

PHILIPPINE NATIONAL STANDARD

PNS/BAFS xxx:2026
ICS 65.060.01

Chipping Machine — Methods of Test



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1 Scope

This standard specifies the methods of test and inspection for power-driven and manually operated chipping machines for multi-crop commodities in food and feed processing. Specifically, it shall be used to:

- a. verify the conformity of the machine's mechanism, dimensions, materials, components, and accessories with the manufacturer's declared specifications;
- b. determine the performance of the machine under test conditions;
- c. evaluate the ease of operation, handling and safety feature;
- d. determine the physical quality characteristics of the chips; and
- e. report the results of the tests.

2 Normative References

The following normative document contains provisions which through reference in this text constitute provisions of these standards:

Agricultural Machine and Testing Evaluation Center (AMTEC) - University of the Philippines Los Baños (UPLB). (2005). Chipping machine — Specifications (PAES 222: 2005)

<https://amtec.uplb.edu.ph/wp-content/uploads/2019/07/paes-222-chipper-specs-1.pdf>

AMTEC- UPLB. (2005). Chipping machine — Methods of test (PAES 223: 2004)<https://amtec.uplb.edu.ph/wp-content/uploads/2019/07/paes-223.pdf>

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2022). Methods of sampling for agricultural and biosystems power and machinery — Guidelines (PNS/BAFS 391:2024).https://drive.google.com/file/d/1U942cHfs_mHJuqUu7BFk-58Zm3sySnns/view

BAFS-DA. (2026). Chipping machine — Specifications (PNS/BAFS xxx:2026).

3 Terms and Definitions

For the purpose of this Standard, the following definitions below apply. The preferred terms are written in bold type after the Clause number while admitted terms are listed in italicized type after the definition, which could be interchangeably used in interpreting the provisions of this Standard:

3.1

blade bevel angle

angle of the cutting edge of the blade (AMTEC-UPLB, 2004)

NOTE 1 A double bevel blade is characterized by the presence of a primary bevel and secondary bevel, while a single bevel blade has only one primary bevel angle.

NOTE 2 See Figure 1.

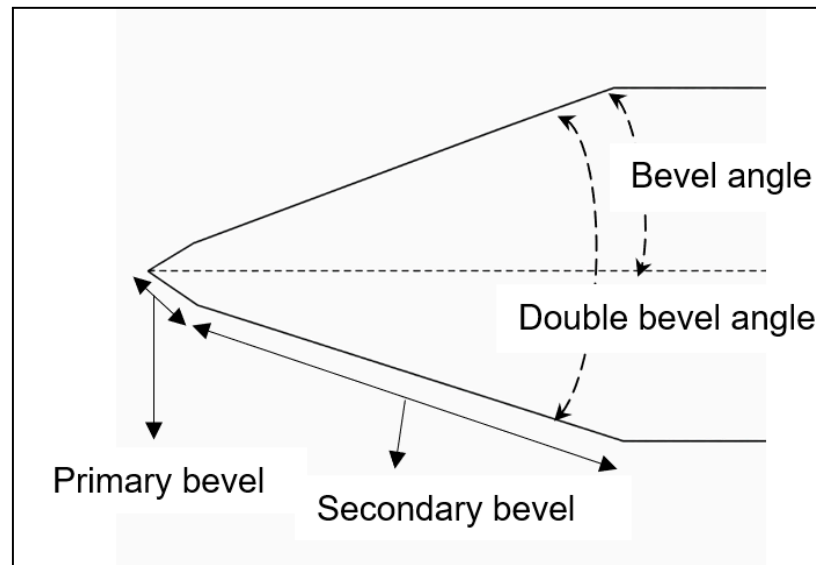


Figure 1. Double blade angle

3.2

chip

thin slice of material with desired thickness that varies depending on the material type or user preference (AMTEC-UPLB, 2004, *modified*)

3.3

chipping machine

size reduction machine either power or manually-operated which is used to cut or slice multi-crop commodities into small thin pieces called chips (AMTEC-UPLB, 2005, *modified*)

admitted term: chipper

3.4

chipping capacity

amount of input material that can be processed per unit time, expressed in kilograms per hour, kg/h (AMTEC-UPLB, 2005)

3.5

chipping efficiency

ratio of the weight of the chips collected at all outlets, to the total weight of the input of the chipper, expressed in percentage, %AMTEC-UPLB, 2005)

3.6

chipping recovery

ratio of the weight of the chips collected at the main outlet, to the total weight of the input of the chipper, expressed in percentage, % (AMTEC-UPLB, 2005)

3.7

coefficient of variation (CoV)

a percentage of deviation from the average chip thickness, expressed in percentage, % (AMTEC-UPLB, 2025, *modified*)

admitted term : variation of cut

3.8

cutting disc

rotating part of the chipping machine that holds the cutting blades (AMTEC-UPLB, 2005)

3.9

foreign matter

all matters other than the raw materials (AMTEC-UPLB, 2005, *modified*)

Note to entry : Raw materials may consist of sand, gravel, dirt, pebbles, stones, metal fillings, lumps of earth, clay, mud, chaff, straw, weed seeds and other crop seeds.

3.10

overall height

distance between the horizontal supporting surface and the horizontal plane touching the uppermost part of the chipping machine (AMTEC-UPLB, 2005)

NOTE All parts of the chipping machine 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 chipping machine and touching its front and rear extremities (AMTEC-UPLB, 2005)

NOTE All parts of the chipping machine, in particular, components projecting at the front and at the rear are contained between these two planes. Where an adjustment of components is possible, it shall be set at minimum length.

3.12

overall width

distance between the vertical planes parallel to the median plane of the chipping machine, each plane touching the outermost point of the chipping machine (AMTEC-UPLB, 2005)

NOTE All parts of the chipping unit projecting laterally are contained between these two planes.

3.13

plate angle

angle of orientation of the chipping plate with respect to the horizontal plane (AMTEC-UPLB, 2005)

3.14

prime mover

refers to the electric motor, internal combustion engine (ICE) (e.g., gasoline or diesel), and other integral power sources used to run the chipping machine (AMTEC-UPLB, 2005, *modified*)

3.15

running-in period

preliminary operation of the machine to make various adjustments prior to the conduct of test until the operation is stable (AMTEC-UPLB, 2004)

3.16

thickness

shortest distance measured between two parallel or nearly parallel surfaces of a material

4 Principles of Test

The test shall be carried out to verify the conformity of the actual specifications of the Chipping Machine with the requirements of PNS/BAFS xxx:2026.

5 Test Instrument, Equipment and Materials

The test shall be carried out using the suggested minimum list of test equipment and materials in Annex A (Minimum list of test instrument, equipment and materials). The test equipment to be used shall be calibrated regularly, physically checked for operation, and shall be cleaned before and after each test.

6 General Considerations

6.1 Conditions for the test

6.1.1 Test site conditions

The chipping machine shall be tested as installed for normal operation. The site shall have ample provisions for crop handling, temporary storage and workspace.

6.1.2 Selection of chipping machine to be tested

The chipping machine shall be sampled for testing in conformance with PNS/BAFS 391:2024 (Methods of sampling for agricultural and biosystems power and machinery — Guidelines) or other suitable method of selection validated by the testing authority.

6.2 Test materials

6.2.1 Test materials to be used shall be commonly or locally grown root crops representative of the intended use of the machine (e.g., potato, banana, cassava, sweet potato etc.).

6.2.2 The amount of test material to be supplied shall be at least 75% of chipper's input capacity.

6.3 Pre-test activities

6.3.1 Running-in and preliminary adjustment

The chipping machine shall have undergone a running-in period before the start of the test. Various adjustments of the chipping machine shall be made according to the recommendation of the manufacturer. No other adjustments shall be permitted while the test is ongoing.

6.3.2 Verification of specifications

6.3.2.1 This inspection is carried out to verify the mechanism, main dimensions, materials and accessories of the chipping machine in comparison with the list of specifications.

6.3.2.2 A plain and level surface shall be used as reference plane for verification of chipping machine dimensional specifications.

6.3.2.3 The items to be inspected and verified shall be recorded using the form in Annex B (Specifications of chipping machine).

6.4 Termination of test

The test shall be terminated by the test engineer if during the test trials, the machine stops due to major component breakdown or malfunctions.

7 Performance Test and Procedures

7.1 Performance Test

The performance test is carried out to obtain actual data on overall machine performance using Annex C (Performance test data sheet).

7.2 Operation of the chipping machine

The chipping machine shall be operated at the recommended settings of the manufacturer and the setting shall be maintained during the test trial. After the test trial, the chipping area shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials.

7.3 Test trial

A minimum of two test trials, with duration of at least 15 minutes per trial, shall be adopted. If there is a considerable discrepancy between the results of the first and second trials, an additional trial shall be performed to verify the data.

7.4 Test materials to be used

7.4.1 Test materials to be used for the running-in and for each test trial shall be the same.

7.4.2 Initial data of the crop conditions such as type of crop variety/species, source and dimensions of test materials shall be recorded.

7.5 Data collection

7.5.1 Duration of test

The duration of each test trial shall commence at the start of the chipping operation and end after feeding of the last batch and shall be recorded as operating time.

7.5.2 Noise level

The noise level, expressed in decibel [dB(A)], shall be measured 50 mm away from the operator's ear using a sound level meter. For each data on the location to be taken, there shall be a minimum of five observations.

Before collecting data, it should be ensured that the operations and other functional characteristics of the machine have stabilized. The time of recording shall be properly spaced during the whole duration of the test trial.

7.5.3 Speed of components

The speed of the rotating shafts of the major components of the chipping machine shall be taken using a tachometer.

7.5.4 Fuel consumption for power-operated chipping machine

The fuel tank shall be filled to its capacity, before the start of each test trial. After the test, the tank shall be refilled using a graduated cylinder. The volume of fuel required to refill the tank shall be recorded and the fuel consumption shall be computed using Annex E (Formula used for calculations and testing). When filling up the tank, keep the tank horizontal so as not to leave empty space in the tank. In case an electric motor is used as a prime mover, a calibrated multimeter shall be used to measure electric energy consumption. The time of fuel consumption shall be recorded.

7.5.5 Operator's physical attributes for manually-operated chipping machine

Operator's physical attributes for manually operated chipping machine such as height, weight and stature of the operator shall be recorded. Pulse rate and blood pressure before and after each test trial shall be recorded.

7.5.6 Determination of chipping efficiency

The weight shall be recorded for analysis. The chipping efficiency shall be computed using the following formula in Annex E (Formula used for calculation and testing) .

7.6 Sampling

7.6.1 Sampling procedures for test materials

Randomly take twenty (20) representative samples for determination of input material dimension. This is done by taking samples, each at the top, middle and bottom of the pile.

7.6.2 Sampling from the outlet

During each test trial, three 200 g samples shall be randomly collected from the output of the chipper to be analyzed in the laboratory. Half (300 g) of the 600 g sample shall be used for laboratory analysis and the other half (300 g) shall be used for reference purposes or for an eventual second check in case of review.

7.6.3 Handling of samples

All samples to be taken to the laboratory shall be placed in resealable containers and properly labeled.

7.7 Laboratory Analysis

Laboratory analyses shall be made to determine moisture content, thickness of chips and quality of cut of the chipping machine. All data gathered shall be recorded in the laboratory data sheet in Annex D.

7.7.1 Determination of moisture content

The determination of moisture content shall be taken using the oven-dry method as provided below.

7.7.1.1 Oven-dry method

For each test trial, select three representative samples weighing at least 100 grams of chips and be placed in the moisture can. The moisture can shall be sealed to ensure that no moisture is lost or gained by the sample between the time it was collected and when it is weighed. The initial weight shall be recorded.

7.7.1.1.1 The sample shall be dried in the oven with a temperature of $103 \text{ d } ^\circ\text{C} \pm 1 \text{ } ^\circ\text{C}$ for 72 hours.

7.7.1.1.2 After removing the samples from the oven, the moisture can with the sample should be placed in a desiccator and allowed to cool to the ambient temperature.

7.7.1.1.3 The moisture can plus the dried sample should be weighed. The final weight should be recorded. The moisture content shall be calculated using the formula stated in Annex E (Formula used for calculations and testing).

7.7.2 Determination of size uniformity of chips

In each test trial, three 30 pieces of chips shall be randomly taken from the outlet. The dimension of each pieces in the samples shall be measured to get the following:

- a. average thickness;
- b. coefficient of variation; and
- c. percent error of cut (% error).

7.8 Data recording and observations

The record sheet for all data and information during the test is given in Annex C (Performance test data sheet).

8 Formula

The formulas provided in Annex E (Formula used for calculations and testing) shall be used.

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) Summary of results;
- e) Purpose and scope of test;
- f) Methods of test;
- g) Description of the machine;
- h) Specifications;
- i) Results;
- j) Observations (include pictures); and
- k) Names, signatures, and designation of test engineers.

Annex A
(Informative)

Minimum list of instrument, equipment and materials

	Item	Quantity
A.1	Test instrument and equipment	
A.1.1	Field	1
A.1.1.1	Tachometer (contact type or photoelectric type) Range: 0 rpm to 5,000 rpm	1
A.1.1.2	Digital Timers (range: 60 minutes) Accuracy: 0.1 sec	2
A.1.1.3	Tape measure (with maximum length of 5 m)	1
A.1.1.4	Noise level meter Range: 30 dB(A) to 130 dB(A)	1
A.1.1.5	Weighing scale (capacity: 100 kg) Scale divisions: 500 g	1
A.1.1.6	Graduated cylinder (for engines) (500 mL capacity) multimeter (for electric motors) 60 Hz, 220 V	1
A.1.1.7	Camera	1
A.1.1.8	Caliper (resolution: 0.01 mm)	1
A.1.1.9	Multimeter/ Energy meter	1
A.1.1.10	Digital blood pressure (BP) monitor/ sphygmomanometer	1
A.1.2	Laboratory	
A.1.2.1	Weighing Scale (Sensitivity: 0.01 g)	1
A.1.2.2	Air oven	1
A.1.2.3	Desiccator with desiccants	1
A.1.2.4	Caliper (resolution: 0.01 mm)	1
A.1.2.5	Aluminum moisture can	9
A.2	Test materials	
A.2.1	Resealable sample bags	9
A.2.2	Labeling tags which include:	9
A.2.2.1	Date of Test	
A.2.2.2	Chipping machine on test	
A.2.2.3	Sample source	
A.2.2.4	Variety/ Species	
A.2.2.5	Trial Number	

Annex B
(Informative)

Specifications of chipping machine

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

GENERAL INFORMATION

Brand and Model: _____ Make: _____
Serial No: _____ Type: _____
Country of Manufacture/Origin : _____
Testing Agency: _____
Date Manufactured: _____ Date of Test: _____

ITEMS	Manufacturer's Specification	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, without prime mover, kg if applicable		
B.2 Chipping assembly		
B.2.1 Type		
B.2.2 Dimension, D x W, mm		
B.2.3 Cutting device		
B.2.3.1 Type		
B.2.3.2 Dimension, L x W x t, mm		
B.2.3.3 No. of blades		
B.2.3.4 Means of attachment		
B.2.3.5 Materials		
B.3 Feeding table		
B.3.1 Dimension, L x W, mm		
B.3.2 Height from the ground, mm		
B.3.3 Dimension of feeding inlet, L x D, mm		
B.3.4 Material		
B.4 Output chute		
B.4.1 Dimension, L x W, mm		

ITEMS		Manufacturer's Specification	Verification by the Testing agency
B.4.2	Height from the ground, mm		
B.4.3	Dimension of outlet opening, L x D, mm		
B.4.4	Material		
B.5	Main frame		
B.5.1	Dimension, L x W, mm		
B.5.2	Material		
B.6	Prime mover		
B.6.1	Engine		
B.6.1.1	Brand		
B.6.1.2	Model		
B.6.1.3	Serial Number		
B.6.1.4	Type (stroke/ignition)		
B.6.1.5	Rated power, kW		
B.6.1.6	Rated speed, rpm		
B.6.1.7	Cooling system		
B.6.1.8	Starting system		
B.6.1.9	Weight, kg		
B.6.2	Electric motor		
B.6.2.1	Brand		
B.6.2.2	Model		
B.6.2.3	Serial Number		
B.6.2.4	Type		
B.6.2.5	Rated power, kW		
B.6.2.6	Rated speed, rpm		
B.6.2.7	Electric service required		
B.6.2.8	Line voltage, V		
B.6.2.9	Maximum load current, A		
B.6.2.10	Frequency, Hz		
B.6.2.11	Weight, kg		
B.7	Transport wheel		
B.7.1	Number of transport wheel		
B.7.2	Dimensions, D x W, mm		
B.8	Other components (as applicable)		
B.9	Power transmission system		
B.9.1	Prime mover to chipping assembly		
B.9.1.1	Prime mover		
B.9.1.2	Chipping assembly		
B.9.1.3	Belt size		
B.9.2	Chipping assembly to feed roller		
B.9.2.1	Chipping assembly		
B.9.2.2	Feed roller		
B.9.2.3	Belt size		

ITEMS	Manufacturer's Specification	Verification by the Testing agency
B.10 Safety feature		
B.11 Special feature		

Annex C
(Informative)

Performance test data sheet

Test Trial No: _____ Data: _____
Test Engineer: _____ Location: _____
Assistants: _____ Test Specimen: _____
Test Requested by: _____ Manufacturer: _____

ITEMS	Trial 1	Trial 2	Trial 3	Average
C.1 Conditions of test sample				
C.1.1 Name of crop				
C.1.2 Variety/Species (if applicable)				
C.1.3 Source				
C.1.4 Thickness of chips, mm				
C.1.5 Diameter of chips, mm (if applicable)				
C.1.6 Width of chips, mm (if applicable)				
C.2 Operating time, h				
C.3 Weight of input, kg				
C.4 Weight of output, kg				
C.5 Input Capacity, kg/h				
C.6 Output Capacity, kg/h				
C.7 Material Recovery, %				
C.8 Chipping efficiency, %				
C.9 Speed of components, rpm				
C.10 Prime mover				
C.10.1 Without load				
C.10.2 With load				
C.11 Chopping shaft				
C.11.1 Without load				
C.11.2 With load				
C.12 Noise level, db(A)				
C.13 Main/ Feeding Operator				
C.13.1.1 Without load				
C.13.1.2 With load				
C.14 Output collector/ Bagger				
C.14.1 Without load				
C.14.2 With load				
C.15 Fuel consumed, mL				
C.16 Fuel consumption, L/h				
C.17 Power Requirements				
C.17.1 Voltage, V				

ITEMS		Trial 1	Trial 2	Trial 3	Average
C.17.2	Current, A				
C.17.3	Power, kW				
C.17.4	Minimum labor requirement				
C.18	Pulse rate (for manually-operated chipping machine)				
C.18.1	Before				
C.18.2	After				
C.19	Blood pressure (for manually-operated chipping machine)				
C.19.1	Before				
C.19.2	After				
C.20	Minimum labor requirements				

C.17 Observations

C.17.1 Ease of loading

C.17.2 Ease of cleaning parts

C.17.3 Ease of adjusting and repair of parts

C.17.4 Ease of transporting the machine

C.17.5 Safety

C.17.6 Vibration

Annex D
 (Normative)

Laboratory test data sheet

Machine Tested: _____

Analyzed by: _____

D.1 Crop dimension (20 sample)

Sample No.	Dimension, mm		
	Length	Width	Diameter
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
Average			

D.2 Moisture Content Determination (Oven Method)

Item	Trial 1			Trial 2			Trial 3			Average
	1	2	3	1	2	3	1	2	3	
Initial weight, g										
Final weight, g										
Moisture content, %										

Item	Trial 1			Trial 2			Trial 3			Average
	1	2	3	1	2	3	1	2	3	
General Average										

D.3 Accuracy and Precision of Cut

Thickness setting: _____

Sample	Thickness of sample, mm									Average
	Trial 1			Trial 2			Trial 3			
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										
29										
30										
Average Thickness, mm										
Average Coefficient of Variation, %										
Percent Error										

Annex E
(Normative)

Formula used for calculations and testing

E.1 Moisture content

$$MC_{wetbasis} = \frac{W_i - W_f}{W_i} \times 100\%$$

where:

MC_{wb} is the moisture content, %
 W_i is the initial weight of the sample, g
 W_f is the final weight of the sample, g

E.2 Chipping capacity

$$Ci = \frac{W_i}{T_o}$$

where:

Ci is the input capacity, kg/h
 W_i is the weight of input materials, kg
 T_o is the time of operation, h

E.3 Chipping efficiency

$$Ce = \frac{W_o - W_{uc}}{W_o} \times 100$$

where:

Ce is the chipping efficiency, %
 W_{uc} is the weight of unchipped materials, kg
 W_o is the weight of total output materials, kg

E.4 Coefficient of variation

$$Cv = \frac{S}{\bar{x}} \times 100 \quad (4)$$

$$\bar{x} = \frac{\Sigma x}{n} \quad (5)$$

$$S = \sqrt{S^2} \quad (6)$$

$$S^2 = \frac{\Sigma (x - \bar{x})^2}{n-1} \quad (7)$$

where:

Cv	is the coefficient of variation, %
S	is the standard deviation
S^2	is the variance
x	is the value of observation
\bar{x}	is the mean of x
n	is the number of observations

E.5 Percent error of cut

$$E = \left| \frac{x - x_o}{x_o} \right| \times 100$$

where:

E	is the error, %
\bar{x}	is the mean of thickness of cut
x_o	is the set of values based on the thickness of cut setting

E.6 Fuel consumption

$$Fc = \frac{F_1}{T_o}$$

where:

- F_c is the fuel consumption, L/h
 F_1 is the amount of fuel consumed, L
 T_o is the total time of operation, h

E.7 Chipping recovery

$$M = \frac{O}{I} \times 100$$

where:

- M is the chipping recovery, %
 O is the output materials, kg
 I is the input materials, kg

References

- Agricultural Machine and Testing Evaluation Center (AMTEC) - University of the Philippines Los Baños (UPLB). (2005). Chipping machine — Specifications (PAES 222: 2005)
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