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SPECIFICATION FOR SANITARY APPLIANCES (VITREOUS CHINA) (First Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard SPECIFICATION FOR SANITARY APPLIANCES (VITREOUS CHINA) (*First Revision*)

SLS 229: 2022

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Sri Lanka Standard SPECIFICATION FOR SANITARY APPLIANCES (VITREOUS CHINA) (*First Revision*)

FOREWORD

This standard was approved by the Sectoral Committee on Building and Construction Materials and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2022-07-07.

Sri Lanka Standard for Specification for Sanitary Appliances (Vitreous China) first published in 1973 and amended in 1987 is superseded by this first revision. Subsequent introduction of new production technologies accompanied by the requirements generated by export and import demands necessitated this revision.

For the purpose of deciding whether a particular requirement of this standard is complied with, final value, observed or calculated expressing the result of a test or an analysis, shall be rounded off in accordance with **SLS 102**. The number of significant figures retained in the rounded off value shall be the same as that of the specified value in this standard.

In the preparation of this standard the assistance derived from the publications of the British Standards Institution (BSI) and the Bureau of Indian Standards (BIS) is gratefully acknowledged.

1 SCOPE

This standard covers the general requirements for materials, manufacture, methods of test, inspection and marking of all vitreous sanitary appliances.

2 **REFERENCES**

BS 3402	Specification for Quality of Vitreous China Sanitary Appliances		
IS 2556 - 1	Vitreous Sanitary Appliances (vitreous China)—Specification		
	Part 1 general Requirements ?		
SLS 102	Rules for rounding off numerical values		
SLS 428	Random sampling methods		
SLS ISO 2859-1	Sampling procedures for inspection by attributes Part 1: Sampling		
	schemes indexed by acceptance quality limit (AQL) for lot-by-lot		
	inspection		

3 DEFINITIONS

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

3.1 blistering : The development during firing of enclosed or broken macroscopic vesicles or bubbles in a body, or in a glaze or other coating.

3.2 bubble : A raised portion of the surface less than 1 mm maximum diameter.

3.3 crazing : Formation of very fine cracks in the glaze caused by either moisture expansion of the body or thermal stress which creates sufficient tension in the glaze to cause it to craze.

3.4 discolouration : A coloured spot greater than 6 mm in its maximum dimension or a concentrated number of specks or spots to give the effect of a change in colour.

3.5 dull finish : Undeveloped glaze, slightly matt in appearance or a non-glossy finish on a visible surface.

3.6 dunting : The cracking that occurs in fired ceramic wares as a result of thermally induced stresses.

3.7 egg shell finish : A uniform semi-matt glaze.

3.8 exposed body (crawling): Glaze jump a parting and contraction of the glazed or engaged ceramic ware during firing resulting in exposed areas bordered by coalesced glazed.

3.9 finish : The texture and condition of a surface other than its colour.

3.10 fire crack : A fine shallow crack in the body, not covered with, glaze. (Fire crack, where not on a visible surface, may not necessarily be detrimental).

3.11 flushing surface : The surface visible after installation and which becomes wet during the operation of the appliance.

3.12 grouping : A number of spots ,blisters, pinholes or specks within any pottery square.

3.13 kiln support marks : Large unglazed surfaces resulting from blocks or pins necessary to support the appliance while firing but not visible after installation of the appliance.

3.14 lot : A group constituting 200 pieces or less of all the appliances of the same type and size in any consignment.

3.15 pinhole : A hole in the body less than 1.5 mm in its maximum dimensions.

3.16 polishing mark : A spot where some minor blemish has been ground off and surface polished, the area of the spot not exceeding the area of a 10 mm diameter circle.

3.17 pottery square : A square of dimensions 50 mm x 50 mm selected on the appliances for examining visual defects.

3.18 projection : A raised portion of not less than 6 mm in its maximum dimension on a visible surface.

3.19 sagger : A fire clay container.

3.20 sample : Number of appliances taken on random or in accordance with a specified sampling plan, from a large quantity or from a fixed lot, relating to the intended tests.

3.21 speck : An area of contrasting colour less than 1 mm maximum dimension. (Speck less than 0.25 mm maximum dimension, do not constitute a defect unless sufficient in number to form a discolouration.

3.22 spot : An area of contrasting colour on the visible surface more than 1 mm but less than 3 mm in its maximum dimension.

3.23 visible surface : The surface, which after installation of the appliance, is readily visible to an observer in a normal standing position.

3.24 warpage : Distortion of original shape during the manufacturing process.

3.25 wavy finish: A defect in the finish having the appearance of numerous runs in the glaze; irregular or mottled finish.

4 MATERIAL AND MANUFACTURE

4.1 Vitreous sanitary ware is a strong fused ceramic ware made from a mixture of suitable clays and finely ground minerals such as quartz and feldspar. After firing at a high temperature the ware shall not, even when unglazed, have a mean value of water absorption greater than 0.5 percent of the dry weight of the ware, when tested in accordance with **10.3**. It shall be coated on all visible exposed surfaces with impervious non-crazing vitreous glaze giving a white or coloured finish.

5 APPLICATION OF GLAZING

5.1 The vitreous glazing medium shall be thoroughly fused to the body. Subject to exceptions, given in **5.1.1**, **5.1.2** and **5.1.3** all exposed surfaces of an appliance shall be uniformly glazed, shall be free from craze and discolouration and shall possess an impervious surface. It shall have such a thickness and opacity as to give a uniform colour and finish to the surface.

5.1.1 Surfaces coming into contact with walls and floors may be without glaze.

5.1.2 On wash basins set away from walls, those portions of the rear aprons used for supporting the appliances in kilns; the backs of overflows and the undersides of outlet bosses may be without glaze.

5.1.3 Appliances may have unglazed portions but the unglazed surfaces shall not be visible when the appliance is installed in the normal manner.

6 PERMISSIBLE BLEMISHES OR DEFECTS

6.1 WC pans & WC suits, Bidets, Squatting Pans, Urinals, Partition Plates, Pedestals, Short Pedestals and Accessories

When examined from any point on the viewing circle as illustrated in Figure 1, the appliance shall not show, to the unaided eye of a trained observer, blemishes or defects in excess of those listed in Table 1.

6.2 Wash Basins, Laboratory Sinks and Drinking Fountains

When examined from a distance of 600 mm, (see Figure 1) the surface of the appliance shall not show to the unaided eye of a trained observer, blemishes or defects in excess of those listed in Table 2.

6.3 Flushing Cisterns, Auto cisterns and Covers

When examined from a distance of 600 mm (see Figure 1), the outer surface of the cistern and its cover when assembled shall not show, to the unaided eye of a trained observer, blemishes or defects in excess of those given in Table 3.

6.4 Illumination During Visual Examination

When checking an appliance by visual examination, either in natural or artificial light, the uniform light intensity at the surface of the appliance shall be 300 lx when checked with a light meter. Artificial lighting when used, shall be provided by one or more fluorescent lamps of colour temperature 6 500 K, positioned 2 m minimum above the top of the appliance. The appliance shall be positioned so that it is between the light source and the observer.

NOTE: *Minor and intentionally added imperfections which do not affect the appearance or efficiency of the appliance shall not constitute valid reasons for rejection.*

All dimensions are in millimeters

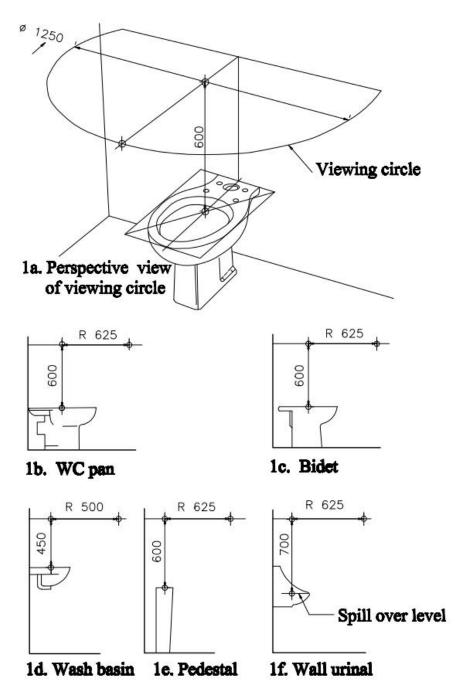


FIGURE 1 – Viewing Circle for WC Pans, Bidets, Wash Basins, Pedestals and Urinals

Location	Blemish or Defect	Maximum Permitted	
(1)	(2)	(3)	
General	Wavy finish	None on all visible surfaces	
	Warpage:		
	WC pan and bidets	Not more than 6 mm	
	Squatting pans	 a) Not more than 6 mm for long patterns of 580 mm size b) Not more than 10 mm for long pattern of 630 mm size and Orissa patterns of 580 mm and 630 mm size 	
	Other appliances	Not more than 1%; total warpage not more than 6 mm	
	Accessories	Not to exceed 6 mm on any plane.	
	Discolouration	None on all visible surfaces	
Flushing surface and horizontal face of rims of	Spots, blisters and pinholes	A total of not over three; no grouping; for coloured appliances, blister and pinhole limited to one each.	
WC pans, squatting pans bidets and	Bubbles and specks	Not over two in one pottery square; a total of not over four. For coloured appliances, a total not over two	
urinals	Polishing marks	Two only. One permitted for coloured appliances	
Visible surfaces other than above	Spots, blisters and pinholes	A total of not over five; no grouping. For coloured appliances, no blisters are permitted and pinhole are limited to a total of two.	
	Bubbles and specks	Not over three in one pottery square; a total of not over ten.	

TABLE 1 - Blemishes or Defects Permitted in WC Pans, Bidets, Squatting Pans, Urinals Partition Plates, Pedestals, Short Pedestals and Accessories

Location	Blemish or Defect	Maximum Permitted	
(1)	(2)	(3)	
General	Wavy finish	None on all visible surfaces	
	Warpage;		
	-Wash basins and drinking fountains	Warpage of slab out of horizontal plane not to exceed 6 mm on all sizes (warpage of backs of wash basins which are attached to the wall not to exceed 3 mm)	
	Discolouration	None on all visible surfaces	
Service space, top of slab, inside of bowl, front of fascia	Spots, blisters and pinholes	A total of not over two; no grouping. for coloured appliances no blisters are permitted and pinhole limited to one only.	
front of fascia	Bubbles and specks	A total of not over four; no grouping	
	Polishing marks	One only, none permitted for coloured appliance	
Face of internal, back	Spots, blisters and pinholes	One only; on back or on either side; a total of not over three	
and side	Bubbles and specks	A total of not over four; no grouping	

 TABLE 2 - Blemishes or Defects Permitted in Wash Basins and Drinking Fountains

TABLE 3 - Blemishes or Defects Permitted in Cistern and Cover

Location (1)	Blemish or Defect (2)	Maximum Permitted (3)	
General	Warpage	Not noticeably warped	
	Discolouration	None on all visible surfaces	
Visible surface	Visible surface Wavy finish Not more than 2 500 mm ² , on ends only; cover		
	Spots, blisters and pinholes	A total of not over four; no grouping, However, a total of not over two on covers. For coloured appliances, no blisters are permitted and pinhole limited to one .	
	Bubbles and specks	Not over two in one pottery square; total of not over six; including not over three on cover.	
	Polishing marks	One only; none on cover; none permitted for coloured appliance.	

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7 MINIMUM THICKNESS

The thickness at any place in an appliance shall not be less than 6 mm.

8 TOLERANCES

Except where otherwise specified in various parts of this standard, the following tolerances, shall apply

- a) On dimensions 75 mm and more; ± 2 percent of the specified dimension or ± 2 mm whichever is more
- b) On dimensions less than 75 mm; \pm 5 percent of the specified dimension or \pm 2 mm whichever is more.
- c) On the height of the flush outlet of P-traps, or horizontal outlets; ± 5 mm; and
- d) On all angles; $\pm 3^0$.

9 PERFORMANCE REQUIREMENTS

9.1 Warpage

The appliance shall be considered to be within the warpage limits, if a feeler gauge of thickness equal to the maximum warpage specified (see Tables 1, 2 or 3) does not slide under the appliances without application of force, as detailed in 10.1

9.2 Crazing

When tested in accordance with the procedure given in **10.2**, none of the test piece shall show crazing.

9.3 Water Absorption

When tested in accordance with **10.3**, the arithmetic average for water absorption of glazed ceramic WC Pans shall not exceed **0.5 %** by mass.

9.4 Modulus of Rupture

The average modulus of rupture of three samples when tested by the method described in **10.4** shall not be less than **34 MPa**.

9.4.1 Values taken for determination of the average shall not vary more than ± 20 percent of the average value. Values above or below 20 percent of the average may be discarded for the calculation of the average value. If the fractured surface of test pieces shows lamination, crack or a cavity at the centre or any other defect, those test pieces shall be rejected but minimum ten test pieces shall be available for working out the average value.

9.5 Chemical Resistance

When tested by the method described in **10.5**, none of the test pieces shall appear to the unaided eye of a trained observer to have suffered any loss of reflectivity of the glaze when compared with the control sample.

9.6 Resistance to Staining and Burning

When tested by the method described in **10.6**, no stain shall remain on either of the test piece.

9.7 Functional Requirements

Functional Requirements of ceramic WC Pans & WC Suites with Integral Traps and ceramic WC and Urinal Flushing Cisterns shall conform to the requirements of **SLS XXXX** and **SLS XXXX** respectively.

9.8 Dangerous Substances

Whenever dangerous substance regulations come into effect, dangerous substance test need to be performed.

When dangerous substance is determined as per the method described in relevant regulation, Sanitary appliance shall conform to the requirements given the regulation. In the absence of test methods, verification and declaration on release/content should be done taking into account provisions in the place of use.

10 TEST METHODS

10.1 Warpage

The appliance shall be placed face down on a flat surface, preferably a surface plate to ascertain the amount of deviation from the horizontal plane that exists at the edges of the appliance. If the appliance rocks, on two points, a horizontal plane shall be determined by placing the feeler gauge of a thickness equal to the maximum warpage permitted for the appliance (see Tables 1, 2 or 3) under one low corner and forcing the appliance down on this gauge. If a second feeler gauge of the same thickness does not slide at any other point, the appliance shall be considered as not warped out of the horizontal plane and to be in conformity with the permissible warpage limits.

10.2 Crazing

10.2.1 Test Pieces

The test sample consists of three pieces broken from widely separated parts of the article, each piece having a total surface area of approximately 25,000 mm². At least one major surface shall be unglazed and freshly broken.

The test pieces are briefly immersed in methylene blue dye solution to reveal any cracks in the glaze or body. Whenever possible crack-free test pieces should be used for the crazing test. If

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a sufficient number of such test pieces are not available, any cracks revealed by dye immersion are marked prior to steam treatment.

10.2.2 Test Procedure

The test pieces shall be placed for 10 hours or, for two periods of five hours each, in a vessel in an autoclave in which saturated steam is maintained at a pressure between 0.33 to 0.35 MPa. The test pieces shall be allowed to cool to room temperature inside the autoclave and afterwards soaked for 12 hours in a solution of dye to which a small quantity of wetting agent has been added. Examine the test pieces for crazing.

10.3 Water Absorption Test

10.3.1 Test material and apparatus

- Weighing balance accuracy of 0.05 g;
- an oven controlled at a test temperature of (105 ± 5) °C;
- a desiccator with fresh prepared silica gel;
- a chamois leather;
- a heated bath with controller;
- demineralized water;
- a pair of fine tweezers.
- a fine brush

10.3.2 *Procedure*

- Break three samples glazed on one face from a WC pan. The unglazed surface area of the samples shall be approximately 30 cm2 and the maximum thickness including the glaze shall be approximately 12 mm.
- Dry the samples at a temperature of 105 °C for (180 ± 5) min.
- Allow the samples to cool in a desiccator.
- Weigh each sample to an accuracy of 0.05 g; the mass is m₀.
- Using the fine tweezers place the samples in the bath and fill with demineralized water. Ensure they do not touch the sides or the bottom of the bath.
- Heat the water to boiling point for (120 ± 5) min. Afterwards stop the heating process and leave the samples immersed for a further (20 ± 1) h.
- Using the fine tweezers take the samples immediately from the water and dry them with a slightly damp chamois leather.
- Any cavities or holes shall be dried using a fine brush.
- Weigh each sample immediately; this mass is m1.
- The coefficient of water absorption in percentage shall be calculated for each sample using equation

$$WA = \frac{m_1 - m_0}{m_0} \times 100 \ \%$$

Where,

WA is the coefficient of water absorption, in %; m₀ is the mass of dry sample, in g; m₁ is the mass of sample after immersion in water, in a

 m_1 is the mass of sample after immersion in water, in g.

Calculate the arithmetical average of the water absorption coefficient for the three samples. Report each individual value and the calculated arithmetical average.

10.4 Modulus of Rupture

10.4.1 Test Pieces

Sample test bars shall be separately prepared, using the same body materials as used in making the appliances of a batch and shall be fired in the same kiln along with the appliances. They shall be square or circular in section and the cross sectional area shall not be less than 150 mm^2 and 150 mm long and shall not be glazed.

10.4.2 Test Procedure

The modulus of rupture shall be determined by using at least 10 of these bars mounted on supports, 125 mm apart, and loaded rapidly (approximately 5 kg/s) at the mid-point.

10.4.3 Evaluation of Results

The modulus of rupture shall be calculated from the formula:

$$S = \frac{1.5 PL}{bd^2} \text{ for rectangular cross section, or}$$
$$S = \frac{8 PL}{\pi D^3} \text{ for circular cross section}$$

Where;

S = Modulus of rupture

P = total load in N,

L = length of span in mm,

b = width of test bar (in mm) to the nearest 0.1 mm

d = depth of test bar (in mm) to the nearest 0.1 mm

D = diameter of test bar in mm.

10.5 Tests for Chemical Resistance

10.5.1 Test Pieces

10.5.1.1 The test sample shall consist of eight pieces each not smaller than 75 mm x 25 mm x 6 mm taken from the glazed part of the appliance. One piece placed in a desiccator and is used as a control test piece.

10.5.2 Test Procedure

10.5.2.1 The other seven test pieces are partially immersed, one in each of the seven solutions listed in Table **4**. The strength of solution, lengths of time for immersion and the temperature shall be as stated in Table **4**. Solutions are all aqueous.

SI NO.	Name of Chemical	Strength of Solution Percent	Time Hours	Temperature ⁰ C
(1)	(2)	(3)	(4)	(5)
i	Acetic acid	10	16	100
ii	Citric acid	10	16	100
iii	Detergent (Note 1)	(See Note 1)	48	60
iv	Hydrochloric acid	(See Note 2)	48	25-35
v	Sodium hydroxide	5	0.5	60
vi	Sodium stearate	0.15	48	60
vii	Sulfuric acid	3	16	100

 TABLE 4 - Chemical Solutions

NOTE 1: This consists of an aqueous solution containing 0.04 percent (w/v) of a condensation product of nonyl-phenol with 8-10 molecules of ethylene oxide.

A suitable solution is commercially obtainable under the trade names 'Lissapol N' and 'Synperonic NP 8'. A solution which contains a minimum of 0.15% (m/v) should be used for this test.

NOTE 2: *This solution consists of equal volumes of water and of hydrochloric acid of specific gravity 1.18.*

10.6 Tests for Resistance to Staining and Burning

10.6.1 Test Pieces

The test sample shall consist of two pieces, each not smaller than 75 mm x 25 mm x 6 mm taken from the glazed part of the appliance.

10.6.2 *Test Procedure*

10.6.2.1 One of the test pieces is placed, at room temperature, with a glazed surface level, uppermost, clean and dry. One spot, not less than 10 mm diameter, of each of the six chemicals listed in **10.6.2.2** is then placed on the glazed surface and allowed to dry. Any residue is then removed with a clean cloth which has been moistened with distilled water only.

10.6.2.2 The chemicals are the following;

- 0.5 percent aqueous solution of methylene blue.
- A solution of sodium hypochlorite, 10-14 percent w/v available chlorine. A 10 percent dilution is prepared for the test
- 3 percent aqueous solution of hydrogen peroxide,
- Amyl acetate,
- Methylene chloride or Perchloro ethylene or Tri chloro ethylene, and
- 13 g of iodine in 1 litre of ethanol.

10.6.2.3 The other piece is placed, at room temperature, with a glazed surface level uppermost, clean and dry.

A light cigarette is placed on the glazed surface, and allowed to remain for 15 minutes and then removed. The stained area is wiped with a clean cloth which has been moistened with distilled water only.

11 MARKING

Name or trade mark of the manufacturer shall be clearly and indelibly marked at a prominent place, visible even after the appliances are installed.

Batch or code number of an appliance shall be clearly and indelibly marked.

NOTE: Attention is drawn to the certification facilities offered by the Sri Lanka Standards Institution. See the inside back cover of this standard.

12 SAMPLING AND CRITERIA FOR CONFORMITY

Samples shall be drawn from each lot as per the sampling scheme and shall be tested separately for ascertaining the conformity of the lot to the requirements of this specification.

12.1 Scale of Sampling

12.1.1 The number of appliances to be selected from the lot shall be in accordance with column(2) of Table 5. The appliances shall be selected at random. In order to ensure randomness of selection, random number tables as given in SLS 428 shall be used.

TABLE 5 Number of appliances in a lot		Number of appliances to be selected	Permissible number of defects
	(1)	(2)	(3)
(a) For finish,	2 to 8	02	0
glazing and	9 to 15	03	0
warpage	16 to 25	05	0
	26 to 50	08	0
	51 to 100	13	01
	101 and above	20	02
(b) For	Up to 25	08	01
minimum	26 to 50	13	02
thickness	51 to 100	20	03
	101 and above	32	05

 TABLE 5 – Scale of sampling

NOTE: The Table **5** was prepared in accordance with **ISO 2859-1:1999**, General inspection level II AQL=1.5%.

12.1.2 When the tests are required to be performed on regulatory requirement/s, the additional sub sample/s of size/s given in test method/s specified by the relevant regulation/s shall be selected as appropriate, in addition to the samples selected as per **12.1.1**.

12.2 Number of tests

12.2.1 Each appliance selected as in **12.1.1** shall be inspected for following requirements as appropriate;

12.2.1.1 crazing, water absorption, chemical resistance and modulus of rupture - Three test pieces for crazing test and three test pieces for water absorption test shall be tested for each firing and Three test pieces for modulus of rupture test, once a month.

12.2.1.2 Number of tests and criteria for conformity for finish, thickness, glazing and warpage - The number of appliances to be selected shall depend upon the size of the lot and shall be in accordance with column (1) and (2) of Table 3.

12.2.1.3 The appliances shall be selected at random from the lot and in order to ensure the randomness of selection, random number tables may be used. In case random number tables are not available the following procedure shall be adopted.

Starting from any appliances in the lot count them as 1,2,3 up to r and so on, in one order, where r is the integral part of N/n (N being the lot size and n being the sample size). Every rth appliance thus counted shall be withdrawn to constitute a sample.

12.2.1.4 Each of the appliances selected in the sample shall be inspected for finish, thickness, glazing and warpage. Any appliances failing to meet any one or more requirements of the above characteristics shall be considered as defective.

12.2.1.5 If the number of defective appliances found is less than or equal to the corresponding permissible number in (3) of Table 5, the lot shall be considered as conforming to the requirements of the above characteristics, otherwise not.

.....

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI which includes surveillance inspection of the factory, testing of both factory and market samples.

Further particulars of the terms and conditions of the permit may be obtained from the Sri Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.



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SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in turn are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of standardization as are of special interest to Sri Lanka.

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