Specifications for Fibre products
DRAFT GUYANA STANDARD

Specifications for Fibre products

Guyana National Bureau of Standards
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Foreword

This Draft Guyana Standard is the first revision of Guyana Standard GYS 557. It was developed by the Technical Committee- Plastic and Plastic Products.

This standard was originally adopted from the IAPMO ANSI Z124.1.2-2005 ‘Plastic bathtub and shower units’ to aid in the manufacture of these products. It was revised to facilitate the manufacture of all fibre glass units.

This standard specifies the requirements and test methods for the manufacture of all fibre glass products. It is intended for use by manufacturers, consumers and all dealers in fibre glass products. Additionally, it can be used by the Guyana National Bureau of Standards for testing to ensure safe use by consumers.
# Members of the Technical Committee – Plastic and Plastic Products

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</tbody>
</table>
Specification for fibre products

1.1 Scope and purpose

This standard covers physical requirements and test methods for performance requirements of materials, workmanship, and finish of fibre glass units with or without walls manufactured; or as a multi-piece unit. Such products shall meet the requirements as outlined in this standard.

While this standard covers the performance requirements of fibre glass units and describes these performance requirements in terms of methods of test applicable to all such units, a number of different materials and methods of manufacture shall be permitted to be used to meet these requirements. Each of these materials and methods have different properties which will affect its end performance and suitability for the intended use. For this reason, portions of the standard are broken into separate requirements designed to identify these individual characteristics.

The materials and equipment which are listed as having been used to conduct the testing procedures in this standard are provided solely for informational reference. Materials and equipment of similar design, composition and specification shall only be used to conduct these testing procedures when they produce equivalent results.

1.2 Purpose

The purpose of this standard is to establish minimum performance requirements for fibre glass units. Conformance to this standard and test procedures herein shall indicate the acceptability of a fibre glass unit.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM D 883, Standard Terminology Relating to Plastics

ASTM D 2244-02e1, Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D 2565, Standard Practice for Xenon Arc Exposure of Plastics Intended for Outdoor Applications

ASTM E 84 (NFPA 255), Standard Method of Test of Surface Burning Characteristics of Building Materials


ASTM E 662-03e1, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

ASTM F 446, Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area

ASTM G21, Standard Practice For Determining Resistance Of Synthetic Polymeric Materials To Fungi

NFPA 255, (See ASTM E 84)
3 Definitions

3.1 resin
A solid or liquid synthetic organic polymer used as the basis of plastics.

3.2 finish
The manner in which the manufacture of an article is completed in detail.

3.3 dimensional tolerance
An acceptable deviation of a feature in measurement.

3.4 porosity
The degree of minute holes for passage of liquid or air.

3.5 chamois
A type of soft pliable.

3.6 deflection
Redirection after reaching a target.

3.7 apron
A small area adjacent to another larger area or structure.

3.8 spall
Break into smaller pieces.

3.9 crazing
Producing a network of fine cracks on a surface.

3.10 spalling
Breaking into smaller pieces.

4 General requirements

4.1 Materials

4.1.1 Composition
The units shall be made of suitable grades of plastic resins and such other filling, coloring, reinforcing, and coating materials as will meet the performance requirements of this standard.

4.1.2 Finish
The finished surface of the unit shall be of a quality which meets all of the applicable requirements of the standard. Six common types of plastic finishes shall be as defined.

(a) Type 1 - No separate surface finish: The surface finish is the same as, and is usually integral with, the structural base. (Excluding Type 4.)

(b) Type 2 - Coated surface finish: These units are characterized by the presence of a surface coating which is applied to the structural base either prior to or after the molding process. (Excluding Type 4.)
Type 3 - Shell-coated surface finish: These units are characterized by the presence of a thermoplastic sheet material which is thermoformed and to the back of which a structural base is applied.

Type 4 - Cast Filled Polymers: These units are characterized by their composition and manufacturing process; whereby polymers are filled with particulates, acting as both structural and decorative elements, and are cast into a complete fibre glass unit with or without a pre-coated finish.

Type 5 - Laminated Finish: A thermoplastic surface co-extruded, adhesive bonded, or otherwise adhered to a thermoplastic substrate. If a structural base is subsequently applied, it shall be treated as a Type 3 unit.

Type 6 - Flexible Core Construction: A combination of materials comprising a flexible core, faced on both sides with other materials.

4.1.3 Supporting structure
The material of the supporting structure integral with the unit and its attachment shall be adequate to meet the performance requirements of this standard.

4.2 Dimensional tolerances
The finished trim dimensional tolerances for units shall be the manufacturer's stated “rough-in” dimensions.

4.3 Units for testing
Units to be inspected and tested shall be taken from finished goods inventory.

4.4 Installation instructions
Each unit shall be supplied with a copy of the manufacturer's written installation instructions, unless intended to be installed by the manufacturer. The instructions shall be affixed to the unit in a conspicuous location and shall state, "To be removed for use by the occupant."

4.5 Care and maintenance instructions
Each unit shall be supplied with a copy of the manufacturer's written care and maintenance instructions affixed to the unit in a conspicuous location and shall state, "To be removed for use by the occupant."

4.6 Identification
Manufacturer's name or trademark, or both, shall be permanently and legibly marked on the unit so as to be visible after installation.

4.6.1 Field installed flange kits shall be marked on the package or the product with at least the following:
(a) manufacturer's name or trademark,
(b) kit model number,
(c) model number of the fixture(s).

4.7 Grab bars
Where integral grab bars are provided as part of the finished unit, the grab bars shall meet the requirements of Section 7, Test Methods of ASTM F 446.
4.8 Raised flanges and tiling beads

4.8.1 Bathtubs intended for installation against a vertical surface (wall) shall incorporate a raised flange or bead not less than 7.9mm (5/16in.) above the rim at any point. The bottom of any hole in the flange shall not be less than 7.9mm (5/16in.) above the flood level surface of the tub. The raised flange or bead shall be: (a) integral with the bathtub; (b) added to the island tub in the factory; or (c) field installed using an optional installation kit.

4.8.2 Shower bases intended for installation against a vertical surface (wall) shall incorporate a raised flange not less than 25.4mm (1in.) above the rim at any point. The raised flange shall be: (a) integral with the shower base; (b) added to the shower base in the factory; or (c) field installed using an optional installation kit.

4.8.3 Countertops shall be made with minimum 76.2 (3in.) backsplash and 139.7mm (1.5in.) overlap to the sides for installation of flanges and tilting beads.

Each kit shall include installation instructions. Necessary parts and fasteners shall be provided or specified by the manufacturer. The effectiveness of the moisture seal between the field installed flange and the fixture shall be tested in accordance with Section 8.2.

4.9 Nomenclature

Some commonly used nomenclature are shown in Figures 9(a) through 9(c).

5 Workmanship and finish

5.1 Unit preparation

The unit shall be washed with a standard liquid detergent and water solution, rinsed with clear water, and dried prior to the application of ink and standard dirt as specified in 5.3.1 and 5.4.1.

5.2 Method of inspection of unit surface

The surface of the unit shall be inspected visually for defects and blemishes from a distance of between 305 and 610mm (1 and 2ft.) after being inked or soiled in accordance with the ink test (see 5.3.1) and the standard dirt test (see 5.4.1). The light source shall be equivalent to an illumination intensity near the surface to be inspected of 1615 ± 540 lx (150 ± 50ft candles).

5.3 Surface test

5.3.1 Test method

Rub the entire finished surface of the unit with a sponge and a 50% solution of tap water and water soluble black or blue-black ink after the unit has been washed and dried as described in 5.1. When inspecting colored units, a contrasting colored ink shall be used. The ink shall be rinsed from the surface which shall then be dried before inspection.
### Table 1

**Appearance requirements***

<table>
<thead>
<tr>
<th>Defects and Blemishes</th>
<th>Maximum No. Allowed within Any 76.2 mm (3 in.) Diameter Area</th>
<th>Maximum No. Allowed per Fixture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below Tub Rim &amp; Shower Threshold</td>
<td>Wall Surround</td>
</tr>
<tr>
<td>Cracks</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chipped Areas</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blister</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Surface Porosity</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Molding Irregularities</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Pits</td>
<td>&lt;0.4 mm (1/64 in.) 8</td>
<td>16</td>
</tr>
<tr>
<td>Pinholes and small specks</td>
<td>≥0.4 - 0.8 mm (1/64 - 1/32 in.)</td>
<td>4</td>
</tr>
<tr>
<td>Medium specks</td>
<td>≥0.8 - 1.6 mm (1/32 - 1/16 in.)</td>
<td>2</td>
</tr>
<tr>
<td>Large specks</td>
<td>≥1.6 mm (1/16 in.)</td>
<td>0</td>
</tr>
</tbody>
</table>

*Not applicable to unobservable portion

† ≤ means "less than" or "equal to" ≥ means "greater than" or "equal to"

**NOTE**

Cracks: Actual fractures at or under the surface.

Chipped Areas: Surface damage causing loss of material greater than 0.4 mm (1/64 in.) in two or more dimensions.

Blisters or voids: Any unsupported surfaces that fracture upon the application of manual pressure with a rounded plastic tool.

Surface Porosity: Presence of numerous voids in the surface not extending through to the substrate.

Molding Irregularities: Any visible distortions related to forming such as dimple, dome, short, let-go, or sink mark as defined in ASTM D 883.

Pits: Small craters in the surface with widths and depths being approximately equal.

Pinholes: Very small holes into the surface.

Specks: Particles of foreign matter which produce irregularities in the surface, not including specks or flecks incorporated in the surface to produce a decorative pattern.

**5.3.2 Performance requirements**

The unit shall be free from cracks, chipped areas and blisters. The number and size of molding and other defects or blemishes shall not exceed those given in Table 1. Such defects shall be determined by inspection as specified in 5.2 after surface conditioning and application of ink as specified in 5.3.1.
5.4 Subsurface test

5.4.1 Any finish surfaces suspected of having subsurface porosity shall be subjected to the standard dirt test as outlined in 5.4.2.

5.4.2 Test method

A maximum of two areas of the unit, identified as being suspect, shall be conditioned by rubbing these areas for at least 25 cycles with 600-grit wet silicon carbide abrasive paper. Each test area shall be approximately 0.01m² (16 sq.in.). Following the abrasion, these areas shall be rinsed with tap water, dried, and soiled by application of standard dirt. Apply about 5 grams of standard dirt to each area and rub dirt with dampened chamois and heavy thumb pressure in circular motion for about 25 cycles. After the dirt is allowed to dry for at least 1 hour, the areas shall then be washed by rubbing with a clean, dampened chamois and standard liquid detergent before visual inspection.

NOTE 1 All reagents and chemicals in this specification have varying degrees of acute and chronic toxicity when entering the body through inhalation, ingestion or skin absorption. You should be aware of these toxic effects and take precautions (e.g., gloves, ventilation, respirator) to avoid harmful exposure. The Material Safety Data Sheet (MSDS) for these chemicals and reagents will be reviewed and precautions will be taken as required.

NOTE 2 Standard liquid detergent consists of, by volume: 8.0% tetrapotassium pyrophosphate; 7.0% ethoxylated-alkyl-phenol; 8.0% sodium-xylenesulfonate; 1.5% butyl cello-solve (2-butoxy ethanol); 75.5% water.

NOTE 3 To hasten drying, surfaces may be wiped with a clean chamois leather or a clean, absorbent, lint-free material (for this test only).

NOTE 4 "A" weight wet or dry 600-grit silicon carbide abrasive paper was used in preparing this test method.

NOTE 5 Standard dirt consists of 20 parts carbon black (pigment grade), 20 parts iron black (iron oxide, black), 10 parts calcium stearate, 5 parts 30W motor oil, 1 part wetting agent (Triton X-100, Rohm and Haas, or the equivalent), and 44 parts tap water. All parts are to be measured by weight.

5.4.3 Performance requirement

There shall be no visible voids larger than 1.6mm (1/16in.) in diameter below the original finish surface. The maximum allowable number of voids smaller than 1.6mm (1/16in.) for the two scrubbed areas shall be 8.

6 Structural integrity of complete units (all types)

6.1 Unit preparation

These load tests shall be performed on complete full-size units installed according to manufacturer’s installation instructions so as to simulate conditions of permanent installation, excluding fittings and piping.

6.2 Drain fitting connection

6.2.1 Test method

A weight of 220 ± 4N (50 ± 1lb/22.7± 0.5kg.) shall be gradually applied by means of a lever arm 610 ± 6mm (24 ± 1/4in.) in length connected to the drain fitting and extending horizontally as shown in Figure 1. The weight shall be applied to the lever arm over a 5 to 10 second interval so as not to cause a momentary loading exceeding the specified test parameters. Any combination of weight and lever arm can be used in lieu of the 50lb. (22.7kg) weight and 24in. lever arm as long as the moment is equal to 100ft lb (135.6Nm). The arm and weight shall then be placed for one minute in each of three radial positions, two of which shall be approximately 180° (3.141 rad) apart.
6.2.2 Performance requirement
Following the test described in 6.2.1, there shall be no visible cracks in the floor surface when inspected with the load in place after again inking as described in 5.3.1.

6.3 Point impact loads

6.3.1 Test method
A 38.1 mm (1-1/2 in.) diameter, 2.2N (1/2lb./0.2kg) steel ball shall be dropped from a height of 0.9m (36in.) to strike three different points on flat areas in the bottom of the unit and, three different points on the rim if applicable. A 38.1 mm (1-1/2in.) diameter, 2.2N (1/2lb.)/(0.2kg.) steel ball shall be dropped from a height of 610 mm (24in.) to strike three different points on radii in the bottom/threshold of the unit. The ball shall be free of deformation, dents, gouges or other surface defects.

6.3.2 Performance requirement
The fibre glass unit shall not show any cracks or chips in the finish surface for each of the series of three impact tests. Inspect for damage after again inking as described in 5.3.1

6.4 Load on seats (Bathrooms and Bathtubs)

6.4.1 Seats
The seat as designated by the manufacturer, whether it is an integrally molded part of the unit, or supplied affixed to unit by the manufacturer, shall be tested in accordance with the following test procedures.

6.4.2 Test method
A preloaded weight of 300 ± 5lb./136 ±2.3kg. (1335 ±22N force), shall be applied to the center of the seat on a weight distribution disk 6in. (152mm) in diameter covered with a 1/2in (13mm) thick sponge rubber or other suitable material between the disk and the surface to be loaded. Leave the load in place for 2 to 3 minutes to allow settlement of the seat. Ten (10) to fifteen (15) minutes after removing the preload, reapply the 300lb./136kg. (1335N force) load for not less than 2 minutes.

6.4.3 Performance requirement
After the test there shall be no cracking in the surface of the seat, or in the event the seat is attached with fasteners or other types of retainers, there shall be no cracks or other sign of failure where the seat is attached or the seat itself.

6.5 Loads on rim and bottom of bathtubs, and on threshold and bottom of showers

6.5.1 Test method for load deflection
A preload weight of 1335 ± 22N (300 ± 5lb./136 ±2.3kg.) shall be applied to the center of the bottom of the unit on a weight distribution disk 76.2mm (3in.) in diameter covered by a 13mm (1/2in.) thickness of sponge rubber or other suitable soft material between the disk and the surface being loaded. Leave the load in place for 2 to 3 minutes to allow for settlement of the test frame and any initial slip in fasteners. Ten to 15 minutes after removing the preload, reapply the 1335N (300 lb./136kg.) load for 1 to 2 minutes. The center of this load shall be placed in the approximate center of the bottom of the unit midway between ribs if ribs are present on the underside of the unit. Measure the deflection under this applied load with a deflectometer or other suitable device with a minimum reading of 0.025mm (0.001in.). Measure the residual deflection within 10 minutes after removal of the load.
6.5.2 Alternate test method for load deflection for bathtubs

The test stand shall consist of a fixture in which the bathtub is installed in a manner specified by the manufacturer; a means of applying and removing a 1335N (300lb./136kg.) load at the center of the bathtub bottom; and a means of measuring deflections such as dial indicators. The test stand shall have a floor of not less than 19mm (3/4in.) particle board or 15.9mm (5/8in.) plywood and 50.8 x 152.4mm (2 x 6in.) minimum joists 508mm (20in.) on center to simulate a typical manufactured home floor.

The fixture in Figure 2 provides an example of a means for measuring the deflection of the top surface on the fibre glass unit bottom at a point directly under the applied load. The fixture includes a 76.2mm (3in.) diameter load distribution disk padded with suitable soft material as required in Section 6.4.1. The compression of the soft material shall be measured by the dial indicator "A" in the fixture.

The required 1335N (300lb./136kg.) load shall be applied to the top of the fixture, with respect to the absolute reference, as measured by dial indicator "B". Additional dial indicators shall be applied if lateral motion of the fixture causes tilting of the top plate. The average of all dial indicator readings shall be used. The net deflection of the bottom shall then be corrected for the deflection of the test stand, if measurable, which is measured by the third dial indicator "C". See Figure 3. Alternate constructions which result in a suitable rigid test stand shall be permitted for testing purposes.

For each deflection measurement, record the readings of dial indicator "A", indicator "B" and the test stand deflection indicator "C". Apply the 1335N (300lb./136kg.) load to the fixture for 2-3 minutes. Remove the load for 10-15 minutes. Record the deflection with the load removed. If desired, all three indicators shall be set to zero at this point before recording. Apply the 1335N (300lb./136kg.) load and record deflections after 1-2 minutes. Remove the 1335N (300lb./136kg.) load and record deflections within 10 minutes. Calculate the loaded and residual deflections using the following formula:

\[
\text{Deflection Formula } \quad "B" - "A" - "C" = \text{net deflection}
\]

"B" = Total load

"A" = Deflection of the pad material

"C" = Deflection of the test stand bottom

6.5.3 Test method for secondary load

For fibre glass units, the 1335N (300lb./136kg.) load shall be applied for between 1 and 2 minutes at two other points at the bottom, top and if applicable one at the midpoint and one near an end, for the purpose of checking for cracks only (the loading arrangement is shown for showers and bathtubs in Fig. 1, 2 and 4 respectively).

6.5.4 Performance requirement

Following the test described in 6.5.1, 6.5.2 or 6.5.3, there shall be no cracks in the surface of the unit when inspected after again inking as described in 5.3.1. The deflection under the applied load shall not exceed 3.81 mm (0.150in.) of the fibre glass unit bottom only. The maximum residual deflection 10 minutes after removal of the load shall not exceed 0.203mm (0.008in.) of the fibre glass unit bottom only.
6.6  Area impact load on wall surrounds

6.6.1  Test method

While the fibre glass unit is in the test frame, a 127mm (5in.) diameter sandbag weighing 44.5 ± 5N (10 ± 1lb.) / (4.5 ± 0.5kg) shall be suspended by a lightweight cable from a minimum height of 2440mm (8ft.) above the inside bottom of the unit. The minimum suspension arm length shall be 1220mm (4 ft.) and shall ensure impact approximately 1220mm (4ft.) above the bottom of the unit. When the sandbag is suspended and at rest, it shall just come in contact with the desired point of impact. Impact load tests shall be conducted two times at each of the following two locations by raising the sandbag 838mm (33in.) higher than the rest position along the arc of the radius arm and then releasing it:

(1) At midpoint between framing members (studs) at approximately the center of the unit and 1220mm (ft.) above the bottom.

(2) At midpoint between the intersection of adjacent walls and the first framing member (stud) 1220mm (4 ft.) above the bottom of the unit.

The 838 mm (33in.) height difference shall be measured vertically. If the design of the unit precludes adherence to the test method given in this subsection, appropriate modification shall be made to the method, provided equivalent impact energy is obtained in the revised method.

6.6.2  Performance requirement

The unit shall not show any cracks in the finish surface after inking as described in 5.3.1.

6.7  Loads on wall surrounds

6.7.1  Test method

A load of 111N (25lb./11.3kg.) shall be applied to the fixture wall through a weight distribution disk 76.2mm (3in.) in diameter covered by a 13 mm (1/2 in.) thickness of sponge rubber or other suitable material between the disk and the surface thus loaded. The 111N(25lb./11.3kg.) load shall be applied for 1 minute, repeated at 2 minute intervals for a total of 10 cycles. This load test shall be performed at each of the following three locations:

(1) At midpoint between framing members (studs) at approximately the center of the longest wall and approximately 1220 mm (4ft.) from the floor of the fixture.

(2a) For Bathtubs. At a point halfway between the fixture fill spout and showerhead or directly in a vertical line with the fixture fill spout and showerhead or directly in a vertical line with the fixture fill spout.

(2b) For Showers. At a point halfway between the showerhead and the bottom of the unit.

(3) At the midpoint between the intersection of adjacent walls and the first framing member (stud) at approximately 1220mm (4ft.) above the floor of the fixture on any unit not tested at the locations given in (1) and (2).

6.7.2  Performance requirement

6.7.2.1 With the load applied, deflection at any point shall not exceed 6.35mm (0.25in.). For free-standing fibre glass units, the deflection at any point shall not exceed 25.4mm (1.0in).
6.8  Radii load test

6.8.1  Test method

All outside radii shall be loaded by passing over with a 13mm (1/2in.) diameter nylon rod using approximately 44.5N (10lb./4.5kg.) pressure at an angle tangent to the radius.

6.8.2  Performance requirement

The surface shall show no cracks, chips, or voids.

6.9  Loads on unsupported areas

6.9.1  Test method

A load of 44.5 ± 0.5N (10 ± 0.1lb./ 4.5 ± 0.5kg.) shall be applied at the central point of all unsupported areas below the rim of the fibre glass unit by means of a 25.4mm (1in.) diameter steel rod rounded to a 13mm (1/2in.) radius at the end in contact with the unit. Measure the deflection opposite the applied load by means of a deflectometer or other suitable device with a least reading of 0.025mm (0.001in.) (see Fig. 4).

6.9.2  Performance requirement

Following the test described in 6.8.1 there shall be no cracks in the fibre glass unit surface when inspected after again inking as described in 5.3.1. The deflection under the applied load shall not exceed 3.175 (0.125in.) at any individual load point.

7  Physical characteristics of materials (all types)

7.1  Colorfastness test

7.1.1  Test method

One specimen shall be tested for 200 hours in accordance with ASTM D 2565. Black panel temperature shall be maintained at 63° ± 5°C (145° ± 9°F). The irradiance of the xenon arc bulb shall be maintained at .35 ± .02 w/m at 340nm for the 200 hours. The light filters surrounding the bulb shall be borosilicate glass. Humidity control shall not be required. One specimen shall be retained as a control specimen. The control specimen shall be stored away from any light source at a temperature of 23 ± 5°C. Color readings shall be taken on the specimen to be tested with the instrument set to read at an illumination of D65, a CIE 10° observer with the specular component excluded and using the CIELAB color scale. After the specimen has been tested, final readings shall be taken on the sample using the aforementioned parameters. Final readings for determining color change shall be taken at least 72 hours after testing. The test sample shall be kept with the control during this time period.

7.1.2  Performance requirement

Tested specimens shall show no significant change in color or surface texture when compared with the control specimen when using a light source as specified in section 5.2. In the case of a conflict, examination shall be made by the method stated in ASTM D 2244. The δE between the initial and final readings on the tested specimen shall be no more than 2. In the case of failure, two more specimens shall be tested and shall pass.
7.2 Stain resistance test

7.2.1 Test method

Specimen(s) shall be cut from the inside or bottom of the unit (below the rim) and conditioned by wet-rubbing with a scouring compound and cheesecloth using at least 20 scrub cycles. Two (2) drops of each of the liquid reagents listed in Table 2 and a similar amount of the solid reagents shall be applied to the test specimen(s). One test shall be conducted with each reagent uncovered and the other test with each reagent covered with a small watch glass to prevent evaporation and to ensure contact with the test specimen(s). Allow the specimen(s) to remain for sixteen hours at a temperature of 23° ± 2°C (73.4° ± 3.6°F) and a relative humidity of 50% ± 5%. At the end of the test, remove the excess reagent by blotting lightly with a paper towel. The stain specimen(s) shall be subjected to cleansing tests immediately and rated at that time. Visual inspection of staining shall be in accordance with 5.2. Each stain, both covered and uncovered, shall be given a number in accordance with the rating procedure given in 7.2.1.1 through 7.2.1.5.

Table 2 - Reagents used in stain resistance test

<table>
<thead>
<tr>
<th>Reagent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black crayon</td>
</tr>
<tr>
<td>Black liquid shoe polish</td>
</tr>
<tr>
<td>Blue washable ink</td>
</tr>
<tr>
<td>Lipstick (contrasting color)</td>
</tr>
<tr>
<td>Hair dye (contrasting color)</td>
</tr>
<tr>
<td>Iodine solution (1% alcohol solution)</td>
</tr>
<tr>
<td>Gentian violet solution</td>
</tr>
<tr>
<td>Blue washable ink</td>
</tr>
</tbody>
</table>

7.2.1.1 Wash the specimen with tap water and cheese-cloth or soft bristle brush using 20 scrub cycles with normal hand pressure. Dry by blotting. A stain shall be defined as a change in surface texture or a change in color. Specimens not staining at this point shall have a rating of 1 - non-staining.

7.2.1.2 Stains present after initial wash with water shall be washed with alcohol (commercial rubbing alcohol) or naphtha (lighter fluid) using cheesecloth or soft bristle brush with 20 scrub cycles applying normal hand pressure. Wash with tap water and dry by blotting. Specimens not staining at this point shall have a rating of 2 - removable by alcohol or naphtha.

7.2.1.3 Stains present after the aforementioned cleanings shall be scrubbed 20 scrub cycles with household scouring powder and a wet cheesecloth or soft bristle brush using normal hand pressure. Wash with tap water and dry by blotting. Reduction of gloss due to scrubbing with household scouring powder shall not constitute staining. Specimens whose stain is removed by household scouring powder shall have a rating of 3 - removable by first application of household scouring powder.

7.2.1.4 Stains present after the aforementioned cleanings shall be scrubbed an additional 40 scrub cycles with household scouring powder and wet cheesecloth or soft bristle brush using normal hand pressure.
Wash with tap water and dry by blotting. Reduction of gloss due to scrubbing with household scouring powder shall not constitute staining. Specimens whose stain is removed by this additional cleaning shall have a rating of 4 - removable by two household scouring powder scrubblings.

7.2.1.5 Any specimen with stain remaining after the aforementioned cleanings shall have a rating of 5. Any specimen with stain remaining after the above cleanings shall be tested to determine the depth of staining. Cut through the affected area and sand lightly (600 grit) until the stain is removed. Measure depth to the nearest 0.025mm (0.001 in.).

7.2.2 Performance requirement

The maximum stain resistance rating shall be the sum of all the individual stain ratings, for each of the covered and uncovered stain areas. The maximum stain resistance rating shall be 50. The maximum allowable thickness of material removed to eliminate the stain shall be 0.127mm (0.005 in.).

7.3 Wear and cleanability

7.3.1 Specimen preparation

Three test specimens shall be cut from three different areas (front, back, ends or bottom) inside the fibre glass unit having nontextured surfaces where possible. (If relatively flat specimens cannot be obtained from the fibre glass unit they shall be selected from the apron or if no apron is available, test samples shall be cut from prepared sheets made by the same process, techniques, and materials as a manufactured unit.) Specimens to be tested shall be cut 95 x 95mm (3-3/4 x 3-3/4in.) (82 x 82mm) (3-1/4 x 3-1/4in.) for the AG-8100). Finish surfaces of specimens shall be flat and in the same plane. If the specimens have insufficient rigidity, they shall then be bonded to 92 x 92mm (3-5/8 x 3-5/8in.) by 11-gauge flat stainless-steel plates using an adhesive that is water-resistant and allows the stainless-steel backing plates to be salvaged after testing is completed. The edges of the specimens shall then be sanded to the dimensions of the stainless-steel backing plates.

7.3.2 Test method

The test equipment shall be a modification of a heavy-duty wear tester. The abrasive slurry shall be contained in a 200 mm (8in.) diameter x 305mm (12in.) high clear container, or the equivalent, with cover to accept tubes and motor driven stirring apparatus sufficient to maintain particulate matter in suspension. Extend 3mm (1/8in.) ID (inside diameter) vinyl laboratory tubes from the abrasive slurry container through a laboratory tester.

Special 38 x 89mm (1-1/2 x 3-1/2in.) hog bristle brushes shall be required for this test. Each brush block shall contain fifty-nine bristles placed in alternate rows of five and four bristles each which are staggered, resulting in nine lanes of bristles in the direction of brush travel. Each brush also shall contain fifty-four No. 40 (2.5mm) (drill size) holes through the brush block and adjacent to each bristle to allow the abrasive slurry to feed through to each bristle area. Brush bristles shall not be allowed to wear to a total length of less than 13mm (1/2in.). The total weight on each brush, including the brush itself, shall be 1100 ± 10g (38.3 ± 0.35oz.).

7.3.2.1 Mix abrasive slurry consisting of 3000ml of tap water, 15 grams of sodium carboxymethyl cellulose, 60 grams of trisodium phosphate (Na₃PO₄₁₂H₂O), and 2700 grams of 160-mesh pottery flint, ground quartz or equivalent.

7.3.2.2 Flow rate of the slurry shall be 3 to 3.5ml per minute through each tube. To check flow rate, run pump until no further bubbles are visible in-tubing, then place each tube in a separate 200ml graduated
cylinder and run pump for 10 minutes. The level in each cylinder shall be 30 to 35ml.

7.3.2.3 Clamp specimens in specimen trays and shim end plates so that they are level and at the same height as the specimens. (For the AG-8100) Bond three specimens to a steel plate as shown in Figure 6. Position specimens along wear tracks and adhere them to the plate with contact cement.

7.3.2.4 Scrub-cycle rate shall be set at 60 cycles per minute (37 cycles/min. for the AG-8100).

7.3.2.5 Start pump and make certain slurry is flowing freely before starting scrub cycle.

7.3.2.6 Scrub for 10,000 cycles. Stop machine at 2,500, 5,000 and 7,500 cycles to wash excess slurry from specimen trays and to switch brushes. Also check brush blocks at this time and make certain that holes are free for the passage of slurry. For changing brushes, follow this table:

<table>
<thead>
<tr>
<th>Cycles</th>
<th>Lane Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2,500</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>2,500 - 5,000</td>
<td>4 1 2 3</td>
</tr>
<tr>
<td>5,000 - 7,500</td>
<td>3 4 1 2</td>
</tr>
<tr>
<td>7,500 - 10,000</td>
<td>2 3 4 1</td>
</tr>
</tbody>
</table>

7.3.2.7 On completion of 10,000 cycles, all samples shall be removed, rinsed in tap water, dried and measured for cleanability.

7.3.2.8 Abrasive slurry shall not be reused.

7.3.3 Cleanability test

Procedures for the cleanability test shall be as described in 7.3.3.1 through 7.3.3.5.

7.3.3.1 Measure the white-light reflectance of the scrubbed specimens with a high sensitivity color difference meter. The reading for each specimen shall be taken as the average of three individual readings approximately 13mm (1/2in.) apart.

7.3.3.2 Place 10 grams of standard dirt on each specimen and rub dirt on scrubbed area with dampened chamois and a heavy thumb pressure in a circular motion for 25 cycles. Allow dirt to dry for 1 hour and then wash specimens by rubbing with a clean dampened chamois and standard liquid detergent for 50 cycles. Rinse specimens in tap water and allow to dry.

7.3.3.3 Again measure white-light reflectance as before to obtain the average of three readings for each specimen and determine the absolute percentage losses in reflectance from the averages of the first readings.

7.3.3.4 If the average absolute percentage loss of white-light reflectance is greater than 2% but less than 5%, give the specimens an additional cleaning by rubbing with a clean dampened chamois or soft bristle brush and abrasive slurry from the slurry container for 50 cycles in the same direction of brush travel as in the wear tester. Rinse specimens in tap water and allow to dry.

7.3.3.5 Again, measure white-light reflectance as before, taking the average of three readings, and determine the absolute percentage loss in reflectance from the average of the first readings.
7.3.4 Performance requirement

If a surface finish is used, it shall not be worn through in the middle of the specimen. Each specimen, after 10,000 cycles, shall pass the cleanability test with an absolute percentage loss of white-light reflectance of not more than 5% after cleaning with standard liquid detergent and an absolute percentage loss of white-light reflectance of not more than 2% after the additional cleaning with abrasive slurry.

7.4 Cigarette test

7.4.1 Test method

The cigarette burn resistance of units shall be measured using specimens approximately 150mm x 150mm (6in. x 6in.). Select three popular brands of cigarettes. Light one cigarette each from freshly opened packages of three brands. Place the cigarettes on the specimen(s) with the lighted end 25.4mm (1in.) in from the edge. Allow the cigarettes to burn for 2 minutes ± 2 seconds. Remove the cigarettes and allow the burned areas to cool. Wipe the burn areas with a clean cheesecloth or soft bristle brush. If a visible stain remains, sand the stained area with 400 grit wet or dry sandpaper and water until the stain is removed.

7.4.2 Performance requirement

There shall be no ignition or progressive glow of the surface during or after contact with the lighted cigarettes. Any resulting damage shall not impair the serviceability of the unit, and shall be easily repairable by using abrasive and polishing compounds to approximate the original finish.

7.5 Chemical resistance test

7.5.1 Test method

Two (2) drops of each of the following liquid reagents shall be applied to the surface finish:

- Naphtha
- Ethyl alcohol
- Amyl acetate
- 1 part commercial household ammonia solution, 9 parts water by volume
- Citric acid, 10% water solution
- Urea, 6.0% water solution
- Hydrogen peroxide, 3% water solution
- Concentrated sodium hypochlorite solution
- Toluene
- Ethyl acetate
- Lye, 1% to 2% water solution
- Acetone

Specimen(s) shall have an untextured surface where possible and be cut from the inside or bottom of the unit (below the rim), or from the apron and conditioned as shown in paragraph 5.1. If suitable flat

**NOTE 7** The white-light reflectance shall be determined using the Y component of the XYZ color scale, illuminant C and a 10 aperture. (Test results on translucent materials are known to vary.)

specimens are not available from the unit, manufacturer shall supply suitable flat specimen made from the same materials as the unit. Conduct one test with each reagent uncovered and the other with reagent
covered with a small watch glass to prevent evaporation. Allow the specimens to remain for a total of 16 hours. At the end of 16 hours remove the watch glass and the excess reagent. The sample shall be held for a period of 24 hours at a temperature of 23° ± 2°C (74.3° ± 3.6°F) and a relative humidity of 50% ± 5% before rating.

7.5.2 Performance requirement

The surface finish shall be unaffected by the reagents except for superficial surface changes which are removable by sanding with 600 grit wet or dry sandpaper and water. Any resulting damage shall not impair the serviceability of the unit, and shall be easily repairable by using abrasive and polishing compounds to approximate the original finish.

7.6 Ignition test

7.6.1 Test method

Five test specimens, each approximately 305mm x 305mm (12in. x 12in) shall be cut from the service wall that is specified by the manufacturer's instructions. If sufficient area is not available, test samples shall be cut from prepared sheets made by the same process, techniques, and materials as a typical manufactured unit. The ignition test shall be conducted in a draft-free laboratory hood having provision for removal of products of combustion immediately after each test is conducted. The test specimen is mounted in the hood in a vertical position. The burner of a propane torch shall be adjusted to provide a blue flame, the visible portion of which is 25.4mm (1in.) long. Position the burner such that the flame is inclined upward at a 45° angle to the specimen, which is in a vertical plane, and with the tip of the blue portion of the flame touching the center of the specimen on the opposite side from the finish surface. After 30 seconds, remove the burner to at least 458mm (18in.) away from the test specimen and start the stopwatch to time the burning period. When no evidence of flame or progressive glow is seen, the time is recorded and, 1 minute later, the burner is again applied to the same position of the specimen for an additional 30 seconds. Remove and extinguish the burner and again time the burning period.

7.6.2 Performance requirement

All five specimens of the unit or material shall cease to burn (if ignited) within 30 seconds after removal of the burner. Burning will be permitted beyond 30 seconds if it takes place only along the upper edge of the sample. If any one of the samples fails the test, five additional samples shall be tested and all five shall pass.

7.7 Thermal shock resistance

7.7.1 Test methods

Impinge, on fixture surface, where water will normally strike, at 65.5° ± 1.6°C (150° ± 3°F) for 1.5 minutes. Allow water to drain for 30 seconds. Follow immediately at the same point with cold water at 10° ± 1.6°C (50° ± 3°F) for 1.5 minutes. Allow water to drain for 30 seconds. This shall constitute one complete cycle. Continue test for a total of 250 cycles. Flow rates shall be 0.063 ± 0.013 L/s (1 ± 0.2 gpm).

7.7.2 Performance requirement

There shall be no cracking, crazing, blistering or spalling; or delamination. Inspection for cracking and crazing shall be made using an ink solution as described in Section 5.3.1.

8 Additional material tests

8.1 Water resistance test
8.1.1 Hot water resistance test (types 1, 2, and 3 units)

8.1.1.1 Test method

A total of three test specimens shall be required to complete this test. One specimen shall be taken from the wall surround area and the other two specimens taken from two different areas of the fibre glass unit. If there are no wall surrounds, all three specimens shall be from different areas of the fibre glass unit. One specimen shall be cut from the bottom. If the specimens differ in appearance or surface texture, a control specimen shall be cut from an area immediately adjacent to each test specimen. If the specimens are the same in appearance and surface texture, only one control specimen shall be required. Condition the surfaces of the specimens, including the control specimen(s), by wet-rubbing with a scouring compound and cheesecloth using at least 20 scrub cycles. Then wash surfaces with tap water. Three specimens shall be placed against the portholes of a suitable nonreactive vessel (Fig. 8). The portholes shall have a minimum area of 3871mm² (6 sq.in.) each. Use silicone rubber gaskets between tank and specimens. Cover any unused portholes with a nonreactive material. Specimens from Type 2 units shall be subjected to boiling distilled water for 100 ± 1/2 hour. Specimens from Types 1 and 3 units shall be subjected to distilled water maintained at 65 ± 1°C (150° ± 2°F) for 100 ± 1/2 hour. See Fig. 8. The test face of the sample shall be submerged. The following method shall be used to determine the water resistance rating when comparing tested specimens with the control specimen: After exposure, use the visual inspection procedure in accordance with the inspection method given in 5.2 (without inking or soiling) to rate each of the specimens for blisters, color change, change in surface profile, cracks, and loss of visible gloss using the following numerical scale.

0 - No Change
1 - Increasing gradations of change
2 - Increasing gradations of change
3 - Increasing gradations of change
4 - Increasing gradations of change
5 - Extreme change, approaching maximum possible

The water resistance rating shall be determined by totaling, for each test specimen, the numerical designation for each of the five gradations of change, then totaling the values for all three specimens and dividing by three. This same rating procedure shall be followed independently by three qualified persons familiar with the procedure, and the final rating reported shall be the average of the ratings of the three persons. The ratings shall be made within 4 hours after removal of the test specimens.

8.1.1.2 Performance requirement

The water resistance rating shall be a maximum of 9 when specimens are evaluated for color change, blistering, change in surface profile, cracks, and loss of visible gloss. For any one of the five types of defects, the maximum average change for any specimen shall be 4.

8.2 Laboratory test for non-integral flange-fixture seal

8.2.1 Unit preparation

This test shall be performed on the largest size unit, for which the kit is designed. The kit shall be installed according to manufacturer’s installation instructions.
8.2.2 Load test
A preload weight of 1335 ± 22N (300 ± 5lbs./136 ±2.3kg) shall be applied to the midpoint of the longest section of the land surface. The load shall be applied on a weight distribution disk 76mm (3in.) in diameter or equivalent, covered by a 13mm (1/2in.) thickness of sponge rubber or other suitable soft material between the disk and the surface being loaded. Leave the load in place for two (2) to three (3) minutes to allow for settlement of the test frame and any initial slip in fasteners. Repeat the mid-point loading two (2) times. Ten (10) to fifteen (15) minutes after removing the preload, reapply the 1335 ± 22N (300 ± 5lb./136 ±2.3kg.) load to the center of the sump bottom. The load shall remain during the water spray test as described in 8.2.3.

8.2.3 Test method
The flange seal at the joint with the fixture shall be exposed to a continuous water spray through a 30° full jet spray nozzle for thirty (30) minutes. The spray shall be applied to the flange seal joint from a distance of 1.2m (4 feet) from the face of the spray nozzle at an angle of forty-five (45) degrees to the vertical with a flow rate of 11.4L/m (3gpm) at 550kPa (40psi), and a water temperature of 40° ± 3°C (100° ± 5°F).

8.2.4 Performance requirement
Water transmission through the flange-fixture joint to the back of the flange shall be cause for rejection.

8.3 Resistance to fungi and bacteria growth (type 6 units)
8.3.1 Resistance to growth of fungi and bacteria shall be determined in accordance with ASTM G 21.

8.4 Puncture resistance test (type 6 units)
8.4.1 (a) Twenty-four common dry wall nails shall be randomly distributed over the centermost 300mm by 300 mm area on the floor of the fibre glass unit. A 12in. x12in. (305mm x 305mm) piece of 1in. (25.4mm) thick plywood shall be placed over the nails. A test load of 150lbs./68kg (0.65kN) shall be applied for one minute. A test area shall be visibly inspected after removal of the test load. There shall be no punctures. Any resulting depressions on the surface shall disappear within twenty-four (24) hours.
(b) A No. 2 Phillips screw driver weighing 3.3oz. (0.094kg) shall be raised until the tip of the screw driver is at a height of 5 ft. (1524mm) above a flat area on the bottom of the fibre glass unit. The screw driver shall be dropped from this height to strike the test area perpendicularly. There shall be no puncture of the elastomeric surface layer.
Load test for bathtub drain fitting connections

Units installed in accordance with manufacturer's instructions

Minimum dimension to obtain clearance

610 mm (24 in.)

222.4N weight (50 lb.)

Load test for shower drain fitting connection

Figure 1
Test load
(Hydraulic ram or weight)

Dial indicator mounted to absolute base as close to load centerline as possible.

Spacers epoxied in place. Epoxy cured under load.
(Typ. 4 places)

Metal top plate, 76.2 mm (3 in.) dia., 12.7 mm (1/2 in.) thick, minimum

Spacers, 12.7 mm (1/2 in.) diameter

Dial indicator mounted on fixture

76.2 mm (3 in.) dia. metal disk, 12.7 mm (1/2 in.) thick

12.7 mm (1/2 in.) sponge rubber or other suitable soft material

Bathtub

Figure 2

Fixture for measuring bathtub bottom deflection

1335 N (300 lb.)

Load test on shower threshold and bottom

1335 N (300 lb.)

76 mm. (3 in.) dia. weight distribution disk

76 mm. (3 in.) diameter weight distribution disk
NOTES Load and fixture centered in tub

**Figure 3 - Typical test stand**

- 76 mm (3 in.) diameter weight distribution disk
- 44.5 N (10 lbs.)
- 1335 N (300 lbs.)

**Figure 4 - Load test on bathtub rim and bottom, and load on unsupported areas**
Figure 5 – Brush holder (sled) (Z124 wear test)

Specimen mounting plate (AG-8100)

NOTE Construction: acrylic sheet solvent cemented

NOTE For metric conversion, 1 in. = 25.4 mm

Figure 6 – Platform & mounting plate for wear tester

NOTE Construction: steel or aluminum 0.06” -0.100” thick

NOTE For metric conversion, 1 in. = 25.4 mm
NOTE: For metric conversion, 1 in. = 25.4 mm

**Figure 7 - Brush block details**

### Material List

<table>
<thead>
<tr>
<th>Item</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>1</td>
<td>Nylon Flat Stock 4.8 x 4.8 x 54.0 mm (3/16 x 3/16 x 2-1/8 in.)</td>
</tr>
<tr>
<td>J</td>
<td>4</td>
<td>Stainless Steel Flat Soc. HD Screw #10-24 x 9.5 mm (3/8 in.)</td>
</tr>
<tr>
<td>M</td>
<td>1</td>
<td>Soft Gasket Rubber 3.2 x 38.1 x 88.9 mm (1/8 x 1-1/2 x 3-1/2 in.) Long</td>
</tr>
<tr>
<td>P</td>
<td>1</td>
<td>Hard Brass 38.1 x 50.8 x 104.8 mm (1-1/2 x 2 x 4-1/8 in.) Bright Chrome Plated</td>
</tr>
<tr>
<td>Q</td>
<td>1</td>
<td>Brass Set Screw Cup Point #10-24 x 6.4 mm (1/4 in.)</td>
</tr>
<tr>
<td>R</td>
<td>1</td>
<td>De Vilbiss Hose Connector for 3.2 mm (1/8 in.) I.D. Hose, 3.2 mm (1/8 in.) - 27 M. Thd. 31.8 mm (1-1/4 in.) Long (Bright Chrome Plated)</td>
</tr>
</tbody>
</table>
Figure 8 – Boil test tank (top view of tank without screws)

Note: For metric conversion 1 in. = 25.4 mm

Typical side view
Figure 8 – Boil test tank

**Connector end view**

1/2" dia. hole to be aligned with female connector.

**Section A-A**

3/4" o.d. type 303 or 304 stainless steel female connector, 1/2" - 18 t.i.d. welded to tank wall.

**End view**

1/2" dia. hole to be aligned with female connector.

**Weld seams and grind flush. All seams must be watertight.**

**NOTE:** For metric conversion, 1 in. = 25.4 mm

**Connector plug detail**

Weld shrow from tank interior and grind smooth. All welds must be watertight.

**Side wall detail**

Typical 1/4" - 20 x 1-1/8" stainless f.h. screw

**Prefilled 3/8" dia. hole for screw placement.**
Figure 9(a) – Commonly used nomenclature

*Service Wall shall be defined by manufacturer

Figure 9(b) - Commonly used nomenclature
Figure 9 (c) – Commonly used nomenclature
Appendix A
(Non Mandatory)

Flammability

A.1 Flame spread and smoke density tests

When information is desired by regulatory organizations to describe or specify the properties of materials used in fibre glass fixtures in response to heat and flame, the following optional test methods have been found to provide the most meaningful data for comparative purposes. However, these tests, run under controlled conditions, are not intended to appraise fire hazard or fire conditions, but they may be considered as elements of a fire risk assessment, which takes into account all of the factors which are pertinent to an assessment of fire hazard of a particular structure in which the product is used.

A.2 Test Methods

Units shall be tested by an independent laboratory using the test methods specified for either option in Table III. The option shall be selected by the manufacturer. When various products are made of the same materials, of the same nominal thickness of finished and supporting surfaces and by the same process by multiple manufacturers, only one test per variation shall be required.

A.3 Performance Requirements

As a guide a flame spread rating of 200 or less and a smoke density or smoke generation average rating of 450 or less is usually required. (See Footnote). Building codes may have other requirements for special occupancies such as medical facilities, nursing homes, multi-story lodging facilities and residences and similar installations.

Table A

<table>
<thead>
<tr>
<th>Option</th>
<th>Flame Spread Tests</th>
<th>Smoke Density (Generation) Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ASTM E 84 (NFPA 255) Standard Method of Test for Surface Burning Characteristics of Building Materials. (Front and back sides of material shall be tested.)</td>
<td>ASTM E 84 (NFPA 255) or NFPA 258 (ASTM E 662), Standard Research Test Method for Determining Smoke Generation of Solid Materials. (Front and back sides of material shall be tested.)</td>
</tr>
<tr>
<td>2</td>
<td>ASTM E 162, Test for Surface Flammability of Materials Using a Radiant Energy Heat Source. (Front and back sides of material shall be tested.)</td>
<td>NFPA 258 (ASTM E 662), Standard Research Test Method for Determining Smoke Generation of Solid Materials. (Front and back sides of material shall be tested.)</td>
</tr>
</tbody>
</table>
**NOTE** NFPA 258 (ASTM E 662) Smoke generation shall be determined by averaging the Flaming (Dm) and Non-Flaming (Dm) modes for each surface material.