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**PHILIPPINE AGRICULTURAL ENGINEERING STANDARD      PAES 532:2012**  
**Slaughterhouse Equipment – Poultry Defeathering Machine – Methods of Test**

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## **Foreword**

The formulation of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Development of Technical Standards for Poultry Dressing/Slaughtering Plant” which was funded by the Department of Agriculture – National Meat Inspection Services (DA-NMIS).

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:

PAES 020:2005    General – Metrication Guidelines

PAES 509:2007      Slaughterhouse Equipment – Defeathering Machine – Methods of  
Test

Sams, Alan R. *Poultry meat processing*. Department of Poultry Science, Texas A&M University. CRC Press. 2001

Mead, G.C. 2004.*Poultry meat processing and quality*. Woodhead Publishing in Food Science and Technology. Woodhead Publishing Limited. Cambridge England

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## **1 Scope**

This standard specifies the methods of test and inspection for defeathering machine with rubberized fingers for poultry animals such chicken, geese, turkeys, ducks, ostriches, and others. Specifically, it shall be used to:

- 1.1** verify the mechanism, dimensions, materials, installation, accessories of the defeathering machine and the list of specifications submitted by the Manufacturer;
- 1.2** determine the performance of the device/equipment;
- 1.3** evaluate the ease of operation and safety features;
- 1.4** report the results of the tests

## **2 References**

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

<b>PAES 102:2000</b>	Agricultural Machinery – Operator’s Manual – Content and Presentation
<b>PAES 411:2000</b>	Agricultural Structures – Slaughterhouse for Swine, Small and Large Animals – General Requirements
<b>PAES 531:2012</b>	Slaughterhouse Equipment – Poultry Defeathering Machine – Specifications

## **3 Definitions**

For the purpose of this standard, the definitions given in PAES 531 and the following shall apply:

### **3.1**

#### **feather density**

number of feathers at a given area, expressed in feathers per square centimeter

### **3.2**

#### **defeathering rate**

number of poultry animals defeathered at a given time, expressed in poultry animals per hour

**3.3****defeathering efficacy**

measures the quality of the carcasses after defeathering

**3.4****defeathering efficiency**

ratio of amount of feathers removed and the total amount of poultry feathers, expressed in percent

**4 General Conditions for Test and Inspection****4.1 Role of manufacturer/dealer**

The manufacturer shall submit the operator's manual for defeathering machine conforming to PAES 102 and shall abide with the terms and conditions set forth by the official testing agency.

**4.2 Role of the operator**

An officially designated operator shall be skilled and shall be able to demonstrate, operate, adjust and repair as the case may be related to the operation of the equipment.

**4.3 Test site conditions**

The defeathering machine shall be tested on site. The site should have ample provisions for material handling, temporary storage and workspace conforming to PAES 411.

**4.4 Test instruments**

The instruments to be used shall be calibrated and checked by testing agency prior to the conduct of testing. The suggested list of test instruments and materials needed to carry out the defeathering machine test is shown in Annex A.

**4.5 Test materials**

Test materials to be used shall be of the same specie. There shall be at least thirty (30) test materials to conduct the test. For ostrich, one (1) or more test materials shall be used.

**4.6 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 technical data and information of the Manufacturer**

**5.1.1** This inspection is carried out to verify the mechanisms, dimensions, materials, and accessories of the defeathering machine in comparison with the list of technical data and information of the Manufacturer. The items to be inspected and verified shall be recorded in Annex B.

### **5.2 Condition of test material**

Initial data of the poultry animals shall be obtained prior to testing of the defeathering machine. Data shall be recorded in Annex C.

### **5.3 Performance test**

**5.3.1** This is carried out to obtain actual data on overall performance of defeathering machine.

**5.3.2** Initial data of the poultry animal's conditions such as feathers covering density and scalding condition shall be recorded.

**5.3.3** Visual inspection shall be made on the welded parts of the defeathering machine and shall be recorded in Annex C.3.

### **5.3.4 Operation of the Defeathering machine**

**5.3.4.1** The defeathering machine shall be operated at the recommended settings of the manufacturers. After each test run, the defeathering machine and the area shall be cleaned for the next trial.

**5.3.4.2** Defeathering machine shall be turned on for the plucking process. For horizontal defeathering machine, the distance between the rubber spine assemblies shall be adjusted depending on the size of poultry animal to be defeathered.

**5.3.4.3** Poultry animal shall be loaded to the defeathering machine (vertical defeathering machine) or shall be moved using overhead railing to the defeathering station (for horizontal defeathering machine).

**5.3.4.4** Water shall be sprayed on poultry animal during defeathering to clean the poultry animals and defeathering machine.

**5.3.4.5** Speed of prime mover and defeathering shaft with and without load shall be measured and recorded in Annex C.

### **5.3.5 Defeathering Efficiency**

**5.3.5.1** The condition of the scalded poultry animals shall be recorded. The initial weight of the poultry animal before defeathering shall be taken.

**5.3.5.2** After defeathering, conditions of the poultry animal's skin shall be carefully examined and noted for presence of feathers. Weight of the machine-defeathered poultry animal shall be taken.

**5.3.5.3** The remaining feathers shall be manually plucked. The weight of totally defeathered carcass shall be taken.

**5.3.5.4** All the data obtained shall be recorded in Annex C and the defeathering efficiency shall be computed using the equations in Annex D.

### **5.3.6 Defeathering Efficacy**

**5.3.6.1** The scalding condition of the test materials shall be noted and recorded before defeathering.

**5.3.6.2** After defeathering, physical appearances listed in Table 1 shall be observed on the carcass. The corresponding percent damage for each physical appearance shall also be noted and recorded.

**Table 1. Classes and percent damages of carcass physical appearance after defeathering**

<b>Class</b>	<b>Descriptions</b>	<b>Percent Efficacy, %</b>
A	Clean without bruises or hematoma	100
B.1	Slight hematoma	95
B.2	Slight bruises and cuts	90
C	With severe hematoma and broken and cut parts	85

**5.3.6.3** All the data obtained shall be recorded in Annex C.

### **5.3.7 Duration of test**

The duration of each test trial shall start with the loading of the scalded poultry animals into the defeathering machine and ends after unloading the defeathered poultry animals. The time obtained shall be recorded as defeathering time.

### **5.4 Speed of Components and Power Consumption**

The speed of the rotating shafts of the defeathering machine's components shall be measured using a tachometer. Power meter shall be used in measuring the power consumption. The measurement for both speed and power shall be done with and without load. The data obtained shall be recorded in Annex C.

### **5.5 Test trials**

There shall be at least three (3) test trials with ten (10) poultry animals per trial. For ostrich, one (1) test trial shall be used.

## **6 Formula**

The formula to be used during calculations and testing shall be given in Annex D.

## **7 Test Report**

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

**7.1** Title

**7.2** Summary

**7.3** Purpose and Scope of Test

**7.4** Methods of Test

**7.5** Description of the Equipment

Table 1 – Equipment Specifications

**7.6** Results and Discussions

**7.7** Observations (include pictures)

Table 2 – Performance test data

**7.8** Name(s), signature(s) and designation of test engineer(s)

## Annex A

Suggested List of  
Test Instruments and Materials

<b>A.1</b>	<b>Test Poultry Animal Characteristics</b>	<b>Quantity</b>
<b>A.1.1</b>	digital weighing scale: 20 kg capacity and 0.001g accuracy	1
<b>A.1.2</b>	tape measure	1
<b>A.2</b>	<b>Defeathering machine Characteristics</b>	
<b>A.2.1</b>	steel tape	1
<b>A.2.2</b>	weighing scale, capacity: 1000 kg	1
<b>A.2.3</b>	vernier caliper: 0.05 mm accuracy, 200 mm length	1
<b>A.3</b>	<b>Speed</b>	
	tachometer (contact type or photo electric type) range: 0 rpm to 5,000 rpm	1
<b>A.4</b>	<b>Power</b>	
	power meter (for electric motor) 60 Hz, 220V	1
<b>A.5</b>	<b>Calculations</b>	
	scientific calculator	1
<b>A.6</b>	<b>Time</b>	
	digital timer (range: 60 minutes)	1
	Accuracy: 0.1 second	
<b>A.7</b>	<b>Labelling</b>	
	permanent marker	1



## Annex B

### Specifications of Defeathering Machine

Name of Applicant/Distributor: \_\_\_\_\_

Address: \_\_\_\_\_

Tel No: \_\_\_\_\_

Name of Manufacturer: \_\_\_\_\_

Address: \_\_\_\_\_

Tel No: \_\_\_\_\_

#### General Information

Classification: \_\_\_\_\_

Serial No: \_\_\_\_\_ Type: \_\_\_\_\_

Testing Agency: \_\_\_\_\_ Test Engineer: \_\_\_\_\_

Date of Test: \_\_\_\_\_ Location of Test: \_\_\_\_\_

#### Items to be inspected

ITEMS	Manufacturer's Specification	Verification by the Testing Agency
<b>B.1 Defeathering machine</b>		
<b>B.1.1</b> Type		
<b>B.1.2</b> Overall dimensions, mm		
<b>B.1.2.1</b> diameter (if vertical)		
<b>B.1.2.2</b> length (if horizontal)		
<b>B.1.2.3</b> width (if horizontal)		
<b>B.1.2.2</b> height		
<b>B.1.2.3</b> thickness		
<b>B.1.2.4</b> weight, kg		
<b>B.1.3</b> Materials of constructions		
<b>B.1.4</b> Defeathering device		
<b>B.1.4.1</b> Materials of constructions		
<b>B.1.4.2</b> Dimensions, mm		
<b>B.1.4.2.1</b> length		
<b>B.1.4.2.2</b> diameter of head		
<b>B.1.4.3</b> Number of spines/fingers		
<b>B.1.4.4</b> Arrangements (describe)		
<b>B.1.4.5</b> Hardness		
<b>B.1.5</b> Defeathering shaft		
<b>B.1.5.1</b> Dimensions, mm		
<b>B.1.5.1.1</b> length		
<b>B.1.5.1.2</b> diameter		
<b>B.1.5.2</b> Material of constructions		
<b>B.1.6</b> Prime mover		
<b>B.1.6.1</b> Position		
<b>B.1.6.2</b> Type		
<b>B.1.6.2</b> Rated speed, rpm		
<b>B.1.6.3</b> Rated power, kW		

<b>B.1.7</b> Main frame		
<b>B.1.7.1</b> Material of constructions		
<b>B.1.7.2</b> Dimensions		
<b>B.1.7.2.1</b> length		
<b>B.1.7.2.2</b> height		
<b>B.1.7.2.3</b> width		
<b>B.1.7.2.4</b> thickness		
<b>B.1.8</b> Water source		
<b>B.1.8.1</b> Type		
<b>B.1.8.2</b> Position		
<b>B.1.9</b> Collecting pan for feathers (if available)		
<b>B.1.9.1</b> Material of constructions		
<b>B.1.9.2</b> Dimensions, mm		
<b>B.1.9.2.1</b> length		
<b>B.1.9.2.2</b> width or diameter		
<b>B.1.9.2.3</b> height		
<b>B.2 Other Observations</b>		
<b>B.2.1</b> Safety features:		
<b>B.2.2</b> Others, specify:		

<b>B.3 Welding Acceptance test</b>				
<b>B.3.1</b> Crack prohibition				
<b>B.3.2</b> Weld/base-metal fusion				
<b>B.3.3</b> Crater cross section				
<b>B.3.4</b> Weld profile				
<b>B.3.5</b> Time of inspection				
<b>B.3.6</b> Undersize welds (if any)				
<b>B.3.7</b> Undercut				
<b>B.3.8</b> Porosity (presence of air holes on the welded part)				

## Annex C

## Performance Test Data Sheet

Test Engineer: \_\_\_\_\_ Date: \_\_\_\_\_  
 Assistants: \_\_\_\_\_ Location: \_\_\_\_\_  
 Test Location: \_\_\_\_\_  
 Test Requested by: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_

	Trial			Average
	1	2	3	
<b>C.1 Information on the Test Materials</b>				
C.1.1 Type				
<b>C.2 Speed of Components, rpm</b>				
C.2.1 Prime mover				
C.2.1.1 without load				
C.2.1.2 with load				
C.2.2 Defeathering shaft				
C.2.2.1 without load				
C.2.2.2 with load				
<b>C.3 Power Consumption, kW</b>				
C.3.1 without load				
C.3.2 with load				
<b>C.4 Voltage, V</b>				
C.4.1 without load				
C.4.2 with load				
<b>C.5 Current, A</b>				
C.5.1 without load				
C.5.2 with load				
<b>C.6 Fuel Consumption, L/h</b>				
C.6.1 Engine operating time, h				
C.6.2 Fuel consumed, L				

<b>C.7 Observation before and after defeathering</b>	<b>Remarks/Observations</b>
C.7.1 Ease of loading	
C.7.2 Ease of cleaning parts	
C.7.3 Ease of adjusting, repair and replacement of parts	
C.7.4 Ease of collecting output	
C.7.5 Safety	

**C.8 Defeathering Efficacy and Efficiency**

ITEMS											Average
	1	2	3	4	5	6	7	8	9	10	
<b>C.8.1</b> Before defeathering											
<b>C.8.1.1</b> Initial weight, g											
<b>C.8.2</b> After defeathering											
<b>C.8.2.1</b> Weight of machine defeathered poultry animal, g											
<b>C.8.2.2</b> Weight of totally defeathered carcass, g											
<b>C.8.2.3</b> Weight of feathers removed during defeathering, g											
<b>C.8.2.4</b> Total weight of feathers, g											
<b>C.8.3</b> Total percent damage (bruises, blisters, broken bones, ruptured skins), %											
<b>C.8.4</b> Defeathering time, s											
<b>C.8.5</b> Defeathering rate, poultry animal/h											
<b>C.8.6</b> Defeathering efficacy, % (base on class in Table 1)											
<b>C.8.7</b> Defeathering efficiency, %											

**C.9 Other Observations:**


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## Annex D

### Formula Used During Calculations and Testing

#### D.1 Defeathering Rate

$$D_r = \frac{N_D}{T_t}$$

where:

$D_r$	=	defeathering rate, poultry animals/h
$N_D$	=	number of poultry animals defeathered
$A_T$	=	total time, h

#### D.2 Feather Weight Plucked

$$W_{PF} = W_{bd} - W_{ad}$$

where:

$W_{PF}$	=	total weight of feathers plucked during defeathering, g
$W_{bd}$	=	initial weight of poultry animal before defeathering, g
$W_{ad}$	=	final weight of poultry animal after machine defeathering, g

#### D.3 Total Feather Weight Unplucked

$$W_{UF} = W_{bd} - W_{amd}$$

where:

$W_{UF}$	=	total weight of feathers unplucked after machine defeathering, g
$W_{bd}$	=	initial weight of poultry animal before defeathering, g
$W_{amd}$	=	final weight of poultry animal after manual defeathering, g

#### D.4 Total Feather Weight

$$W_T = W_{PF} + W_{UF}$$

where:

$W_T$	=	total weight of feathers, g
$W_{PF}$	=	total weight of feathers plucked during defeathering, g
$W_{UF}$	=	total weight of feathers unplucked after machine defeathering, g

**D.5 Defeathering Efficiency**

$$Eff_d = \frac{W_{PF}}{W_T} \times 100\%$$

where:

$Eff_d$	=	defeathering efficiency, %
$W_{PF}$	=	weight of feathers plucked during defeathering, g
$W_T$	=	total weight of feathers, g