

PHILIPPINE NATIONAL STANDARD

PNS/BAFS 359:2023
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Egg Incubator — Methods of Test



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Foreword

In February 2022, the University of Southeastern Philippines (USEP) requested the Department of Agriculture-Bureau of Agriculture and Fisheries Standards (DA-BAFS) to standardize the quality performance of commercially available egg incubators to ensure consistent and good hatchability. DA-BAFS endorsed the project proposal to the Philippine Council for Agriculture and Fisheries-Committee on Agricultural and Fisheries Mechanization (PCAF-CAFMech) for prioritization. In March 2022, PCAF-CAFMech issued Resolution No. 14, series of 2022 (Recommending to the BAFS and Agricultural Machinery Testing and Evaluation Center [AMTEC] the Prioritization of the Development of Philippine National Standards [Specifications and Methods of Test] for Cacao bean fermenter, Egg incubator, and Drone-powered sprayer) endorsing the development of PNS on Egg incubator — Specifications and Methods of Test. These PNS aim to set the minimum requirements for egg incubators in terms of performance and quality factors.

In response, the DA-BAFS created a Technical Working Group (TWG) to develop the PNS under the following Special Order (SO):

1. SO No. 487, series of 2022 (Addendum to the SO No. 103, Series of 2022 Entitled “Creation of TWG for the Development of PNS for Agriculture and Fishery Products, Machineries, and Infrastructures”);
2. SO No. 617, series of 2022 (Amendment to SO No. 487, Series of 2022 [Addendum to the SO No. 103, Series of 2022 Entitled “Creation of TWG for the Development of PNS for Agriculture and Fishery Products, Machineries, and Infrastructures”]); and
3. SO No. 146, series of 2023 (Creation of TWG for the Development of PNS for Agricultural and Fishery Products, Machinery, and Infrastructures).

The TWG is composed of representatives from relevant DA agencies, other National Government Agencies (NGAs), academe/research institutions, private sector, and Civil Society Organizations (CSO). The draft PNS underwent a series of TWG meetings and stakeholder consultations conducted via blended platforms from May 2022 to March 2023 prior to its endorsement to the DA Secretary for approval.

This PNS was drafted in accordance with the editorial rules of the BAFS-Standards Development Division Standardization Guide No. 1 (Writing the Philippine National Standards).

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1 Scope

This Standard specifies the methods of test for the egg incubator used in poultry breeding and production. Specifically, it shall be used to:

- a) Verify the mechanism, main dimensions, materials, accessories of the egg incubator, and the list of specifications submitted by the manufacturer;
- b) Determine the laboratory and/or performances of the machine;
- c) Evaluate the ease of handling and safety features; and
- d) Prepare the report for the results of the tests.

2 Normative References

The following documents are referred to in the text in such a way that some or all their contents constitute the requirements of this document. The latest edition of the referenced documents (including any amendments) applies.

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2018). Code of Good Animal Husbandry Practice (GAHP) for poultry hatchery (PNS/BAFS 263:2018).
<https://bai.gov.ph/gahp/index.php/philippine-national-standards/download/3-gahp-standards/10-pns-bafs-263-2018-code-of-good-animal-husbandry-practice-for-hatchery>

BAFS-DA. (2023). Egg incubator — Specifications (PNS/BAFS 358:2023).

3 Terms and Definitions

For the purpose of this Standard, the definition given in PNS/BAFS 358:2023 (Egg Incubator – Specifications) and the following shall apply:

3.1

candling

process of examining the interior condition of an egg and the integrity of the shell by rotating or causing the egg to rotate in front or over a light source that illuminates the content of the egg (BAFS-DA, 2017, *modified*)

3.2

dead embryo

egg with an embryo that has died during development (AMTEC-UPLB, 2022, *modified*)

3.3

fertility rate

percentage of incubated eggs that are fertile (AMTEC-UPLB, 2022)

3.4

hatching eggs

fertilized egg that are incubated for poultry breeding and production (BAFS-DA, 2021, *modified*)

3.5

reject egg

egg that is removed during candling (AMTEC-UPLB, 2022)

3.6

running-in period

preliminary operation conducted before the actual testing of the machine to make various adjustments until the operation is stable (AMTEC-UPLB, 2022)

3.7

same batch

a period of collection or gathering, and storing of eggs, for 7 to 14 days, to be used for incubation (BAFS-DA, 2023)

3.8

setter tray

tray that hold eggs in the duration before hatching BAFS-DA, 2023)

3.9

test material

appropriate material used during the test operation of the machine (AMTEC-UPLB, 2022)

3.10

test site

place (e.g., field, recognized testing agency laboratory) where the test is conducted (AMTEC-UPLB, 2022)

3.11**unfertilized egg**

egg that has not fused with a sperm and will not develop into a chick (AMTEC-UPLB, 2022)

4 Principles of Test

The test shall be carried out to verify the actual specification of the egg incubator. Its specifications shall be validated with PNS/BAFS 358:2023 (Egg incubator — Specifications).

5 Test Instruments and Materials

5.1 The suggested list of minimum laboratory test equipment and materials needed to carry out the egg incubator test is shown in Annex A (Minimum list of field and laboratory test equipment and materials). The instruments to be used shall be calibrated regularly, physically checked for operation and shall be cleaned before and after each test.

5.2 Hatching eggs shall be used as test materials. Eggs to be tested should be from the same species, same batch, uniform weight class (± 2.5 g per egg), and shall be free from damages (i.e., cracks, deformations, etc.).

5.3 The eggs shall be handled in accordance with the Clause 4.9 of PNS/BAFS 263:2018 (Code of Good Animal Husbandry Practices [GAHP] for poultry hatchery) as shown in Annex B (Handling of hatching eggs).

5.4 The amount of hatching eggs to be supplied shall be enough to load the egg incubator at full capacity.

6 General Considerations**6.1 Test site conditions**

The egg incubator shall be installed and tested under normal operations in an area with ample space. The site should have ample provisions for material handling and temporary storage. The site should also be suitable to normal working conditions. Adequate ventilation and lighting shall be provided in the area. Uninterrupted power source or a backup generator shall be provided in case of power failure.

6.2 Suspension/termination of test

During the test run, if the egg incubator stops (due to breakdown or malfunction) affecting its performance, the test shall be suspended. If the machine is unable to continue operation, the test shall be terminated.

6.3 Pre-test activities

6.3.1 Running-in and preliminary adjustments

The egg incubator shall be run-in in accordance with the operator's manual provided by the manufacturer before the start of actual test. During the running-in period, various adjustments of the egg incubator shall be made according to the recommendation of the manufacturer. Adjustments for the purpose of maintaining a steady temperature and relative humidity of the egg incubator may be made at any time, except for any adjustment of an automatic control.

6.3.2 Pre-test observations

6.3.2.1 Verification of specifications

The specifications claimed by the manufacturer and other physical details given in Annex C (Specifications of egg incubator) shall be verified. A stable and level surface shall be used as reference plane for verification of dimensional machine specifications.

6.3.2.2 Test sample conditions at day of candling

The test material conditions including species, batch, and weight class shall be obtained and recorded. Sampling procedure is shown in Annex D (Sampling and weight class determination procedures for input test materials).

7 Performance Test and Procedures

7.1 Operation of the incubator

The egg incubator shall be operated with and, if applicable, without load using the recommended setting of the manufacturer. The manufacturer may make any adjustment during the test period, in case of breakdown of any parts and components. The items to be inspected or measured shall be recorded in the corresponding performance test data sheets.

7.2 Test trials

A minimum of one test trial shall be conducted for the egg incubator, considering the limitations of the replicability condition.

7.3 Data collection

7.3.1 Duration of test

7.3.1.1 The egg incubator shall undergo a two-part machine testing.

7.3.1.2 The first part shall be conducted on the day of candling, as prescribed by the test applicant, while the second part shall be conducted any day during the hatching period.

7.3.2 Tests and measurements

7.3.2.1 First part of the machine test

The following shall be measured during the first part of the machine testing every hour for eight hours.

a) Noise level

The sound emitted by the incubator with load and, if applicable, without load, shall be measured using a sound level meter at the location of the operator/s. The noise level, expressed in dB (A), shall be measured 50 mm away from the ear level of the operator/s. For each data to be taken, there shall be a minimum of five observations.

b) Speed of components

The speed of the turning mechanism for the egg incubator, as applicable, shall be taken using a tachometer or any other suitable methods. For each data to be taken, there shall be a minimum of five observations.

c) Power requirement

A power meter shall be used to measure the total voltage and current of the egg incubator with or without load. All components shall be switched-on during the collection of the data, as applicable. The total input electric power requirement shall be computed using the formula in Annex E (Formulas used during calculations and testing).

d) Temperature and relative humidity

The temperature and relative humidity of ambient, exhaust, and incubating air, with and without load, shall be measured. Additionally, the temperature of the eggs and water shall be measured. The procedure for taking the temperature and relative humidity is in Annex F (General tests and measurements).

e) Air velocity

The air velocity generated by the exhaust fan and air circulating fan, if provided, should be measured using an air velocity meter in m/s.

7.3.2.2 Candling

a) During the first part of the machine test, after the measurement of the parameters indicated in 7.3.2.1, a qualified personnel of the requesting party shall subject all the eggs to candling.

b) Reject eggs such as dead embryo (e.g., *penoy*), cracked eggs and other eggs that are unsuitable for hatching shall be removed and recorded.

7.3.2.3 Second part of the machine test

During the second part of the machine test, the requirements indicated in 7.3.2.1 shall be measured. The recommended incubation periods for different test materials are indicated in Annex G (Incubation period for different types of egg).

7.3.3 Data recording and observations

Record sheet for all data and information during the test is given in Annex H (Performance test data sheet). Necessary observations and other parameters to be taken during the field performance test should be recorded in this sheet.

8 Formula

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

9 Test Report

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

- a) Name of testing agency;
- b) Test report number;
- c) Title;
- d) Summary of results;
- e) Observations;
- f) Purpose and scope of test;
- g) Methods of test;
- h) Description of the machine;
- i) Specifications;
- j) Results;
- k) Observations (include pictures); and
- l) Names, signatures, and designation of test engineers.

Annex A
(Informative)

**Minimum list of field and laboratory
test equipment**

	Test equipment	Quantity
A.1.1	Sound level meter Range: 30 dB(A) to 130 dB(A) Minimum resolution: 0.1 dB(A)	1
A.1.2	Stopwatch Minimum resolution: 0.1 sec	1
A.1.3	Steel tape (at least 5 m)	1
A.1.4	Camera	1
A.1.5	Clamp-on type power meter/Multimeter 60 Hz, 220V	1
A.1.6	Caliper resolution: 0.01 mm	1
A.1.7	Data logger/Thermometer Range: 0°C to 100°C Minimum resolution: 0.1°C	1
A.1.8	Thermocouple	7
A.1.9	Hygrometer Resolution: 0.1; 25 – 100% RH	1
A.1.10	Weighing scale Capacity: 1kg, Resolution: 0.01 kg	1
A.1.11	Air Velocity meter Resolution: 0.01 m/s	1

Annex B
(Normative)

Handling of hatching eggs (BAFS-DA, 2018)

- B.1** All incoming eggs should be sourced from farms accredited/certified by the competent authority.
- B.2** One-way product flow should be maintained from egg receipt to chick dispatch.
- B.3** Incoming air should be filtered. Room pressure should be regulated (e.g., egg rooms and incubator rooms should be positive, pullout room/chick processing room should be negative).
- B.4** Differentiation should be maintained between clean and dirty areas.
- B.5** All eggs should be fumigated or sanitized prior to setting.
- B.6** Incubation hatcher and setter equipment should be easy to clean, in good working order and sealed to the floor.
- B.7** Egg should be stored in a temperature and humidity controlled room.
- B.8** Hatching eggs should be identifiable. Hatching eggs and trays should be properly marked/labelled for traceability purposes.
- B.9** The hatchery should retain production records for each consignment of eggs.

Annex C
(Normative)

Specifications of egg incubator

Name of Applicant : _____
Address : _____
Tel. No. : _____

Name of Manufacturer : _____
Address : _____
Tel. No. : _____

GENERAL INFORMATION

Make : _____ Type : _____
Serial No. : _____ Brand/Model : _____
Date of Manufacture : _____
Testing Agency : _____ Test Engineer : _____
Location of Test : _____ Date of Test : _____

No.	Item ¹	Manufacturer's specification	Verification by the testing agency
1	Overall dimensions		
1.1	Length, mm		
1.2	Width, mm		
1.3	Height, mm		
2	Incubating bin		
2.1	Capacity, no. of eggs		
2.2	Type		
2.3	Dimensions, L x W x H, mm		
2.4	Material		
3	Fan		
3.1	Air circulation fan		
3.1.1	Type		
3.1.2	Location		
3.1.3	Diameter, mm		
3.1.4	Number of blades		
3.1.5	Blade dimensions, L x W, mm		
3.2	Exhaust fan		
3.2.1	Type		
3.2.2	Location		
3.2.3	Diameter, mm		
3.2.4	Number of blades		
3.2.5	Blade dimensions, L x W, mm		
4	Heater		

No.	Item ¹	Manufacturer's specification	Verification by the testing agency
4.1	Type		
4.2	Number of units		
5	Tray		
5.1	Setter tray		
5.1.1	Number of trays		
5.1.2	Capacity per tray		
5.1.3	Dimensions, L x W, mm		
5.1.4	Material		
5.2	Hatcher tray		
5.2.1	Number of trays		
5.2.2	Capacity per tray		
5.2.3	Dimensions, L x W x H, mm		
5.2.4	Material		
5.3	Water tray		
5.3.1	Number of trays		
5.3.2	Dimensions, L x W x H, mm		
5.3.3	Material		
6	Safety features		
7	Special features		
¹ The parameter will be checked upon availability			

Annex D
(normative)

Sampling and weight class determination procedures for input test materials

- D.1** The weight class of the hatching eggs used during testing shall be determine using representative samples. This is done by randomly obtaining the required number of samples according to the classification of the egg incubator based on capacity as shown in Table D.1.

Table D.1. Sampling of test materials (BAFS-DA, 2019, *modified*)

Classification	Capacity, no. of chicken eggs	Required number of Sample, piece
Micro	<100	20
Small	101-300	40
Medium	301-2000	80

- D.2** The eggs shall be handled carefully with clean hands and instruments in order to prevent passing bacteria and other harmful substances to the eggs.

Annex E
(Normative)

Formulas used during calculations and testing

E.1 Electric power requirement

$$P_r = \frac{V \times I \times PF}{1000}$$

where:

- P_r is the electric power requirement, kW
- V is the voltage, V
- I is the current, A
- PF is the power factor

Annex F
(Normative)

Measurement of temperatures and relative humidity

- F.1** The ambient air and exhaust air temperature and relative humidity shall be measured using a thermometer and hygrometer. For the exhaust air, place the hygrometer at the exhaust and at the air holes located at different parts of the egg incubator, respectively, and record the data once the temperature and relative humidity readings have stabilized.
- F.2** The incubating air temperature and relative humidity shall be measured using a thermometer/thermocouples and hygrometer. Place at least one thermometer/thermocouple and hygrometer at the top, middle, and bottom of the egg incubator and record the incubating air temperature and relative humidity at each point.
- F.3** The egg and water temperature shall be measured using thermometer/thermocouples. Secure a thermocouple on at least one egg at the top, middle, and bottom of the egg incubator and a thermometer/thermocouples in the water tray, then record the data.

Annex G
(Informative)

Incubation period for different types of egg (Archer et al., 2022)

Common name	Day of Transfer (setter to hatcher)	Incubation Period
Chicken	18	21
Duck	25	28
Muscovy duck	31–33	35–37
Quail (Japanese)	15	17–18
Turkey	25	28
Domestic goose	27	30
Geese (various)	20–27	22–30
Ostrich	39	42

Annex H
(Informative)

Performance test data sheet

Test Trial No. : _____ Date : _____
 Test Engineers : _____ Location : _____
 Assistants : _____ Machine : _____
 Test Applicant : _____ Manufacturer: _____

No.	Item	Data	
1	Condition of test material		
1.1	Egg species and breed		
1.2	Source		
1.3	Dimensions, L × D, mm		
1.4	Weight, g/piece		
1.5	Total number of eggs to be incubated		
2	Incubator settings	First part	Second part
2.1	Temperature, °C		
2.1	Relative humidity, %		
3	Performance test		
3.2	Ambient condition		
3.2.1	Dry bulb temperature, °C		
3.2.2	Relative humidity, %		
3.3	Incubating air		
3.3.1	Dry bulb temperature, °C		
3.3.1.1	Standard deviation		
3.3.2	Relative humidity, %		
3.3.2.1	Standard deviation		
3.4	Incubator's sensor reading		
3.4.1	Incubating air temperature, °C		
3.4.2	Incubating air relative humidity, %		
3.5	Exhaust condition		
3.5.1	Dry bulb temperature, °C		
3.5.2	Relative humidity, %		
3.6	Egg temperature, °C		
3.6.1	Standard deviation		
3.7	Water temperature, °C		
3.8	Noise level, dB(A)		
3.8.1	Operator's ear level		
3.9	Power consumption		
3.9.1	Total input power, kW		
3.9.2	Line voltage, V		
2.9.3	Load current, A		

No.	Item	Data
3.10	Analysis of eggs	
3.10.1	Number of fertile eggs	
3.10.2	Number of reject eggs	
3.10.2.1	Unfertilized eggs	
3.10.2.2	Dead embryo	
3.10.2.3	Cracked eggs	
3.10.2.4	Others	

4 Observations

4.1 Safety controls/devices

4.2 Availability of manuals, brochure, and standard and special tools for adjustments and repair

4.3 Instrumentation

4.4 Settings and adjustments

4.5 Number of operators

4.6 Warning and safety stickers

4.7 Failures or abnormalities of the incubator or its component parts during and after the operation

4.8 Other remarks

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