

Foreword

The formulation of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Enhancing the Implementation of the AFMA Through Improved Agricultural Engineering Standards” which was funded by the Bureau of Agricultural Research (BAR) of the Department of Agriculture (DA).

This standard has been technically prepared in accordance with PNS 01-4:1998 (ISO/IEC Directives Part 3:1997 – Rules for the Structure and Drafting of International Standards. It specifies the general requirements for the construction of plant tissue culture laboratory.

The word “shall” is used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.

In the preparation of this standard, the following references were considered:

Bridgen, Mark P. and John W. Bartok, Jr. Designing a Plant Micropropagation Laboratory. Departments of Plant Science and Agricultural Engineering, University of Connecticut, March 1996.

Pelczar, M.J., Jr., E.C.S. Chan and N.R. Krieg. Microbiology. 5th Edition. Tata McGraw-Hill Publishing Company. New Delhi, 1993.

Tissue Culture Laboratory. CIP Training Manual.

Agricultural Structures –Plant Tissue Culture Laboratory

1 Scope

This standard specifies the minimum requirements for plant tissue culture laboratory. It includes general, structural and functional requirements.

2 Reference

The following normative document contains provisions which through reference in this text constitute provisions of this National Standard:

National Structural Code of Building

National Plumbing Code of the Philippines

National Building Code of the Philippines

PAES 414-1:2002 Agricultural Structures – Waste Management Structures: Part 1 –
Agricultural Liquid Waste

PAES 414-2:2002 Agricultural Structures – Waste Management Structures: Part 2 –
Agricultural Solid Waste - Composting

Philippine Electrical Code 2000

3 Definition

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

3.1**tissue culture**

growth of protoplasts, cells, tissues, shoot tips, roots, anthers, embryos, flowers and meristems in a laboratory medium

3.2**culture medium**

any nutrient material prepared for the growth and cultivation plant tissue

3.3**sterilization**

process of making any material entirely free from living microorganism

3.4

asepsis

condition that describes the freedom of plant materials, culture medium, confines of the culture vessel from contaminating microorganisms

3.5

incubation

subjecting of cultures to conditions favorable to the growth of the plant tissue

3.6

laminar flow

flow air currents in which air currents do not intermingle

4 Location

4.1 The location shall conform to the land use plan of the area.

4.2 The building should be located away from sources of contamination such as a gravel driveway or parking lot, soil mixing area, pesticide storage, or dust and chemicals from fields.

4.3 The area immediately surrounding the building shall be concreted, covered with asphalt or with similar material. The access road, walkways and parking areas shall be similarly treated.

4.4 The site shall be accessible to service roads, water supply and electric lines.

4.5 The site shall be well drained.

5 Structural Requirements

5.1 Roof

5.1.1 The roof structure should be treated timber or steel with anti-rust paint.

5.1.2 Roofing materials should be G.I. sheet and other steel sheeting with corrosion resistant coatings.

5.1.3 Roof vents, when provided, shall be properly screened.

5.2 Ceilings

5.2.1 Ceilings shall be at least 2.4 m from the finished floor line.

5.2.2 Ceilings shall be constructed to prevent the collection of dirt or dust that might sift through from the areas above or fall from overhead collecting surfaces onto equipment or exposed products.

5.2.3 Ceilings shall be painted with white emulsion or latex paint.

5.3 Wall

5.3.1 The wall shall be concreted, smooth finished and properly painted. Internal surface of the walls should be painted with white emulsion or latex paint.

5.3.2 Wall in growth room shall be painted with antifungal-epoxic-paint.

5.3.3 All wall tops and ledges shall slope at 45° (Refer to Figure 1).

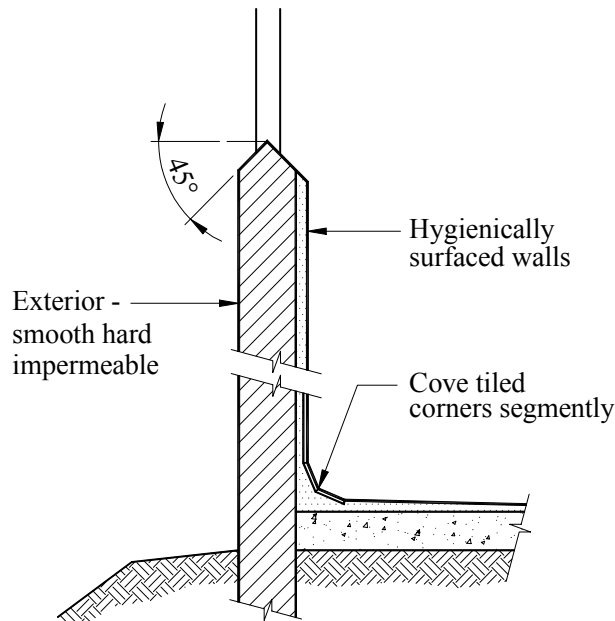


Figure 1 – Finishing of a laboratory wall

5.3.4 It should be coved to the floor-wall and at wall-to-wall junctions with a radius of 50 mm - 60 mm.

5.4 Windows

5.4.1 All windows shall be properly installed with 16-mesh screen.

5.4.2 Windowsill shall be at least 1 m from the finish floor line.

5.5 Doors

5.5.1 Main doorways shall be at least 1.5 m wide to allow easier movement of large equipment and facilities (e.g. laminar flow cabinets, photo-thermal cabinets, and shelves). Door for staff, storage and chemical rooms should be at least 0.8 m.

5.5.2 Doors and doorjambs shall be moisture and rust-resistant material.

5.6 Floor

5.6.1 Floor shall be concreted, properly reinforced to prevent cracks and shall be smooth finished or tiled.

5.6.2 Floor shall be non-skid. Cement floor shall be painted with epoxy or urethane floor enamel.

5.6.3 The floor slope should be 2% - 4% towards the drain.

5.7 All other matters concerning structural design of the building not provided in this Standard shall conform with the provisions of the National Structural Code of Building.

6 Functional Requirements

6.1 Laboratory

6.1.1 Glassware washing and storage area

6.1.1.1 The glassware washing area shall be located near the sterilization and media preparation areas.

6.1.1.2 The glassware area shall be equipped with at least two sink. The top of the working space should be tiled or smooth-finished. Sink shall be stainless steel which is acid and alkali resistant.

6.1.1.3 Adequate workspace should be provided on both sides of the sink; this space shall be used for glassware soaking tubs and drainage trays.

6.1.1.4 Storage area shall be provided with dust-proof cabinets that are placed low enough to allow easy access.

6.1.1.5 Storage cabinets/shelves for chemicals should be provided and it should be made of non-corrosive materials.

6.1.2 Media preparation and sterilization area

6.1.2.1 The area shall be provided with working tables. Tables should be up to 1.2 m wide if it is to be access from both sides, and should not exceed 600 mm if it is accessible only from one side and the height should be 850 mm – 900 mm. Tabletop shall be covered with materials which are easily cleaned and which will stand disinfectant solution.

6.1.2.2 Water source and glassware storage area shall be provided.

6.2 Transfer room

6.2.1 Transfer room shall be provided for isolation of explants, initial culture and transfer culture.

6.2.2 Laminar flow hoods or still-air boxes shall be provided to be used for all aseptic work.

6.3 Growth room

6.3.1 Growth room shall be isolated from the external environment. Anteroom should be constructed to prevent the entry of contaminants.

6.3.2 Ceilings shall be insulated with a minimum R-value of 2.64 (R-15).

6.3.3 Artificial lighting should be provided for the production of photo-period sensitive plants. For the workers, 200 lux should be provided.

6.3.4 Shelves or trays shall be provided. Shelves should be painted white and should be made of wood, expanded metal or tempered glass. Shelves should be fitted with casters to permit movement during cleaning and maintenance of the growth room.

6.3.5 The width of the shelves should be 405 mm if accessible only from one side and should be 1 m if accessible from both sides. The distance between each layer of the shelves shall be 455 mm.

6.3.6 Aisles and passage shall be at least 1 m.

6.4 Facilities and equipment

6.4.1 Lighting

6.4.1.1 Artificial lighting shall always be available for use during the night or darkened periods of the day.

6.4.1.2 Table 1 shows the recommended lighting intensity for tissue culture laboratory.

Table 1 – Recommended lighting intensity for tissue culture laboratory

Area	Lighting intensity lux (Lumen/m ²)
Outside the laboratory	100
General	200
Working table	500
Growth room	100 - 1000

* Refer to Annex B

6.4.1.3 All electrical design and installation shall conform to Philippine Electrical Code.

6.4.2 Ventilation, Temperature and RH

6.4.2.1 There shall be provision for uniform airflow within the growth room to maintain the same temperature in the whole environment.

6.4.2.2 Thermostat shall be provided to prevent temperature variations in the room from exceeding the favorable culture environment.

6.4.2.3 Humidifiers or dehumidifier shall be provided to control relative humidity (RH) inside growing vessels.

6.4.3 Water supply and drainage

6.4.3.1 Both hot and cold water should be available with water distillation and/or deionization devices.

6.4.3.2 The pipes leading from the sink shall be PVC which resists damage from acids and alkalis.

6.4.3.3 The drainage channel shall be fitted with an easily removed steel grating so that the drain can be cleaned.

6.4.3.4 Drainage and plumbing system shall be in accordance with the National Plumbing Code. It shall collect all liquid wastes incidental to the operation and properly connected to an approved sewage treatment and disposal system.

6.4.4 Hand-washing facilities

Adequate and convenient hand-washing and, if necessary, hand-sanitizing facilities should be provided anywhere in the laboratory where the nature of employees jobs requires that they wash, sanitize and dry their hands.

6.4.5 Fire extinguishing system

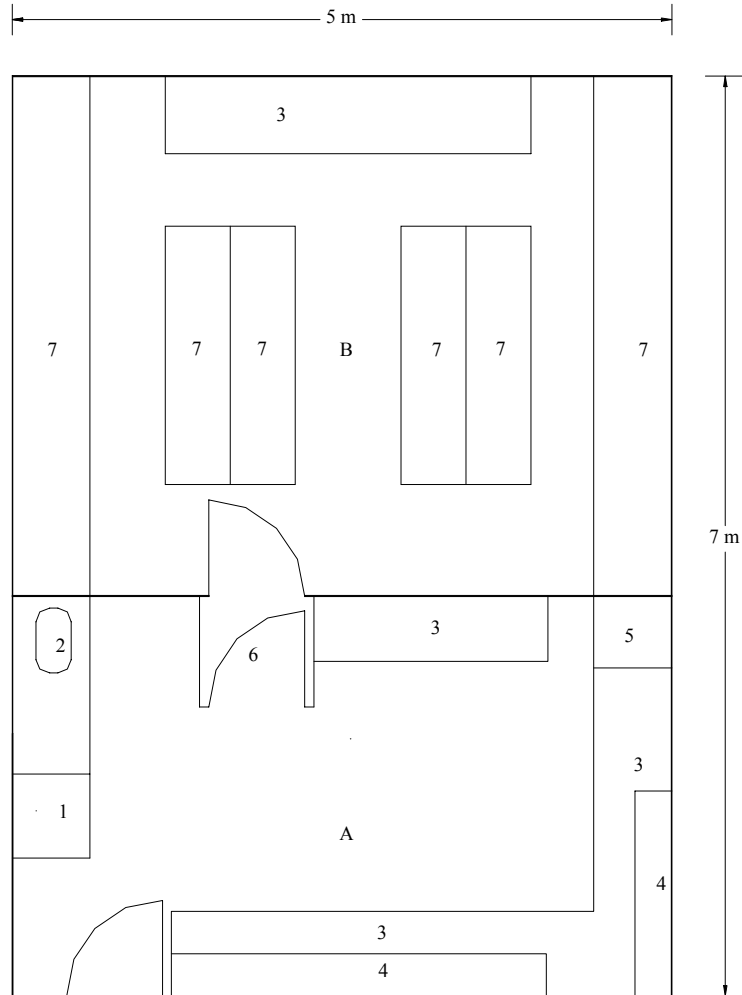
Construction of fire extinguishing system shall conform with the provision of the National Building Code of the Philippines.

7 Waste disposal

For waste management, refer to **PAES 414-1:2002** and **PAES 414-2:2002**.

Annex A
(informative)

Typical layout of a tissue culture laboratory



- A** Laboratory
- B** Growth Room
- 1** Autoclave
- 2** Washbasin
- 3** Working tables
- 4** Wall cabinet
- 5** Refrigerator
- 6** Anteroom
- 7** Incubation shelves

Annex B
(informative)

Lighting Requirements

Lighting Intensity lux	No. of Bulbs Required per m ²							
	Incandescent lamp						Fluorescent lamp	
	25W	40W	60W	100W	150W	200W	20W	40W
500	3.935	1.989	1.052	0.520	0.314	0.226	0.682	0.266
400	3.148	1.591	0.842	0.416	0.251	0.181	0.546	0.213
300	2.361	1.193	0.631	0.312	0.189	0.136	0.409	0.160
200	1.574	0.796	0.421	0.208	0.126	0.090	0.273	0.107
150	1.180	0.597	0.316	0.156	0.094	0.068	0.205	0.080
100	0.787	0.398	0.210	0.104	0.063	0.045	0.136	0.053
50	0.393	0.199	0.105	0.052	0.031	0.023	0.068	0.027
10	0.079	0.040	0.021	0.010	0.006	0.005	0.014	0.005