PHILIPPINE NATIONAL STANDARD

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Agricultural machinery – Feed Mixer – Methods of Test

BUREAU OF PRODUCT STANDARDS

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National Foreword

This Philippine Agricultural Engineering Standards PAES 259:2011, Agricultural machinery – Feed Mixer – Methods of Test was approved for adoption as Philippine National Standard by the Bureau of Product Standards upon the recommendation of the Agricultural Machinery Testing and Evaluation Center (AMTEC) and the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development of the Department of Science and Technology (PCARRD-DOST).

Foreword

The formulation of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) through the project "Development of Standards for Agricultural Production and Postharvest Machinery" funded by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development – Department of Science and Technology (PCARRD-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 the preparation of this standard, the following documents/publications were considered:

Herrman, Tim and Keith Behnke .Testing Mixer Performance. Department of Grain Science and Industry. Kansas State University. October 1994 http://www.oznet.ksu.edu/library/grsci2/MF1172.PDF.<accessed on June 02, 2009>

Eisenberg, David A**.** Mixer Performance, Cross-contamination Testing Examined. Feedstuffs, The Weekly Newspapers for Agribusiness. March 29, 2004

Eisenberg, David A. Measuring Mixer Variation- performance and Cross-contamination Validation. 16th Annual ASA-IM SEA Feed Technology and Nutrition Workshop. May 2008

CONTENTS

1 Scope

This standard specifies the methods of test and inspection for feed mixer for agri-fisheries. Specifically, it shall be used to:

1.1 verify the mechanism, dimensions, materials, accessories of the feed mixer and the list of specifications submitted by the manufacturer;

1.2 determine the performance of the machine;

1.3 evaluate the ease of handling and safety features; and

1.4 report the results of the tests.

2 References

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

PAES 103:2000 Agricultural Machinery – Methods of Sampling

PAES 258:2011 Agricultural Machinery – Feed Mixer – Specifications

3 Definitions

For the purpose of this standard, the definitions given in PAES 258 and the following shall apply:

3.1
mixing rate
weight of feed ingredients fed into the feed mixer per unit time, expressed in kilogram per hour.

NOTE: Applicable for feed mixer with continuous input of feed ingredients to the hopper

3.3
coefficient of variation of salt content
statistical representation of the precision of distribution of feed ingredients

3.4
mean
mathematical average of the samples taken from the feed mixed

3.6
overall height
distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the feed mixer.

NOTE: All parts of the feed mixer projecting upwards are contained between these two planes.

3.7
overall length
distance between the vertical planes at the right angles to the median plane of the feed mixer and touching its front and rear extremities.

NOTE: All parts of the feed mixer, 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.

3.8
overall width
distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of the feed mixer on its respective side.

NOTE: All parts of the feed mixer projecting upwards are contained between these two planes.

3.9
standard deviation
statistical measurement of dispersion or variation in distribution of feed ingredients.

3.10
running-in period
preliminary operation of the machine to make various adjustments prior to the conduct of the test

4 General Conditions for Test and Inspection

4.1 Selection of feed mixer to be tested

Feed mixer selected for test shall be sampled in accordance with PAES 103.

4.2 Role of manufacturer/distributor

The manufacturer or distributor shall submit specifications and other relevant information about the feed mixer and shall abide with the terms and conditions set forth by an official testing agency.

4.3 Role of the operator

An officially designated operator shall be skilled and shall demonstrate, operate, adjust, and repair as the case maybe, related to the operation of the feed mixer.

4.4 Test site conditions

The feed mixer shall be tested as installed for normal operation. The site should have ample provisions for material handling, temporary storage, workspace and suitable for normal working condition.

4.5 Test instruments

The instrument to be used shall be calibrated and checked by the testing agency prior to the measurements. The suggested list of minimum test instruments and materials needed to carry out the feed mixer test is shown in Annex A.

4.6 Test materials

Feed ingredients to be used shall be common or locally available. The amount of test material to be supplied shall be at least 75% of input capacity (kg/h) of feed mixer.

4.7 Termination of Test

If there is major component breakdown during testing, the test engineer from the official testing agency shall terminate the test.

5 Test and Inspection

5.1 Verification of the technical data and information of the manufacturer

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

5.1.2 A plane level surface shall be used as reference plane for verification of dimensional specifications of feed mixer.

5.1.3 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 obtain actual data on overall feed mixer performance.

5.2.2 Initial data on feed ingredients such as types, varieties and sources shall be recorded.

5.2.3 Test materials to be used.

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

5.2.4 Running-in and preliminary adjustment

Before the start of the test, the feed mixer should have undergone running-in period. (No other adjustment shall be permitted while the test is on-going).

5.2.5 Operation of the feed mixer

Feed mixer shall be operated at the speed and feed rate recommended by the manufacturer. The same recommended feeding rate shall be maintained during the test run. After the test run, the area and the feed mixer shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for succeeding test trials.

5.2.6 Test trial

There shall be a minimum of three test trials.

5.2.7 Data collection

5.2.7.1 Duration of test

The duration of each test trial shall depend on the specifications of the manufacturer on the mixing time.

5.2.7.2 Noise level

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

5.2.7.3 Speed of components

The speed of the rotating components shall be taken.

NOTE: Measurements shall be taken with and without load for sub-clauses 5.2.7.2 and 5.2.7.3 as specified in Annex C.

5.2.7.4 Power or Fuel consumption

A power meter shall be used to measure electric energy consumption. In case an internal combustion engine is used, 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.

5.2.7.5 Data recording and observations

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

5.2.7.6 Sampling

5.2.7.6.1 Sampling procedures for test materials

Before the start of each test trial, take at least 500 g of representative samples of feed ingredients for determination of material conditions (i.e. size, moisture content)

5.2.7.6.2 Sampling from outlet

5.2.7.6.2.1 Sampling in horizontal feed mixer

After each test trial, samples shall be collected using grain probe. The sampling points for this type of feed mixer as shown in Figure 1. A total of 9 samples shall be collected from the horizontal feed mixer.

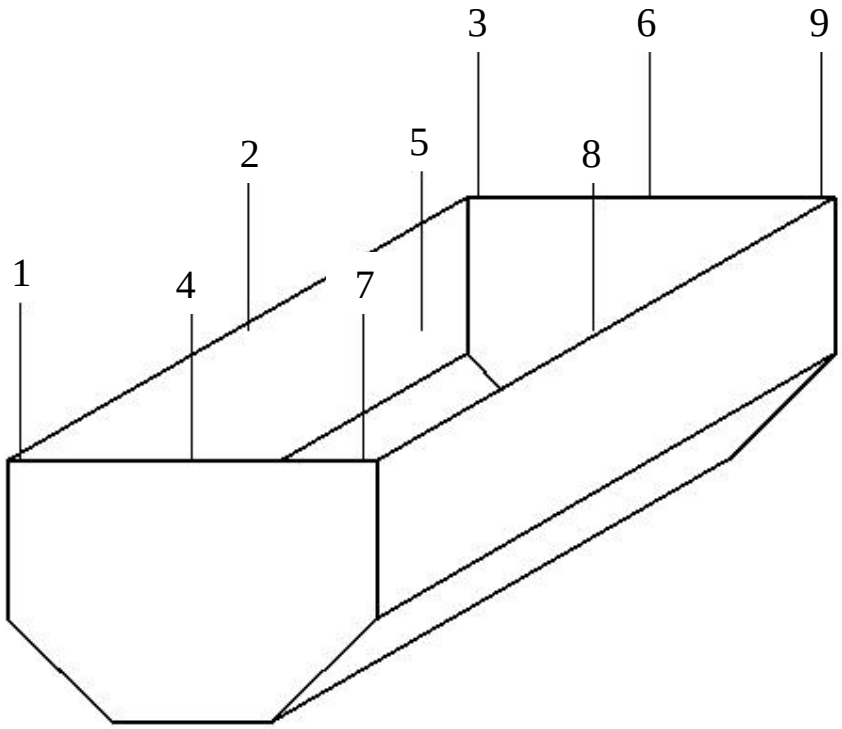

Figure 1. Sampling points for horizontal feed mixer

5.2.7.6.2.2 Sampling in vertical feed mixer

After each test trial, 10 samples shall be randomly collected from the outlet. One sample shall be obtained for every interval of collection for five-second duration per collection. Interval of collection shall be calculated using formula in Annex E.

5.2.7.6.3 The samples collected shall be analyzed in the laboratory for feed uniformity.

5.2.7.6.4 Handling of samples

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

6 Laboratory Analysis

Laboratory analyses shall be made to determine processing effeciency of the feed mixed. The laboratory test data sheet to be used is given in Annex D.

6.1 Moisture content

6.1.1 This shall be taken using air oven method.

6.1.2 For each test trial, randomly obtain three-100g of feed ingredients and place in the moisture can. Ensure that no moisture is lost or gained by the sample between the time it was collected and when it is weighed in a moisture can. Weigh and record all the initial weights.

6.1.3 Dry the samples in the oven with a temperature of 105 °C ± 1 °C for 72 hours.

6.1.4 After removing the samples from the oven, sample container with samples should be placed in desiccator and allowed to cool to the ambient temperature.

6.1.5 Weigh the moisture can with the dried sample. Record the final weight. Calculate the moisture content using formula in Annex E.

6.2 Feed uniformity (using Assaying procedures)

6.2.1 The feed ingredients shall be incorporated with 0.5 percent salt by weight.

6.2.2 After the mixing process, samples shall be mixed to water solution (chloride titrators measure dissolved Cl^-) or using Omnion Sodium Analysis (measure Na^+)

6.2.3 The amount of Cl^- (Chlorine) or Na^+ (Sodium) will determine the amount of salt per sample. Using this data, compute for the coefficient of variation for the feed uniformity.

7 Formula

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

8 Test Report

The test reports 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 Condition of the Machine

8.6 Description of the Machine

Table 1 – Machine Specifications

8.7 Results and Discussions

8.8 Observations (include pictures)

Table 2 – Performance test data

8.9 Names, signatures and designation of test engineers

Annex A

Suggested List of Field and Laboratory Test Instruments and Materials

A.1	**Instruments**	**Quantity**
A.1.1	**Field**	
A.1.1.1	Digital Tachometer	1
A.1.1.2	Digital timers (Accuracy: 0.1 sec.)	2
A.1.1.3	Tape measure (with maximum length of 5m)	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 division: 0.5 kg	1
A.1.1.6	Graduated cylinder (500 mL capacity)	1
A.1.1.7	Power meter 60 Hz, 220 V	1
A.1.1.8	Psychrometer	1
A.1.1.9	Digital camera	1
A.1.1.10	Grain probe	
A.1.2	**Laboratory**	
A.1.2.1	Weighing scale (sensitivity: 0.1g)	1
A.1.2.2	Air oven	1
A.1.2.3	Desiccator	1
A.1.2.4	Vernier caliper (0.05mm accuracy, 200 mm length)	1
A.1.2.5	Foot ruler	1
A.1.2.6	Aluminum moisture can	
A.2	**Materials**	
A.2.1	Sample bags	
A.2.2	Labeling tags which include	
A.2.2.1	Date of test	
A.2.2.2	Feed mixer on test	
A.2.2.3	Sample source	
A.2.2.4	Variety	
A.2.2.5	Trial number	

Annex B

Specifications of Feed Mixer

Name of Applicant/ Distributor: _____
Address: _____
Tel No: _____
Name of Manufacturer: _____
Address: _____
Tel No: _____

GENERAL INFORMATION

Make: _____ Type: _____
Serial No: _____ Brand/Model: _____
Production date of Feed Mixer: _____
Testing Agency: _____ Test Engineer: _____
Date of Test: _____ Location of Test: _____

Items to be inspected

ITEMS	Specifications of the Manufacturer	Verification by the Testing Agency
B.1 Main Structure		
B.1.1 Material(s) of construction		
B.1.2 Overall dimensions, mm		
B.1.2.1 length		
B.1.2.2 width		
B.1.2.3 height		
B.1.3 weight of machine without prime mover, kg		
B.2 Hopper (if available)		
B.2.1 Material(s) of construction		
B.2.2 Dimensions, mm		
B.2.2.1 length		
B.2.2.2 width		
B.2.2.3 height		
B.2.3 Angle of friction		
B.3 Mixing tank/chamber		
B.3.1 Horizontal mixer		
B.3.1.1 Material(s) of construction		
B.3.1.2 Dimensions, mm		
B.3.1.2.1 length		
B.3.1.2.2 diameter/width		

B.3.1.3 Mixing Device		
B.3.1.3.1 Horizontal auger		
B.3.1.3.1.1 Material(s) of contruction		
B.3.1.3.1.2 Dimensions, mm		
B.3.1.3.1.2.1 inner diameter		
B.3.1.3.1.2.2 outer diameter		
B.3.1.3.2.2 length		
B.3.1.3.2.3 thickness of threads		
B.3.1.4 Ribbon metal		
B.3.1.4.1 Material(s) of construction		
B.3.1.4.2 Dimensions, mm		
B.3.1.4.2.1 length of assembly		
B.3.1.4.2.2 diameter of assembly		
B.3.1.4.2.3 thickness		
B.3.1.4.2.4 diameter of shaft		
B.3.1.4.2.5 pitch, ribbon per meter		
B.3.1.5 Paddles		
B.3.1.5.1 Material(s) of construction		
B.3.1.5.2 Dimensions, mm		
B.3.1.5.2.1 length of paddle assembly		
B.3.1.5.2.2 diameter of paddle assembly		
B.3.1.5.2.3 length of paddle		
B.3.1.5.2.4 width of paddle		
B.3.1.5.2.5 thickness of paddle		
B.3.1.5.2.6 diameter of shaft		
B.3.1.4.2.7 Angle of inclination of paddles, degree		
B.3.2.4 Chain and paddles		
B.3.2.4.1 Material(s) of construction		
B.3.2.4.2 Dimensions, mm		
B.3.2.4.2.1 size of chains		
B.3.2.4.2.2 length of paddle		
B.3.2.4.2.3 width of paddle		
B.3.2.4.2.4 thickness of paddle		
B.3.2.5 Reel and augers		
B.3.2.5.1 Augers		
B.3.2.5.1.1 Material(s) of construction		
B.3.2.5.1.2 Dimensions, mm		
B.3.2.5.1.2.1 length		
B.3.2.5.1.2.2 outer diameter		
B.3.2.5.1.2.3 inner diameter		
B.3.2.5.1.2.3 thickness of threads		
B.3.2.5.1.2.4 pitch, thread per inch		

B.3.2.5.2 Spirals on interior circumference of mixing drum		
B.3.2.5.2.1 Material(s) of construction		
B.3.2.5.2.2 Dimensions, mm		
B.3.2.5.2.2.1 length		
B.3.2.5.2.2.2 width		
B.3.2.5.2.2.3 thickness		
B.3.2 Vertical mixer		
B.3.2.1 Material(s) of construction		
B.3.2.2 Dimensions, mm		
B.3.2.2.1 length		
B.3.2.2.2 diameter/width		
B.3.2.3 Mixing device		
B.3.2.3 Vertical auger		
B.3.2.3.1 Material(s) of construction		
B.3.2.3.2 Dimensions, mm		
B.3.2.3.2.1 length		
B.3.2.3.2.2 outer diameter		
B.3.2.3.2.3 inner diameter		
B.3.2.3.2.4 thickness of threads		
B.4 Discharge chute		
B.4.1 Material(s) of construction		
B.4.2 Location		
B.4.3 Dimensions, mm		
B.4.3.1 length		
B.4.3.2 width		
B.4.3.3 height from the ground		
B.5 Safety device(s):		
B.6 Special feature(s):		
B.7 Prime mover		
B.7.1 Engine		
B.7.1.1 Brand		
B.7.1.2 Model		
B.7.1.3 Serial number		
B.7.1.4 Type (stroke/ignition)		
B.7.1.5 Rated power, kW		
B.7.1.6 Rated speed, rpm		
B.7.1.7 Cooling system		
B.7.1.8 Starting system		
B.7.1.9 Weight, kg		
B.7.2 Electric motor		
B.7.2.1 Brand		

B.7.2.2 Type		
B.7.2.3 Make or manufacturer		
B.7.2.4 Serial number		
B.8.2.5 Rated power, kW		
B.8.2.6 Rated speed, rpm		
B.8.2.7 Phase		
B.8.2.8 Voltage, V		
B.8.2.9 Current, A		
B.8.2.10 Frequency, Hz		

Annex C

Performance Test Data Sheet

Test Trial No. _____Date: _____
Test Engineer: _____Location: _____
Assistants: _____ Test Specimen: _____
Test Requested by: _____Manufacturer: _____

	Trials			Ave
	I	**II**	**III**	
C.1 Information of Ambient Condition				
C.1.1 Temperature, °C				
C.1.1.1 Wet-bulb temperature				
C.1.1.2 Dry-bulb temperature				
C.2 Input capacity, kg/h				
C.3 Operating time, h				
C.4 Speed of components, rpm				
C.4.1 Feed mixer				
C.4.1.1 Without load				
C.4.1.2 With load				
C.4.2 Prime mover				
C.4.2.1 Without load				
C.4.2.2 With load				
C.5.6 Noise level, dB(A)				
C.5.6.1 Without load				
C.5.6.2 With load				
C.6 Power consumption				
C.6.1 Internal Combustion Engine				
C.6.1.1 Engine operating time, min				
C.6.1.2 Fuel consumed, L				
C.6.1.3 Fuel consumption rate, L/h				
C.6.2 Electric Motor				
C.6.2.1 Power, kW				
C.6.2.1.1 Without load				
C.6.2.1.2 With load				
C.6.2.2 Current, A				
C.7.2.2.1 Without load				
C.7.2.2.2 With load				
C.6.2.3 Voltage, V				
C.6.2.3.1 Without load				
C.6.2.3.2 With load				

C.7 Welding Acceptance Test	**Remarks**
C.7.1 Crack prohibition	
C.7.2 Weld/base-metal fusion	
C.7.3 Crater cross section	
C.7.4 Weld profile	

C.7.5 Time of inspection	
C.7.6 Undersize welds (if any)	
C.7.7 Undercut	
C.7.8 Porosity (presence of air holes on the welded part)	

C.8 Evaluate the following observations:

Items	**Rating***	**Remarks**
C.8.1 Ease of loading		
C.8.2 Ease of cleaning parts		
C.8.3 Ease of adjusting parts		
C.8.4 Ease of repairing of parts		
C.8.5 Ease of collecting output		
C.8.6 Ease of operating		
C.8.7 Safety		
C.8.8 Availability of the switches needed		
C.8.9 Ease of transporting the machine		
C.8.10 Vibration		

***** F – Fail
P – Poor
S – Satisfactory
VG – Very Good
E – Excellent

C.9 Other Observations:

_____
_____
_____
_____
_____
_____
_____

Annex D

Laboratory Test Data Sheet

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

D.1 Characteristics of feed samples

Items	Trial			Average
	I	II	III	
D.1.1 Moisture content, %				
D.1.1.1 Initial weight, g				
D.1.1.2 Final weight, g				
D.1.2 Salt content, %				
D.1.2.1 Samples*				
D.1.2.1.1 sample 1				
D.1.2.1.2 sample 2				
D.1.2.1.3 sample 3				
D.1.2.1.4 sample 4				
D.1.2.1.5 sample 5				
D.1.2.1.6 sample 6				
D.1.2.1.7 sample 7				
D.1.2.1.8 sample 8				
D.1.2.1.9 sample 9				
D.1.2.1.10 sample 10				

* 9 samples for horizontal feed mixer
10 samples for vertical feed mixer

D.2 Other physical observations on feeds

_____
_____
_____
_____
_____

Annex E

Formula

E.1 Moisture Content

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

where:

MC_{wb} = moisture content, %
Wi = initial mass of the sample, g
Wf = final mass of the sample, g

E.2 Interval of Collection

$$i_c = \frac{T_m}{n}$$

where:

i_c = interval of collection
T_m = mixing time, sec
n = number of samples

E.3 Mixing Rate

$$M_R = \frac{W_{fi}}{T_o}$$

where:

M_R = mixing rate, kg/h
W_{fi} = total weight of feed ingredients input, kg
To = total operating time, h

E.4 Fuel Consumption Rate

$$Fr = \frac{Fc}{Te}$$

where:

Fr = fuel consumption rate, L/h
Fc = amount of fuel consumed, L
Te = engine operating time, h

E.5 Coefficient of Variance for Salt Content

$$CV = \frac{s}{M} \times 100$$

$$\text{Mean of } x = M = \frac{\sum x_j}{n}$$

$$s = \sqrt{s^2}$$

$$s^2 = \frac{\sum (x_j{}^2) - n(M^2)}{n-1}$$

where:

CV = coefficient of variation, %
s = standard deviation
s^2 = variance
x_j = individual sample
n = total number of samples
M = mean of x (salt content, %)

Philippine Agricultural Engineering Standards

AMTEC-UPLB – PCARRD Project: "Development of Standards for Agricultural Production and Postharvest Machinery"

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