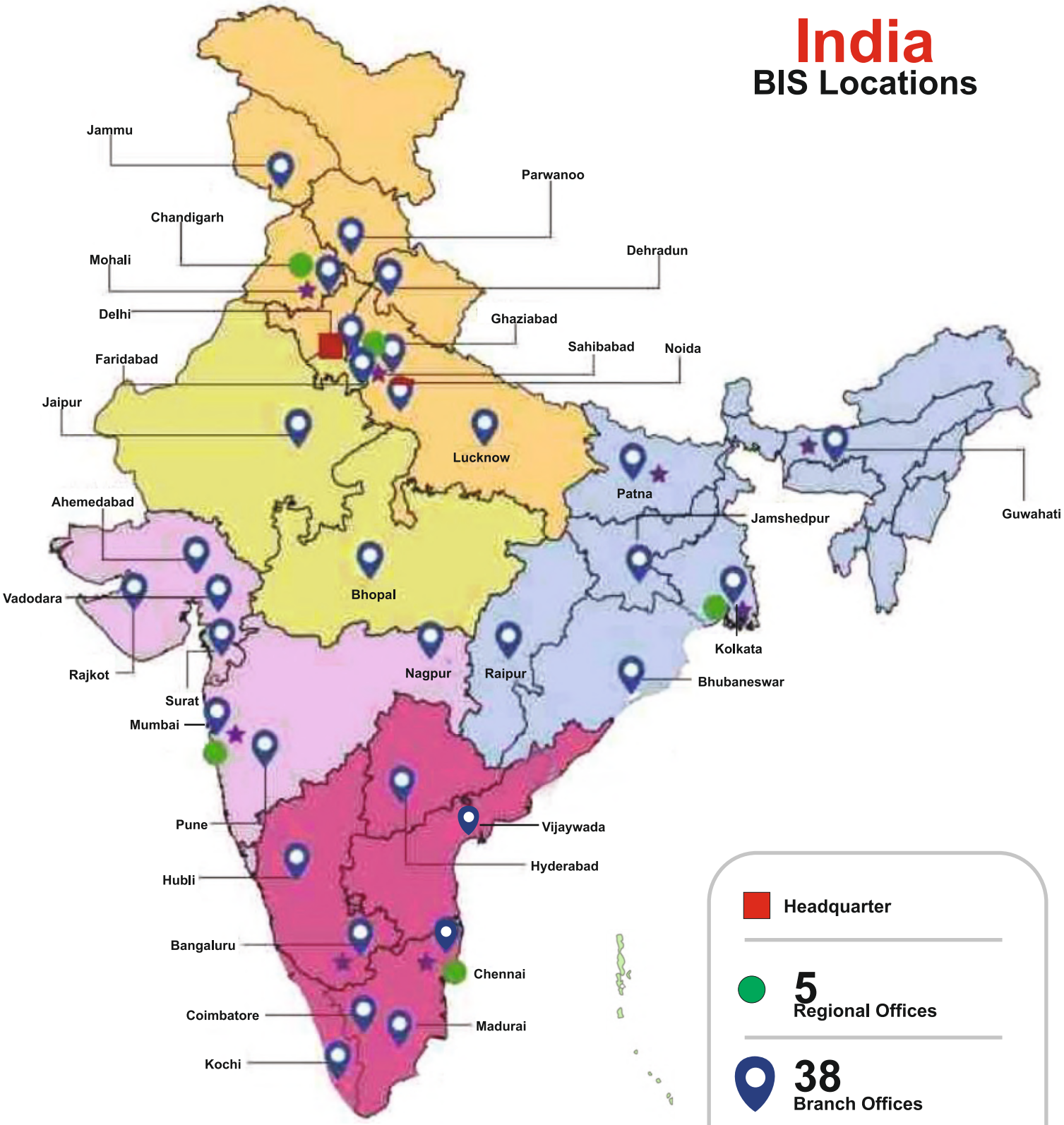
INDIAN STANDARDS
ON
MECHANICAL ENGINEERING DEPARTMENT

BUREAU OF INDIAN STANDARDS
Ministry of Consumer Affairs
Food and Public Distribution
Government of India

भारतीय मानक ब्यूरो
उपभोक्ता मामले, खाद्य और
सार्वजनिक वितरण मंत्रालय
भारत सरकार

India
BIS Locations



Headquarter

5 Regional Offices

38 Branch Offices

8 Laboratories

— Training Institute (NITS)

सत्यमेव जयते

मानकः पथप्रदर्शकः

Azadi Ka Amrit Mahotsav

ABOUT BIS

Bureau of Indian Standards (BIS), the National Standards Body (NSB) of India was established under the *BIS Act*, 1986 and came into existence on 1 April 1987 assuming the functions of the erstwhile Indian Standards Institution (ISI). The ISI was established on 6 January 1947. *The BIS Act*, 2016 came into force on 12 October 2017 superseding BIS Act 1986. *The BIS Act*, 2016 provides for the establishment of a national standards body for the harmonious development of the activities of standardization, conformity assessment and quality assurance of goods, articles, processes, systems and services and for matters connected therewith or incidental thereto.

BIS through its core activities of standardization and conformity assessment, has been benefiting the national economy by providing safe, reliable and quality goods; minimizing health hazards to consumers; protecting the environment; controlling over proliferation of varieties; promoting exports and imports substitutes, etc. The standardization and conformity assessment schemes of BIS apart from benefitting the consumers and industry also support various public policies especially in areas of product safety, consumer protection, food safety, environment protection, building and infrastructure development, etc.

BIS also represents India in international standards bodies like International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and participates actively in the international standardization work undertaken by these bodies. BIS presents the national viewpoints on new areas taken up for international standardization and on various draft international standards during the process of development of these standards so that the country's interest is protected and reflected in these standards. This also enables the BIS technical committees to consider adoption of the international standards as Indian Standards, with or without modifications, in order to enable our products and services to integrate with global trade and commerce.

What are Standards?

Standard is a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Importance of Standardization

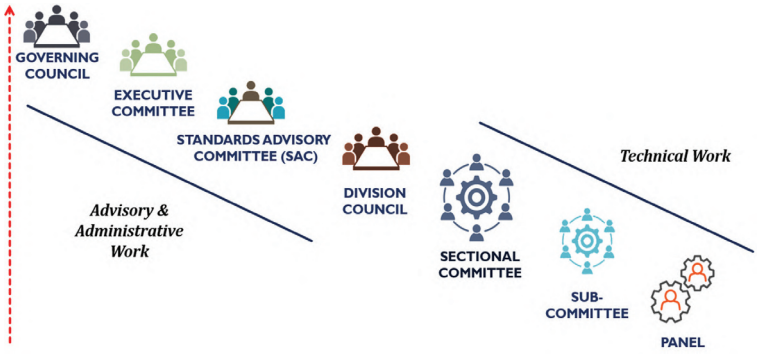
Standardization is the process of developing technical standards through consensus of different parties.This standardization aims to address one or all of compatibility, interchangeability, variety control, safety, environment protection, product protection and fitness for purpose. Standards provide numerable benefits to the technologists, producers, consumers and traders besides defining purpose for each of these entities.

Standards can be formulated at various levels ranging from an individual through National (IS) to International level (ISO). Also, depending on the subject in hand, standards can be made on various aspects such as terminology, specification, sampling, testing, code of good practice, systemes and services.

STANDARDIZATION ACTIVITY OF BIS

Standardization Structure

There are 16 Technical Departments formulating standards in various subject areas. Corresponding to these departments, 16 division councils exist. Each division council has several sectional committees working under it. The standards cover important segments of economy and help the industry in upgrading the quality of their goods and services.

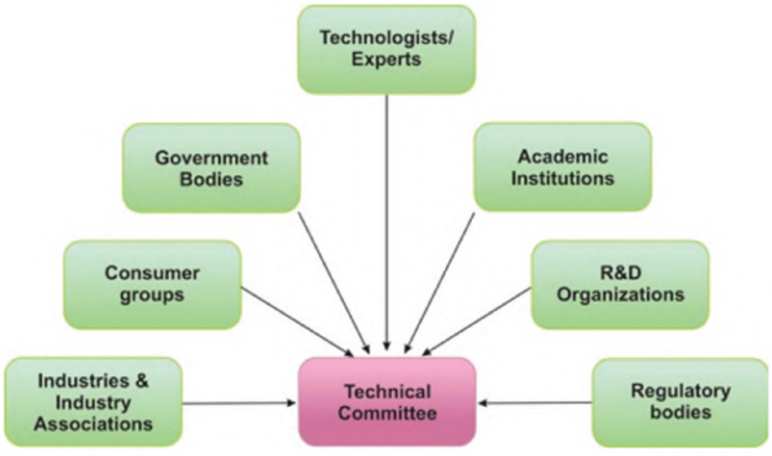


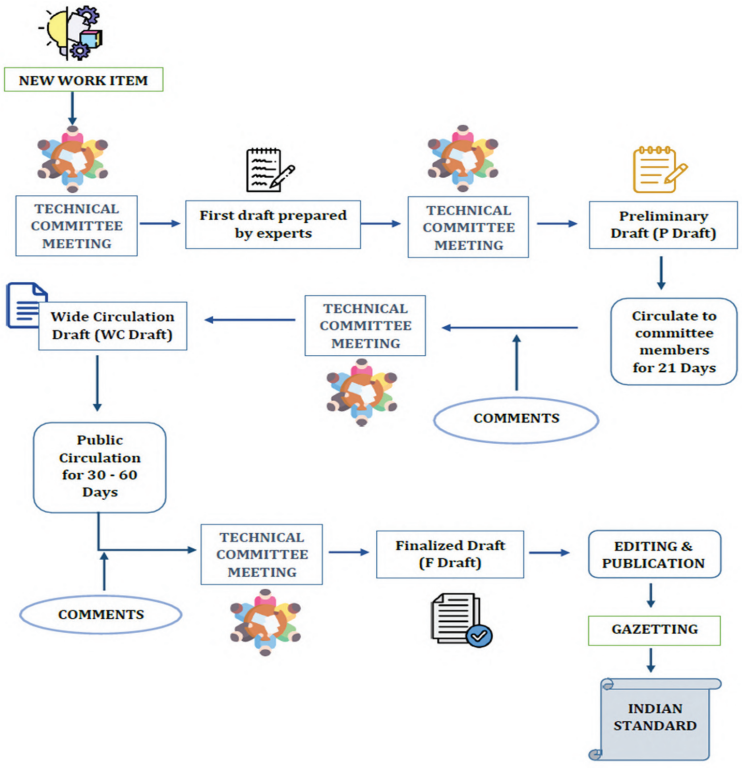
Ayush Division Council (AYDC)	Chemical Division Council (CHDC)	Civil Engineering Division Council (CEDC)	Electro-Technical Division Council (ETDC)
Electronics & Telecommunication Division Council (LITDC)	Food and Agriculture Division Council (FADC)	Mechanical Engineering Division Council (MEDC)	Management and Systems Division Council (MSDC)
Metallurgical Engineering Division Council (MTDC)	Medical Equipment & Hospital Planning Division Council (MHDC)	Petroleum, Coal & Related Products Division Council (PCDC)	Production and General Engineering Division Council (PGDC)
Transport Engineering Division Council (TEDC)	Textile Division Council (TXDC)	Water Resources Division Council (WRDC)	Service Sector Division Council (SSDC)

Standards Formulation Process

The Indian Standards are developed by technical committees that are representative of various stakeholders having interest in the relevant subject of standardization under the scope of such committees through a process of consultation so that views of all are given due consideration and a consensus is evolved in formulating a standard. The stakeholders involved in national standardization can broadly be categorized as industry, consumers/ users, technologists (R&D and scientific institutions, academia, individual subject experts, etc) and government departments/regulators.

The process of standards development of BIS is aligned with accepted international best practices that are based on the core principles of openness, transparency, impartiality and consensus. The process begins with the identification of the standardization needs of the given sector or subject following which the development of the standard is taken up and planned bythe relevant technical committee. Apart from consultation within the technical committees, draft standards are also open for public views/comments.





Standards Development Process Flow

Indian Standards on Refrigeration and Air Conditioning

Scope of Mechanical Engineering Division Council (MEDC):

Mechanical Engineering Department (MED) is one of the 16 technical department of BIS and its scope is "*Standardization in the field of Mechanical Engineering covering Boilers and Pressure Vessels; Refrigeration and Air-conditioning; Renewable Energy Sources; 'Earth Moving Equipment and Material Handling; Chemical Engineering Plants and Equipment; Construction Plant and Machinery; Pumps and Hand pumps; Compressors, Blowers and Exhausters; Gas Cylinders; Security Equipment; Mining Techniques and Equipment; Printing Machinery; Sewing Machines; Water Well Drilling; Utensils, Cutlery and domestic hardware; Oil and gas burning appliances; wire ropes and wire products; Gaskets and packing; Methods and Equipment for underground gasification and coal bed methane; Mechanical Vibration and shock condition monitoring; mechanical Equipment used in refueling stations for petroleum and gaseous fuels, Energy Management and Energy Savings and Safety of Machinery*."

The aspect wise breakup of the standards formulated by MEDC as on date is given below:

Aspect	**No. of Standards**
Product Standards	607
Methods of Test	123
Codes of Practice	193
Terminology	63
Dimensions	65
System Standard	17
Safety Standard	55
Others	273
Total	**1396**

List of Technical Committees under Mechanical Engineering Department (MED):

Sl No	**Committee Number**	**Committee Name**
1.	MED 1	Boilers And Pressure Vessels
2.	MED 3	Refrigeration And Air Conditioning
3.	MED 4	Renewable Energy Sources
4.	MED 6	Continuous Bulk Conveying, Elevating, Hoisting Aerial Ropeways And Related Equipment
5.	MED 7	Earth Moving Equipment and Material Handling
6.	MED 8	Mining Techniques And Equipment
7.	MED 10	Wire Ropes And Wire Products
8.	MED 14	Cranes, Lifting Chains And Related Equipment
9.	MED 16	Gas Cylinders
10.	MED 17	Chemical Engineering Plants And Related Equipment

11.	MED 18	Construction Plant And Machinery
12.	MED 20	Pumps
13.	MED 21	Diamond Core And Water Well Drilling
14.	MED 22	Turbo Machinery
15.	MED 23	Domestic And Commercial Gas Burning Appliances
16.	MED 24	Security Equipment
17.	MED 25	Printing Machinery
18.	MED 26	Oil Burning Appliances
19.	MED 27	Handpumps
20.	MED 28	Mechanical Vibration And Shock Condition Monitoring
21.	MED 29	Sewing Machines
22.	MED 30	Gaskets And Packing
23.	MED 32	Photographic Equipment
24.	MED 33	Utensils, Cutlery And Domestic Hardware
25.	MED 37	Methods and Equipment for Underground Coal Gasification and Coal Bed Methane
26.	MED 38	Mechanical Equipment used in Refuelling Stations for Petroleum and Gaseous Fuel
27.	MED 39	Energy Management and Energy Savings
28.	MED 40	Safety of Machinery

Scope of Refrigeration and Air Conditioning Sectional Committee, MED 03

- Formulation of standards for refrigeration and air-conditioning equipment and appliances including terminology, definitions and symbols, designation of refrigerants, testing of refrigerating systems, and refrigerating units.
- Co-ordination of work with International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC)

ISO/IEC Liaison committees/sub-committees:

ISO TC-86 : *Refrigeration & Air-Conditioning*

ISO TC-86 SC-1 : *Safety and environmental requirements for refrigerating systems*

ISO TC-86 SC-4 : *Testing and rating of refrigerant compressors*

ISO TC-86 SC-6 : *Testing and rating of air-conditioners and heat pumps*

ISO TC-86 SC-7 : *Testing and rating of commercial refrigerated display cabinets*

ISO TC-86 SC-8 : *Refrigerants and refrigeration lubricants*

ISO TC-142 : *Cleaning equipment for air and other gases*

IEC TC- 59 SC- 59M : *Performance of Electrical Household and Similar Cooling and Freezing Appliances*

IEC TC- 61 SC- 61C : *Safety of Refrigeration Appliances for Household and Commercial Use*

IEC TC- 61 SC- 61 D : *Appliances for Air-conditioning for Household and Similar Purposes.*

List of Standards published by REFRIGERATION AND AIR CONDITIONING (RAC) SECTIONAL COMMITTEE, MED 03

- A total of 58 standards have been formulated by Refrigeration and Air Conditioning sectional committee,MED 03.
- A complete list of published standards can be accessed at https://www.services.bis.gov.in:8071/php/BIS_2.0/dgdashboard/published/standards?commttid=Mjkw&commttname=TUVEIDM%3D&aspect=&from=&to=
- A list of RAC standards under various categories published by BIS is given below:

Standards on Refrigeration:

IS No.	Title
IS 1474 : 1959	Specification for commercial refrigerators
IS 1475 : Part 1 : 2001	Self - Contained drinking water coolers - Specification: Part 1 energy consumption and performance (Third Revision)
IS 2167 : 2019	Specification for bottle coolers (Second Revision)
IS 2370 : 2014	Walk - In cold rooms - Specification (First Revision)
IS 3315 : 2019	Evaporative air coolers (Desert Coolers) - Specification (Third Revision)
IS 3615 : 2020	Glossary of Terms Used in Refrigeration and Air Conditioning (Second Revision)
IS 4831 : 2019	Recommendation on units and symbols for refrigeration (First Revision)
IS 7872 : 2020	Deep Freezers - Specification (Second Revision)
IS 11328 : 2022	Self-contained Automatic Ice Makers —Specification
IS 17550 (Part 1) : 2021	Household Refrigerating Appliance- Characteristics and test methods Part 1 General Requirements
IS 17550 (Part 2) : 2021	Household Refrigerating Appliance- Characteristics and test methods Part 2 Performance requirements
IS 17550 (Part 3) : 2021	Household Refrigerating Appliance- Characteristics and test methods Part 3 Energy Consumption and volume
IS 16672 (Part 1) : 2017	Refrigerated display cabinets: Part 1 vocabulary
IS 16672 (Part 2) : 2017	Refrigerated display cabinets: Part 2 classification, requirements and test conditions

on Air Conditioners:

IS No.	Title
IS 1391 (Part 1) : 2023	Room air conditioners - Specification: Part 1 unitary air conditioners (Third Revision)
IS 1391 (Part 2): 2018	Room air conditioners - Specification: Part 2 split air conditioners (Third Revision)
IS 7896 : 2001	Data for outside design conditions for air conditioning for Indian cities (First Revision)

IS 8148 : 2018	Ducted and package air - Conditioners - Specification (Second Revision)
IS 16590 : 2017	Water cooled chilling packages using the vapour compression cycle – Specification

Standards on Air Filters:

IS No.	Title
IS 16753 (Part 1) : 2018/ ISO 29463-1 :2011	High - Efficiency filters and filter media for removing particles in air: Part 1 classification, performance testing and marking
IS 16753 (Part 2) : 2018/ ISO 29463-2 :2011	High - Efficiency filters and filter media for removing particles in air: Part 2 aerosol production, measuring equipment and particle - Counting statistics
IS 16753 (Part 3) : 2018/ ISO 29463-3:2011	High - Efficiency filters and filter media for removing particles in air: Part 3 testing flat sheet filter media
IS 16753 (Part 4) : 2018/ ISO 29463-4:2011	High - Efficiency filters and filter media for removing particles in air: Part 4 testing method for determining leakage of filter elements - Scan method
IS 16753 (Part 5) : 2018/ ISO 29463-5:2011	High - Efficiency filters and filter media for removing particles in air: Part 5 test method for filter elements
IS 17570 (Part 1) : 2021/ ISO 16890-1:2016	Air Filters for general ventilation Part 1 Technical specifications requirements and classification system based upon particulate matter efficiency ePM
IS 17570 (Part 2) : 2021	Air Filters for general ventilation Part 2 Measurement of fractional efficiency and air flow resistance
IS 17570 (Part 3) : 2021/ ISO 16890-3:2016	Air Filters for general ventilation Part 3 Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured
IS 17570 (Part 4) : 2021 ISO 16890-4:2016	Air Filters for general ventilation Part 4 Conditioning method to determine the minimum fractional test efficiency

Standards on Components:

IS No.	Title
IS 655 : 2006	Air ducts - Specification (Second Revision)
IS 5111 : 1993/ISO 917 : 1999	Testing of refrigerant compressors (First Revision)
IS/ISO 8066-2 : 2001	Rubber and Plastics Hoses and Hose Assemblies for Automotive Air Conditioning Specification Part 2 Refrigerant 134a
IS/ISO 8066 -3 : 2020	Rubber and Plastics Hoses and Hose assemblies for Automotive Air Conditioning Specification Part 3 Refrigerant 1234yf
IS 10594 : 2021	Specification for Thermostatic Expansion Valves
IS 10617 : 2018	Hermetic compressors - Specification (Second Revision)
IS 11327 : 2022	Requirements for refrigerant condensing units (First Revision)
IS 11329 : 2018	Finned type heat exchanger for room air conditioner (First Revision)
IS 11330: 2021	Refrigeration Oil Separator — General Specification, Construction Requirements and Testing (First Revision)

IS 11561 : 2018	Code of practice for testing of water cooling towers (First Revision)
IS/ISO 11650 : 1999	Performance of refrigerant recovery and/or recycling equipment
IS 11951 : 2009	Pumpset for Desert Coolers - Specification (First Revision)
IS 12249: 2021	Desiccant Driers — Specification (First Revision)
IS/ISO 13261-1 : 1998	Sound power rating of air - Conditioning and air - Source heat pump equipment: Part 1 non - Ducted outdoor equipment
IS/ISO 13261-2 : 1998	Sound power rating of AirConditioning and air - Source heat pump equipment: Part 2 non - Ducted indoor equipment
IS 14618 : 2022	Automotive vehicles Air-conditioning and heating systems thermal performance Method of measurement
IS 16656 : 2017/ ISO 817 : 2014	Refrigerants - Designation and safety classification
IS/ISO 17584 : 2005	Refrigerant properties

Standards on Safety of Refrigeration and Air Conditioning:

IS No.	**Title**
IS/ISO 13043 : 2011	Road Vehicles Refrigerant Systems used in Mobile Air Conditioning Systems MAC Safety Requirements
IS 16678 (Part 1) : 2018/ ISO 5149 (Part 1):2014	Refrigerating Systems and Heat Pumps â•" Safety and Environmental Requirements Part 1 Definitions, Classification and Selection Criteria
IS 16678 (Part 2) : 2018/ ISO 5149 (Part 2):2014	Refrigerating systems and heat pumps - Safety and environmental requirements: Part 2 design, construction, testing, marking and documentation
IS 16678 (Part 3) : 2018/ ISO 5149 (Part 3):2014	Refrigerating systems and heat pumps - Safety and environmental requirements: Part 3 installation site
IS 16678 (Part 4) : 2018 ISO 5149 (Part 4):2014	Refrigerating systems and heat pumps - Safety and environmental requirements: Part 4 operation, maintenance, repair and recovery
IS/IEC 60335-2-40 : 2018	Household and similar electrical appliances safety : Particular requirements for electrical heat pumps air-conditioners and dehumidifiers
IS/IEC 60335-2-89 : 2010	Household and similar electrical appliances - Safety: Part 2 - 89: particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant unit or compressor

IS 1391 (Part 1& 2): 2023

Room Air Conditioners - Specification

This standard has two parts:

1. Part 1 Unitary Air Conditioners.

Scope: This standard (Part 1) specifies safety andperformance requirements of single-phase non-ductedunitary with single-stage, two-stage, multistage,fixed and variable speed air conditioners andheat pumps for household and similar applicationof rated capacity up to and including 10 500 Wtheir rated voltage not more than 250 V a.c., 50 Hzfor single-phase employing air cooled condensersand test methods for determination of variousratings. This standard is limited to systems utilizinga single refrigeration circuit, having one evaporatorand one condenser.

2. Part 2 Split Air Conditioners

Scope: This standard (Part 2) specifies safety and performance requirements of single or three phase non-ducted split with single stage, two stage, multistage, fixed and variable speed air conditioner and heat pumps (residential, commercial, and industrial) of rated capacity up to and including 18 000 W their rated voltage up to and including 250 V a.c., 50 Hz for single-phase and up to and including 415 V a.c., 50 Hz for three-phase power supply employing air cooled condensers and test methods for determination of various ratings. This standard is limited to systems utilizing a single refrigeration circuit, having one evaporator and one condenser.

This standard (both parts) is not applicable to the following:

a) Water-source heat pumps or water-cooledair conditioners;

b) Mobile (windowless) units having acondenser exhaust duct;

c) Individual assemblies not constituting acomplete refrigeration system;

d) Equipment using the absorptionrefrigeration cycle; and

e) Portable air-conditioners.

3. Some common Terminology:

a) Unitary Air Conditioner — An encased assembly designed as a self-contained unit primarily for mounting in a window or through the wall or as a console. It consists of compressor, heat exchangers, and air handling system installed in one cabinet. It is designed primarily to provide free delivery of conditioned air to an enclosed space, room, or zone (conditioned space). It includes a prime source of refrigeration for cooling anddehumidification and a means for the circulation and filtering of air. It shall include means for exhausting air. It may also include means for heating, humidifying, or inducting fresh air.

b) Standard Barometric Pressure — Barometric pressure at 1.013 25 bar (760 mm Hg).

c) Room Discharge Airflow — Rate of flow of air from the outlet of the unit into the conditioned space.

d) Room Intake Airflow — Rate of flow of air into the unit from the conditioned space.

e) Outdoor Discharge Airflow — Discharge rate of flow of air from the unit.

f) Outdoor Intake Airflow — Rate of flow of air into the unit from the outdoor-side.

g) **Exhaust Airflow** — Rate of flow of air from the room side through the unit to the outdoor-side.

j) **Leakage Airflow** — Rate of flow of air interchanged between the room side and outdoor side through the unit as a result of its construction features and sealing techniques.

k) **Bypassed Room Airflow** — Rate of flow of conditioned air directly from the room side outlet to the room side inlet of the unit.

m) **Bypassed Outdoor Airflow** — Rate of flow of air directly from the outdoor-side outlet to the outdoor-side inlet of the unit.

n) **Equalizer Opening Airflow** — Rate of flow of air through the equalizer opening in the partition wall of a calorimeter.

p) **Total Cooling Capacity** — The amount of sensible and latent heat that the unit can remove from the conditioned space in the definiteinterval of time.

q) **Rated Cooling Capacity** — Total cooling capacity at rated conditions.

r) **Total Heating Capacity** — The amount of heat that the unit can add to the conditioned space (but not including supplementary heater) in the definite interval of time.

s) **Room calorimeter** — It is a test facility consisting of two contiguous calorimeters with a common partition. One is designated as the room side compartment, and the other as the outdoor compartment. Each side is equipped with instrumented reconditioning equipment whose output may be measured and controlled to counterbalance the room side humidifying and cooling effect and the outdoor side humidifying and heating effect of the unitary air conditioner under test.

t) **Room psychrometric** — It is facility consisting of two contiguous test rooms with a common partition. One is designed as the room side compartment and the other as the outdoor compartment. Each side is equipped with reconditioning equipment for maintaining the required room temperature and humidity.

u) **Rated Voltage** — Voltage shown on the nameplate of the unit.

v) **Rated Frequency** — Frequency shown on the nameplate of the unit.

w) **Fixed Capacity Unit** — Equipment which does not have possibility to change its capacity. This definition applies to each cooling and heating operation individually.

x) **Two-Stage Capacity Unit** — Equipment where the capacity is varied by no more than two steps. This definition applies to each cooling and heating operation individually.

y) **Multi-Stage Capacity Unit** — Equipment where the capacity is varied by 3 or 4 steps. This definition applies to each cooling and heating operation individually.

z) **Variable Capacity Unit** — Equipment where the capacity is varied to represent continuously variable capacity. This definition applies to each cooling and heating operation individually.

4. CLASSIFICATION

According to function, unitary air conditioners shall be classified as follows:

a) Cooling only — Cooling and dehumidification during cooling mode; and

b) Cooling and heating — Cooling and dehumidification during cooling mode andheating during heating mode.

5. IMPORTANT TESTS

a) Cooling Test

- Cooling Capacity Test
- Maximum Operating Test
- Freeze-Up Test
- Enclosure Sweat Test
- Condensate Disposal Test for unitary ACs

b) Heating Test

- Heating Capacity Test
- Maximum Heating Performance Test

c) Safety Test

d) Measurement of Indian Seasonal Energy Efficiency Ratio (ISEER)

d) Power Consumption Tests for cooling/ heating

e) Sound Pressure test

IS 17693 : 2022

Non-electric Cooling Cabinet Made of Clay

1. Scope

This standard specifies the construction and performance requirement of a cooling cabinet made outof clay, which operates on the principle of evaporative cooling. These cabinets may be used to store perishable foodstuff in areas where electrical power is not available.

2. Terminology:

a) **Clay** - Clay is a type of fine-grained natural soil material containing clay minerals. Clays develop plasticity when wet, due to a molecular film of water surrounding the clay particles, but become hard, brittle, and non-plastic upon drying or firing.

b) **Cooling Cabinet** - It is a cabinet to cool the water as well as foodstuffs and store them for prescribed time.

c) **Foodstuff** - Food and beverages intended for consumption.

d) **Time Period** - Time during which the stored items remain usable.

e) **Volume** - Space within the inside liner of the cooling cabinet, or a compartment or sub-compartment.

3. Cooling Performance Evaluation

a) General

As the cooling cabinet functions on the evaporative cooling principle, the cooling effect will be more when the difference between dry-bulb temperature (DBT) and wet bulb temperature (WBT) is more.

b) Test Condition

The performance shall be examined as below and stored water temperature shall not be more than28 °C. To provide the appropriate ventilation, the air velocity around the cabinet shall be between 1 m/s to 2 m/s with airflow direction from top to bottom and the temperature gradient in the test lab at every height of 1 m shall be less than 1.0 °C.

c) Test Method

To determine the characteristics of a cooling cabinetmade of clay, as per this standard, it is necessary tomeasure the temperature for a representative period ofsteady-state operation that complies with the relevantrequirements.These values are measured at specified ambienttemperature 32 ± 1 °C for cooling performancedetermination.To assess whether a proposed period of test datais acceptable for the determination of coolingperformance, the data are analyzed and examinedto assess whether changes in internal temperaturesare within acceptable limits. Steady-state internaltemperature determination where the change in cabinetinternal temperature is within ± 0.5 °C between thetwo consecutive temperature readings at an interval of15 min.

After achieving the steady-state condition, at least7 internal temperature readings shall be taken.

Cooling effect shall be calculated as follows:

Cooling effect = Ambient DBT – Cabinet internal DBT

Where, DBT is dry bulb temperature.

IS 17773 : 2022

Closed-Circuit Ammonia Refrigeration System —

Code of Practice for Design and Installation

1. Scope:

This standard covers the code of recommendedpractice for the safe design and installation ofclosed-circuit vapour compression ammoniarefrigeration systems.

The requirements outlined in this standard applyto stationary closed-circuit mechanical refrigeratingsystems utilizing ammonia as the primary refrigerant.

This standard provides normative requirementsrelating to the equipment, design, safety, and installationof the following:

a) Stationary closed-circuit ammonia refrigerating systems and their components in industrial occupancies and limited charge self-contained systems for commercial occupancies; and

b) Indirect closed-circuit ammonia refrigerating systems for industrial, commercial, public assembly and large mercantile occupancies.

This standard does not apply to:

a) Ammonia absorption and adsorption refrigerating systems; and

b) Replacements of machinery, equipment or piping, meeting the functional equivalents.

2. Some common Terminology:

2.1 Actuator - Mechanism for transmission of movement or force.

2.2 Acute-Toxicity Exposure Limit (ATEL) - The maximum recommended refrigerant concentration determined in accordance with the established systems and intended to reduce the risks of acute toxicity hazards to human in the event of a refrigerant release.

2.3 Accumulator - A low pressure vessel, separating refrigerant liquid and gas installed after the expansion device but before the liquid enters the evaporator in gravity flooded systems.

2.4 Air-Cooled Condenser - A refrigerant condenser in which heat removal is accomplished entirely by heat absorption by the air flowing over condensing surfaces.

2.5 Air-Cooled De-super-heater - A part of the system/equipment designed to cool the ammonia refrigerant vapour after it is discharged from the compressor and before it enters the condenser.

2.6 Air Cooler, Dry - It is a forced circulation air cooler wherein heat transfer is a combination consisting of air circulation and refrigerant cooling.

2.7 Air Cooler Spray Type - It is a forced circulation air cooler wherein the coil surface capacity is augmented by a liquid spray during the period of operation.

2.8 Air Duct - A tube or conduit for conveying air.

2.9 Ammonia - Refrigerant-grade anhydrous ammonia.

2.10 Approved - Acceptable to the jurisdictional authorities.

2.11 Approximate Lethal Concentration (ALC) - The concentration of a substance, or refrigerant in this standard, that was lethal to even a single test animal but no less than 50 percent of the animals in that group when tested by the same conditions as for an LC50 test.

2.12 Authorized Personnel - Persons who, have been specifically granted permission to enter a restricted area.

2.13 Automatic Expansion Valve - A controlling device that regulates the flow of the volatile mixture of refrigerant into an evaporator of a closed-circuit ammonia refrigerating system and which is actuated by evaporator pressure or temperature or liquid level.

2.14 Automatic Liquid Refrigerant Drain Valve - Valves provided for liquid ammonia condensate draining from hot gas defrost lines or other ammonia lines where liquid ammonia is likely to condense and accumulate.

2.15 Auxiliary Door - Any non-principal door communicating with a machinery room.

2.16 Booster Compressor - A compressor for discharging gas to the suction of a higher-stage compressor either directly or through an intermediate pressure vessel or heat exchanger.

2.17 Boiling Point — It is the temperature at which liquid changes its phase to vapour at atmospheric pressure at sea level.

2.18 Burning Velocity (S_u) - Velocity in cm/s, relative to the unburnt gas, at which a laminar flame propagates in the direction normal to the flame front, at the concentration of refrigerant with air giving the maximum velocity.

2.19 Building Code - The National Building Code of India.

2.20 Building Opening - A permanent or operable area that allows outdoor air in to the building envelope including operable doors (for example, swinging doors, slide doors, roll- up doors, fire doors, access hatches), operable make- up air intakes (where the intakes are not equipped with the ability to close automatically when ammonia is present), and other vents with permanent openings.

2.21 Cascade Refrigeration Systems - Two or more independent refrigerant circuits where the condenser of one system rejects heat in the evaporator of another system.

2.22 Closed-Circuit Ammonia Refrigerating System - A refrigerating system using mechanical compression to transfer the refrigerant from the low pressure side and to deliver it to the high pressure side of the system.

2.23 Compressor - A specific machine with or without accessories, for compressing ammonia refrigerant vapour. *See* also booster compressor, positive displacement compressor.

2.24 Compressor Positive Displacement - It is a refrigerant compressor in which increase of refrigerant gas/vapour pressure is attained by decreasing the internal volume of the compressor chamber.

2.25 Compressor Open - Compressor having a drive shaft penetrating the refrigerating tight housing.

2.26 Coefficient of Performance (Refrigerating) - It is the ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigerating plant or some specific portion/part of that plant, under designated operating conditions. It is dimensionless value.

2.27 Compound Refrigeration Systems - A multi-stage refrigerating system in which a single charge of refrigerant circulates through all stages of compression (*see* multi-stage refrigerating system).

2.28 Combustible - A material that does not meet the definition of non-combustible material.

2.29 Coil - Part of the refrigerating system constructed from pipes or tubes suitably connected and serving as a heat exchanger (evaporator or condenser).

2.30 Condenser - A heat exchanger in which compressed refrigerant, to a suitable pressure, is condensed by the rejection of heat to an appropriate external cooling medium.

2.31 Condenser, Natural Draught Water-Cooled Condenser - A condenser that obtains cooling effect by the evaporation of water in natural air stream on the external surface of the tubes for the heat removal necessary to refrigerant vapour on the inside of the tubes. It is a condenser (without forced/induced air circulation) that is exposed to the atmosphere, cooled with water only.

2.32 Condenser, Evaporative - A condenser that obtains cooling effect by the evaporation of water in a forced/induced airstream on the external surface of the tubes for the heat removal necessary to liquify refrigerant vapour on the inside of the tubes. *See* also air-cooled condenser, double-pipe (tube-in-tube) condenser, desuperheater condenser, shell-and-tube condenser.

2.33 Condenser Water Cooled - It is a refrigerant condenser in which heat rejection is accomplished entirely by raising the temperature of the water used as cooling medium.

2.34 Condensing Unit- Combination of one or more compressors, condensers and or liquid receivers (when required) and the required accessories.

2.35 Condenser Coil - That part of a condenser constructed of pipe or tubing not enclosed in a pressure vessel.

2.36 Containers, Refrigerant - A pressurized cylinder for the storage of refrigerant.

2.37 Control - It is any manual or automatic device for regulation of a system or component on system in normal operation.

2.38 Controlled-Pressure Receiver - An intermediate pressure receiver used to flash-cool refrigerant and to control the feed pressure. Also known as inter stage open or closed flash cooler and economizer in case of screw compressors (*see* also pressure vessel).

2.39 Corrosion Allowance -An extra thickness added to the designed thickness of wall of pressure vessel or shell and tube heat exchanges. This acts as a safety factor against expected metal loss throughout the life span in equipment.

2.40 Critical Point - A point on the saturation curve where the refrigerant liquid and vapour states of a substance meet and become indistinguishable. They have identical volume, density, and enthalpy and there is no latent heat. The density, pressure, specific volume, and temperature at the critical point are referred to as the critical density, critical pressure, critical volume, and critical temperature respectively.

3. Equipment and Components

3.1 Compressors

Compressors are a vital component in a vapour compression industrial refrigeration system. Compressors are the principle prime movers responsible for providing the motive force for circulating refrigerant throughout a system and for creating a sufficiently high refrigerant pressure differential that allows the transfer of heat from spaces or products to the outside environment. Compressors are the single largest consumer of primary energy (usually electricity) in a refrigeration system. The compressor technologies are reciprocating and screw compressors. Depending on the plant size, pressure ratio and other parameters number of compressors, type or a combination can be decided.

3.1.1 Design of compressors

Minimum design pressure for high stage compressors with water-cooled, or evaporative condensing shall be 2 070 kPa gauge and for air cooled 2 760 kPa gauge.

For reciprocating compressors, minimum low side design pressure shall be 2 070 kPa gauge.

Minimum design pressure for booster compressors shall be 2 070 kPa gauge.

3.2 Refrigerant Pumps

This clause applies to mechanical refrigerant pumps applied for use in closed-circuit ammonia refrigerating systems. This requirement does not apply to liquid refrigerant transfer employing pressure differential to move liquid refrigerant.

The refrigerant pumps are recommended for industrial refrigeration system where the system is designed with forced circulation of the refrigerant on the low-pressure side.

The layout and dimensioning of the pumps depends on the refrigeration output, the circulation factor, the evaporation temperature, the design of the evaporator and the geometric layout of the system.

3.2.1 Design of Refrigerant Pumps

Pump casing minimum design pressure requirements are as follows:

a) High side service utilizing water-cooled, air-cooled, or evaporative condensing: 2 070 kPa gauge; and

b) Low side service: 2 070 kPa gauge.

3.2.2A hydrostatic or differential pressure relief device (or non-closeable vent pipe) shall be used for pressure protection of a liquid pump and its associated piping. The inlet connection for the relief device or vent pipe shall be located on the pump casing or piping between the stop valves at the pump inlet and outlet, except that when a check valve is located between the pump and its outlet stop valve, the relief device or vent pipe inlet shall be connected to the pipe between the discharge check valve and stop valve. The discharge of this relief or vent pipe shall connect either to the pump suction line upstream of the pump suction stop valve or to the vessel to which the pump suction is connected. This pressure relief device or vent pipe shall be external to the pump housing.

3.3 Condensers

3.3.1 Air-Cooled Condensers and Air-Cooled De-superheaters

This applies to tube-and-fin and microchannel type air cooled condensers and air cooled de-superheaters which are applied to closed-circuit ammonia refrigerating systems.

3.3.2 Design

a) Minimum design pressure shall be 2 760 kPa gauge.

b) Where the refrigerant inlet and outlet lines of air-cooled condensers and de-superheaters can be automatically isolated, they shall be protected from hydrostatic pressure.

c) All exposed rotating components (for example, shafts, fans, belts, pulleys, flywheels, couplings)

shall be protected with screens or guards in accordance with approved safety standards.

d) Fan speeds shall not exceed the safe design speed recommended by the manufacturer for the temperature and the nature of the application.

e) A condenser or portion of a condensing unit supported from the ground shall rest on a concrete or other approved housekeeping pad base.

3.4 Evaporators

3.4.1 Forced-Air Evaporator Coils

This applies to evaporator coils and micro-channel heat exchangers which are applied to closed-circuit ammonia mechanical refrigerating systems.

3.4.2 Design

a) Minimum design pressure shall be 1 720 kPa gauge.

b) Where refrigerant coil inlet and outlet lines can be automatically isolated, they shall be protected from hydrostatic pressure.

c) All exposed rotating components (for example, fans, shafts, belts, pulleys, flywheels, couplings) shall be protected with screens or guards in accordance with governing safety standards.

d) Fan speeds shall not exceed the safe design speed recommended by the manufacturer for the temperature and the nature of the application.

IS 17681 : 2022

Bottled Water Dispensers - Specification

1. Scope

1.1 This standard specifies the safety and performance requirements of bottled water dispensers based on avapor compression refrigeration system for dispensingcold and hot water including water at room temperature.

It covers a bottled water dispenser with a rated voltage not exceeding 240 V a.c., 50 Hz for a single-phase and the rated cooling capacity up to and including 8 l/h and heating capacity up to and including 5 l/h.

1.2 The following types of bottled water dispensers are covered in this standard:

a) Bottom load water dispenser;

b) Table-top water dispenser; and

c) Freestanding water dispenser.

1.3 The product covered in this standard can have oneor more combinations for dispensing cold water, hotwater, and water at room temperature as follows:

a) Cold and hot;

b) Cold, hot, and room temperature;

c) Hot and room temperature;

d) Cold and room temperature; and

e) Water dispenser with an in-built refrigerator cabinet.

This standard does not apply to the following:

a) Peltier-based bottled water dispenser;

b) Self-contained water coolers covered in IS 1475 (Part 1); and

c) Point-of-use water dispensers (connected directly to the water line from the overhead water tank or connected through a direct water pipeline).

2. Some common Terminology:

a) **Cold and Normal Water Storage Tank**— A thermally insulated food-grade stainless steel or a food-grade plastic material tank intended for storage of cold and normal water.

b) **Ambient Temperature**— The measured temperature in the space surrounding the water dispenser under test.

c) **Hot Water Storage Tank**— It is a food-grade stainless steel tank that is fitted with a heater. It shall be constructed by sheathing material which should be copper or food-grade stainless steel.

d) **Refrigeration Compartment/Cabinet**— A floor-standing type water dispenser where the bottom space is fitted with a refrigeration compartment physically separated from the dispenser unit and an integral part of the dispenser to store beverages, cans, etc., at a temperature comparatively lower than the room/ambient temperature.

e) **Overall Dimensions (Unit without Bottle Loaded on Top)** — Measurement of the outside

rectangular dimensions over the horizontal base within which the water bottle is inscribed to include the complete appliance.

f) **Overall Space Required for Use**— Overall space necessary for the free circulation of the cool air when the appliance is in service, plus the space necessary to allow door opening (in case of a refrigeration cabinet models).

g) **Floor Standing**— Appliance in which the minimum height must be maintained in such a way that user can take the water freely. Itmay contain a storage compartment, or the bottle canbe placed in the cabinet asrefrigerated cabinets.

h) **Table Top** — Appliance in which there is no storage volume compartment normally and can be placed on the table.

j) **Pull-Down**— It is the capability of water dispensers to achieve the water temperatures within the prescribed time when the appliance is operated under normal operating condition.

3. Construction

3.1 General Design

The water dispensers shall have adequate mechanicalstrength and be constructed to withstand handlingand transportation. There shall be no sharp edges orcorners liable to cause injury to the user in the normalconditions of use.

3.2 Materials

Materials used in the construction of the cabinet shallcomply with relevant Indian Standards whereverapplicable, except where such requirements aremodified by this standard. They shall be free fromdefects that are liable to cause undue deterioration orfailure. Under normal conditions of use, the materialsused shall not shrink, warp or cause odour and shall beresistant to attack by local vermin and destructive pests.

Where liable to be exposed to moisture, chemically active substances, and beverages, they shall be suitably resistant and shall not contaminate stored products placed in contact with them. Sealing materials used shall not lose in service, any of their essential properties, such as adhesiveness, plasticity, and moisture resistance, due to aging, temperature, and humidity variations.

3.3 Finish

The interior and exterior finish shall be durable and capable of being cleaned effectively and hygienically without undue physical deterioration.

3.4 Thermal Insulation

The quality, thickness, and application of the insulating material shall be such that insulation of the water storage tank or cabinet is effective and efficient to maintain the required temperature inside the water storage tank and cabinet. There shall be proper sealing against moisture penetration by diffusion or condensation. Detachable plates and covers in the tank shall be provided with suitable sealing to prevent the ingress and trapping of moisture into the insulation.

Highly thermal conductive external or internal surfaces shall be separated by suitable insulating material. As far as possible, no part of the frame shall penetrate and cause damage to the insulation layers. The thermal insulation for the cooling unit, connections therefrom to the outlets, and for suction pipe of the condensing

unit shall be of vapour-proof materials or covered with an external vapour-proof barrier. The insulation shall have no interior air gap and shall be of sufficient thickness to prevent condensation on the exterior cold surfaces.

3.5 Hardware

The structure fitted with fasteners and hinges shall be smooth and positive in action and designed to maintain their proper function without undue wear under normal conditions of service. Screws and all other hardware shall be adequately protected from corrosion.

3.6 Disposal of Waste Water

The appliance shall be suitably designed at the water dispense area, such that the wastewater must be stored for a certain quantity without any spillage or have a provision of proper disposal through a drain.

3.7 Hot Water Tank

The thermostat is connected to the tank in such a way that it controls the required temperature and cuts off the heater power supply once the required temperature is achieved.

3.8 Hermetically Sealed Compressor

The compressor shall comply with the requirements of IS 10617.

3.9 Protective Guards

All moving parts shall be protected by suitable guards, shields, or screens of adequate strength and durabilityto avoid the possibility of making inadvertent contact therewith during normal service conditions.

4. Safety Requirements :

4.1 Electrical Accessories

All internal electrical fittings, such as indicators, waterlifting pumps, and switches, shall be provided with suitable guards for protection against mechanical damage and shall be suitable for operation at the lowestair temperature likely to occur.

4.2 Salt Mist Test

All metal parts used inside or outside the water dispenser which are exposed to moisture or ambient conditions shall be corrosion resistant or adequately protected against corrosion as per IS 9000 (Part 11) for72 h.

5. Sound Pressure Level

The water dispenser shall not have a sound pressure level of more than 55 dBA. The water dispenser shall be placed centrally in the test chamber with a background noise of less than 45 dBA. With the help of calibrated sound meter/analyser/ recorder, the sound level is to be measured at a distance of 1.1 m from the front side.

IS 3315 : 2019

Evaporative air coolers (Desert Coolers) – Specification

1 SCOPE

1.1 This standard covers the air capacity, constructional features, performance requirements and methods of testing for evaporative air coolers suitable for rated voltage up to and including 250 V, 50 Hz. ac.

1.2 These coolers are not suitable if difference between dry bulb temperature (DBT) and wet bulb temperature

(WBT) is less than 3°C and humidity is over 75 percent.

2 DEFINITIONS

2.1 Evaporative Air Cooler — A device which cools air by evaporation of water.

2.2 Evaporative Air Cooling — It involves the process of evaporating water into air stream. Air is cooled by direct contact with water through a wetted surface. The heat and mass transfer process between the air and water lowers the air dry bulb temperature at constant wet bulb temperature.

2.3 Temperature (Dry Bulb - DBT) — The temperature of air read on a thermometer placed in such a way as to avoid errors due to radiation.

2.4 Temperature (Wet Bulb - WBT) — The steady temperature finally given by a thermometer having its bulb covered with gauze or muslin moistened with distilled water and placed in air with relative velocity of not less than 2.5 m/s.

2.5 Cooling Efficiency — The extent to which the leaving air dry bulb temperature approaches the wet bulb temperature of entering air is expressed as cooling efficiency. It is expressed as:

$= ((T\text{db} - T\text{db}')/(T\text{db} - T\text{wb})) \times 100$

Where,

*T*db= dry bulb temperature of inlet air;

*T*db' = dry bulb temperature of outlet air; and

*T*wb= wet bulb temperature of inlet air.

2.6 Zero Static Pressure — It is the pressure at the outlet of air cooler made equal to the static pressure atthe inlet of the air cooler.

3 MINIMUM AIR CAPACITY

The minimum air capacities of the evaporative air coolers based on the delivery of air at 'Zero' static pressure shall be as under:

750, 1 000, 1 260, 1 500, 1 800, 2 000, 2 500, 3 000, 4 000, 5 000, 6 000 and 8 000 m3/h

4 PERFORMANCE REQUIREMENTS

4.1 The overall design of the air cooler shall be such that reasonably silent performance is obtained. It is recommended that noise level should not be more than 65 dBA at 1 m distance from the desert cooler when tested in an anechoic room.

4.2 The air cooler shall satisfy the following requirements:

a) The air delivery shall be not less than the declared minimum air capacity;

b) The cooling efficiency shall be not less than 65 percent

5 RATING

5.1 Rating Voltage

The rated voltage shall be 230 ~ 240 volts.

5.2 Rated Frequency

The rated frequency of cooler shall be standardfrequency of 50 Hz.

5 IMPORTANT TESTS

- Protection against Electric Shock
- High Voltage Tests
- Insulation Resistance Test
- Leakage Current
- Earthing Connections Tests
- Power Consumption Test
- Cooling efficiency Test
- Air delivery Test

IS 1475 (Part 1) : 2001

Self - Contained drinking water coolers - Specification: Part 1 energy consumption and performance

1 SCOPE

This standard (Part 1) prescribes the general constructional requirements, recommended standard sizes, methods of testing and rating, and installation of self contained drinking water coolers operated by electrically driven vapour compression type refrigerating machine with air-cooled condenser.

2 TERMINOLOGY

2.1 Cooling Capacity Rating of a Water Cooler —Itis the quantity of water,it will cool under given ambient temperature conditions with a given inlet watertemperature and a given outlet water temperature. This shall be expressed as number of litres of watercooledper hour.

2.2 Power Input of a Water Cooler — It is the totalpower input in watts when the cooler is operated under given conditions.

2.3 Self-Contained Drinking Water Cooler — A factory made assembly, in one structure which includes a complete mechanical refrigerating system, and which has the primary function of cooling potable water and also provides for dispensing such water, by either integral or remote means, or both.

2.4 Pressure type Water Cooler — A type of water cooler which employs a closed cooling chamber having connections for inlet water under pressure and outlet for cold water.

2.5S torage type Water Cooler — A type of water cooler which stores and cools the water in the same container or separate containers. Such water coolers may or may not be fitted with plumbing connections for water inlet, drain, overflow, etc.

2.6 StaticHead— It is the minimum head in metres of water column required to promote the flow at the rated capacity through cooling unit and its controlling valve. This is essentially applicable to pressure type after cooler.

2.7 Storage Capacity of Tank in the Storage type Drinking Unit — It shall be the amount of water in litres that can be drawn from drinking water faucet after the storage tank has been first filled to the level which is normally maintained, either by a water level actuated automatic shut off valve or manually in case of non-plumbing type models.

3 CLASSIFICATION

3.1 Self-propelled water coolers shall be classified as:

a) Pressure type water coolers, and

b) Storage type water coolers.

3.2 Pressure type water coolers shall ordinarily beof the two types given below:

a) Bubbler Type, and

b) Faucet Type

3.3 Storage type water coolers shall ordinarily be any of the following types:

a) Cooler which may store or cool water in the same container, and

b) Cooler which may employ bottle or container for storing supply of water to be cooled. Such bottle or container is placed on or within the water cooler.

4 PERFORMANCE REQUIREMENTS

4.1 All ratings shall be based on either 230 or 240 volts in the case of single phase supply and either 400 or 415 volts in the case of 3 phase supply. The unit, however, shall be capable of working at any voltage within ± 10 percent of the rated voltage.

4.2 Capacity Rating Test Conditions

Self-contained water coolers of all type shall be rated under the following conditions:

a) Ambient temperature 35.0°C,

b) Inlet water temperature 30.0°C, and

c) Maximum outlet water temperature 13.5°C.

4.3 Maximum Operating Test Conditions

Self-contained water coolers of all types shall perform satisfactorily when tested under the following conditions:

a) Ambient temperature 43.0°C,

b) Inlet water temperature 35.0°C,

c) Maximum outlet water temperature 18.5°C,

d) Water flow rate maintained at 90 percent of the capacity and

e) Supply voltage at 90% and 110% of rated voltage.

5 TESTS

a) Insulation resistance tests,

b) High voltage test,

c) Electric insulation test,

d) Performance test,

e) Cooling capacity rating test, and

f) Maximum operating condition test.

IS 7872 : 2020

Deep Freezers — Specification

1 SCOPE

1.1 This standard specifies the safety, constructional and performance requirements including methods of determining performance of deep freezers based on vapour compression working principle. This standard covers deep freezers of top access type, having a storage volume up to and including 1 000 litre, with both hard top, glass top (sliding, hinged and curved) and their rated voltage not exceeding 240 V a.c. 50 Hz for single phase and 415 V a.c. 50 Hz for three phase a.c. including units with fixed speed and variable speed compressors.

1.2 The following types of deep freezers are not within the scope of this standard:

a) Vertical freezer;

b) Combo freezers (freezer+ cooler); and

c) PCM/Eutectic based freezers/ Blast freezers.

2 TERMINOLOGY

2.1 Food Freezer — A thermally insulated cabinet which is intended for storing of frozen food for storage application when the food is brought in at same or lower average temperature than -18°C.

2.2 Ambient Temperature — The measured temperature in the space surrounding the deep freezer under test. It is the arithmetical average value of temperatures measured at three points, located at 350 mm from the vertical centreline of the two opposite side walls and front side of the deep freezer.

2.3 Balanced Pressure — It is the pressure in the 'off' cycle at any point in the refrigeration system after the high and low sides have attained a condition of thermal equilibrium at design ambient condition.

2.4 The Average Freezer Air Temperature — The average inside air temperature taken by means of thermocouples or thermometers located at places in the freezer cabinet.

2.5 Cycles per 24 Hours — A cycle in the operation of a freezer is the period during which a compressor goes through the steps of starting, running, stopping and starting again. Cycles per day can be determined by dividing the number of complete cycles by the elapsed time in hours and multiplying the result by 24.

2.6 Percentage Running Time — The percentage running time, under required conditions of ambient temperature and of average internal temperature, is the ratio of duration of compressor operation during a full number of cycles to the total duration of full number of cycles as represented by the following equation:

$R = d / D \times 100$

where

d = duration of compressor operation during a full

number of cycles, and

D = total duration of full number of cycles

2.7 Overall Dimensions (Door or Lids Closed)—Measurement of the outside rectangular dimensions over the horizontal base within which the freezer inscribed to include the complete appliance shall also

include the protrusion of the handle. The dimensions of all external accessories other than handle provided/ recommended by manufacturers shall be specified separately.

2.8 Overall Space Required for Use (Doors or Lids Open) — Overall dimensions including the handle, space necessary for free circulation of the cooling air when the appliance is in service, plus the space necessary to allow door opening up to minimum angle permitting removal of all removable parts such as containers and shelves, etc.

2.9 Gross Volume — Total volume contained within interior walls of the freezer without internal fittings namely, baskets, partition self and similar fittings with the door closed.

2.10 Rated Gross Volume — Gross volume declared by the manufacturer

2.11 Storage Volume — The total volume contained within interior walls of the freezer for storage of food, which remains after deduction of the volume of components and spaces recognized as unusable for the storage of food (considering maximum storage limit line).

2.12 Rated Storage Volume — Storage volume declared by the manufacturer.

2.13 Maximum Storage Limits Line — The line which defines maximum line up to which the storage can be done as per manufacturer instruction.

2.14 Front Access Type — Appliance in which the storage compartment(s) is (are) accessible from the Front.

2.15 Top Access Type — Appliance in which the storage compartment(s) is (are) accessible from the top.

2.16 Storage Basket — A basket is any combination of vertical and/or horizontal surface (shelves, partitions, etc.) in which food can be placed. It may be formed by one component or by components fitted side-by-side, which may be fixed or removable.

2.17 Storage Partitions — A partition is any combination of vertical and/or horizontal surface (shelves etc.) by which food can be separated from each other. It may be formed by wire self-partition or by components fitted side-by-side, which may be fixed or removable.

2.18 Pull-Down — It is the capability of deep freezers to achieve the average freezers air temperatures up to -18°C from an ambient temperature of 43°C at no load.

2.19 Pressure (Refrigeration System Components Except Compressor)

2.19.1 *Design Pressure* **—** Pressure chosen for the strength calculation of each refrigerant containing component.

2.19.2 *Tightness Test Pressure* **—** Pressure that is applied to test a system or any part of it for tightness under pressure

2.19.3 *Maximum Allowable Pressure* (PS) **—** Maximum pressure which system or component is designed, as specified by the manufacturer

2.19.4 *Refrigerating Strength Pressure* **—** Pressure that is applied to test the strength of a refrigerating system or any part of it.

2.20 Operating Cycle — For refrigerating appliance systems designed to operate continuously, the operating cycle is defined as a period of 24 h under stable operating conditions.

For other refrigerating appliances the operating cycle is the period between two successive stops of the refrigerating system, or a part of a system, under stable operating conditions.

If a single operating cycle is longer than 48 h the value of storage temperatures and energy consumption from the first 24 h are to be compared.

2.21 Energy Consumption — Energy used by the deep freezer over a specified period of time or for a specified operation as determined in accordance with this standard stated, in kWh (kilowatt hour).

3 REFRIGERATION SYSTEM

3.1 Construction

The pipes and connections to moving or resiliently mounted parts shall be arranged so as not to foul or transmit vibration to other parts. The pipes and connections shall be securely fixed and should be of sufficient length to minimize the risk of failure due to vibration. The evaporator may be of suitably copper coated or plated steel, copper, brass or aluminium. Stainless steel may also be used for this purpose.

3.2 Control of Operation

Refrigerant flow and compressor motor shall be controlled with the help of thermostat to maintain the cabinet temperature within the limits of application. Suitable capacity strainer or dehydrator shall be provided in the refrigeration circuit for smooth functioning of refrigeration cycle in presence of contaminations.

4 IMPORTANT TESTS

- **No Load Pull Down Test**
- **Energy Consumption Test**
- **Temperature Rise Test**
- **Door Seal Test**
- **Mechanical Strength of the Shelves and Similar Components**
- **Thermal Insulation Test (ExternalCondensation Test)**
- **Pressure Test**

IS 8148 : 2018

Ducted and package air - Conditioners – Specification

1 SCOPE

1.1 This Standard specifies performance testing, the standard conditions and the test methods for determining the capacity and efficiency ratings of air-cooled air-conditioners and air-to-air heat pumps. This Standard is applicable unitary and split ducted air conditioners having air-cooled and water cooled condenser, and ducted air to air heat pumps.

1.2 This standard is applicable for:

a) Residential and commercial unitary and split air conditioners and heat pumps;
b) Utilizing single stage, two stage, multi stage and variable capacity components;
c) Single refrigeration system having nominal cooling capacity 3 500 W and above with one evaporator and one condenser, controlled by a single thermostat/controller; and
d) Multiple split system utilizing one or more refrigeration systems controlled by a single thermostat/ controller:
    1) One outdoor and one or more indoor units, or
    2) One or more outdoor and one indoor unit.

1.3 This Standard is not applicable to the rating and testing of the following:

a) Water-source heat pumps;
b) Multi-split-system air-conditioners and air-to-air heat pumps (VRF);
c) Mobile (windowless) units having a condenser exhaust duct;
d) Individual assemblies not constituting a complete refrigeration system;
e) Equipment using the absorption refrigeration cycle; and
f) Non-ducted equipment

2 TERMINOLOGY

2.1 Packaged Air Conditioner — The unit for which the condenser is built as a separate package for remote field installation and interconnection shall be considered as a packaged air conditioner. It is an encased assembly as a self-contained unit primarily for floor mounting designed to provide free delivery of conditioned air to an enclosed space, room, or zone (conditioned space). It includes a prime source of refrigeration for cooling and dehumidification and means for the circulation and cleaning of air, with or without external air distribution ducting. These machines are equipped with either water-cooled or air-cooled condenser.

2.2 Ducted Air Conditioner — An encased factory-made assembly or assemblies designed primarily to provide conditioned air to enclosed space (s) through a duct. It includes a prime source of refrigeration for cooling and dehumidification and means for the circulation and cleaning of air. This may be provided in more than one assemble, the separated assemblies which are designed to be used togeth.er

2.3 Ducted Heat Pump — An encased factory made assembly or assemblies designed to provide conditioned air to enclosed space (s) through a duct. It includes a prime source of refrigeration for heating

and means for the circulation and cleaning of air. This may be provided in more than one assemble, the separated assemblies which are designed to be used together

2.4 Two (2)-stage Capacity Unit — Equipment where the capacity is varied by no more than two steps. This definition applies to each cooling and heating operation individually.

2.5 Multi-stage Capacity Unit — Equipment where the capacity is varied by 3 or 4 steps. This definition applies to each cooling and heating operation individually.

2.6 Variable Capacity Unit — Equipment where the capacity is varied to represent continuously variable capacity. This definition applies to each cooling and heating operation individually.

2.7 Standard Air — Dry air at 20.0°C, and standard barometric pressure 10 332.275 kgf/m2 (101.325 kPa), having a mass density of 1 204 kg/m3.

2.8 Wet Bulb Temperature — Temperature indicated when the temperature-sensing element and wetted wick have reached a state of constant temperature (evaporative equilibrium) and when air is flowing over the cotton wick at a velocity of 5 to 10 m/s, wick is wetted with continuous source of distilled water.

2.9 Discharge Air Flow of a Unit — Outlet of the indoor unit of split system or indoor side of the unitary system.

2.10 Nominal Water Flow Rate — Rate of water flow through the condenser of water-cooled unit under capacity rating test conditions.

2.11 Heating Capacity — Amount of heat that the equipment can add to the conditioned space in a defined interval of time expressed in watts.

2.12 Total Cooling Capacity — Total available capacity of the unit for removing of sensible and latent heat from the space to be conditioned in a defined interval of time.

2.13 Latent Cooling Capacity (Net Dehumidifying Effect) — Amount of latent heat that equipment can remove from conditioned space in a defined interval of time expressed in watts.

2.14 Sensible Cooling Capacity — Amount of sensible heat that equipment can remove from conditioned space in a defined interval of time expressed in watts.

2.15 Sensible Heat Ratio — Ratio of the sensible cooling capacity to the total cooling capacity

2.16 Indian Seasonal Energy Efficiency Ratio (ISEER) — Ratio of the total amount of heat that equipment can remove from the indoor air when operated for cooling in active mode to the total amount of energy consumed by equipment during the same period.

2.17 Full-load Operation — Operation with the equipment and controls configured for the maximum continuous duty refrigeration capacity specified by the manufacturer and allowed by the unit controls

2.18 Cooling Seasonal Total Load (CSTL) — Annual amount of heat that is removed from indoor air when equipment is operated for cooling active mode.

2.19 Cooling Seasonal Energy Consumption (CSEC)— Total annual amount of energy consumed by equipment when it is operated for cooling active mode.

2.20 Test Room — Room or space in which the unit is installed for test, with conditioning apparatus to

ensure proper temperatures of air and water entering the unit, In case of water-cooled unit single room is required for the evaporator side along with water handling equipment to feed water into the condenser at desired temperature and rate of flow. In case of air-cooled unit two rooms are required, one for evaporator side and the other for condenser side, each with appropriate conditioning apparatus.

3 CONSTRUCTION (GENERAL)

3.1 The unit shall be constructed with sufficient strength and rigidity to withstand normal manual and mechanical handling, transportation and usage without damage or failure.

3.2 All parts that require periodic cleaning or maintenance shall be easily accessible when the unit is installed in accordance with manufacturer's instructions. These shall be resistant to corrosion and withstand neutral salt spray test for 72 h

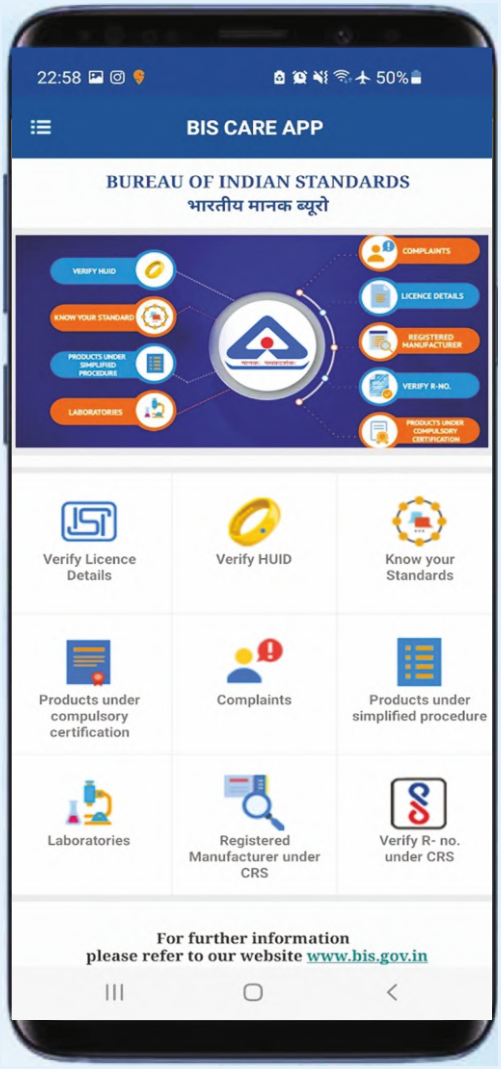
3.3 Units shall be free from undue noise and vibration.

3.4 All parts that constitute an accident hazard shall be effectively guarded.

3.5 An adequate method of condensate removal shall be provided. There shall be condensate tray of adequate size so that no water overflows. The tray and drain shall be made of corrosion-resistant material, or suitably treated with corrosion-resistant coating to withstand neutral salt spray test for 72 h

4 IMPORTANT TESTS

- **Capacity Rating Test**
- **ISEER Test**
- **Maximum Operating Test**
- **Freeze-up Test**
- **Enclosure Sweat Test**
- **Condensate Disposal Test**
- **Cooling/ Heating Capacity**
- **Power Consumption Test**



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- Select 'Know your Standards' for information on any Indian Standard, licenses against it and laboratories for this product.
- Check the authenticity of electronic products with R-number by using 'Verify R-number' under CRS.
- Register complaints regarding quality of product or misuse of mark by using 'Complaints'.

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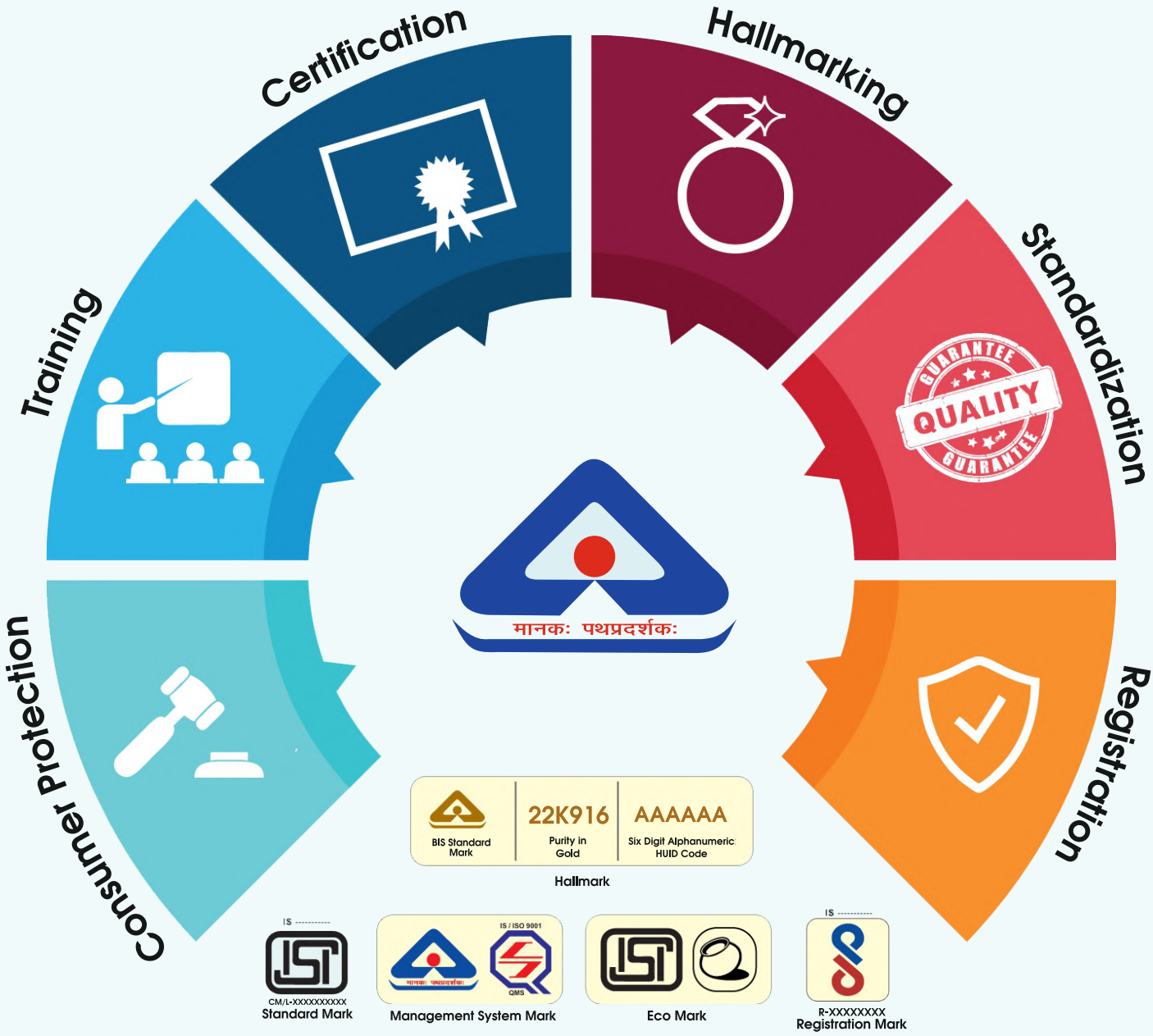

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