

PHILIPPINE NATIONAL STANDARD

**PNS/BAFS 358:2023
ICS 65.060.99**

Egg Incubator — Specifications



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

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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 minimum requirements for the fabrication, construction, and performance of egg incubators used for poultry breeding and production.

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.

Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2000a). Agricultural machinery — Method of sampling (PAES 103:2000).

<https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2019/07/PAES-103-2000-Agricultural-Machinery-Method-of-Sampling.pdf>

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BAFS-DA. (2023). Egg incubator — Methods of test (PNS/BAFS 359:2023).

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<https://oshc.dole.gov.ph/wp-content/uploads/2020/02/OSH-Standards-2020-Edition.pdf>

3 Terms and Definitions

For the purpose of this Standard, the following definitions shall apply:

3.1

egg incubator incubator

machine that provides a suitable environment condition for an egg to develop and hatch successfully (Peprah, et al., 2020, *modified*)

3.1.1

setter setter machine

incubator in which the temperature, humidity, air ventilation and egg turning are controlled during the incubation for embryo development (BAFS-DA, 2018)

3.1.2

hatcher hatcher machine

incubator for hatching after the incubation process in the setter with the control of appropriate temperature, humidity, and air ventilation (BAFS-DA, 2018)

3.2

egg turner

device that rotates or tilts the egg to prevent the yolk from settling to one side and allows the diffusion of gases inside the eggs and between the eggs and the external environment (Boleli, I., et al., 2016, *modified*)

3.3

fan

device used for moving air which utilizes a power-driven rotating impeller. It can be an air-circulating fan or an exhaust fan (AMTEC-UPLB, 2010, *modified*)

3.4

hygrometer

device used to measure the internal relative humidity of the egg incubator (Philippine Atmospheric, Geophysical and Astronomical Services Administration [PAGASA]-Department of Science and Technology [DOST], n.d., *modified*)

3.5**incubation period**

duration where eggs undergo artificial means of supporting its development after being laid until hatching (Smith, 2011, *modified*)

3.5.1**setting period**

duration to which eggs are placed in the setter

3.5.2**hatching period**

duration to which eggs are placed in the hatcher

3.6**thermometer**

device used to measure the internal temperature of an incubator (PAGASA-DOST, n.d., *modified*)

3.7**thermostat**

device used to regulate the temperature of the incubator to achieve the required settings (American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 2017, *modified*)

3.8**tray**

accessory used to contain eggs (BAFS-DA, 2021, *modified*)

3.8.1**egg tray**

accessory that holds the eggs during the setting period

3.8.2**hatcher tray**

accessory that holds the eggs during the hatching period

4 Classifications

The classifications of egg incubators shall be based on, but not limited to the following:

4.1 Heating method

Warm air is distributed throughout the egg chamber to achieve the desired temperature.

4.1.1 Forced-air

Egg incubator that uses fan to circulate the hot air to maintain the level of heat, moisture and oxygen content (Ramli, et al., 2015, *modified*). A basic illustration of a forced-air incubator is shown in Figure 1.

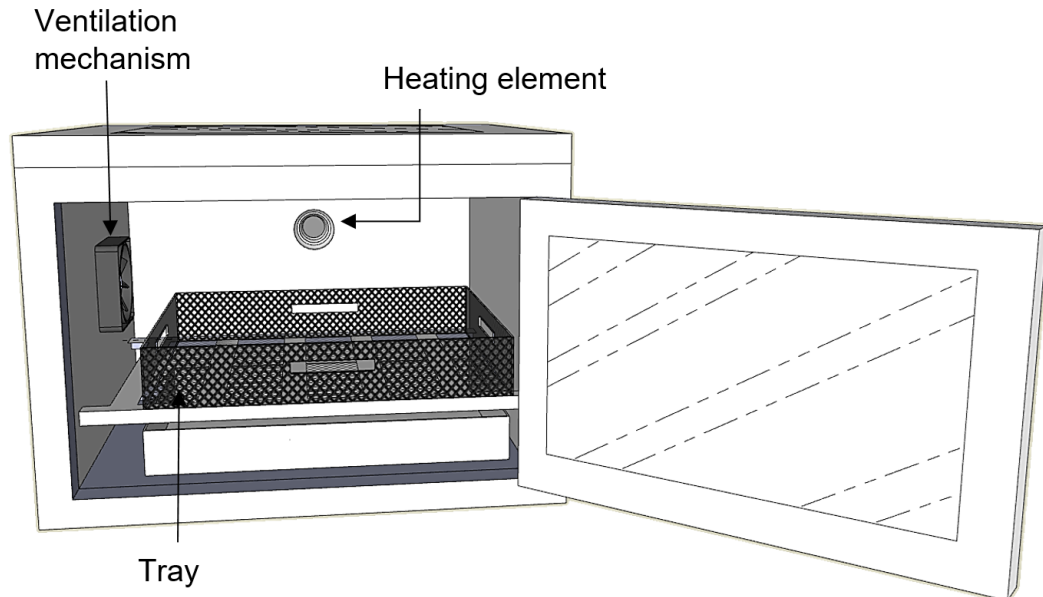


Figure 1. Basic illustration of a forced-air incubator (BAFS-DA, 2023)

4.1.2 Still-air

Egg incubator without ventilating mechanism (e.g., air holes, exhaust fan, etc.) (Ramli, et al., 2015, *modified*) as illustrated in Figure 2.

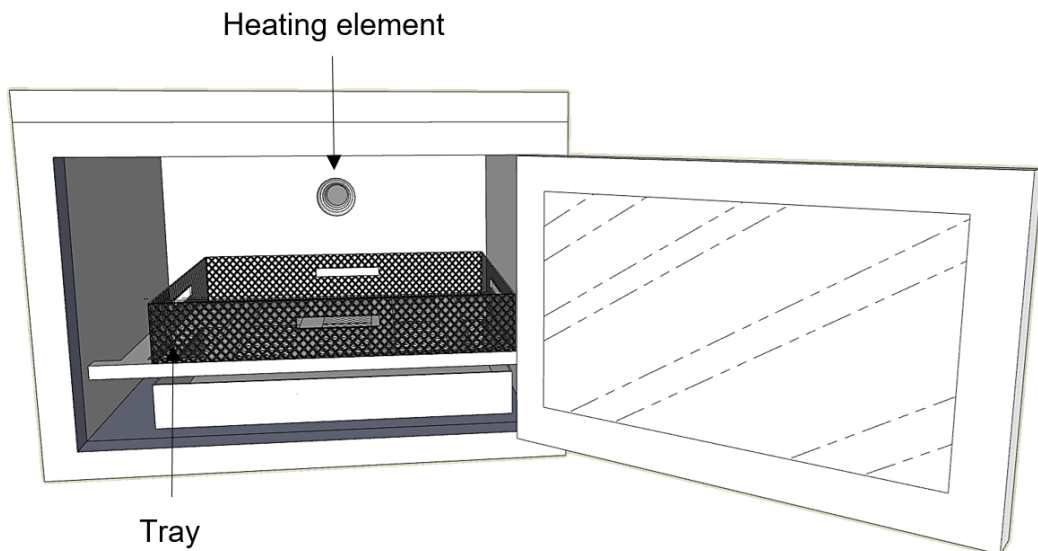


Figure 2. Basic illustration of a still-air incubator (BAFS-DA, 2023)

4.2 Methods of turning

Turning of eggs is performed for the embryo to be fully developed and ensure that they are in hatching position.

4.2.1 Manual

Turns the egg by hand as shown in Figure 3.

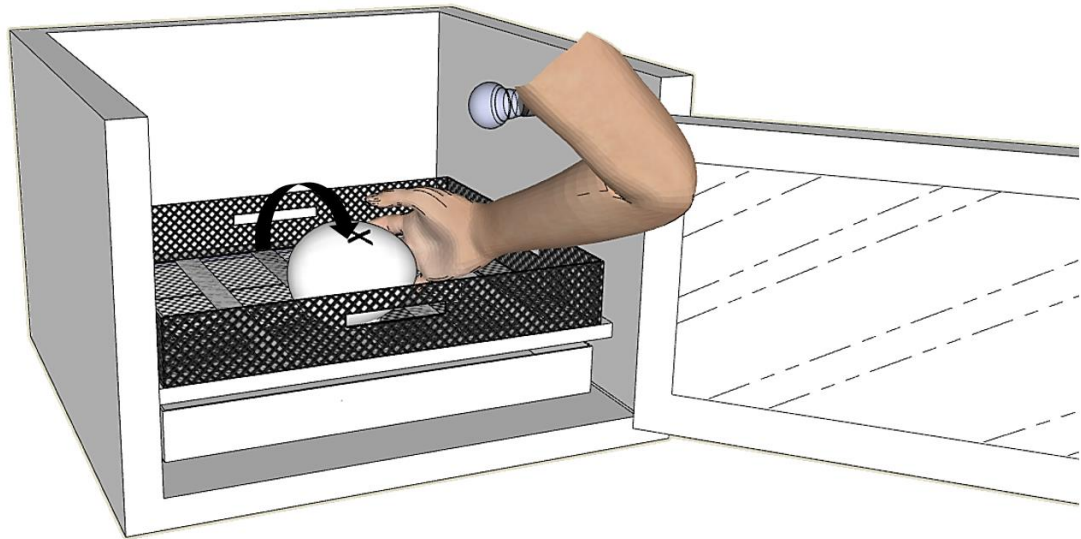


Figure 3. Basic illustration of a manually rotated incubator (BAFS-DA, 2023)

4.2.2 Mechanical

Tilts or rotates the tray with the assistance of a mechanical lever or other similar mechanism for turning.

4.2.2.1 Tilt-type

Tilts the tray to expose all parts of the egg to the same conditions. A typical tilt-type mechanical incubator is shown in Figure 4.

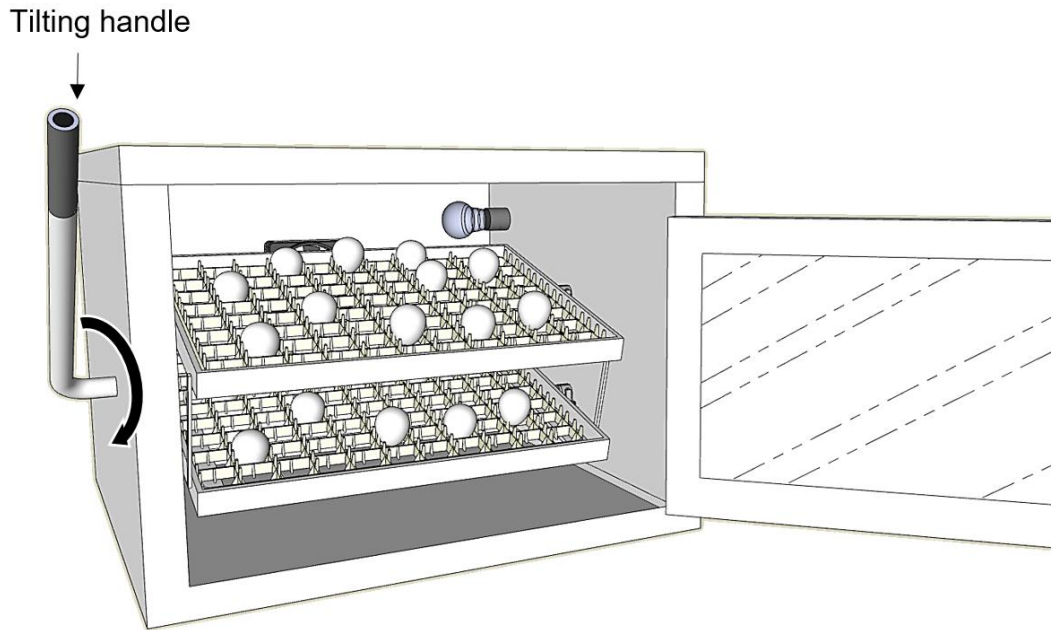


Figure 4. Basic illustration of a tilt-type mechanical incubator (BAFS-DA, 2023)

4.2.2.2 Roll-type

Rolls the eggs to expose all parts to the same conditions. A typical roll-type mechanical egg incubator is shown in Figure 5.

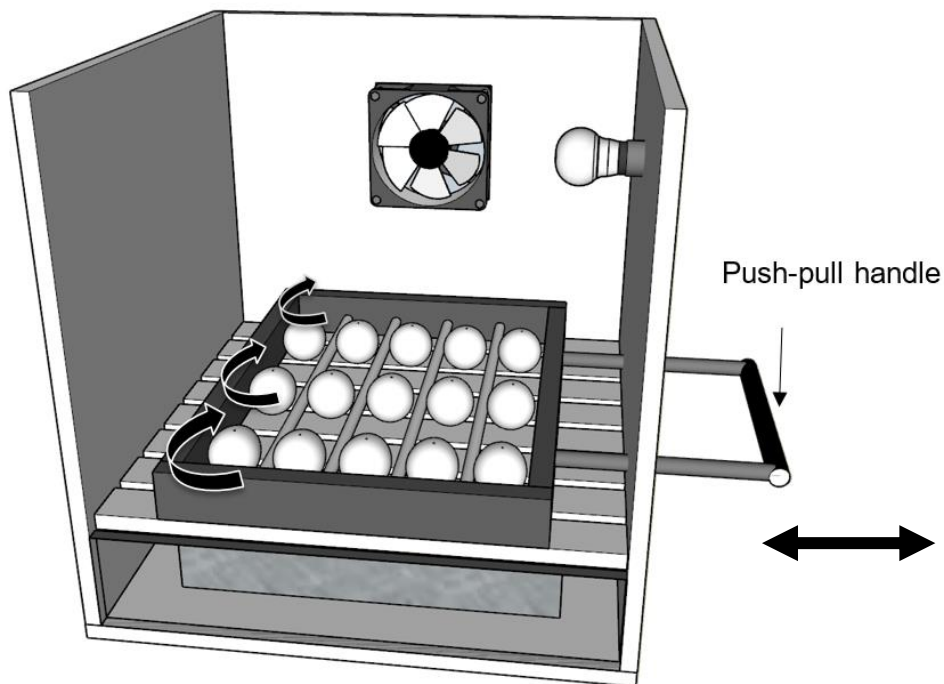


Figure 5. Basic illustration of a roll-type mechanical incubator (BAFS-DA, 2023)

4.2.3 Automated

An incubator with a control system programmed to tilt the tray or rotate the eggs without human intervention.

4.3 Capacity

Egg incubators are classified based on the number of chicken eggs it can accommodate at a time, as characterized in Table 1.

Table 1. Types of egg incubators based on capacity (BAFS-DA, 2023)

Types	Capacity, no. of eggs
Micro	<100
Small	101-300
Medium	301-2000

4.4 System operation

4.4.1 Single-stage/batch type

An incubator that uses an “all-in all-out” approach to place the eggs in the incubating chamber all at once. Another batch of eggs are placed again for incubation once the incubation period is completed.

4.4.2 Multi-stage

An incubator with various compartments designating different incubation periods.

4.5 Configuration of setter and hatcher

Incubators are classified based on the presence of a setter, a hatcher or both in one unit.

4.5.1 Combo

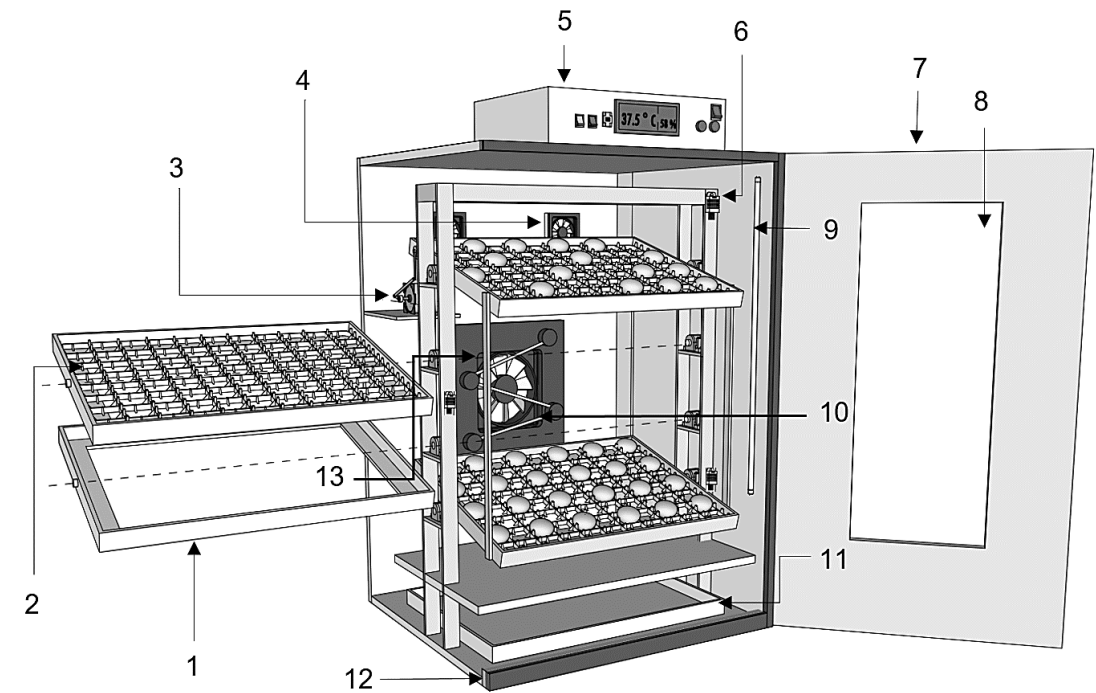
A combination of both setter and hatcher in one unit.

4.5.2 Modular

Setter machine is separated from the hatcher machine.

5 Basic Components

The basic components of the egg incubator are shown in Figure 6.



NOTE Figure not drawn to scale

Key

1	Tray frame	7	Door
2	Egg Tray	8	Sight glass
3	Prime mover	9	Lighting device
4	Exhaust fan	10	Heating element
5	Control panel	11	Water tray
6	Sensor (Temperature and Humidity)	12	Door gasket
		13	Air circulating fan

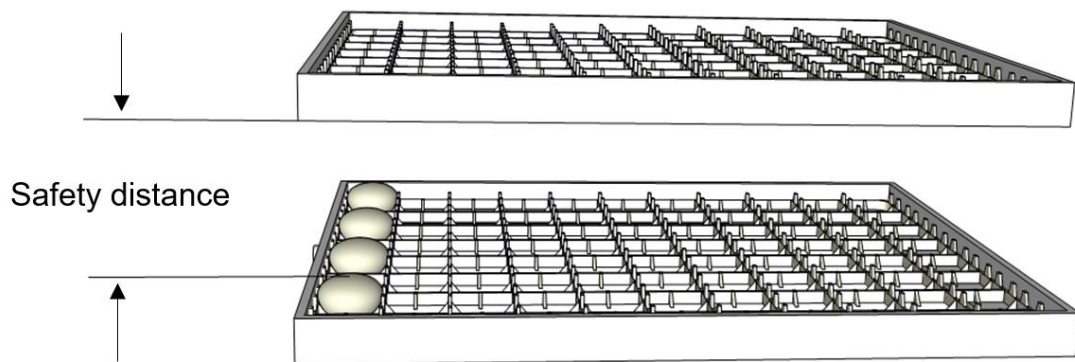
Figure 6. Typical illustration of a setter egg incubator (BAFS-DA, 2023)

6 Fabrication Requirements

6.1 General

- 6.1.1** The egg incubator shall be equipped with an insulating system. It shall be made of materials that prevent loss of heat and maintain the internal condition of the chamber, such as but not limited to, plyboard and polystyrene.
- 6.1.2** A gasket shall be installed at the door or any other openings of the egg incubator to prevent heat to escape.

- 6.1.3** As applicable, bolts and nuts, belts and pulleys, chains and sprockets, screws, bearings, and bushing and seals to be used should conform to PAES 311:2001 (Engineering materials – Bolts and nuts for agricultural machines – Specifications and applications), PAES 301:2000 (Engineering materials – V-belts and pulleys for agricultural machines – Specifications and applications), PAES 303:2000 (Engineering materials – Roller chains and sprockets for agricultural machines – Specifications and applications), and PAES 313:2000 (Engineering materials – Screws for agricultural machines – Specifications and applications), or other international standards.
- 6.1.4** Tray carts, if provided, shall be able to support its load. Wheels should be installed for ease of transporting the trays inside and outside the egg incubator.
- 6.1.5** There shall be light provided inside the incubator for inspection purposes.
- 6.1.6** The incubator shall be provided with water tray or any similar device or mechanism to help maintain the appropriate level of humidity and temperature inside the egg incubator.
- 6.2 Heating system**
- The egg incubator shall have a heating device that shall maintain the required temperature necessary for the hatching of the eggs. Typical heating devices are enumerated in Annex A (Heating devices).
- 6.3 Ventilation system**
- The egg incubator should contain an air-circulating fan and exhaust mechanism (e.g., fan or ventilation holes) to allow airflow inside the incubator and maintain a uniform temperature and relative humidity for incubation.
- 6.4 Turning system**
- 6.4.1** There shall be a provision for a turning mechanism to rotate or tilt the eggs for small and medium setter egg incubators. For micro setter egg incubators, manual turning should be allowed.
- 6.4.2** For automated egg incubators, eggs shall be rotated or tilted according to the manufacturers specifications.
- 6.4.3** For the tilt-type egg incubator, the eggs shall be tilted at an angle of 35° to 45°.
- 6.5 Tray**
- 6.5.1** The egg tray shall be designed to securely hold the eggs. There shall be a safety distance between the eggs and the egg tray frame to prevent any damage during turning, as shown in Figure 7.



NOTE The safety distance will vary depending on the size of egg to be placed.

Figure 7. Distance between egg and egg tray frame

6.5.2 Egg tray and hatcher tray should be made of either plastic, wire mesh (e.g., 3.175 mm) or aluminum.

6.5.3 A guard or cover shall be installed on the hatcher tray to prevent the chicks from migrating or mixing for proper identification.

6.6 Control system

6.6.1 General

Control panel shall be provided to monitor and adjust the internal conditions (i.e., temperature and relative humidity) of the egg incubator.

6.6.2 Temperature

6.6.2.1 Temperature controller (e.g., thermostat), of any type, shall be provided to regulate the internal temperature of the egg incubator.

6.6.2.2 The egg incubator shall have a thermometer, preferably built-in otherwise provided separately. It shall have a minimum resolution of 0.1 °C.

6.6.3 Humidity

6.6.3.1 Humidity controller, of any type, shall be provided to regulate the internal relative humidity.

6.6.3.2 The egg incubator shall have a hygrometer, preferably built-in otherwise provided separately. It shall have a minimum resolution of 1 %.

7 Performance Requirements

- 7.1 The egg incubator shall attain the relative humidity and temperature specified in Table 4.

Table 4. Performance criteria of the egg incubator (Archer et al., 2022)

Common name	Setting period		Hatching period	
	Relative humidity, %	Temperature, °C	Relative humidity, %	Temperature, °C
Chicken	58	37.5	66–75	36.9
Duck	58–62	37.5	66–75	36.9
Muscovy duck	58–62	37.5	66–75	36.9
Quail (Bobwhite)	54–58	37.5	66–74	37.2
Quail (Japanese)	58–62	37.5	66–74	37.2
Turkey	54–58	37.5	66–75	36.9
Geese (Domestic and various)	62	37.5	66–75	36.9
Ostrich	32–40	36.4	69	36.4

- 7.2 For both chicken and geese during the setting period and ostrich during the hatching period, the standard deviation for relative humidity shall be maintained within $\pm 2\%$.
- 7.3 The standard deviation for the temperature of both setting and hatching period for all type of eggs to be incubated shall be maintained within $\pm 1\text{ }^{\circ}\text{C}$.
- 7.4 There shall be no damaged eggs due to turning.

8 Safety, Workmanship, and Finish

- 8.1 Safety requirements (e.g., warning stickers) for the egg incubator shall conform with PNS/BAFS 330:2022 (Technical means for ensuring safety — Guidelines). Guards or insulation shall be provided for exposed parts with surface temperature exceeding 60°C .
- 8.2 All wiring terminals shall be properly insulated to prevent electrical hazards.
- 8.3 The noise level shall conform to Rule 1074.01 to 1074.03 of Occupational safety and health standards of Occupational Safety and Health Center (OSHC)-Department of Labor and Employment (DOLE), as shown in Annex B (Occupational safety and health standard [Rule 1074.01– 1074.03]). There shall be earmuffs or other ear protection device for the operator to use when 90 dB(A) is exceeded during an eight-hour operation.

8.4 The egg incubator shall be free from defects that may be detrimental to its use and shall be free from sharp edges and surfaces that may hurt the operator. All metal parts should be machine bent, pressed and cut and all rough surfaces should be machine finished and smoothed.

8.5 Surfaces and coatings of the egg incubator shall be free from pits and crevices, resistant to cracking, chipping, flaking and abrasion, and shall prevent penetration of unwanted matter under intended use.

8.6 The egg incubator shall have protection from or for all moving parts.

9 After-sales Services Requirements

Requirements for after-sales services shall conform to PNS/BAFS/PAES 192:2016 (Guidelines on after-sales service).

10 Maintenance and Operation

10.1 Each unit of egg incubator shall be provided with a set of standard tools prescribed by the manufacturer.

10.2 An operator's manual which conforms to PAES 102:2000 (Operator's manual — Content and presentation) shall be provided. Calibration procedures shall also be included.

10.3 The instruments and controls provided in the egg incubator shall be calibrated as recommended by the manufacturer.

10.4 The egg incubator should be placed in a well-ventilated area.

10.5 There shall be a provision for ease of handling of the trays in and out of the egg incubator.

10.6 The egg incubator should be accessible for cleaning during operation.

10.7 For manual type egg incubator, it shall be rotated at least three times a day at an angle of 180°.

11 Sampling

The incubators shall be sampled for testing in accordance with PAES 103:2000 (Methods of sampling) or any other suitable method of sampling.

12 Testing

The sampled egg incubator shall be tested in accordance with PNS/BAFS 359:2023 (Egg incubator — Methods of test).

13 Marking and Labeling

13.1 Each unit of egg incubator shall be provided with the following information, either in the body or in a metal nameplate attached at the most conspicuous place:

- a) Brand;
- b) Model;
- c) Serial number; and
- d) Country of manufacture.

13.2 In addition, marking and labeling should comply with the applicable regulations set by the competent authority.

13.3 Basic operation reminders shall be stated in the operator's manual.

Annex A
(Informative)

Heating devices

A.1 Bulb

- a) Infrared bulb;
- b) Incandescent bulb; and
- c) Ceramic bulb

A.2 Wire

- a) Nichrome wire
- b) Heating tubes/coils

A.3 Positive temperature coefficient (PTC) plate

Annex B
(Informative)

Occupational safety and health standards (Rule 1074.01–1074.03)

B.1 Threshold limit values for noise

- B.1.1** The threshold limit values refer to sound pressure that represents conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech.
- B.1.2** Feasible administrative or engineering controls shall be utilized when workers are exposed to sound levels exceeding those specified in Table B.1 hereof when measured on a scale of a standard sound level meter at slow response. If such controls fail to reduce sound within the specified levels, ear protective devices capable of bringing the sound level to permissible noise exposure shall be provided by the employer and used by the worker.

Table B.1. Permissible noise exposure

Duration per day, h	Sound levels (slow response), dB(A)
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼	115

B.2 Permissible noise exposure

- B.2.1** The values specified in Table B.1 apply to total time of exposure per working day regardless of whether this is one continuous exposure or a number of short-term exposures but does not apply to impact or impulsive type of noise.
- B.2.2** If the variation in noise level involves maximum intervals of one second or less, it shall be considered as continuous. If the interval is over one second, it becomes impulse or impact noise.
- B.2.3** When the daily noise exposure is composed of two or more periods noise exposure of different levels, their combined effect should be considered rather than the effect of each.
- B.2.4** If the sum of the fraction in Equation A exceeds one, then the mixed exposure should be considered to exceed the threshold limit value. C indicates the total

time exposure at a specified noise level, and T indicates the total time of exposure permitted at the level. However, the permissible levels indicated in Table B.1 shall not be exceeded for the corresponding number of hours per day allowed. Noise exposures of less than 90 dB(A) are not covered by Equation A.

$$X = \frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} \quad (\text{Equation A})$$

where:

- X is the sum of the ratios of C and T
- C is the total time of exposure at a specified noise level
- T is the total time of exposure permitted at the level

B.2.5 Exposures to impulsive or impact noise shall not exceed 140 decibels peak sound pressures level (ceiling value).

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