

## **Foreword**

The formulation of this National Standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) with support from the Department of Agriculture.

This standard has been technically prepared in accordance with BPS Directives Part3:2003 – Rules for the Structure and drafting of the 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 as suitable without mentioning or excluding others.

In the preparation of this standard the following documents/publications were considered:

Catalog on Fiber Properties, Products, and Machines, Tools and Devices for Fiber Extraction and processing. Section No. 3.1984.

FIDA Multi-Fiber Decorticating Machine Leaflet. Fiber Technology and Utilization Division, Fiber Industry Development Authority. Diliman, Quezon City.

Regional Network for Agriculture Machinery (RNAM) Test Codes and Procedures for Farm Machinery. Technical Series No. 12:1983.

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**Agricultural Machinery – Fiber Decorticator – Methods of Test**

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**1 Scope**

This standard specifies the methods of test and inspection for fiber decorticator used for fiber plants such as abaca, maguey, pineapple, banana, ramie and sisal.

- 1.1** verify the mechanism, main dimensions, weight, materials, accessories of the machine and the list of specifications submitted by the manufacturer;
- 1.2** determine the performance of the machine;
- 1.3** evaluate the ease of handling, safety features and labor requirement;
- 1.4** analyze the fiber quality;
- 1.5** report the result of the tests.

**2 Reference**

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

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

**PAES 228:2005** Agricultural Machinery – Fiber Decorticator - Specifications

**3 Definitions**

For the purpose of this standard, the definitions given in PAES 228:2005 and the following shall apply:

**3.1****cleaning**

the method or extent of extracting (by retting or decorticating) the fiber from the leaves

**3.2****color**

principal factor which determine the grade of a fiber

**3.3**

**cylinder length**

distance between the outermost points along the cylinder base axis

**3.4**

**cylinder peripheral speed**

equivalent linear speed of the cylinder tip when running at normal operating speed

**3.5**

**elongation**

elasticity or stretch of a fiber before rupture

**3.6**

**effective allowance**

distance between the scraper block/breaker block and blades in order to separate fiber elements from the non-fiber elements of the plant

**3.7**

**effective cylinder diameter**

outside diameter generated by the outermost point of the cylinder decorticating elements

**3.8**

**extraction efficiency**

ratio of the amount between the total weight of the fiber extracted to the total amount of fiber content on a dry basis

**3.9**

**extraction loss**

difference between the total amount of fiber content and amount of fiber extracted on a dry basis

**3.10**

**fiber quality**

refers to the physical, chemical and morphological properties of fibers extracted

**3.11**

**fiber recovery**

ratio of the dry weight of fiber extracted and total fresh weight of stalks/leaves, expressed in percent

**3.12**

**grade**

indicator of the quality or the characteristics of the physical property of a fiber

**3.13**

**labor requirement**

number of persons needed in the operation of the fiber decorticator

**3.14****morphological properties**

properties of the fiber which deal with its anatomical characteristics such as length, diameter, lumen and wall thickness

**3.15****output capacity**

dry weight of the fiber at 13-14% moisture content extracted per unit time

**3.16****overall height**

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

**NOTE:** All parts of the machine projecting upwards are contained between these two planes.

**3.17****overall length**

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

**NOTE** All parts of the 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.

**3.18****overall width**

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

**NOTE** All parts of the machine projecting upwards are contained between these two planes.

**3.19****physical properties**

inherent strength and behavior of fibers under applied force which determines the mechanical serviceability or usefulness in commerce such as tensile strength, cleaning and color

**3.20****primemover**

electric motor or internal combustion engine used to run the decorticating machine

**3.21****running -in period**

preliminary operation of the machine to make various adjustments prior to the conduct of test until the operation is stable

**3.23****total decorticating input**

sum of the weights of collected decorticated fiber and all losses

## **4 General Conditions for Test and Inspection**

### **4.1 Selection of decorticating machine to be tested**

Decorticating machine submitted for test shall be sampled in accordance with PAES 103.

### **4.2 Role of manufacturer/dealer**

The manufacturer shall submit to the official testing agency specifications and other relevant information on the decorticator. It shall abide with the terms and conditions set forth by an official testing agency.

### **4.3 Role of the representative of the manufacturer**

An officially designated representative of the manufacturer shall operate, adjust, repair, and shall decide on matters related to the operation of the machine.

### **4.4 Test site conditions**

The machine shall be installed on a stable level ground on a site with sufficient working space.

### **4.5 Test materials**

Test materials to be used shall be commonly or locally grown and newly harvested fiber crop. The amount of test materials to be supplied shall be at least 75 % of input capacity (kg/h) of decorticator.

### **4.6 Test instruments**

The instruments to be used shall have been calibrated and checked by the testing agency prior to the measurements. The suggested list of minimum field and laboratory test equipment and materials needed to carry out the decorticator test is shown in Annex A.

### **4.7 Running-in and preliminary adjustment**

Before the start of the test, the decorticator should have undergone running-in period wherein various adjustments of the decorticator shall be made according to the recommendation of the manufacturer. (No other adjustments shall be permitted while the test is on-going).

### **4.8 Termination of test**

If during the test run, the machine stops due to major component breakdown or malfunctions, the test shall be terminated by the test engineer.

## **5 Test and Inspection**

### **5.1 Verification of the manufacturer's technical data and information**

**5.1.1** This inspection is carried out to verify the mechanism, dimensions, materials and accessories of the decorticator in comparison with the list of manufacturer's technical data and information.

**5.1.2** A plain and level surface shall be used as reference plane for verification of decorticator's dimensional specifications. The items to be inspected and verified shall be recorded in Annex B.

### **5.2 Performance test**

**5.2.1** This is carried out to determine machine performance and adaptability to varied crops such as abaca, banana, maguey, pineapple, ramie and sisal.

**5.2.2** Initial data shall be collected before the test such as crop conditions. In case of banana/abaca stalks, the leaf sheaths shall be classified according to its position (outer, middle, inner) to facilitate the grading of fibers.

Take the initial weight of the test material to be used in each test trials.

#### **5.2.3 Operation of the decorticator**

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

#### **5.2.4 Test trial**

A minimum of two test trials, with duration of at least 15 minutes per trial, shall be performed.

Record the initial weight of the test materials to be used in each test trial.

#### **5.2.5 Measurement of performance parameters**

##### **5.2.5.1 Duration of test**

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

##### **5.2.5.2 Noise level**

The noise emitted by the machine shall be measured using a noise level meter at the location of the feeder. The noise level shall be measured approximately 50 mm away from the ear level of the feeder.

#### 5.2.5.3 Speed of components

The speed of the rotating shafts of the major components of the fiber decorticator shall be taken using a tachometer.

**NOTE** Measurements shall be taken with and without load for sub-clauses 5.2.5.2 and 5.2.5.3 as specified in Annex C.

#### 5.2.5.4 Fuel/Power consumption

Before the start of each test trial, the fuel tank shall be filled to its capacity. After each test trial the tank shall be refilled using graduated cylinder. The amount of refueling is the fuel consumed for the test. 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 primemover, a power meter shall be used to measure electric energy consumption.

**5.2.6** Air dry the extracted fiber and when the moisture content is around 13% - 14%, record the weight.

#### 5.2.7 Sampling and sample handling

##### 5.2.7.1 Sampling for test materials

The conditions of the test materials such as the morphological properties and moisture content shall be taken by randomly getting “representative samples” which represent the different conditions of test materials in the bulk.

##### 5.2.7.2 Sampling from extracted fiber

During each test trial, three samples each weighing approximately 50 g shall be randomly collected from the output of the decorticator to be analyzed in the laboratory. Half (25 g) of each sample shall be used for laboratory analysis of fiber physical quality and the other half (25 g) shall be used for reference purposes or for an eventual second check in case of review.

##### 5.2.7.3 Sampling from extraction waste

During each test trial, three samples shall be randomly collected from the extraction waste outlet with twenty-second duration per collection.

##### 5.2.7.4 Handling of Samples

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

##### 5.2.7.5 Data recording and observations

Record sheet for all data and information during the performance test is given in Annex C.



### **5.3 Determination of the potential fiber content of the test material used**

**5.3.1** Weigh five 1-kg sample from the test material. Decorticate each sample separately using the machine on test.

**5.3.2** After each operation, collect the extracted fiber, extraction waste and undecorticated fibers. Put in appropriate containers, label and bring to the laboratory for analysis.

## **6 Laboratory Analysis**

Laboratory analyses shall be made to determine morphological properties, moisture content, fiber quality, amount of losses, and the potential fiber content of the test materials. The laboratory test data sheet to be used is given in Annex D.

### **6.1 Morphological properties**

Measure and record the dimensions, i.e. length, width and thickness of the leaves/stalks of the fiber crop used in the test.

### **6.2 Moisture content**

This shall be taken using oven-dry method.

**6.2.1** For each test trial, select three representative samples weighing at least 25 g of fiber materials and place them in the moisture cans. The moisture cans shall be sealed to ensure that no moisture is lost or gained by the samples between the time they were collected and weighed. Record the initial weight.

**6.2.2** Dry the samples in the oven with a temperature of 103 °C until they are totally dried.

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

**6.2.4** Weight each moisture cans including the dried sample. Record the final weight. Calculate the moisture content using the equation in Annex D.

### **6.3 Extraction Loss**

**6.3.1** Inspect the collected extraction waste.

**6.3.2** If there are extracted and undecorticated fibers collect, clean, dry, weigh, and then record separately.

**6.3.3** Compute for the losses.

### **6.4 Samples from the determination of potential fiber content**

**6.4.1** Clean the extracted fiber and dry until its moisture content is about 13% - 14%. Weigh and record the dried fiber.

**6.4.2** Inspect the extraction waste, if there are fiber present collect, clean, dry and weigh then record.

**6.4.3** If there are undecorticated leaves, manually extract the fiber. Clean, dry and record the weight.

**6.4.4** Get the summation of the dry weights of decorticated fiber, fiber from the waste, and the fiber from the undecorticated leaves. Compute the potential fiber content of the sample and calculate the average potential fiber content of the five samples, expressed in percentage. The computed value shall be used in the computation of the percentage extraction losses and efficiency.

## **6.5** Fiber quality

The quality of fiber extracted shall be evaluated using the existing grading system of fibers. This shall be done by sight evaluation.

## **7** Formula

The formulas to be used are given in Annex E.

## **8** Test Report

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

**8.1** Title

**8.2** Summary of Results

**8.3** Purpose and Scope of Test

**8.4** Methods of Test

**8.5** Description of the Machine

Table 1. Machine Specifications

**8.6** Results and Discussions

**8.7** Observations (include pictures)

Table 2. Machine Performance Test Results

**8.8** Names, signatures and designation of test engineers

**Annex A**  
(informative)

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

**A.1 Equipment**

**A.1.1 Field**

<b>A.1.1.1</b>	Tachometer (contact or photoelectric) Range: 0-5000 rpm	1
<b>A.1.1.2</b>	Noise Level Meter Range: 30 to 130 db (A)	1
<b>A.1.1.3</b>	Timer Range: 60 minutes; accuracy: 1/10 sec	1
<b>A.1.1.4</b>	Measuring Tape Capacity: 5m	1
<b>A.1.1.5</b>	Camera	1
<b>A.1.1.6</b>	Weighing Scale Capacity: 100kg; Scale divisions: 0.5kg	1
<b>A.1.1.7</b>	Vernier Caliper	1
<b>A.1.1.8</b>	Graduated cylinder Graduation: 1 ml; Capacity: 1000ml	1
<b>A.1.1.9</b>	Feeler gauge	1

**A.1.2 Laboratory**

<b>A.1.2.1</b>	Air Oven	1
<b>A.1.2.2</b>	Desiccator	1
<b>A.1.2.3</b>	Electronic Balance Sensitivity: 0.1g	1

**A.1.3 Materials**

<b>A.1.3.1</b>	Sample Bags	9
<b>A.1.3.2</b>	Moisture cans	3
<b>A.1.3.2</b>	Labeling tags which includes:	9
<b>A.1.3.2.1</b>	Date of test	
<b>A.1.3.2.2</b>	Sample Source	
<b>A.1.3.2.3</b>	Variety	
<b>A.1.3.2.4</b>	Machine on test	
<b>A.1.3.2.5</b>	Trial number	

**Annex B**  
(informative)

**Specifications of Fiber Decorticator**

Name of Applicant/Distributor: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Tel. No.: \_\_\_\_\_  
 Name of Manufacturer: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Tel. No.: \_\_\_\_\_

**General Information:**

Make: \_\_\_\_\_ Type: \_\_\_\_\_  
 Serial No.: \_\_\_\_\_ Brand/Model: \_\_\_\_\_  
 Production date of decorticating machine to be tested: \_\_\_\_\_  
 Testing Agency: \_\_\_\_\_ Test Engineer: \_\_\_\_\_  
 Date of Test: \_\_\_\_\_ Location of Test: \_\_\_\_\_

**Items to be inspected:**

ITEMS	Manufacture's specification	Verification by the Testing Agency
<b>B.1</b> Dimensions and weight of the fiber decorticator		
<b>B.1.1</b> Over all length (mm)		
<b>B.1.2</b> Over all width (mm)		
<b>B.1.3</b> Over all height (mm)		
<b>B.1.4</b> Weight of the machine(kg)		
<b>B.1.5</b> Weight of the engine(kg)		
<b>B.2</b> Fiber crop(s) for which the machine is suitable		
<b>B.3</b> Decorticating drum (mm)		
<b>B.3.1</b> Inside diameter		
<b>B.3.2</b> Outside diameter including blade		
<b>B.3.3</b> Length of the drum		
<b>B.3.4</b> Material used		
<b>B.4</b> Blade		
<b>B.4.1</b> Number of blade		
<b>B.4.2</b> Type of blade		
<b>B.4.3</b> Dimension, L x W x T (mm)		
<b>B.4.5</b> Mode of attachment		
<b>B.4.6</b> Arrangement		
<b>B.4.7</b> Material used		
<b>B.5</b> Feeding Table		

ITEMS	Manufacture's specification	Verification by the Testing Agency
<b>B.5.1</b> Height from the ground (mm)		
<b>B.5.2</b> Mode of Attachment		
<b>B.5.3</b> Dimensions, L x H (mm)		
<b>B.5.4</b> Material used		
<b>B.6</b> Input Chute		
<b>B.6.1</b> Material used		
<b>B.6.2</b> Opening		
<b>B.6.2.1</b> Length (mm)		
<b>B.6.2.2</b> Height (mm)		
<b>B.6.3</b> End of opening		
<b>B.6.3.1</b> Length (mm)		
<b>B.6.3.2</b> Height (mm)		
<b>B.7</b> Decorticating drum cover		
<b>B.7.1</b> Diameter x Length (mm)		
<b>B.7.2</b> Distance from the blade (mm)		
<b>B.7.3</b> Air vent		
<b>B.7.4</b> Material used		
<b>B.8</b> Scraper block		
<b>B.8.1</b> Length (mm)		
<b>B.8.2</b> Thickness (mm)		
<b>B.8.3</b> Width (mm)		
<b>B.8.4</b> Special Feature		
<b>B.8.5</b> Distance of edge of blade and scraper block		
<b>B.8.6</b> Material used		
<b>B.9</b> Transmission system		
<b>B.9.1</b> Size of pulley (prime mover)		
<b>B.9.2</b> Size of pulley (decorticating drum)		
<b>B.9.3</b> Size of belt		
<b>B.9.4</b> Number of belt(s)		
<b>B.10</b> Transport device (if any)		
<b>B.10.1</b> Type		
<b>B.10.2</b> Size		
<b>B.10.3</b> Adjustment		
<b>B.11</b> Safety device		
<b>B.12</b> Labor requirement		
<b>B.14</b> Other special feature		
<b>B.15</b> Prime mover		
<b>B.15.1</b> Engine		
<b>B.15.1.1</b> Brand		
<b>B.15.1.2</b> Model		
<b>B.15.1.3</b> Serial number		
<b>B.15.1.4</b> Power (kW)		
<b>B.15.1.5</b> Rated Speed (rpm)		
<b>B.15.1.6</b> Displacement (cc)		

<b>ITEMS</b>	<b>Manufacture's specification</b>	<b>Verification by the Testing Agency</b>
<b>B.15.1.7</b> Fuel system		
<b>B.15.1.7.1</b> Kind		
<b>B.15.1.7.2</b> Tank Capacity		
<b>B.15.1.8</b> Cooling system		
<b>B.15.1.9</b> Starting system		
<b>B.15.1.10</b> Weight (kg)		

**Annex C**  
(informative)

**Performance Test Data Sheet**

Test Trial No.: \_\_\_\_\_ Date: \_\_\_\_\_  
 Test Engineer: \_\_\_\_\_ Location: \_\_\_\_\_  
 Assistants: \_\_\_\_\_ Test Specimen: \_\_\_\_\_  
 Test Requested by: \_\_\_\_\_ Manufacturer: \_\_\_\_\_

ITEMS	Trial 1	Trial 2	Trial 3	Ave.
C.1 Crop condition				
C.1.1 Name of the plant				
C.1.2 Variety				
C.1.3 Plant source				
C.1.4 Date harvested				
C.1.5 Length				
C.1.6 Thickness				
C.1.7 Width of leaf sheath/stalk/leaf				
C.1.7.1 Base				
C.1.7.2 Middle				
C.1.7.3 Tip				
C.1.8 Thickness of leaf sheath/stalk/leaf				
C.1.8.1 Base				
C.1.8.2 Middle				
C.1.8.3 Tip				
C.1.9 Age of fiber plant				
C.1.10 Weight of fiber crop, input(kg)				
C.2 Input capacity (kg/h)				
C.3 Operating time (h)				
C.4 Fiber weight (kg)				
C.4.1 Fresh weight				
C.4.2 Dry weight				
C.4.2.1 Brushed				
C.4.2.2 Unbrushed				
C.5. Fiber recovery (%)				
C.6 Speed of components				
C.6.1 Decorticating shaft				
C.6.1.1 Without load				
C.6.1.2 With load				
C.6.2 Prime mover				
C.6.2.1 Without load				
C.6.2.2 With load				
C.6.3 Fuel time (min)				
C.6.3 Fuel consumed (L)				
C.6.4 Fuel consumption (L/h)				
C.6.5 Noise level (db[A])				
C.6.5.1 Without load				

ITEMS	Trial 1	Trial 2	Trial 3	Ave.
C.6.5.2 With load				
C.7 Power consumption				
C.7.1 Power (kW)				
C.7.1.1 Without load				
C.7.1.2 With load				
C.7.2 Current (A)				
C.7.2.1 Without load				
C.7.2.2 With load				
C.7.3 Voltage (V)				
C.7.3.1 Without load				
C.7.3.2 With load				

C.8 Potential Fiber Content	TRIAL					AVE
	1	2	3	4	5	
C.8.1 Weight of extracted fiber (g)						
C.8.1.1 Fresh weight						
C.8.1.2 Dry weight						
C.8.2 Extraction waste						
C.8.2.1 Weight of extracted fiber (g)						
C.8.2.1.1 Fresh weight						
C.8.2.1.2 Dry weight						
C.8.2.2 Weight of unextracted fiber (g)						
C.8.2.2.1 Fresh weight						
C.8.3.2.2 Dry weight						
C.8.4 Potential Fiber Content (C.8.1.2 + C.8.2.1.2 + C.8.3.2.2)						

C.9 Rate the following observations:

Items	Rating*				
	1	2	3	4	5
C.9.1 Ease of loading					
C.9.2 Ease of cleaning parts					
C.9.3 Ease of adjusting and repair of parts					
C.9.4 Ease of collecting output					
C.9.5 Ease of transporting the machine					
C.9.6 Safety					
C.9.7 Vibration					

\* 1 – Very good      3- Satisfactory      5-Very poor  
 2 – Good            4-Poor

C.10 Other Observations:

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**Annex D**  
(informative)

**Laboratory Test Data Sheet**

Machine Tested: \_\_\_\_\_

Analyzed by: \_\_\_\_\_

**D.1 Characteristics**

Items	TRIAL 1	TRIAL 2	TRIAL 3	AVERAGE
<b>D.1.1</b> Moisture content (%)				
<b>D.1.1.1</b> Initial weight (g)				
<b>D.1.1.2</b> Final weight (g)				
<b>D.1.2</b> Fiber properties				
<b>D1.2.1</b> Elongation				
<b>D.1.2.2</b> Length				
<b>D.1.2.3</b> Grade*				
<b>D.1.2.3.1</b> PID-1				
<b>D.1.2.3.2</b> PID-2				
<b>D.1.2.3.3</b> PID-R				
<b>D.1.4</b> Fiber recovery (%)				

\*Example: **Pineapple Grade:** Description

1. PID-1 – Pineapple Decorticated-1 = This grade is produced when the fiber is properly decorticated and dried. The fiber is almost free from scales, epidermal layers and pulps. The cleaning is good, the color varies from ivory white to almost white and texture is soft.
2. PID-2 – Pineapple Decorticated -2 =This is produced when the cleaning process has not been thoroughly carried out, hence the presence of scales and some epidermal layers in the fiber. The cleaning is fair, he color is ivory white to light ochre to dull brown towards the tip and the texture is medium soft.
3. PID-R – Pineapple decorticated residue = In this grade, the fibers are too low to be included in the two grades. It includes therefore the fibers which are discolored, very short partly spoiled, and weak in strength.

**D.2 Possible Uses:**

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**Annex E**  
(informative)

**FORMULA USED**

**E.1** Fiber Recovery,  $F_r$  (%)

$$= \frac{Fw(kg)}{Fp(kg)} \times 100$$

where: Fw= weight of the decorticated fiber  
Fp= weight of the plant

**E.2** Capacity

$$= \frac{wo(kg)}{do(h)}$$

where: wo=weight of the output (kg)  
do=duration of operation (h)

**E.3** Fuel Consumption

$$= \frac{FC(l)}{TO(h)}$$

where: FC=fuel consumed (L)  
TO=time of operation (h)

**E.4** Moisture Content (%), wet basis

$$= \frac{Wi - Wf}{Wi} \times 100$$

where: Wi= fresh weight of the sample (g)  
Wf= dry weight of the sample (g)

**E.5** Extraction Efficiency (%)

$$= \frac{Wef}{Wpf} \times 100$$

**E.6** Extraction Loss (%)

$$= 1 - \frac{Wef}{Wpf} \times 100$$

where: Wef= weight of dried extracted fiber  
Wpf= weight of potential fiber content