

## **Foreword**

The pursuance of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Development of Standards for Slaughterhouse Equipment (for hogs)” which was funded by the Department of Agriculture - National Meat Inspection Services (DA-NMIS).

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:

Baumeister, T., E.A. Avallone and T. Baumeister III. 1978. *Marks’ Standard Handbook for Mechanical Engineers*. 8<sup>th</sup> ed. McGraw- Hill, Inc.

National Meat Inspection Commission. Guidelines on Meat Hygiene, Inspection and Preservation and Meat Inspection Regulations. January 1977.

Bernstein, Robert M. and William R. Rassman. Densitometry and Video-microscopy. International Society of Hair Restoration Surgery. Hair Transplant Forum International. March/April 2007, 17(2): 41, 49-51. <http://www.bernsteinmedical.com/resources/hair-transplant-evaluation.php>

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## **1 Scope**

This standard specifies the methods of test and inspection for dehairing machine used in the slaughtering of hog. Specifically, it shall be used to:

- 1.1** verify the mechanism, dimensions, materials, accessories of the dehairing machine and the list of specifications submitted by the fabricator;
- 1.2** determine the performance of the machine;
- 1.3** evaluate the ease of handling and safety features;
- 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 these standards:

PAES 507:2007 Slaughterhouse Equipment – Dehairing Machine - Specifications

PAES 505:2007 Slaughterhouse Equipment – Hog Scalder - Specifications

## **3 Definitions**

For the purpose of this standard, the definitions given in PAES 507 and the following shall apply

### **3.1**

#### **dehairing rate**

number of hogs dehaired per unit time, expressed in heads per hour

### **3.2**

#### **dehairing time**

actual time of dehairing a single hog, expressed in seconds

### **3.3**

#### **discharge height**

measurement of the highest position of the J-bar during loading from the base of the machine

### **3.4**

#### **effective dehairing height**

measurement of the bottom of the J-bar's holding chamber from the base of the dehairing machine

### **3.5**

#### **effective dehairing width**

actual width of the dehairing mechanism measured from both end sides of dehairing paddle parallel to the dehairing shaft

### **3.6**

#### **evisceration**

removal of the internal organs or entrails of an animal

### **3.7**

#### **gambreling table**

table used before suspending the carcass for particular operation

### **3.8**

#### **hair density**

number of hair present per unit area, expressed in hair per square centimeter

### **3.9**

#### **live weight**

weight of the hog prior to slaughter

### **3.10**

#### **overall height**

measurement from the topmost point to the base of the machine

### **3.11**

#### **overall length**

measurement from both sides of the dehairing machine parallel to the discharge side including the protruding parts such as the J-bar lever, motor, etc.

### **3.12**

#### **overall width**

measurement of the receiving side of the J-bar to the discharge side in its normal position

### **3.13**

#### **receiving height**

measurement of the maximum height of the J-bar, in receiving position, from the base of the machine

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

### **4.1 Role of fabricator/dealer**

The fabricator/dealer shall submit specifications and other relevant information about the dehairing machine and shall abide with the terms and conditions set forth by an official testing agency.

### **4.2 Role of the operator of the fabricator/dealer**

An officially designated operator of the fabricator/dealer shall operate, adjust, repair, and shall decide on matters related to the operation of the machine.

### **4.3 Test site conditions**

The dehairing machine shall be tested as installed in the slaughterhouse.

### **4.4 Test instruments**

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

### **4.5 Test materials**

Test materials to be used shall be properly scalded hog with the following characteristics:

#### **4.5.1 Test material characteristics**

**4.5.1.1 Breed** : locally raised hog (as much as possible single breed and age)

**4.5.1.2 Weight** : weight capacity as specified by the fabricator (70 – 120 kg; 121 – above)

**4.5.1.3 Condition** : properly scalded

### **4.6 Quantity to be supplied**

The live weight of the hogs that will be used in performing the test shall depend on the fabricator's specified minimum and maximum dehairing capability, expressed in kilograms. At least three (3) hogs with live weight that falls in the minimum limit and at least three (3) with live weight falling in the maximum limit shall be used. The operator shall be skilled to perform the test.

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

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

## **4.8 Termination of test**

If during the test run, the machine encounters major component breakdown or malfunctions, the test engineer shall terminate the test.

## **5 Test and Inspection**

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

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

**5.1.2** 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 machine performance.

**5.2.2** Initial data of the hog's conditions such as hair covering density and scalding condition shall be recorded.

**5.2.3** Test materials to be used

Test materials shall be in accordance to sections 4.5 and 4.6.

**5.2.4** Operation of the dehairing machine

The dehairing machine shall be operated at the recommended settings of the fabricator. After the test run, the dehairing machine area shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials.

**5.2.4.1** Dehairing machine is turned on and prepared for loading.

**5.2.4.2** Immediately after scalding, the hog is unloaded from the scalding vat using the unloading cradle.

**5.2.4.3** The "J"- bar assembly receives the hog by tilting the assembly using the lever with counter weight located at the side of the machine.

**5.2.4.4** After receiving the hog, lever is released allowing the hog to enter the dehairing chamber for twelve (12) to fifteen (15) seconds until at least 95% of the hair is removed. (peripheral speed)

**5.2.4.5** Hog is unloaded from the dehairing chamber through the J-bar to the front side of the machine where gambrelling table is located.

**5.2.4.6** Dehaired hog shall be checked for presence of hair using densitometer especially on areas where markings are made.

**5.2.4.7** Observations shall be recorded in annex C.

**5.2.5** Test trial

There shall be at least three (3) trials for each set of weight capacity.

**5.2.6** Data collection

**5.2.6.1** Duration of test

The duration of each test trial shall start with the loading of the a scalded hog into the dehairing chamber and ends after unloading the dehaired hog to the gambrelling table and shall be recorded as dehairing time.

**5.2.6.3** Noise level

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

**5.2.6.4** Speed of components

The speed of the rotating shafts of the major components of the dehairing machine shall be taken using a tachometer.

**NOTE** Measurements shall be taken with and without load for sub-clauses 5.2.6.3 and 5.2.6.4.

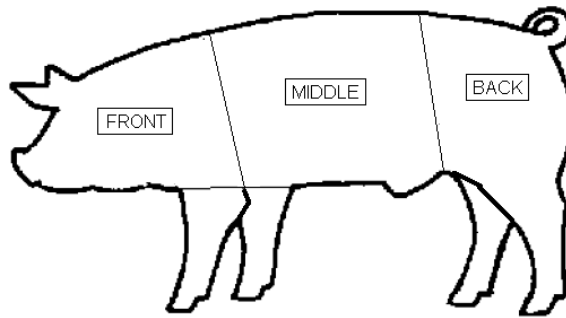
**5.2.6.5** Power consumption

An electric motor is used as the primemover, a power meter shall be used to measure electric energy consumption.

**5.2.7** Sampling and sample handling

**5.2.7.1** Sampling for test materials

The conditions of the test materials such as scalding, skin condition and hair density shall be taken. For an unbiased assessment, hog's surface will be subdivided into three partitions: the front area, from the hog's snout up to the shoulder and fore leg; the middle area, the body of the hog up to the loin and belly area; and the back area, ham leg to the tail and the posterior leg (see Figure 1). Three representative samples (10 cm x 10 cm) from each three areas of the hog's surface will be randomly selected and marked prior to final assessment.



**Figure 1. Hog's partition prior to dehairing process.**

#### **5.2.7.2 Sampling from discharge chamber**

During each test trial, conditions of the hog's surface will be carefully examined in terms of the presence of hair. Final hair density will be counted and recorded in tables.

#### **5.2.7.3 Data recording and observations**

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

### **6 Formula**

The formulas to be used during calculations and testing are 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 Machine

Table 1 – Machine Specifications

**7.6** Results and Discussions

**7.7** Observations (include pictures)

Table 2 –Performance test data

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



**Annex A**  
(informative)

**Minimum List of Field  
Test Equipment and Materials**

<b>A.1</b>	<b>Equipment</b>	<b>Quantity</b>
<b>A.1.1</b>	<b>Field</b>	
<b>A.1.1.2</b>	Tachometer (contact type or photo electric type) Range: 0 rpm to 5,000 rpm	1
<b>A.1.1.3</b>	Digital timers (range: 60 minutes) Accuracy: 0.1 sec	2
<b>A.1.1.4</b>	Tape measure (with maximum length of 5m)	1
<b>A.1.1.5</b>	Caliper	
<b>A.1.1.6</b>	Noise level meter Range: 30 dB (A) to 130 dB (A)	1
<b>A.1.1.7</b>	Weighing scale (capacity: 1000 kg) Scale divisions: 500 g	1
<b>A.1.1.9</b>	Power meter (for electric motors) 60 Hz, 220 V	1
<b>A.1.1.9</b>	Camera	1
<b>A.1.1.10</b>	Densitometer	1
<b>A.1.1.11</b>	Handheld vibration meter	1
<b>A.2</b>	<b>Materials</b>	
<b>A.2.1</b>	Labeling tags which include	20
<b>A.2.1.1</b>	Date of test	
<b>A.2.1.2</b>	Dehairing machine test	
<b>A.2.1.3</b>	Live hogs	
<b>A.2.1.3.1</b>	Age	
<b>A.2.1.3.2</b>	Breed	
<b>A.2.1.3.3</b>	Live weight, kg	
<b>A.2.1.3.4</b>	Sex	
<b>A.2.1.3.5</b>	Trial number	
<b>A.2.2</b>	Water Bath	
<b>A.2.3</b>	Permanent marking pen	1

**Annex B**  
(informative)

**Specifications of Dehairing Machine**

Name of Applicant/ Distributor: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Tel No: \_\_\_\_\_  
 Name of Fabricator: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Tel No: \_\_\_\_\_

**GENERAL INFORMATION**

Classification: \_\_\_\_\_  
 Serial No: \_\_\_\_\_ Brand/Model: \_\_\_\_\_  
 Production date of dehairing machine to be tested: \_\_\_\_\_  
 Testing Agency: \_\_\_\_\_ Test Engineer: \_\_\_\_\_  
 Date of Test: \_\_\_\_\_ Location of Test: \_\_\_\_\_

**Items to be inspected**

ITEMS	Fabricator's Specification	Verification by the Testing agency
<b>B.1 Main structure</b>		
<b>B.1.1 Overall dimensions, mm</b>		
<b>B.1.1.1 length</b>		
<b>B.1.1.2 width</b>		
<b>B.1.1.3 height</b>		
<b>B.1.2 Weight, without engine (kg), if Applicable</b>		
<b>B.2 Power Transmission</b>		
<b>B.2.1 Pulley</b>		
<b>B.2.1.1 Primemover</b>		
<b>B.2.1.1.1 Type</b>		
<b>B.2.1.1.2 Dimension, mm</b>		
<b>B.2.1.2 Speed Reducer Input Shaft</b>		
<b>B.2.1.2.1 Type</b>		
<b>B.2.1.2.2 Dimension, mm</b>		
<b>B.2.2 Sprocket</b>		
<b>B.2.2.1 Speed Reducer Output Shaft</b>		
<b>B.2.2.1.1 Diameter, mm</b>		
<b>B.2.2.1.2 No. of teeth</b>		
<b>B.2.2.2 Dehairing Shaft</b>		
<b>B.2.2.2.1 Diameter, mm</b>		
<b>B.2.2.2.2 No. of teeth</b>		
<b>B.3 Dehairing chamber</b>		
<b>B.3.1 Dehairing Shaft</b>		
<b>B.3.1.1 Effective width, mm</b>		
<b>B.3.1.2 Effective length, mm</b>		
<b>B.3.1.3 Type</b>		

ITEMS	Fabricator's Specification	Verification by the Testing agency
B.3.1.4 Length, mm		
B.3.1.5 Diameter, mm		
B.3.1.6 Material		
B.3.2 "J" - bar		
B.3.2.1. Receiving height, mm		
B.3.2.2. Discharge height, mm		
B.3.2.3. No. of bars		
B.3.2.4. Bar spacing		
B.3.2.5. Bar thickness		
B.3.2.6. Material		
B.3.2.7. Counter weight		
B.3.2.7.1. No. of counter weights		
B.3.2.7.2. Location(s)		
B.3.3 Scraper paddle		
B.3.3.1. Brand		
B.3.3.2. Material		
B.3.3.3. Length		
B.3.3.4. Width		
B.3.3.5. Thickness		
B.3.3.6. Color		
B.3.3.7. No. of paddles		
B.3.4 Scraper blade		
B.3.4.1. Brand		
B.3.4.2. No. of blades per paddle		
B.3.4.3. Material		
B.3.4.4. Length		
B.3.4.5. Width		
B.3.4.6. Thickness		
B.3.4.7. Curvature (degree)		
B.3.5 Star Wheel (If present)		
B.3.5.1. Brand		
B.3.5.2. Material		
B.3.5.3. Width		
B.3.5.4. Thickness		
B.3.5.5. Wheel diameter		
B.3.5.6. No. of paddle attachments		
B.4. Main Frame		
B.4.1. Material		
B.5. Prime mover		
B.5.1. Electric motor		
B.5.1.1. Brand		
B.5.1.2. Fabricator		
B.5.1.3. Serial No.		
B.5.1.4. Type		
B.5.1.5. Rated Power, kW		
B.5.1.6. Rated Speed, rpm		

ITEMS	Fabricator's Specification	Verification by the Testing agency
B.5.1.7. Frequency, Hz		
B.5.1.8. Voltage		
<b>B.5.2. Engine</b>		
B.5.2.1. Brand		
B.5.2.2. Model		
B.5.2.3. Make or fabricator		
B.5.2.4. Serial No.		
B.5.2.5. Type		
B.5.2.6. Rated Power, kW		
B.5.2.7. Rated Speed, rpm		
B.5.2.8. Displacement (cm <sup>3</sup> )		
B.5.2.9. Cooling system		
B.5.2.10. Starting system		
B.5.3. Shower (if present)		
B.5.4. Cover		
B.5.5. Collecting pan		

**Annex C**  
(informative)

**Performance Test Data Sheet**

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

<b>C.1 Information on the Test Materials</b>				
<b>C.1.1.</b> Animal				
<b>C.1.2.</b> Breed				
<b>C.1.3.</b> Weight, kg				
<b>C.1.4.</b> Length, mm				
<b>C.1.5.</b> Perimeter, mm				
<b>C.1.6.</b> Condition				
<b>C.1.7.</b> Hair color				
<b>C.2 Result of Performance Test</b>				
ITEMS	Trial 1	Trial 2	Trial 3	Ave.
<b>C.2.1</b> Speed of Components, rpm				
<b>C.2.1.1</b> Electric Motor				
<b>C.2.1.1.1</b> Without load				
<b>C.2.1.1.2</b> With load				
<b>C.2.1.2</b> Reducer Shaft				
<b>C.2.1.2.1</b> Without load				
<b>C.2.1.2.2</b> With load				
<b>C.2.1.3</b> Dehairing Shaft				
<b>C.2.1.3.1</b> Without load				
<b>C.2.1.3.2</b> With load				
<b>C.2.2</b> Noise Level, dB(A)				
<b>C.2.2.1</b> Without load				
<b>C.2.2.2</b> With load				
<b>C.2.3</b> Power Consumption				
<b>C.2.3.1</b> Power, kW				
<b>C.2.3.1.1</b> Without load				
<b>C.2.3.1.2</b> With load				
<b>C.2.3.2</b> Voltage, V				
<b>C.2.3.2.1</b> Without load				
<b>C.2.3.2.2</b> With load				
<b>C.2.3.3</b> Current, A				
<b>C.2.3.3.1</b> Without load				
<b>C.2.3.3.2</b> With load				
<b>C.2.4</b> Fuel consumption				
<b>C.2.4.1</b> Fuel time, h				
<b>C.2.4.2</b> Fuel consumed, L				

**C.3 Dehairing performance**

Items	Front			Middle			Back			Ave
	1	2	3	1	2	3	1	2	3	
<b>C.3.1 Before dehairing</b>										
<b>C.3.1.1</b> Hair count										
<b>C.3.1.2</b> Hair density, hair/cm <sup>2</sup>										
<b>C.3.2 After dehairing</b>										
<b>C.3.2.1</b> Hair count										
<b>C.3.2.2</b> Hair density, hair/cm <sup>2</sup>										
<b>C.3.3</b> Total no. of bruises										
<b>C.3.4</b> Dehairing time, sec.										
<b>C.3.5</b> Dehairing rate, hogs/hr.										
<b>C.3.6</b> Dehairing efficiency, %.										
<b>C.3.7</b> Peripheral speed, m/sec										

**C.4 Rate the following observations:**

Items	Rating*				
	1	2	3	4	5
<b>C.4.1</b> Ease of loading					
<b>C.4.2</b> Ease of cleaning parts					
<b>C.4.3</b> Ease of adjusting and repair of parts					
<b>C.4.4</b> Ease of collecting output					
<b>C.4.5</b> Safety					
<b>C.4.6</b>					

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

**C.5 Other observations:**

**C.5.1**

ITEMS	Trial 1	Trial 2	Trial 3	Ave.
Vibration, db				

**C.5.2 Other observations not specified in C.5.1**

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**Annex D**  
(informative)

**Formula Used During Calculations and Testing**

**D.1 Hair density**

$$d_h = \frac{H}{A_t}$$

Where:

$d_h$	=	Hair density, hair/cm <sup>2</sup>
$H$	=	total number of hairs
$A_t$	=	Total area, cm <sup>2</sup>

**D.2 Dehairing rate**

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

Where:

$D_r$	=	Dehairing rate, hogs/h
$N_D$	=	Number of hogs dehaired, heads
$T_t$	=	Total time, h

**D.3 Dehairing efficiency, %**

$$Eff = \frac{d_{h(before)} - d_{h(after)}}{d_{h(before)}} \times 100$$

**D.4 Percent undehaired**

$$\% \text{ Undehaired} = 100 - Eff$$

**D.5 Peripheral speed**

$$Speed_p = \frac{2\pi \times (\phi_s + \phi_{sw} + L_p) \times N_s}{60\,000}$$

Where:

$Speed_p$	=	Peripheral speed, m/s
$\phi_s$	=	Diameter of dehairing shaft, mm
$\phi_{sw}$	=	Diameter of star wheel, mm (if present)
$L_p$	=	Length of paddle, mm
$N_s$	=	Angular speed of dehairing shaft, rpm

## D.6 Electrical energy consumption

$$E_c = P_c T_o$$

Where

$E_c$	=	Electrical energy consumption, kW-h
$P_c$	=	Power consumed, kW
$T_o$	=	Time of operation, h