Foreword

The pursuance of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) with funding from the Department of Agriculture.

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

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

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

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

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

Test Procedure for Reaper and Binder, National Test Code of Japan.

CONTENTS **Page**

Agricultural Machinery – Rice Reaper – Methods of Test

1 Scope

This standard specifies the methods of test and inspection for rice reapers. Specifically, it shall be used to:

1.1 verify the dimensions, weight, and other technical data of the rice reaper submitted by the manufacturer/dealer;

1.2 determine the performance of the machine;

1.3 evaluate the ease of handling and safety features; and

1.4 prepare a report on the results of the tests.

2 References

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

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

PAES 103:2000 Agricultural Machinery – Method of Sampling

PAES 212:2004 Agricultural Machinery – Rice reaper - Specifications

3 Definitions

For the purpose of this standard, the definitions given in PAES 212 and the following shall apply:

3.1
cutting width
distance between two outermost divider tips

3.2
lodging angle
degree between the vertical line joining the center of the plant and the imaginary line where the stalk lodges

3.3
potential yield
maximum yield per unit area

3.4
overall height
distance between the horizontal supporting surface and the horizontal plane touching the uppermost part of the reaping unit

NOTE All parts of the reaping unit projecting upwards are contained between these two planes.

3.5
overall length
distance between the vertical planes at the right angles to the median plane of the reaping unit and touching its front and rear extremities

NOTE All parts of the reaping unit, 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.

3.6
overall width
distance between the vertical planes parallel to the median plane of the reaping unit, each plane touching the outermost point of the reaper on its respective side

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

3.7
running-in period
preliminary operation of the machine to make various adjustments prior to the conduct of test until the operation is stable

4 General Conditions for Test and Inspection

4.1 Selection of rice reaper to be tested

Rice reaper 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 rice reaper. He/She 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

Each test shall be carried out in the field with an area of not less than 750 m^2 with three replications. The field should be drained two weeks before reaping.

4.5 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 rice reaper test is shown in Annex A.

4.6 Running-in and preliminary adjustment

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

4.7 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 reaper 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 rice reaper's dimensional specifications.

5.1.3 The items to be inspected and verified shall be recorded in Annex B.

5.2 Field performance test

5.2.1 This is carried out to obtain actual data on machine performance, operating accuracy, work quality and adaptability to varied crops and field conditions.

5.2.2 Initial data shall be collected before the test such as field conditions and crop condition.

5.2.3 Field operation

5.2.3.1 The reaper shall be tested using field operational pattern as shown in Figure 1.

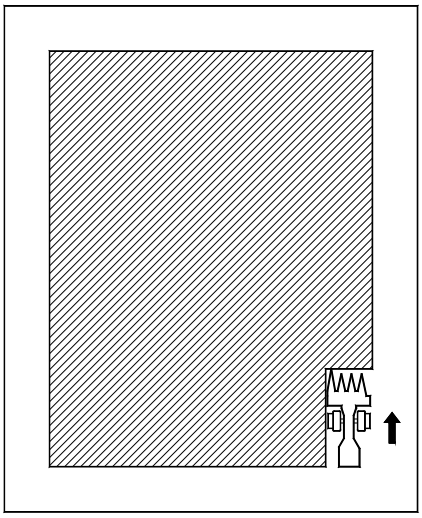

Figure 1 – Recommended Operational Pattern

5.2.3.2 The corners of the field should be manually harvested with the dimension of 3 m x 3m to provide turning space for the machine (see Figure 2).

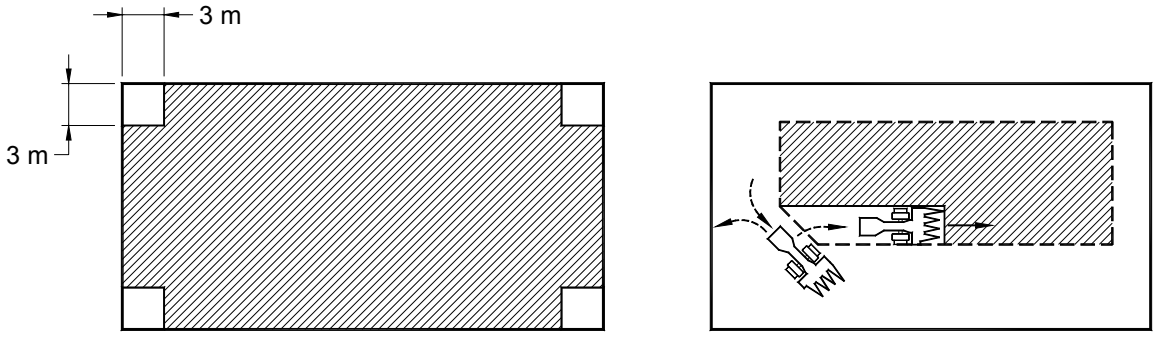

Figure 2 – Field preparation and operation of rice reaper

5.2.4 Measurement of performance parameter:

5.2.4.1 Operating speed

Outside the long boundary of the test plot, two poles 20 m apart (A, B) are placed approximately in the middle of the test run (see Figure 3). On the opposite side also two poles are placed in similar position, 20 m apart (C, D) so that all four poles form corners of a rectangle, parallel to at least one long side of the test plot. The speed will be calculated from the time required for the machine to travel the distance (20 m) between the assumed line connecting two poles on opposite sides AC and BD. The easily visible point of the machine should be selected for measuring the time.

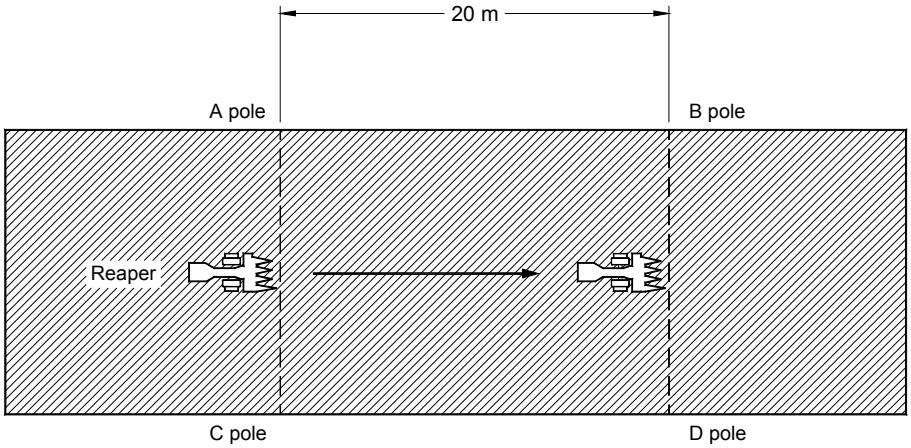

Figure 3 – Measurement of operating speed

5.2.4.2 Noise level measurement

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

5.2.4.3 Fuel 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 consumption for the test. When filling up the tank, keep the tank horizontal so as not to leave empty space in the tank.

5.2.4.4 Total operating time

Total operating time shall be measured once the machine starts to reap up to the time it cuts the last stalk. Time losses for adjustment, turning and machinery breakdown shall be deducted from the total operating time.

5.2.4.5 Potential yield

Before the test run, randomly select three 1 m x 1 m area within the test plot and manually harvest the panicles. The harvested panicles in each area shall be collected, labeled and taken to the laboratory.

5.2.4.6 Header loss

Before the test run, five 1 m x 1 m area shall be taken at random within the test plot and the grains detached from the panicle within the area shall be collected weighed and recorded as pre-harvest loss. After the test run, using the same area, loose grains on ground, grains from cut panicles but fallen on the ground and grains from uncut panicles fallen on ground after harvesting, shall be collected, labeled and taken to the laboratory.

5.2.4.7 Conveying loss

A canvass shall be spread for a length of 2 m on a place where cut stalks are expected to fall. Detached grains from the panicle shall be collected, labeled and taken to the laboratory. Five sets of sample shall be taken.

5.2.4.8 Randomly measure the height and width of cut of the rice reaper during the operation.

5.2.4.9 Measure the turning time of the rice reaper.

5.2.4.10 The following items shall be observed:

- Ease of handling and stability when the machine is working and turning
- Ease of manipulating the operating levers
- Ease of adjusting and repair of parts
- Ease of transporting the machine
- Safety
- Vibration
- Labor requirements
- Other necessary items

5.2.5 The items to be inspected and measured shall be recorded in Annex C.

6 Laboratory Analysis

Laboratory analysis shall be made to determine the potential yield of the area, grain moisture content, and losses (header and conveying). The laboratory test data sheet is given in Annex D.

6.1 Potential yield of the area

Manually thresh the grains from the cut stalk from each sample separately. Clean the grains to remove the impurities and other foreign matters. The clean grain shall be weighed and recorded. Calculate the average potential yield per square meter of the three samples.

6.2 Grain moisture content

Five samples shall be taken for moisture content determination using a calibrated moisture meter. The mean moisture content from samples shall be taken as the moisture content of the test paddy.

6.3 Determination of losses

6.3.1 Header loss

Each of the five samples collected after the test run shall be manually threshed, cleaned and weighed. Calculate the average weight of grains of the five samples representing the loose grain on the ground, grains from cut panicles but fallen on the ground and grains from uncut panicles fallen on the ground after harvesting.

Five samples taken before the test shall be cleaned and weighed separately. Calculate the average weight of grains of the five samples representing pre-harvest loss.

6.3.2 Conveying loss

Grains collected from the canvass where the cut stalks fall during the reaping operation shall be collected, cleaned and weighed for the determination of conveying loss.

7 Data Analysis

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

8 Test Reports

8.1 Name of testing agency

8.2 Test report number

8.3 Title

8.4 Summary

8.5 Purpose and scope of test

8.6 Methods of test

8.7 Table 1 – Machine specifications

8.8 Results and discussion

8.9 Table 2 – Field performance test data

8.10 Observations (include pictures)

8.11 Name, signature and designation of test engineers

Annex A
(informative)

Minimum List of Field and Laboratory Test Equipment and Materials

A.1	**Equipment**	**Quantity**
A.1.1	**Field**	
A.1.1.1	Grain moisture meter (Capacitance or conductance type) Range: 6% to 24% or 6% to 30%	1
A.1.1.2	Noise level meter Range: 30 dB(A) to 130 dB(A)	1
A.1.1.3	Digital timers (range: 60 minutes) Accuracy: 1/10 sec	2
A.1.1.4	Measuring tape Capacity: 50 m	1
A.1.1.5	Camera	1
A.1.1.6	Weighing scale Capacity: 100 kg Scale divisions: 500 g	1
A.1.1.7	Graduated cylinder (for engines) (500 mL capacity)	1
A.1.2	Laboratory	
A.1.2.1	Weighing scale (Sensitivity: 0.1 g)	1
A.1.2.2	Grain sample cleaner	1
A.2	**Materials**	
A.2.1	Field	
A.2.1.1	Canvas sheet (2 m x 1m)	1
A.2.1.2	Nylon net (2 m x 1m)	1
A.2.1.3	Sample bags	50
A.2.1.4	Labeling tags which include	50
A.2.1.4.1	Date of test	
A.2.1.4.2	Machine on test	
A.2.1.4.3	Sample source	
A.2.1.4.4	Variety	
A.2.1.4.5	Trial number	

Annex B
(informative)

Specifications of the Rice reaper

Name of Applicant (or Distributor) : _____
Address : _____
Telephone No : _____
Name of Factory/Distributor : _____
Address : _____

GENERAL INFORMATION
Model :_____ Make :_____
Serial No :_____ Classification :_____
Production date of rice reaper to be tested :_____

Item to be inspected:

ITEMS	Manufacturer's Specifications	Verification by the Testing Agency
B.1 Overall dimensions and weight of rice reaper		
B.1.1 length, mm		
B.1.2 width, mm		
B.1.3 height, mm		
B.1.4 Weight of the machine, without engine, kg		
B.2 Crop condition for which machine is suitable		
B.2.1 Variety		
B.2.2 Maximum cutting angle of straw		
B.2.3 Adaptable length of straw		
B.2.4 Crop moisture content		
B.3 Harvesting section		
B.3.1 No. of cutting row		
B.3.2 Cutting method		
B.3.3 Cutting width, mm		
B.3.4 Minimum cutting height, mm		
B.3.5 Capacity, ha/h		
B.3.5.1 Wetland		
B.3.5.2 Dry land		
B.4 Engine		
B.4.1 Brand		
B.4.2 Model		
B.4.3 Serial number		
B.4.4 Type (stroke & ignition)		
B.4.5 Rated power, hp		
B.4.6 Rated speed, rpm		
B.4.7 Weight, kg		
B.4.8 Starting system		

ITEMS	Manufacturer's Specifications	Verification by the Testing Agency
B.5 Operating speed		
B.5.1 Reaping, m/s		
B.5.1.1 Dryland		
B.5.1.2 Wetland		
B.6 Running parts		
B.6.1 Tire, kind		
B.6.2 Tire, size		
B.6.3 Wheel for wetland, kind		
B.6.4 Wheel for wetland, size		
B.6.5 Wheel tread and adjustment		

Annex C
(informative)

Field Performance Test Data Sheet

Test Engineer: _____ Date:_____
Assistants: _____ Location:_____
Test Requested by:_____ Manufacturer: _____
Test Specimen:_____

Items to be measured and inspected:

Items	Trial			
	1	2	3	Ave.
C.1 Crop condition				
C.1.1 Variety				
C.1.2 Whether susceptible to shattering				
C.1.3 Date of sowing/planting				
C.1.4 Row spacing				
C.1.5 Recommended period of maturity				
C.1.6 Average plant height (8 observations)				
C.1.7 Lodging angle of plant (8 observations)				
C.1.8 Plant population/m^2 (3 observations)				
C.1.9 Number of tillers/plant (5 observations)				
C.2 Field conditions				
C.2.1 Location of test field				
C.2.2 General topography (undulating/leveled)				
C.2.3 Area of test field				
C.2.4 Shape of field				
C.2.5 Soil type				
C.2.6 Penetrometer profile (8 observation)				
C.3 Test conditions				
C.3.1 Date of test				
C.3.2 Duration of test				
C.3.3 Time lost				
C.3.3.1 Turning, min				
C.3.3.2 Adjustments, min				
C.3.3.3 Minor repair, min				
C.3.3.4 Others (specify, min)				
C.3.4 Operating speed, m/s				
C.3.5 Effective width of cut, cm				
C.3.6 Fuel consumed, mL				
C.3.7 Fuel consumption, L/h				
C.3.8 Noise level, db(A)				
C.3.9 Height of cut or height of stubbles, mm				
C.3.10 Pre-harvest loss (average of 5 observations, g)				
C.3.11 Header loss (average of 5 observations, g)				
C.3.12 Conveyor loss (average of 5 observations, g)				
C.3.13 Header loss, %				

Items	Trial			
	1	2	3	Ave.
C.3.14 Conveying loss, %				
C.3.15 Total machine loss, %				
C.3.16 Actual field capacity, ha/h				
C.3.17 Theoretical field capacity, ha/h				
C.3.18 Field efficiency, %				
C.4 Minimum labor requirements				

C.5 Rate the following observations:

Items	Rating*				
	1	2	3	4	5
C.5.1 Ease of handling and stability when machine is working and turning					
C.5.2 Ease of manipulating the operating lever					
C.5.3 Ease of adjusting and repair of parts					
C.5.4 Ease of transporting the machine					
C.5.5 Safety					
C.5.6 Vibration					

* 1 – Very Good
2 – Good
3 – Satisfactory
4 – Poor
5 – Very Poor

C.6 Other observations

_____

_____

_____

Annex D
(informative)

Laboratory Test Data Sheet

Machine Tested: _____ Analyzed by : _____
Date of Test: _____ Date Analyzed: _____

D.1 Potential yield

Sample No.	Weight of Grain and Straw g	Weight of Grain g
1		
2		
3		
4		
5		
Average		

D.2 Moisture Content, (% w.b.)

Average			

D.3 Loss Determination

D.3.1 Header loss

Sample No.	Pre-harvest loss g	Weight of Loose grains on ground g	Weight of grains from cut but fallen panicles g	Weight of grains from uncut but fallen panicles after harvesting g
1				
2				
3				
4				
5				
Average				

D.3.2 Conveying loss

Sample No.	Weight of grains on the canvass g
1	
2	
3	
4	
5	
Average	

Annex E
(informative)

Formulas Used During Calculations and Testing

E.1 Actual field capacity

$$FC_A = \frac{A_T}{T_T}$$

where:

FC_A = Actual field capacity, ha/h
A_T = Area covered during test, ha
T_T = Total operating time, h

E.2 Theoretical field capacity

$$FC_T = \frac{W_C S_O}{10}$$

where:

FC_T = Theoretical field capacity, ha/h
W_C = Cutting width, m
S_O = Operating speed, km/h

E.3 Field efficiency

$$E = \frac{FC_A}{FC_T} x\ 100$$

where:

E, = Field Efficiency, %
FC_A = Actual field capacity, ha/h
FC_T = Theoretical field capacity, ha/h

E.4 Header Loss

$$L_H = \frac{\text{Average}(W_{g1} + W_{g2} + W_{g3}) - \text{Average}\, W_{gp}}{\text{Average}\, W_{py}} x\ 100$$

where:

L_H = Header loss, %
Wg_1 = Weight of loose grain on ground per square meter, g/m^2
Wg_2 = Weight of grains from cut panicles but fallen on ground per square meter, g/m^2

Wg_3 = Weight of grains from uncut panicles fallen on ground after the harvesting per square meter, g/m^2

Wgp = Weight of the grain on ground (pre-harvest loss) per square meter, g/m^2

W_{Py} = Weight of the potential yield per square meter, g/m^2

E.5 Conveying loss

$$L_C = \frac{CL}{PY} x100$$

where:

L_C = Conveying loss, %

CL = Average conveying loss/m^2

PY = Average potential yield/m^2

E.6 Total machine loss

$$L_T = L_H + L_C$$

where:

L_T = Total machine loss, %

L_H = Header loss, %

L_C = Conveying loss, %