

BUREAU OF INDIAN STANDARDS

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भारतीय मानक मसौदा
चीनी कारखाने की प्रयोगशालाओ के लिए अभिन्यास
(आई एस 5527 का पहला पुनरीक्षण)

Draft Indian Standard
**LAYOUT PLAN FOR
SUGAR FACTORY LABORATORIES**
(*First Revision of IS 5527*)

ICS 67.180

Sugar Industry Sectional Committee, FAD 02

Last date for Comments:

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FOREWORD

(*Formal adoption clause to be added later*)

The need for a standard layout for a sugar factory laboratory for quality control of sugar, sugar-products and by-products is keenly felt by those responsible for planning and organization of sugar factories. Such a readily available plan is of great use to various sugar factories in guiding them, to set up laboratories according to their type of production,

This standard covers the tests that are generally carried out in a sugar factory laboratory; guidelines regarding flooring, ventilation, cupboards, and benches to help various organizations in starting work in the laboratories. This standard was originally published in 1969. In this revision, the following major modifications have been incorporated —

- Typical plan for a layout of sugar factory laboratory has been updated and the requirements soil parameters are omitted,
- Conformance for potable water supply as per IS 10500 has been given,
- List of chemicals and apparatus has been removed and referred to corresponding Indian Standards on sugar products given to ensure updated information on the chemicals and apparatus required, and
- In addition, references to Indian Standards wherever applicable, have been updated.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard prescribes the layout plans for laboratories of sugar factories primarily for routine testing of sugar, its raw materials, and by-products.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below

<i>IS No</i>	<i>Title</i>
IS 1151 : 2021	Refined sugar — Specification (<i>second revision</i>)
IS 1152 : 2022	Icing sugar — Specification (<i>second revision</i>)
IS 1162 : 2021	Cane molasses — Specification (<i>first revision</i>)
IS 1168 : 2020	Cube sugar — Specification (<i>second revision</i>)
IS 1742 : 1983	Code of practice for building drainage (<i>second revision</i>)
IS 2190 : 2010	Selection, installation and maintenance of first-aid fire extinguishers — Code of practice (<i>fourth revision</i>)
IS 2312 : 1967	Specification for propeller type AC ventilating fans (<i>first revision</i>)
IS 2440 : 1975	Guide for daylighting of buildings (<i>second revision</i>)
IS 2556 (Part 5) : 1998	Vitreous sanitary appliances (Vitreous China) - Specification: Part 5 Specific requirements of laboratory sinks (<i>third revision</i>)
IS 3646 : (Part 1) : 1992	Code of practice for interior illumination: Part 1 General requirements and recommendations for working interiors (<i>first revision</i>)
IS 4971 : 2007	Recommendations for selection of industrial floor finishes (<i>first revision</i>)
IS 5982 : 2003	Plantation White Sugar – Specification (<i>first revision</i>)
IS 10500 : 2012	Drinking water — Specification (<i>second revision</i>)

3 TESTS

3.1 The laboratory shall be equipped for carrying out the tests as given in Table 1.

Table 1 Tests to Be Generally Carried Out in A Sugar Factory Laboratory at Different Stages of Manufacture of Sugar
(Clause 3.1)

Sl. No.	Particulars of Test	Relevant Indian Standards
(1)	(2)	(3)
<i>Juice, Syrup, Molasses and Massecuite</i>		-
1.	Brix	
2.	Pol	

3.	Sucrose	
4.	Reducing Sugars	
5.	Phosphate	
6.	Sulphated Ash	
7.	Calcium oxide	
8.	pH	
9.	Colour	
10.	Turbidity	
11.	Conductivity Ash	
12.	ICUMSA Colour	
<i>Bagasse and Filter Cake</i>		-
1.	Moisture	
2.	Pol	
3.	Fibre	
<i>Additives and Chemicals</i>		-
1.	Calcium, active	
2.	Calcium carbonate (CaCO ₃), Food grade	
3.	Phosphoric acid, Food grade	
<i>Condensate Water, Boiler Feed Water, Spray Pond Water, Boiler Blow Down Water and Effluent Water</i>		
1.	Sugar content	
2.	pH	
3.	Solids in suspension and dissolved	
4.	BOD value for effluent water	
<i>Plantation White Sugar</i>		IS 5982
1.	Loss on drying	
2.	Polarization	
3.	Reducing sugars	
4.	ICUMSA Colour	
5.	Conductivity Ash	
6.	Sulphur dioxide	
<i>Refined Sugar</i>		IS 1151
1.	Loss on drying	
2.	Polarization	
3.	Reducing sugars	
4.	ICUMSA Colour	
5.	Conductivity Ash	
6.	Sulphur dioxide	
7.	Lead	
8.	Chromium	
9.	Sediment	
10.	Iron	
11.	Floc test	
<i>Icing Sugar</i>		IS 1152
1.	Loss on drying	
2.	Reducing sugars	

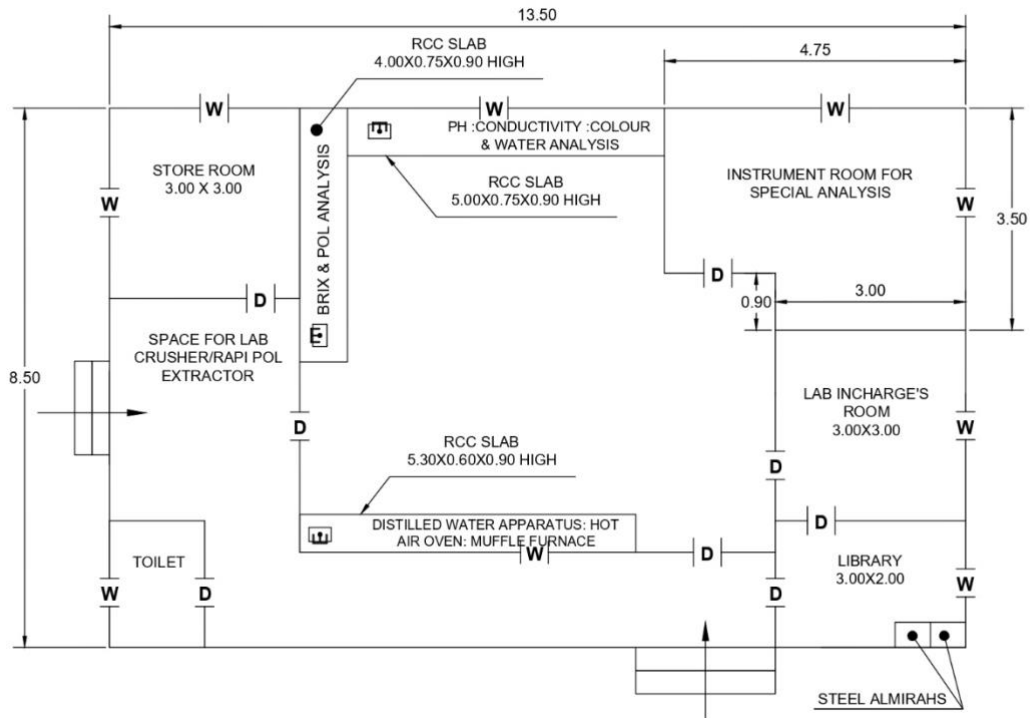
3.	ICUMSA Colour	
4.	Conductivity Ash	
5.	Starch	
6.	Total of starch and sucrose	
7.	Sulphur dioxide	
8.	Lead	
<i>Cube Sugar</i>		IS 1168
1.	Loss on drying	
2.	Pol	
3.	Sucrose	
4.	Reducing sugars	
5.	Conductivity Ash	
6.	Total ash	
<i>Final Molasses</i>		IS 1162
1.	Density in degrees Brix at 27-5°	
2.	Ash sulphated	
3.	Total reducing matter as invert sugar	
<i>Water Supply</i>		IS 10500
1.	Total Hardness	
2.	Chlorine content	
3.	Coliform test	
4.	Plate count	
6.	pH	

4 LOCATION

4.1 The laboratory should be so located in the sugar factory that it is easily accessible to all the major activities of the factory and shall be so located as to avoid vibrations of all kinds and should preferably be in a separate building close to the processing units.

5 LAYOUT

5.1 The laboratory should have adequate number of rooms as indicated in Table 2. While setting up a laboratory, the possible expansion of the factory should be kept in view. Typical layout plans for a sugar factory laboratory have been given in Fig.1.



All dimensions in metres.

FIG. 1 TYPICAL LAYOUT PLAN OF SUGAR FACTORY LABORATORY

Table 2 Recommended Floor Area for A Sugar Factory Laboratory
(Clause 5.1)

Sl. No.	Particulars or Room	Area m ²
(1)	(2)	(3)
1.	Laboratory-in-charge's room	12
2.	Store	9
3.	Chief chemist's room/library	12
4.	Analytical hall	53
5.	Room for polarimeter	8.75
6.	Space for shredder and laboratory crusher	9
7.	Verandas and toilet	26.50
8.	Balance instruments room	10
9.	Total floor area	140.25

6 GENERAL REQUIREMENTS

6.1 Walls — Walls of the laboratory shall be smoothly finished. They may be tiled with glazed tiles. Working platforms may be made of RCC slab with white coloured tiles or 18 mm granite top for wet area analysis.

6.2 Windows — There should be a sufficient number of windows fitted with glass panes to receive adequate natural light (*see* IS 2440). To facilitate easy access, the windows should be at a height over 100 cm from floor and the benches should be at the same or lesser height.

6.3 Lighting — Direct sunlight should be avoided for benches intended for sensitive instruments, for example, chemical balances. Lights should be provided to give a minimum average intensity of 300 to 450 lux at working level. For store room, corridor, etc, the intensity may be considerably lower. Special operations may require special lighting [*see* IS 3646 (Part 1)].

6.4 Flooring — The laboratory flooring should be non-slippery, capable of being easily cleaned and non-absorbent. Any type of *in situ* cement concrete or tiled floor is considered satisfactory (*see* IS 4971).

6.5 Store Room — The store room should consist of two chambers, one for keeping acids, ammonia, other alkalis, etc, and the other for keeping fine chemicals, apparatus and equipment (*see* Fig. 1). Alternatively, separate steel almirahs may be used for storing chemicals and apparatus. These almirahs may be kept in the analytical hall (*see* Fig. 1).

6.6 Benches

6.6.1 The minimum height of benches from the floor shall be 90 cm.

6.6.2 The thickness of the bench top should be 3 cm. The bench top should be fitted with either glazed tiles or decorative thermosetting synthetic resin bonded laminated sheets.

6.6.3 The benches shall not have any under bench fittings as they tend to collect lot of dirt and insects in them.

6.6.4 The benches may be arranged as shown in Fig. 1.

6.6.5 Typical details of above-bench fittings are shown in Fig. 1 for guidance only.

6.7 Cupboards

6.7.1 A laboratory should be provided with adequate number of cupboards to protect apparatus and also to permit tidiness and cleanliness in laboratory work.

6.7.2 Wall Cupboards — Wall cupboards may be provided and fixed at a convenient height of, say, 135 cm. With this height it is possible to have a wall bench below the cupboard which could be used for routine work. The convenient dimensions for wall cupboards are 150 cm × 90 cm × 30 cm, and 180 cm × 85 cm × 35 cm. The doors of the cupboard should preferably be of sliding type rather than hinged. These should be used for keeping certain reagent and chemical bottles. Use of steel almirahs in place of the wall cupboards may also be considered (*see* 6.5).

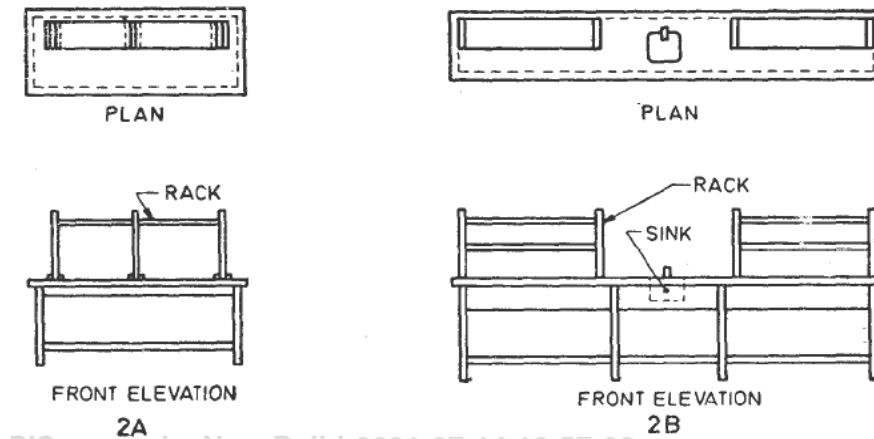


FIG 2 TYPICAL PLANS AND ELEVATIONS OF ABOVE-BENCH FITTINGS

6.8 Sinks

6.8.1 Sinks of suitable dimensions should be provided in the laboratory. They should be made of glazed earthenware or vitreous ware [see IS 2556 (Part 5)] or stainless steel and should be preferably of dimensions of 60 cm × 45 cm × 20 cm or 45 cm × 30 cm × 15 cm. There shall be no overhanging shelf or cupboard over the sink.

6.8.2 It is advantageous to have a sink at a distance of about one metre on either side of the laboratory bench.

6.8.3 It is recommended that the sinks on the service bench should be fitted beneath the bench top, the hole being cut to reveal part of the rim and sealed with a non-hardening mastic or protected by a decorative thermosetting synthetic bonded laminated sheets flushing. The sinks on the surface bench may be made out of porcelain or other suitable material.

6.8.4 A washing sink and draining board may be provided in one corner of the laboratory to facilitate washing and drying of apparatus.

6.9 Fume Cupboard

6.9.1 The laboratory should be equipped with a fume cupboard of suitable dimensions. The fume cupboard should be equipped with services and provided with an efficient means of removing objectionable fumes, gases, vapours, etc.

6.9.2 The fume cupboards may be built against the wall. The inside wall shall be faced with white glazed tiles or glazed with a white acid resistance paint. The fume cupboard floor may be made of RCC slab faced with white glazed tiles. An adequate air flow through the fume cupboard shall be ensured.

6.9.3 Services — The main services required in a fume cupboard are gas, water, waste outlet and electricity. All services should be plainly identified by the use of colours, distinctively shaped taps, labelling, etc. All mechanical services should have outside controls with the outlets arranged in the front corners of the base, in the front pilasters or along the sides of the

fume cupboard. Electricity outlets should be arranged outside the fume cupboard and it is desirable that they be kept as far away as possible from the water services.

6.10 Water Supply — In the normal course, when sugar factories have adequate water supply, there should be no special problems of providing water to the laboratory as such. Adequate water supply at sufficient head to work or filter pump efficiently should be provided. Generally, 2 to 10 points are needed in a sugar factory laboratory depending upon the size. Water supply should be provided with flow meter and shall meet the requirement of IS 10500.

6.11 Distilled Water — The laboratory shall be equipped with a distilled water plant of adequate capacity.

6.12 The laboratory shall be equipped with electrical heating system. Provision of 15 amperes power point units should be adequate. Wherever necessary, the laboratory may be provided with gas heating system.

6.13 Service Lines — The service lines, namely, those of tap water, electric power and gas should run along walls, 80 cm above floor level and connections taken to the laboratory benches. Following points should be borne in mind while installing service lines:

- a) Benches should be easily removable, and
- b) Service lines should be easily accessible.

6.13.1 There should be a provision for 3-phased 5 kW electric connections. Provision for suitable voltage stabilization shall also be made.

6.14 Drainage — An underground system complying with the requirements given in IS 1742 should be provided. It should be covered with metal or cement slabs which are easily removable for easy cleaning and inspection. At the outlet of the laboratory drain a siphon trap shall be provided to prevent the entry of rodents. It is, however, desirable that the drainage should be through closed drain pipes to effluent treatment plant.

6.15 Each laboratory shall be equipped with fire extinguishers of suitable sizes (*see* IS 2190).

6.16 To ensure sufficient ventilation, an exhaust fan of suitable size should be provided in the laboratory (*see* IS 2312).

6.17 The laboratory shall be equipped with a first-aid box.

7 SPECIAL REQUIREMENTS

7.1 Balance/Instruments Room — The balance room should be so located in the laboratory that it is least affected by vibrations and be away from all sources of air contamination.

7.2 Doors — The laboratory should be provided with minimum of two exits. The doors of the laboratory should be self-closing.

7.3 Drains — The drains should be made of stoneware. The volume of discharge should be considered while constructing the drains. The drains should be made of an acid-proof material and should be provided with suitable traps.

7.4 All the rooms meant for analytical work in the laboratory should be fly-proof and rodent-proof.

8 CHEMICALS AND CONSUMABLE STORES

8.1 The lists of chemicals and consumable stores required for routine and special analytical work in a sugar factory laboratory are provided in relevant Indian Standard on sugar and sugar products. Pure chemicals should be stored unless mentioned otherwise.