commodity shall be used in the computation.

Annex F
(informative)

Laboratory Analysis Test Data Sheet

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

G.1 Dimension of the Input Product

Trial No.	Length, mm	Width, mm	Height, mm
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Average			

G.2 Moisture content (% wet basis) of the test material

Trial No.	Input test material		
	Initial Weight (g)	Final Weight (g)	%MC
1			
2			
3			
4			
5			
Average			

G.3 Analysis of Pulverized Product

ASTM E11 Standard Testing Sieve	Weight of Material Retained			Percent of Material Retained		
	Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3
12						
16						
20						
30						
40						
50						
pan						
Total						

Annex G
(normative)

Formula Used During Calculations and Testing

G.1 Input Capacity

$$C_i = \frac{W_i}{T_i}$$

where:

C_i is the input capacity (kg/h)
 W_i is the weight of input material (kg)
 T_i is the input time (h)

G.2 Pulverizing Capacity

$$C_P = \frac{W_O}{T_O}$$

where:

C_P is the pulverizing capacity (kg/h)
 W_O is the weight of the pulverized product (kg)
 T_O is the total operating time (h)

G.3 Pulverizing Recovery

$$PR = \frac{W_O}{W_i} \times 100\%$$

where:

PR is the pulverizing recovery (%)
 W_O is the weight of the pulverized product (kg)
 W_i is the weight of input material (kg)

G.4 Pulverizing Efficiency

$$Eff = \frac{FP}{PR} \times 100\%$$

where:

Eff is the pulverizing efficiency (%)
 FP is the acceptable pulverized product (%)
 PR is the pulverizing recovery (%)

G.5 Moisture Content (wet basis)

$$MC = \frac{W_{is} - W_{fs}}{W_{is}} \times 100\%$$

where:

MC	is the moisture content (%)
W_{is}	is the initial weight of the sample (g)
W_{fs}	is the final weight of the sample (g)

G.6 Electric energy consumption

$$E_c = P_c \times T_o$$

Where:

E_c	is the electrical energy consumption (kW-h/kg)
P_c	is the power consumed (kW)
T_o	is the total operating time (h)

G.7 Fuel consumption

$$F_c = \frac{F_v}{T_o}$$

where:

F_c	is the fuel consumption (L/h)
F_v	is the volume of fuel consumed (L)
T_o	is the total operating time (h)

Bibliography

PAES 238:2008, *Agricultural Machinery – Multicrop Micromill – Methods of Test*

**Department of Agriculture
Bureau of Agriculture and Fisheries Standards**

**Technical Working Group (TWG) for the Development of Philippine National
Standard for Agricultural Machinery – Multicrop Pulverizer**

Chairperson

Cristy Cecilia Polido
Bureau of Agricultural and Fisheries
Engineering

Co-Chairperson

Aurelio Delos Reyes Jr.
Agricultural Machinery Testing and
Evaluation Center

Members

1 Romulo Eusebio
Agricultural Machinery Testing
and Evaluation Center

2 Fatima Joy Raytana
Agricultural Machinery Testing
and Evaluation Center

3 Janice Vargas
Bureau of Agricultural and
Fisheries Engineering

4 Jessa Rica Pandiño
Bureau of Agricultural and
Fisheries Engineering

5 Arjay Sabasaje
Bureau of Agricultural and
Fisheries Engineering

6 Rose Ann Arienda
Bureau of Agricultural and
Fisheries Engineering

7 Darwin Aranguren
Agricultural Machinery Testing
and Evaluation Center

8 Victor Rodolfo Jr.
Center for Agricultural and
Biosystems Mechanization

9 Donald Mateo
Philippine Center for
Postharvest Development and
Mechanization

10 Triniza Jardin-Millare
Department of Agriculture –
Regional Field Office – IVA

11 Dennis Tactac
Department of Agriculture –
Regional Field Office – I

12 Peachie Melendez
Philippine Council for
Agriculture and Fisheries

Project Managers

Lara Navarro
John Gregory Aquino
Charmine Diann Mejia
Abbygail Jaylo

Advisers

Vivencio R. Mamaril
Karen S. Bautista

Bureau of Agriculture and Fisheries Standards



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines

T/ (632) 928-8741 to 64 loc. 3301-3319

E-mail: info.dabafs@gmail.com

Website: www.bafs.da.gov.ph