PHILIPPINE NATIONAL STANDARD

PNS/PAES 207:2015
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ICS 65.060.01

Agricultural machinery – Rice mill – Methods of test

BUREAU OF PRODUCT STANDARDS*

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***BUREAU OF PHILIPPINE STANDARDS**

National Foreword

The Philippine Agricultural Engineering Standards PAES 207:2015, Agricultural machinery – Rice mill – Methods of test was approved for adoption as Philippine National Standard by the Bureau of Philippine Standards upon the recommendation of the Agricultural Machinery Testing and Evaluation Center (AMTEC) and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (PCAARRD-DOST).

This standard cancels and replaces PNS/PAES 207:2003 (PAES published 2000).

Foreword

The revision of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled "Development of Standards for Rice Production and Postproduction Machinery" which was funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) of the Department of Science and Technology (DOST).

This standard has been technically prepared in accordance with PAES 010-2 – 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.

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

Milling. IRRI Rice Knowledge Bank (http://www.knowledgebank.irri.org/step-by-step-production/postharvest/milling)

Codex Standard for Rice. 198-1995

Primer on Philippine Grains Standardization Program of the National Food Authority.

Rice Postharvest Technology. 1995. The Food Agency Ministry of Agriculture, Forestry and Fisheries. Tokyo, Japan.

Rice Postproduction Technology A Technical Reference Guide. 2003. Philippine Rice Postproduction Consortium. Japan Grain Inspection Association. National Food Authority. Quezon City.

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1 Scope

This standard specifies the methods of test for rice mill. Specifically, this shall be used to:

1.1 verify the mechanism, main dimensions, weight, material accessories of the rice mill 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;

1.4 determine the effect of milling on grain quality through laboratory analysis; and

1.5 report the result of tests

2 References

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

PNS/PAES 102:2000 Agricultural Machinery – Operator's Manual – Content and Presentation

PNS/PAES 103:2000 Agricultural Machinery – Method of Sampling

PNS/PAES 203:2000 Moisture Content Determination for Rice and Corn

PNS/PAES 206:2015 Agricultural Machinery – Rice Mill – Specifications

3 Definitions

For the purpose of this standard the definitions given in PNS/PAES 206:2015 – Agricultural Machinery – Rice Mill – Specifications and the following shall apply.

3.1
brewers rice
"binlid"
chips
small pieces or particles of grains that pass through a sieve having round perforations of 1.4mm in diameter

3.2
destoner
auxiliary device used to separate stones from the paddy and/or brown rice

3.3
output capacity
weight of milled rice per unit of milling time, expressed in metric tons per hour

3.4
over milled rice
rice grain from which the hull, the germ, and the bran layers have been completely removed (0%)

3.5
paddy grader
auxiliary device used to classify paddy based on length and thickness

3.6
paddy separator
auxiliary device used to separate paddy from brown rice

3.7
polisher
pearler
auxiliary device used to remove the remaining small bran particles on the milled rice and gives it a glossy appearance

3.8
pre-cleaner
auxiliary device used to remove foreign matter/impurities from the paddy before milling

3.9
regular milled rice
rice grain from which the hull, the germ, the outer bran layers and the greater part of the inner bran layers have been removed but part of the lengthwise streaks of the bran layers may still be present on 21% to 40% of the sample grains

3.10
undermilled rice
rice grain from which the hull, the germ, the outer bran layer, and the greater part of the inner bran layer have been removed, but part of the lengthwise streaks of the bran layer may still be present on more than 40 % of the sample grains

3.11
well-milled rice
rice grain from which the hull, the germ, the outer bran layer, and the greater part of the inner bran layer have been removed, but part of the lengthwise streaks of the bran layer may still be present on 1% to 20% of the sample grains

4 General Conditions for Test and Inspection

4.1 Role of manufacturer/dealer

The manufacturer/dealer shall submit to the official testing agency the specifications and other relevant information on the rice mill. He/She shall abide with the terms and conditions set forth by the authorized testing agency. The interested party shall provide testing materials and shall shoulder other variable costs such as fuel, etc.

4.2 Role of the representative of the manufacturer/dealer

An officially designated representative of the manufacturer/dealer shall operate, adjust, repair and shall decide on matters related to the operation of the machine. Manufacturers/dealers should provide appropriate authorization documents.

4.3 Test site conditions

The rice mill shall be tested as installed for normal operation. The site should have ample provisions for grain handling, temporary storage, and work space. Adequate ventilation and lighting shall be provided in the area.

4.4 Suspension of test

If during the test run, the machine stops due to breakdown or malfunction so as to affect the machine's performance, the test may be suspended. The decision to suspend or to continue the test is at the discretion of the test engineer and concurred by the representative.

5 Test Preparation

5.1 Preparation of the rice mill for testing

A check shall be made by the manufacturer and testing authority that the rice mill has been assembled and installed in accordance with the instruction of the manufacturer.

In case of testing commercially manufactured rice mill, the machine sampled for acceptance, lot, routine, and type tests in accordance with PNS/PAES 103:2000 – Agricultural Machinery – Method of Sampling shall be submitted for test.

5.2 Test instruments and other materials

The suggested list of minimum field and laboratory test equipment and materials needed to carry out the rice mill test is shown in Annex A. These instruments should be calibrated regularly. Before and after each test, these instruments shall be physically checked for operation and shall be cleaned, respectively. A checklist of instruments and materials shall be prepared to be used before departure to and from the testing area.

5.3 Test materials

The paddy to be used for testing shall be prepared in sufficient quantity following the procedure in Annex B.

5.4 Running-in and preliminary adjustments

Before the start of the test, the rice mill should have undergone a breaking-in period. The rice mill shall be operated at the test site by the official representative of the manufacturer for sufficient duration with and without load. During the running-in period, the various adjustments of the rice mill shall be made according to the manufacturer's recommendations.

(No other adjustments shall be permitted during the test.)

6 Pre-test Observation

6.1 Verification of specifications

The specifications claimed by the manufacturer and the physical details given in Annex C shall be verified by the testing agency.

6.2 Test materials

Representative paddy samples shall be collected from the test lot to determine the moisture content, percent cracked grains, and purity.

7 Performance Test

7.1 Operation of the rice mill

The rice mill shall be operated at the manufacturer's recommended setting of its components. The testing authority shall make all measurements, which form part of the test and take the prescribed samples. An instruction manual which conforms to PNS/PAES 102:2000 Agricultural Machinery – Operator's Manual – Content and Presentation shall be provided. The recommended feeding rate shall be maintained during the test run with duration of at least 30 minutes. For multi-pass rice mills with control tanks, these tanks shall be fully opened during the test runs.

After the test-run, the milling area shall be cleaned and then prepared for the next test trial(s). This procedure shall be repeated for the succeeding test trial(s).

7.2 Sampling

Samples shall be collected at different outlets during each test trial. Sampling procedure is given in Annex D.

7.3 Data collection

7.3.1 Duration of test

The duration of each test trial shall start with the loading of the paddy into the huller (first drop) and ends at the last drop of the paddy into the huller.

7.3.2 Noise level

The noise emitted by the machine, with or without load, shall be measured using a noise level meter both at the location of the operators and baggers. The noise, expressed in dB(A), shall be taken approximately 5 cm away from the ear level of the operators and baggers.

7.3.3 Speed of components

The speed of the rotating shafts of the rice mill's major components shall be taken using a tachometer.

> Note – Measurements shall be taken with and without load for sub-clause 7.3.2 and 7.3.3 as specified in Annex E.

7.3.4 Fuel/Electric energy consumption

Before the start of each test trial, the fuel tank shall be filled to its capacity and after each test; the fuel consumed shall be measured. In case an electric motor is used as a primemover, a power meter shall be used to measure electric energy consumption.

7.4 Data recording and observations

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

8 Laboratory Analysis

This is carried out to analyze the grain samples taken during the performance test.

8.1 Laboratory analysis shall be made to determine the grain moisture content, purity, bulk density, coefficient of hulling, coefficient of wholeness, cracked grains, milling degree, whiteness index, head rice and broken grains. The laboratory procedures to be followed in the analysis are given in Annex F. Items to be determined shall be recorded in Annex G.

8.2 The quality of milled rice samples from the rice mill shall be compared to the quality of milled rice using the laboratory rubber roll husker/huller and a laboratory whitener.

9 Formula

The formula to be used during calculations and testing are given in Annex I.

10 Test Report Format

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

10.1 Title

10.2 Summary of Results

10.3 Purpose and Scope of Test

10.4 Methods of Test

10.5 Conditions of the Machine

10.6 Description of the Machine

10.7 Results and Discussions

10.8 Observations (include pictures)

10.9 Names and Signatures of Test Engineers

Annex A

Minimum List of Field and Laboratory Test Equipment and Materials

A.1	**Equipment**	**Qty.**
A.1.1	**Performance test**	
A.1.1.1	Grain moisture meter (duly calibrated using the standard method) Range: 12% to 24% (for paddy)	**1**
A.1.1.2	Tachometer, contact type, range: 0-5000 rpm; or Photoelectric, range: 0-5000 rpm	**1**
A.1.1.3	Timers Capacity: 60 minutes Accuracy: 0.1 second	**2**
A.1.1.4	Measuring tape (capacity: 5m)	**1**
A.1.1.5	Noise level meter Range: 30 to 130 dB(A)	**1**
A.1.1.6	Weighing scale Capacity: 100 kg; scale divisions: 0.5 kg	**1**
A.1.1.7	Graduated cylinder (for engines) 500 mL capacity or watt-hour meter (for electric motors) 60 Hz, 220 V	**1**
A.1.1.8	Camera	**1**
A.1.1.9	Bulk density meter	**1**
A.1.1.10	Indented trays of laboratory grader	**1**
A.1.2	**Laboratory test**	
A.1.2.1	Weighing scale (Sensitivity: 0.1 g)	**1**
A.1.2.2	Magnifying lens (minimum of 10 magnifications)	**1**
A.1.2.3	Grain sample cleaner	**1**
A.1.2.4	Whiteness meter	**1**
A.1.2.5	Grain sampler/Divider	**1**
A.2	**Materials**	
A.2.1	**Sample bags**	**50**
A.2.2	**Labeling tags which include:**	
A.2.2.1	Date of test	
A.2.2.2	Machine on test	
A.2.2.3	Sample source	
A.2.2.4	Variety	
A.2.2.5	Trial number	

Annex B

Test Materials for Rice Mill

B.1 Sample characteristics

Test materials to be used shall have the following characteristics:

B.1.1 Variety : locally grown (as much as possible single variety)

B.1.2 Grain Moisture Content : dried to a uniform moisture content of 14% ± 1%

B.1.3 Purity : 95%, minimum

B.2 Quantity to be supplied

The amount of test material to be supplied shall be sufficient for one and a half hours of continuous milling operation in case of test of single-pass rice mill. At least three test trials shall be conducted with minimum duration of thirty minutes per trial. The excess amount shall be used for running-in prior to the actual conduct of test trials.

For test of multi-pass rice mill, the amount of test material to be supplied shall be sufficient for three hours of continuous milling operation with an additional capacity requirement of half an hour for running-in test. At least three test trials shall be conducted with minimum duration of one hour per trial.

B.3 Sample preparation

Prepare the sample in such a way that test sample to be used for the running-in and in each test trial shall have identical characteristics in terms of moisture content and variety.

Annex C

Specification of Rice Mill

Name of applicant (or Distributor) : _____
Address : _____
Tel. No. : _____

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

General Information:
Serial No.: _____ Brand/Model : _____
Type: _____ Make : _____
Production date of rice mill to be tested: _____
Testing agency :_____ Location of test:_____

Date of testing :_____ Test Engineer :_____

ITEM*	Manufacturer's specifications	Verification by the testing agency
C.1 Main structure		
C.1.1 Overall dimensions (mm)		
C.1.1.1 Length		
C.1.1.2 Width		
C.1.1.3 Height		
C.1.2 Weight (kg), if applicable		
C.2 Prime mover		
C.2.1 Electric motor		
C.2.1.1 Brand		
C.2.1.2 Type		
C.2.1.3 Make or manufacturer		
C.2.1.4 Serial number		
C.2.1.5 Rated power (kW)		
C.2.1.6 Rated speed (rpm)		
C.2.1.7 Phase		
C.2.1.8 Voltage (V)		
C.2.1.9 Current (A)		
C.2.1.10 Frequency (Hz)		
C.2.2 Engine		
C.2.2.1 Brand		
C.2.2.2 Model		
C.2.2.3 Make or manufacturer		
C.2.2.4 Type		
C.2.2.5 Serial number		

ITEM*	Manufacturer's specifications	Verification by the testing agency
C.2.2.6 Rated power (kW)		
C.2.2.7 Rated speed (rpm)		
C.2.2.8 Displacement (cm^3)		
C.2.2.9 Cooling system		
C.2.2.10 Starting system		
C.3 Intake hopper/Loading Pit		
C.3.1 Type		
C.3.2 Holding capacity (kg)		
C.3.3 Materials of construction		
C.3.4 Features		
C.4 Pre-cleaner		
C.4.1 Type		
C.4.2 Size		
C.4.3 Materials of construction		
C.5 Hulling unit		
C.5.1 Type		
C.5.2 Size		
C.5.3 Materials of construction		
C.5.4 Motor		
C.5.4.1 Rated power (kW)		
C.5.4.2 Rated speed (rpm)		
C.6 Paddy separator		
C.6.1 Type		
C.6.2 Number of trays/compartments		
C.6.3 Motor		
C.6.3.1 Rated power (kW)		
C.6.3.2 Rated speed (rpm)		
C.7 Destoner		
C.7.1 Type		
C.7.2 Motor		
C.7.2.1 Power (kW)		
C.7.2.2 Speed (rpm)		
C.8 Whitener		
C.8.1 Type		
C.8.2 Motor		
C.8.2.1 Power (kW)		
C.8.2.2 Speed (rpm)		
C.9 Polisher		
C.9.1 Type		
C.9.2 Motor		
C.9.2.1 Power (kW)		

ITEM*	Manufacturer's specifications	Verification by the testing agency
C.9.2.2 Speed (rpm)		
C.10 Elevator(s)		
C.10.1 Type		
C.10.2 Number of units		
C.10.3 Size of buckets		
C.10.4 Motor		
C.10.4.1 Power (kW)		
C.10.4.2 Speed (rpm)		
C.11 Rice sifter		
C.11.1 Type		
C.11.2 Size		
C.11.3 Number of screens		
C.11.4 Size of perforations (mm)		
C.11.5 Material of construction		
C.12 Bagging bin		
C.12.1 Capacity (kg)		
C.12.2 Material of construction		
C.13 Safety devices		
C.14 Special features		

* The parameter will be checked upon availability

C.15 Rice milling process flow diagram

Annex D

Sampling and Measurement for Test Material

D.1 Sampling procedures for paddy input

The conditions of the paddy input such as bulk density, moisture content, purity and percentage cracked grains to be used in each test shall be taken using three (3) "representative samples" each weighing 1.5 kg which represent the different conditions of paddy input in the bulk. This can be done by taking samples each at the top, middle and bottom portions of the bulk. Samples representing the materials for each test trial shall be placed in appropriate containers for laboratory analysis.

D.2 Sampling from different outlets

During each test trial three samples each shall be collected from the outlets of the different components (huller, paddy separator, destoner, whitener, etc.) of the rice mill to be analyzed in the laboratory. The minimum amount of sample to be taken shall be twice as much as what is needed for a particular analysis. The excess sample shall be used for reference purposes or for an eventual second check in case of review.

D.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.

D.4 Other measurements required during the test run

Data shall be taken for the following: speed of rotating components and noise level at operator's and bagger's location. For each data to be taken there shall be a minimum of five observations. These shall be taken with and without load. Before taking of 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 trials.

D.5 Measurement of fuel/power consumption

For rice mills using engine as primemover. 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 on the tank.

Using electric motors as primemover. Use a power meter to measure the voltage, current, and the total electric power consumption of the rice mill. There shall be three sets of data with a minimum of five observations per set taken with load and one set of data taken without load. Data shall be taken simultaneous with the collection of samples for laboratory analysis.

Annex E

Performance Test Data Sheet

Test trial No.: _____ Date: _____
Test Engineers: _____ Location: _____
Assistants: _____ Machine: _____
Test requested by: _____ Manufacturer: _____

ITEM	Trial 1	Trial 2	Trial 3	Average
E.1 Conditions of crop				
E.1.1 Crop				
E.1.2 Source				
E.1.3 Variety				
E.1.4 Moisture content (%)				
E.2 Weight of input (kg)				
E.3 Input time (h)				
E.4 Input capacity (kg/h)				
E.5 Weight of milled rice (kg)				
E.6 Output time (h)				
E.7 Output capacity (kg/h)				
E.8 Milling time (h)				
E.9 Milling capacity (kg/h)				
E.10 Speed of components (rpm)				
E.10.1 Paddy cleaner				
E.10.1.1 Without load				
E.10.1.2 With load				
E.10.2 Paddy cleaner motor				
E.10.2.1 Without load				
E.10.2.2 With load				
E.10.3 Rubber roll (fixed)				
E.10.3.1 Without load				
E.10.3.2 With load				
E.10.4 Rubber roll (adjustable)				
E.10.4.1 Without load				
E.10.4.2 With load				
E.10.5 Rubber roll motor				
E.10.5.1 Without load				
E.10.5.2 With load				
E.10.6 Paddy separator				
E.10.6.1 Without load				
E.10.6.2 With load				
E.10.7 Abrasive whitener				
E.10.7.1 Without load				
E.10.7.2 With load				
E.10.8 Friction whitener				
E.10.8.1 Without load				
E.10.8.2 With load				

ITEM	Trial 1	Trial 2	Trial 3	Average
E.10.9 Rice Sifter				
E.10.9.1 Without load				
E.10.9.2 With load				
E.10.10 Main drive				
E.10.10.1 Without load				
E.10.10.2 With load				
E.11 Noise level, dB(A)				
E.11.1 Operator				
E.11.1.1 Without load				
E.11.1.2 With load				
E.11.2 Bagger				
E.11.2.1 Without load				
E.11.2.2 With load				
E.12 Power consumption				
E.12.1 Power (kW)				
E.12.1.1 Without load				
E.12.1.2 With load				
E.12.2 Current (A)				
E.12.2.1 Without load				
E.12.2.2 With load				
E.12.3 Voltage (V)				
E.12.3.1 Without load				
E.12.3.2 With load				
E.13 Fuel consumed (L)				
E.14 Fuel consumption (L/h)				

E.15 Other observations

E.15.1 Ease of loading

_____
_____
_____
_____

E.15.2 Ease of cleaning of parts

_____
_____
_____
_____

E.15.3 Ease of adjustments

_____
_____
_____
_____

E.15.4 Ease of collecting output

_____
_____
_____
_____

E.15.5 Safety

_____
_____
_____
_____

E.15.6 Labor requirements

_____
_____
_____
_____

E.15.7 Failure or abnormalities that may be observed on the rice mill or itscomponents parts during and after the milling operation

_____
_____
_____
_____

Annex F
Laboratory Analysis

F.1 Laboratory analysis of input paddy

The steps in sampling input paddy for processing in the laboratory huller and laboratory whitener as well as determining the grain parameters are shown in Figure 1.

F.1.1 Purity

Each of the three 0.5 kg test paddy sample is cleaned and the components namely, the paddy and the impurities, are separated for weighing.

F.1.2 Moisture content

This shall be taken using a calibrated moisture meter.At least five (5) representative samples taken randomly at 500 g each shall be taken for moisture content determination preferably using the Air-Oven Method or any calibrated moisture meter. Refer to PNS/PAES 203:2000 – Moisture Content Determination for Rice and Corn.

F.1.3 Cracked grains

Three 100-whole head grain sample is drawn for hand hulling to determine the percentage cracked brown rice.

Each grain shall be hulled carefully by hand, taking care not to use undue rubbing force or high pressure to minimize mechanical stress on the grain. Each hulled grain or brown rice grains shall be examined for cracks under a magnifying lens against a backlight through a translucent plate or light diffuser. Grains which show cracks or which have been broken in the process of hand hulling shall be counted as cracked grains. Broken grains that were not due to hand hulling shall be counted as broken grains. The mean value determined from the three 100-grain samples shall be taken as the percentage cracked hand-hulled brown rice.

F.1.4 Weight per 1000 grains full grain test paddy

Three 1000-grain sample is drawn and weighed as soon as possible.

F.1.5 Weight of 1000 grains whole head brown rice

Take three 1000-whole head grain samples from the brown rice sample and weigh.

F.1.6 Milled rice grain parameters

Three 100-grams sample of milled rice from the laboratory whitener shall be weighed and separated into components of head rice, broken rice, and brewer’s rice. Each component shall be weighed individually to determine the percentage on weight basis.

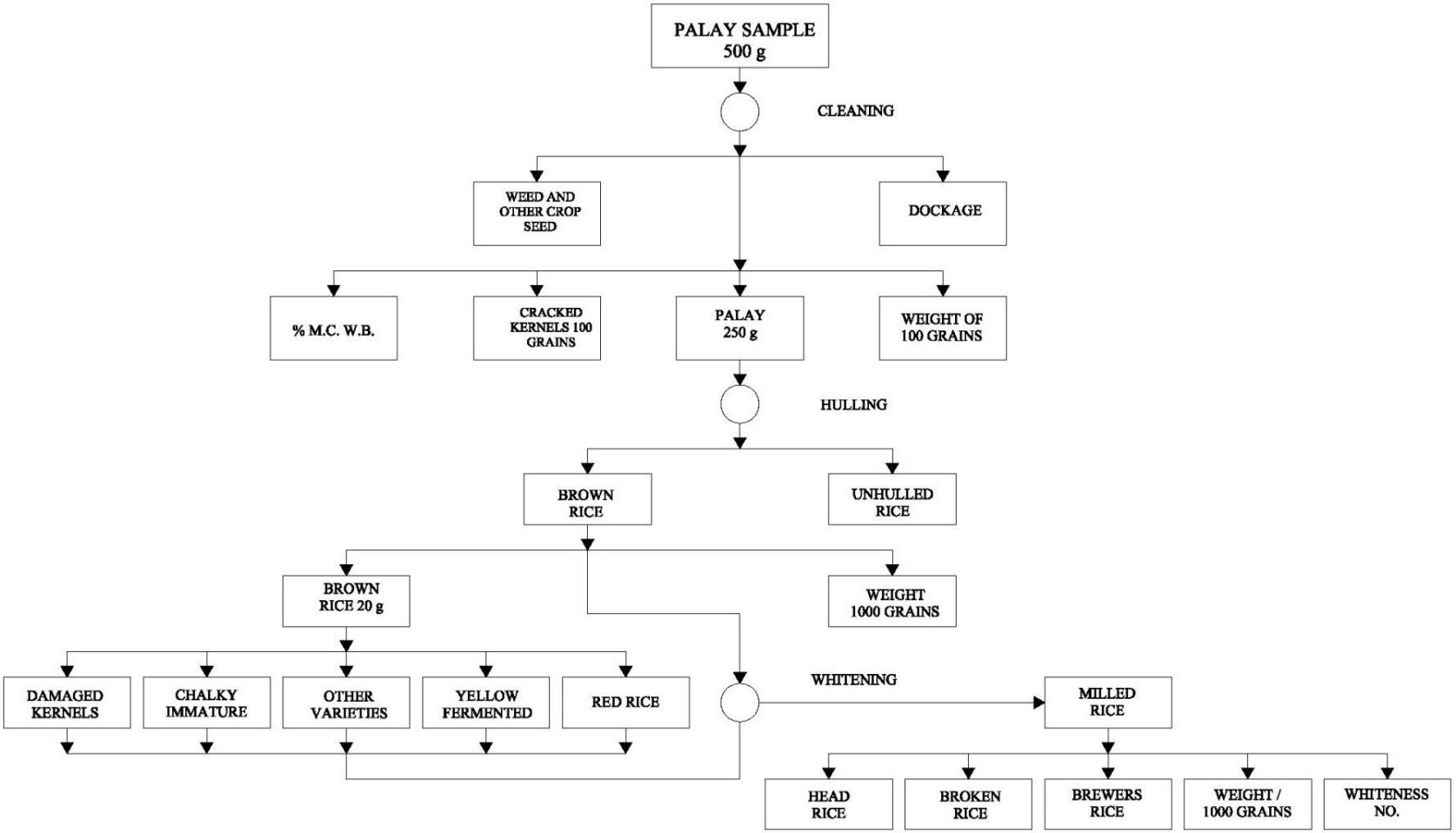

Figure 1 – Standard laboratory method in assessing milling quality of paddy

F.1.7 Weight of 1000-grain whole head milled rice

Three 1000-grain sample of whole head milled rice shall be drawn from the head rice component and then weighed.

F.1.8 Damaged grain

Three 100-grain head milled rice samples shall also be drawn from the head milled rice component and examined under a magnifying lens for grain damage. The percentage grain damage is taken as the mean value from three 100-grain sample.

F.2 Laboratory analysis of samples from test rice mill

The steps in sampling brown rice and milled rice from test rice mill for analysis of grain parameters is the same as in Figure 1.

F.2.1 Weight of 1000 grains whole head brown rice

Three 1000-g sample of whole head brown rice shall be drawn to determine the weight of 1000 grains.

F.2.2 Coefficient of hulling

Three samples of 100g of huller output shall be drawn and separated into brown rice and unhulled paddy to determine the coefficient of hulling.

F.2.3 Coefficient of wholeness

Three samples of 100-g brown rice sample is drawn and separated into broken brown rice and head brown rice. The coefficient of wholeness is determined from the weight of the components and shall be taken as the mean of the three samples.

F.2.4 Weight of 1000 whole grains

Three 1000-grain samples of milled rice shall be taken and weighed.

F.2.5 Grain parameters

The head milled rice recovery, total milling recovery, and percentage, on weight basis, of broken milled rice and brewer's rice shall be determined from the nominal 200-g milled rice sample.

F.2.6 Milling degree

Milling degree shall be determined using the simple Alcohol-Alkali Bran Staining Method or any other comparable method that can be developed in the future. The method to be used shall be certified by an authorized agency. A flowchart for determining the milling degree using Alcohol-Alkali Bran Staining Method is shown in Annex H.

Annex G

Laboratory Analysis Data Sheet

Items	Trial						Mean	
	1		2		3			
	Control [1]	Test [2]	Control [1]	Test [2]	Control [1]	Test [2]	Control [1]	Test [2]
G.1 Test paddy								
G.1.1 Purity (%)								
G.1.2 Moisture content, wet basis								
G.1.3 Weight of 1000 full paddy grains (g)								
G.1.4 Cracked handhulled brown rice								
G.1.5 Bulk density								
G.2 Brown rice								
G.2.1 Weight of 1000 whole head brown rice (g)								
G.2.2 Chalky and immature (%)								
G.2.3 Yellow and fermented (%)								
G.2.4 Red rice (%)								
G.2.5 Coefficient of hulling								
G.2.6 Coefficient of wholeness								
G.2.7 Hulling efficiency(%)								
G.3 Milled rice								
G.3.1 Weight of 1000 whole milled rice (g)								
G.3.2 Damaged milled rice (%)								
G.3.3 Broken milled rice(%)								
G.3.3.1 based on input paddy								
G.3.3.2 based on total milled rice								
G.3.4 Brewer's rice (%)								
G.3.4.1 based on input Paddy								
G.3.4.2 based on total milled rice								
G.3.5 Head milled rice Recovery (%)								
G.3.5.1 based on input paddy								
G.3.5.2 based on total milled rice								
G.3.6 Total milling recovery (%)								
G.3.7 Milling degree (%)								

Annex H

Determining the Milling Degree of Milled Rice (Alcohol-Alkali Bran Staining Method)

Alcohol-Alkali Bran Staining is a method of determining the milling degree which involves dipping the rice kernels in a 2% KOH-EtOH (Potassium Hydroxide-Ethyl Alcohol) solvent where the residual bran layers shown up as brown patches or streaks against a background of light yellow endosperm.

Alcohol-Alkali Staining Solvent is a solution of 2% KOH-EtOH (Potassium Hydroxide-Ethyl Alcohol) in the volume ratio of 1:3.

Bran Streaks (BS) are longitudinal bran layers remaining in the dorsal grain grooves after milling.

Methodology

1. Preparation of the Alcohol-Alkali Staining Solution
    a. Prepare 2% KOH (Potassium Hydroxide)
        i. Weigh 20 grams of KOH
        ii. Dissolve in 1.0 L of distilled water
    b. Mix the 2% KOH with ethyl alcohol (EtOH) in the volume ratio of 1:3 to form the 2% KOH-EtOH solution. Shake or mix well.
2. Preparation of Rice Samples
    a. Separate the head rice from the brokens with the use of indented plates. Discard the brokens.
    b. Mix thoroughly the head rice kernels.
    c. Prepare the working sample for three (3) trials consisting of 100 pieces per trial, using a grain counter.
3. Staining Procedure
    a. Place the kernels (100) pieces in a petri dish and pour twenty milliliters (20 mL) of 2% KOH-EtOH solvent into the dish.
    b. Cover the dish. Allow to stand for 15 minutes.
    c. Pour off and discard the staining solution.
    d. Transfer and stained head rice sample on a piece of white bond paper and air dry for about 5 minutes.
4. Determination of Milling Degree
    a. Using either a grain picker or finger, separate the stained kernels with residual bran streak/s whose length is at least 2 mm or aggregate of 2 mm. Residual bran streaks are highlighted distinctly brown against a background of light yellow endosperm.
    b. Count the separated kernels with bran streaks. The count corresponds to the percentage of kernels with bran streaks (BS) in a working sample, Present the result as number of kernel with bran streak per 100 grain sample.

Note : Adopted from the Procedure for Determining the Milling Degree of Milled Rice by the National Food Authority

Annex I

Formula Used During Calculations and Testing

I.1 Milling Capacity (t/h)

$$\text{Milling capacity (t/h)} = \frac{\text{Weight of input paddy (tons)}}{\text{Total input time (h)}}$$

I.2 Milling Recovery (%)

$$\text{Milling recovery (\%)} = \frac{\text{Weight of clean milled rice (kg)}}{\text{Weight of clean paddy (kg)}} \text{ x } 100$$

I.3 Hulling Efficiency, H_e (%)

$$H_e = \text{(Coefficient of hulling) x (Coefficient of wholeness) x } 100$$

where:

Coefficient of hulling, H_c

$$H_c = \frac{\text{weight of brown rice (kg)}}{\text{weight of brown rice and unhulled paddy (kg)}} \text{ x } 100$$

Coefficient of wholeness, W_c

$$W_c = \frac{W_s}{t_s}$$

where : W_s is the weight of the whole brown rice
t_s is the weight of the total hulled samples

I.4 Head Rice

$$\text{Head Rice (\%)} = \frac{\text{weight of head rice (g)}}{\text{weight of milled rice (g)}} \text{ x } 100$$

I.5 Broken Rice

$$\text{Broken Rice (\%)} = \frac{\text{weight of broken rice (g)}}{\text{weight of milled rice (g)}} \text{ x } 100$$

I.6 Brewers rice or “Binlid” or Chips

$$\text{Brewers rice or "Binlid" or Chips (\%)} = \frac{\text{Weight of brewers rice (g)}}{\text{Weight of milled rice (g)}} \text{ x } 100$$

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BUREAU OF PRODUCT STANDARDS*

3F Trade and Industry Building
361 Sen. Gil J. Puyat Avenue, Makati City 1200, Metro Manila, Philippines
T/ (632) 751.3125 / 751.3123 / 751.4735
F/ (632) 751.4706 / 751.4731
E-mail: bps@dti.gov.ph
www.dti.gov.ph

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