मानकः पथप्रदर्शकः
Bureau of Indian Standards

COMPENDIUM OF INDIAN STANDARDS ON VOLUMETRIC LABORATORY GLASSWARE

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INTRODUCTION

Volumetric laboratory glassware plays a critical role in scientific research, quality assurance, and educational laboratories where precise measurement of liquids is essential. The Bureau of Indian Standards (BIS), in alignment with ISO specifications, has developed a dedicated suite of standards to ensure accuracy, uniformity, and safety in the design and use of volumetric glassware.

These standards cover calibrated instruments such as flasks, beakers, burettes, pipettes, and cylinders, which are primarily manufactured from borosilicate glass 3.3 or equivalent materials known for their high chemical resistance and thermal stability. By standardizing volumetric glassware, BIS ensures that laboratories across India operate with measurement tools that meet rigorous national and international quality benchmarks — enhancing reproducibility, regulatory compliance, and the global credibility of analytical data.

PRODUCT SPECIFICATIONS FOR VOLUMETRIC LABORATORY GLASSWARE

1. IS 878 : 2008 Laboratory Glassware – Graduated Measuring Cylinders (Second Revision)

This standard specifies dimensions, material and constructional and metrological requirements of graduated measuring cylinders of tall form (Type 1a and Type 1b) and of squat form (Type 2). All types are suitable for general laboratory use.

Key Provisions:

1.Types & Classes: Following three types of graduated measuring cylinders are specified in the standard with capacity ranging from 5 ml to 2000 ml:

a) *Type 1a* — Tall form with spouted neck

b) *Type 1b* — Tall form with stoppered neck

c) *Type 2* — Squat form with spouted neck

With two classes of accuracy: a) *Class A* for higher accuracy, and b) *Class B*

2. Construction requirements include wall thickness, stability on inclined surfaces, smooth spouts for controlled pouring, and fire-polished rims. Stoppered cylinders must include interchangeable joints and well-fitted stoppers. Cylinders shall be made from hydrolytic-resistant glass (minimum HGB3), with clearly visible and permanent graduations and markings. Each cylinder must be marked with capacity, unit, reference temperature, class, and manufacturer details, ensuring reliability, usability, and traceability in laboratory operations.

2. IS 915 : 2012 Laboratory Glassware – One-Mark Volumetric Flasks (Third Revision)

This standard specifies requirements for an internationally acceptable series of one-mark volumetric flasks, suitable for general laboratory purposes.

PRODUCT SPECIFICATIONS FOR VOLUMETRIC LABORATORY GLASSWARE

Key Provisions:

1. This standard covers the following series of nominal capacities of One-Mark Volumetric Flasks (in millilitres) with two classes of accuracy, *Class A* (for higher accuracy) & *Class B*:

1–2–5–10–20–25–50–100–200–250–500–1000–2000–5000

2. The construction requirements ensure durability, safety, and precision. Flasks must be made of hydrolytic-resistant glass (at least HGB3), free from visible defects and with uniform wall thickness. Shapes may be pear-shaped or conical, with stable bases and precisely aligned cylindrical necks. The graduation line must be a thin, uniform, and permanent mark encircling the neck. All flasks must be permanently marked with capacity, reference temperature, class of accuracy, material, and manufacturer identification for traceability and proper use.

3. IS 381 (Part 1) : 2003 Laboratory Glassware – Narrow-Necked Boiling Flasks (Second Revision)

This standard specifies requirements and dimensions for an internationally acceptable series of conical flasks and of flat-bottom and round-bottom flasks for general laboratory purposes.

Key Provisions:

1. The standard covers the following series of nominal capacities of conical flasks (in millilitres):

25–50–100–200–250–500–1000–2000–3000–5000

2. And the following series of nominal capacities for flat-bottom and round-bottom flasks (in millilitres):

50–100–250–500–1000–2000–4000–6000–10000

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3. The standard specifies the flasks to be made from borosilicate glass 3.3 along with dimensional and stability requirements to ensure its reliable use in various laboratory processes, including boiling, distillation, and conducting chemical reactions under heat.

4. IS 1117 : 2018 Laboratory Glassware – Single-Volume Pipettes (Second Revision)

This standard specifies metrological and constructional requirements for volumetric pipettes with one mark (total delivery) and for volumetric pipettes with two marks, both of which are adequate for general laboratory purposes.

Key Provisions:

1. The standard covers two types of single-volume pipettes: a) Having no waiting time (Classes A and B for different levels of accuracy); b) Having a waiting time of 5 seconds (Class AS) with the following nominal volume capacities:

0.5–1–2–5–10–20–25–50–100

2. The standard specifies the flasks to be made from glass having hydrolytic resistance of class HGB 3 along with shape, dimensional and delivery time requirements to ensure the precise transfer of liquids in chemical analysis and research.

5. IS 2619 : 2018 Glass Beakers – Specification (Third Revision)

This standard specifies requirements for an internationally acceptable series of glass beakers for laboratory use.

Key Provisions:

1. Types: The standard species following types of beakers having nominal capacities (in millilitres):

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a) *Low-form beakers:* 5–10–25–50–100–250–400–500–600–800–1000–2000–3000–5000–10000;

b) *Thick-walled low-form beakers:* 150–250–400–600–1000–2000–5000;

c) *Tall-form beakers:* 50–100–150–250–400–500–600–800–1000–2000–3000–5000.

2. The standard specifies the beakers to be made from borosilicate glass 3.3 along with shape, dimensional and thermal shock resistance requirements to ensure their reliable and safe usage for mixing, heating, and holding liquids, making them indispensable in laboratory settings.

6. IS 1997 : 2008 Laboratory Glassware — Burettes (Third Revision)

This standard provides metrological and construction requirements for an internationally acceptable series of burettes, suitable for general laboratory purposes.

Key Provisions:

1. The standard covers nominal capacities ranging from 1 ml to 100 ml and defines two classes of accuracy — Class A (and AS) for high precision and Class B for general use, and provides guidelines for construction materials, calibration, delivery volume, and markings. The standard mandates that burettes be made of glass having at least hydrolytic resistant of HGB 3 class, marked at 20 °C, and tested for leakage and accurate delivery. Class AS burettes require a 30-second waiting time before reading.

2. Design specifications include dimensions, graduation patterns, stopcock design, and jet construction to ensure precise liquid measurement. Specific requirements for visibility, marking permanence, and allowable error are outlined to maintain consistency. The standard also details test methods for volume accuracy and leakage, and it allows for optional components made of inert plastics or ceramics. This ensures burettes are suitable for a wide range of laboratory applications with reliable and repeatable results.

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7. IS 1575 : 2003 Laboratory glassware - Separating funnels and dropping funnels (Second Revision)

This standard specifies details of an internationally accepted series of glass separating funnels and dropping funnels suitable for general use in laboratories.

Key Provisions:

1. This standard covers specifications for four types of glass funnels: conical and pear-shaped separating funnels with nominal capacities ranging from 50 ml to 2000 ml, and cylindrical and graduated dropping funnels with nominal capacities range from 50 ml to 1000 ml. The specified nominal capacities range from 50 ml to 1000 ml.

2. It details dimensional requirements, construction, and scale markings where applicable. Graduated dropping funnels include approximate volume scales, which may be in ascending or dual (ascending and descending) order, with visibility features to aid measurement at inclined angles. Funnels must be made from borosilicate glass 3.3 with high thermal and chemical resistance, minimizing breakage risk. Stopcock keys can be made of glass or chemically resistant plastics and must include a retaining device. Additional construction features such as pressure-equalizing tubes or Walter drop tips are allowed, depending on the type. Markings must include nominal capacity, units, and manufacturer's identification.

8. IS 1590 : 2018 Laboratory Glassware — Glass Filter Flasks — Specification (Second Revision)

This standard specifies the requirements for glass filter flasks of conical or cylindrical shape used in general laboratory purposes.

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Key Provisions:

1. Series & Shapes covered:

a) *Series A*: Conical (100 ml to 2000 ml) and cylindrical (3 l to 20 l);

b) *Series B*: Conical, with additional options for vacuum connections (25 ml to 4000 ml)

2. This standard specifies construction, performance, and safety requirements for glass filter flasks used in laboratory filtration. Flasks must be made of borosilicate glass 3.3, ensuring chemical resistance and thermal durability. They must withstand a pressure differential of 2 bar and endure thermal shock up to 75 °C. Wall thickness, base curvature, and vacuum connection design are regulated to ensure structural strength, safe operation under vacuum, and stability on lab surfaces.

9. IS 381 (Part 2) : 2019 Laboratory Glassware – Boiling Flasks Part 2 Boiling Flasks with Conical Ground Joints (Third Revision)

This standard specifies requirements for an internationally acceptable series of boiling flasks with conical ground joints for general laboratory purposes.

Key Provisions:

1. This standard defines three types of flasks—conical, flat-bottom, and round-bottom—across a range of capacities, each available in two series differing in height and joint size combinations. These flasks shall be made from borosilicate glass 3.3 for high thermal resistance and chemical durability. The joints conform to standard dimensions for interchangeability.

2. The flasks must meet specific dimensional criteria and withstand thermal shocks of 150 °C for volumes up to 3000 ml and 100 °C for larger sizes. Each flask must be permanently marked with nominal volume, ground joint size, manufacturer's identification, and include a writable area. The standard ensures safety, compatibility, and reliable performance of flasks in laboratory processes involving boiling or heating of liquids.

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10. IS/ISO 24450 : 2005 Laboratory Glassware – Wide Necked Boiling Flasks

This standard specifies requirements and dimensions for an internationally acceptable series of conical flasks and of flat-bottom and round-bottom flasks with wide neck for general laboratory purpose. The flasks are provided for direct use in laboratory, fitting together with other equipment for general laboratory purposes; further work up to other products.

Key Provisions:

1. This standard covers conical, flat-bottom, and round-bottom flask types, with defined nominal capacities ranging from 50 ml to 10,000 ml. These flasks are intended for direct use or integration with laboratory apparatus. They must be made from borosilicate glass 3.3, ensuring resistance to thermal stress and chemical attack, and must be free from visible defects or internal stress that could impair performance.

2. Constructional features include dimensional specifications for height, neck, and body diameter, along with minimum wall thickness for safety. Conical and flat-bottom flasks must stand stably without rocking, and all flasks must have reinforced necks and smooth transitions at the base. Markings must be permanent and include the nominal capacity, manufacturer's identification, and a writable area. Graduated scales may be provided on conical types for approximate volume indication. The standard ensures functional reliability and safety of these flasks in varied laboratory operations.

TEST METHODS FOR VOLUMETRIC LABORATORY GLASSWARE

1. IS 2303 (Part 1/Sec 1): 2021 Grading Glass for Alkalinity Part 1 Hydrolytic Resistance of Glass Grains Section 1 Determination and Classification of Hydrolytic Resistance at 98 ^{0}C (Third Revision)

This standard is identical to **ISO 719:2020**, specifies a method for determining the **hydrolytic resistance of glass grains at 98** °C. It applies to less chemically resistant glass types such as soda-lime glass. The test involves extracting alkali from 2 grams of crushed and sieved glass grains using distilled water under boiling conditions, then titrating the extract with hydrochloric acid to quantify the released alkali, expressed as sodium oxide (Na_2O). Based on the volume of acid consumed, the glass is classified into five hydrolytic resistance classes (**HGB 1 to HGB 5**), with HGB 1 being the most resistant and HGB 5 the least.

2. IS 2303 (Part 1/Sec 2): 2021 Grading Glass for Alkalinity Part 1 Hydrolytic Resistance of Glass Grains Section 2 Determination and Classification of Hydrolytic Resistance at 121 ^{0}C (Third Revision)

This standard is identical to **ISO 720:2020**, specifies the method for determining the **hydrolytic resistance of glass grains at 121** °C, primarily for more chemically resistant glass types such as **borosilicate glass**. The procedure involves exposing 10 grams of glass grains (sieved to a specific particle size range) to high-pressure steam in an autoclave and titrating the extracted alkali with hydrochloric acid to quantify chemical durability, expressed in terms of sodium oxide (Na_2O) release. Based on the amount of acid consumed, glass is classified into three resistance grades (**HGA 1 to HGA 3**), aiding in quality control and selection for pharmaceutical, laboratory, and industrial applications.

3. IS/ISO 718: 1990 (Reviewed in 2023) Laboratory Glassware – Thermal Shock and Thermal Shock Endurance – Test Methods

This standard is identical adoption of **ISO 718:1990**. It specifies test methods for evaluating thermal shock resistance and thermal shock endurance of laboratory glassware in its delivered condition.

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It excludes fused silica ware and annealed containers made from soda-lime-silicate glass, which are instead covered under IS 11930: 2018. The standard outlines definitions, apparatus requirements (e.g., cold water bath, test oven), and procedures to determine the temperature differential (Δt) at which glassware fails due to rapid temperature changes. This assessment helps ensure the reliability of glassware under thermal stress, supporting its safe and consistent use in laboratory environments.

4. IS 11469: 2016 Laboratory glassware – Methods for assessing the chemical resistance of enamels used for colour coding and colour marking (First Revision)

The standard harmonized with ISO 4794, specifies methods to assess the chemical resistance of enamels used for colour coding and marking on laboratory glassware. It applies to enamelled markings on items like pipettes and beakers, ensuring that colours remain identifiable under harsh chemical conditions. The test methods involve exposing test pieces to a hot alkaline detergent solution and to cold hydrochloric acid, simulating typical laboratory cleaning and usage environments. The standard does not grade enamels but determines if they retain distinguishable colour post-treatment, thereby supporting durability and clarity in lab operations.

5. IS 18235: 2023 Laboratory glass and plastic ware - Volumetric instruments - Methods for testing of capacity and for use (First Revision)

IS 18235:2023, identical to ISO 4787:2021, outlines standardized methods for testing, calibrating, and using volumetric instruments made of glass and plastic—such as pipettes, burettes, flasks, and measuring cylinders—with nominal capacities ranging from 100 µl to 10,000 ml. It prescribes gravimetric procedures for determining volume accuracy, considering factors like temperature, surface cleanliness, and delivery technique. The standard introduces updated guidance on meniscus setting, uncertainty estimation, and cleaning procedures. It supports laboratories in achieving reliable volume measurements through consistent calibration and use practices, ensuring precision in analytical and experimental work.