

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

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 chilling tank for poultry animals such as chicken, geese, turkeys, ducks, ostriches, and others. Specifically, it shall be used to:

- 1.1** verify the mechanism, dimensions, materials, installation, accessories of the chilling tank 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:

PAES 102:2000	Agricultural Machinery – Operator’s Manual – Content and Presentation
PAES 411:2000	Agricultural Structures – Slaughterhouse for Swine, Small and Large Animals – General Requirements
PAES 533:2012	Slaughterhouse Equipment – Poultry Chilling tank – Specifications

3 Definitions

For the purpose of this standard, the definitions given in PAES 533 and the following shall apply:

3.1

chilling efficacy

measures the ability of the chilling tank to lower the temperature and make the temperature at any area in carcasses equal

3.2

chilling tank capacity

total number of carcasses that can undergo chilling per unit time, expressed in carcass per hour

3.3

chilling tank efficiency

measures the ability of the chilling tank to maintain consistent and equal water temperature at any point before and during the chilling

3.4

coefficient of variation

statistical representation of the precision of distribution of temperature in the chilling tank and carcasses

4 General Conditions for Test and Inspection

4.1 Role of manufacturer/dealer

The manufacturer shall submit the operator's manual for chilling tank 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 chilling tank 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 chilling tank test is shown in Annex A.

4.5 Test materials

Test materials to be used shall be of the same species. 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

This inspection is carried out to verify the mechanisms, dimensions, materials, and accessories of the chilling tank 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 carcasses shall be obtained prior to testing of the chilling tank. 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 chilling tank.

5.3.2 Initial data of the carcasses' conditions such as weight and initial temperature shall be recorded.

5.3.3 Visual inspection shall be made on the welded parts of the chilling tank and shall be recorded in Annex C.3.

5.3.4 Operation of the chilling tank

5.3.4.1 Before loading to the chilling tank, the carcass shall be placed in the pre-chilling tank (if available) with the temperature of 12 °C to 16 °C for 10 min to 15 min.

5.3.4.2 After pre-chilling, the cold carcass shall be loaded in the chilling section having temperature range and duration shown in Table 1.

Table 1. Recommended water temperature and chilling time for different weight of carcass

Weight of Carcass, kg	Temperature, °C	Maximum Time, h
Less than 2	0-4	4
2-4	0-4	6
More than 4	0-4	8

Source: United State Department of Agriculture

5.3.4.3 Speed of rotating parts of the chilling tank (if any) with and without load shall be measured and recorded in Annex C.

5.3.4.4 After chilling, the poultry animals shall be hung and shackled to the overhead rails to be drained completely.

5.3.5 Chilling Efficacy

5.3.5.1 The weight of the test materials shall be taken and recorded. The breast part of the carcass shall be divided into eight (8) sections as shown Figure 1. Each section shall be observed and shall be tested after exposure to chilling tank simultaneously.

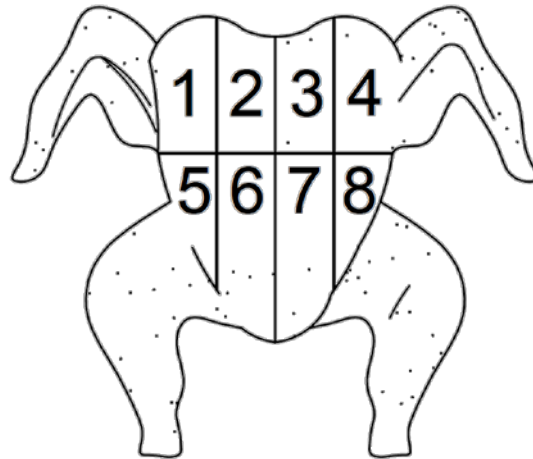


Figure 1. Sectioning of carcass

5.3.5.2 After each test trial, temperature of the carcass skin shall be measured at inner portion of the carcass (at least 1 cm depth) for each section. Data obtained shall be recorded in Annex C. Chilling efficacy shall be computed using formula in Annex D.

5.3.6 Chilling Efficiency

5.3.6.1 The chilling tank shall be tested for uniformity of temperature distribution.

5.3.6.2 The bottom (installation depth shall be at least $\frac{3}{4}$ of the total water depth with water surface as the reference point) and surface of chilling tank shall be divided into 3 x 3 divisions as shown in Figure 2.

1	2	3
4	5	6
7	8	9

Figure 2. Chilling tank 3 x 3 division

- 5.3.6.3 Temperature at each section shall be measured simultaneously using data logger and thermocouple wires.
- 5.3.6.4 The time to reach the desired temperature for each section shall be recorded.
- 5.3.6.5 The process shall be repeated for chilling tank loaded with carcasses.
- 5.3.6.6 The coefficient of variation for temperature at different section in the chilling tank and chilling efficiency before and during the chilling shall be computed using formula in Annex D.

5.3.7 Duration of test

The duration of each test trial shall start with the loading of the carcasses into the chilling tank and ends after unloading the test materials from the tank. The time obtained shall be recorded as chilling time.

5.4 Speed of Rotating Components and Power Consumption

The speed of the rotating shaft of the mechanical agitator (if provided) 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 carcasses. 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

A.1	Test Carcass Characteristics	Quantity
A.1.1	digital weighing scale, capacity: 20 kg (0.001 g accuracy)	1
A.1.2	tape measure	1
A.1.3	Probe type thermometer (1-100 °C)	1
A.2	Chilling tank Characteristics	
A.2.1	steel tape	1
A.2.2	weighing scale, capacity: 1000 kg (0.1 kg accuracy)	1
A.2.3	vernier caliper: 0.05 mm accuracy, 200 mm length	1
A.3	Speed	
	tachometer (contact type or photo electric type) range: 0 rpm to 5000 rpm	1
A.4	Power	
	power meter (for electric motor) 60 Hz, 220V	1
A.5	Calculations	
	scientific calculator	1
A.6	Time	
	digital timer (range: 60 minutes) Accuracy: 0.1 second	1
A.7	Labelling	
	permanent marker	1
A.8	Temperature reading	
A.8.1	thermocouple wires set	9
A.8.2	data logger	1
A.8.3	temperature gauge, range: 1-100 °C	1
A.8.4	Probe thermometer, range: -40-150 °C	1

Annex B

Specifications of Chilling Tank

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.1 Chilling tank		
B.1.1 Type		
B.1.2 Overall dimensions, mm		
B.1.2.1 length		
B.1.2.2 width		
B.1.2.3 height		
B.1.2.4 thickness		
B.1.2.5 weight, kg		
B.1.3 Materials of construction		
B.1.4 Agitator (if any)		
B.1.4.1 Type		
B.1.4.2 Auger type		
B.1.4.2.1 Materials of construction		
B.1.4.2.2 Dimensions, mm		
B.1.4.2.2.1 length		
B.1.4.2.2.2 diameter		
B.1.4.2.2.3 thickness		
B.1.4.2.3 Speed of shaft, rpm		
B.1.4.3 Air/water hose		
B.1.4.3.1 Materials of construction		
B.1.4.3.2 Dimensions, mm		
B.1.4.3.2.1 diameter of nozzle		
B.1.4.3.2.2 length		
B.1.4.3.3 Number of nozzles		
B.1.4.3.4 Volumetric flowrate of air or water, m ³ /min		
B.1.4.3.5 Arrangements (describe)		

B.1.5 Main frame		
B.1.5.1 Material of construction		
B.1.5.2 Dimensions		
B.1.5.2.1 length		
B.1.5.2.2 height		
B.1.5.2.3 width		
B.1.5.2.4 thickness		
B.2 Other Observations		
B.2.1 Safety features:		
B.2.2 Others, specify:		

B.3 Welding Acceptance test				
B.3.1 Crack prohibition				
B.3.2 Weld/base-metal fusion				
B.3.3 Crater cross section				
B.3.4 Weld profile				
B.3.5 Time of inspection				
B.3.6 Undersize welds (if any)				
B.3.7 Undercut				
B.3.8 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	
C.1 Information on the Test Materials				
C.1.1 Weight, kg				
C.1.2 Initial temperature, °C				
C.2 Speed of Components, rpm				
C.2.1 Prime mover				
C.2.1.1 without load				
C.2.1.2 with load				
C.2.2 Auger shaft				
C.2.2.1 without load				
C.2.2.2 with load				
C.3 Power Consumption, kW				
C.3.1 without load				
C.3.2 with load				
C.4 Voltage, V				
C.4.1 without load				
C.4.2 with load				
C.5 Current, A				
C.5.1 without load				
C.5.2 with load				
C.6 Fuel Consumption, L/h				
C.6.1 Engine operating time, h				
C.6.2 Fuel consumed, L				

C.7 Observation before and chilling	Remarks/Observations
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.7.6 Before operation	
C.7.6.1 water leakage	
C.7.6.2 ineffective draining	
C.7.7 After operation	

C.7.7.1 loosened fittings	
C.7.7.2 water leakage	
C.7.8 Other observations (describe):	

C.8 Chilling Efficacy

ITEMS	Right					Left					Average	
	1	2	3	4	5	1	2	3	4	5		
C.8.1 Before Chilling												
C.8.1.1 Temperature, °C												
C.8.1.2 Weight, kg												
C.8.2 After Chilling												
C.8.2.1 Temperature, °C												
C.8.2.2 Weight, kg												
C.8.4 Chilling time, s												
C.8.5 Chilling capacity, poultry animal/h												
C.8.6 Coefficient of variation of temperature of the tank, %												
C.8.6 Chilling efficacy, %												

C.9 Chilling Efficiency before and during chilling

ITEMS	1	2	3	4	5	6	7	8	9	Average
C.9.1 Before										
C.9.1.1 temperature reading, °C										
C.9.1.2 time to reach chilling temperature, mins										
C.9.2 During										
C.9.2.1 temperature reading, °C										
C.9.2.2 time to reach chilling temperature, mins										

C.9 Other Observations:

Annex D

Formula Used During Calculations and Testing

D.1 Chilling Tank Capacity

$$C = \frac{P}{T}$$

where:

C	=	capacity of chilling tank, carcasses per hour
P	=	number of carcasses that was held in the chilling tank
T	=	dumping time, hours

D.2 Coefficient of Variation for Temperature at Different Point in the Carcass

$$CV_{PC} = \frac{s}{M}$$

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

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

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

where:

CV_{PC}	=	coefficient of variation of temperatures of carcass
s	=	standard deviation
s^2	=	variance
x_j	=	individual sample
n	=	total number of samples
M	=	mean of x (temperature)

D.3 Chilling Efficacy

$$E_{ff} = 100 - CV_{PC}$$

where:

E_{ff}	=	efficacy of the chilling tank, %
CV_{PC}	=	coefficient of variation of temperatures of carcass

D.4 Coefficient of Variation for Temperature at Different Point in the Chilling Tank

$$CV_{CT} = \frac{s}{M}$$

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

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

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

where:

CV_{CT}	=	coefficient of variation of temperatures in chilling tank
s	=	standard deviation
s^2	=	variance
x_j	=	individual sample
n	=	total number of samples
M	=	mean of x (temperature)

D.5 Chilling Efficiency

$$E_{ff} = 100 - CV_{CT}$$

where:

E_{ff}	=	efficiency of the chiller, %
CV_{CT}	=	coefficient of variation of temperatures in chilling tank