

# Hydromassage bathtub systems



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***Hydromassage bathtub systems***



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# Contents

ASME Standards Committee on Plumbing Materials and Equipment v

ASME Project Team 19.7 — Hydromassage Bathtubs vii

CSA Technical Committee on Plumbing Fixtures viii

ASME/CSA Joint Harmonization Task Group on Plumbing Fixtures xi

Preface xii

## 1 Scope 1

## 2 Reference publications 1

## 3 Definitions and abbreviations 3

3.1 Definitions 3

3.2 Abbreviations 4

## 4 General requirements 4

4.1 Electrical components 4

4.2 Plumbing fixtures 4

4.3 Plumbing supply fittings 4

4.4 Piping and tubing 4

4.4.1 Copper 4

4.4.2 Plastic 4

4.4.3 Flexible hoses 4

4.4.4 Alternative materials 4

4.5 Solvent cements for use with flexible piping 5

4.6 Suction fittings 5

4.7 Circulation system installation 5

4.8 Pump or blower 5

4.9 Field-assembled or retrofitted bathtubs 5

4.10 Backflow prevention 5

4.11 Suction fitting assemblies (whirlpool bathtubs only) 5

4.12 Suction fitting cover apertures 6

## 5 Testing 6

5.1 Installation 6

5.2 Water retention in whirlpool or air-jetted bathtubs 6

5.2.1 General 6

5.2.2 Preconditioning 6

5.2.3 Performance 6

5.2.4 Chlorine test 6

5.2.5 Volumetric test 9

5.3 Physical tests for suction fittings (whirlpool bathtubs only) 10

5.3.1 General 10

5.3.2 Test conditions 10

5.3.3 Surface exhaustion 10

5.3.4 Deflection test 11

5.3.5 Shear load test 11

5.3.6 Vacuum and point impact test 11

- 5.4 Hair entanglement test for suction fittings 12
- 5.4.1 General 12
- 5.4.2 Test preparation 12
- 5.4.3 Test with the fitting affixed to the test fixture 13
- 5.4.4 Test with the fitting affixed to the bathtub 13

## **6 Markings and installation instructions 14**

- 6.1 General 14
- 6.2 Factory-assembled whirlpool or air-jetted bathtubs 14
- 6.3 Field assemblies and retrofitted bathtubs (whirlpool bathtubs only) 14
- 6.4 Suction fittings (whirlpool bathtubs only) 15
- 6.5 Installation instructions 15
  - 6.5.1 General 15
  - 6.5.2 Factory-assembled whirlpool or air-jetted bathtubs 15
  - 6.5.3 Roughing-in dimensions 15
  - 6.5.4 Service access and controls 15
  - 6.5.5 Electrical 15
  - 6.5.6 Operation, use, and care instructions 15
  - 6.5.7 Flushing instructions 15

## **Annexes**

- A** (informative) — Unit conversion and rounding criteria 23
- B** (normative) — Random sampling method for testing bathtubs 24

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## **Tables**

- 1** — Preparation of chlorine solution 8
- 2** — Residual water comparison 9

---

## **Figures**

- 1** — Shear load test 16
- 2** — Test tank 17
- 3** — Baffles 18
- 4** — Pull structure 19
- 5** — Test equipment with puller assembly 20
- 6** — Test cylinder assembly 21
- 7** — Test procedure 22

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# Preface

This is the first edition of ASME A112.19.7/CSA B45.10, *Hydromassage bathtub systems*.

This Standard replaces ASME A112.19.7-2006, *Hydromassage Bathtub Appliances*, and CAN/CSA-B45.10-01 (R2006), *Hydromassage bathtubs*.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was prepared by the ASME/CSA Joint Harmonization Task Group on Plumbing Fixtures, under the jurisdiction of the ASME Standards Committee on Plumbing Materials and Equipment and the CSA Technical Committee on Plumbing Fixtures. The CSA Technical Committee operates under the jurisdiction of the CSA Strategic Steering Committee on Water Management Products, Materials, and Systems. This Standard has been formally approved by the ASME Standards Committee and the CSA Technical Committee. This Standard was approved as an American National Standard by the American National Standards Institute on February 23, 2012.

March 2012

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# ASME A112.19.7-2012/CSA B45.10-12

## ***Hydromassage bathtub systems***

### **1 Scope**

#### **1.1**

This Standard specifies general requirements, test methods, and markings for whirlpool and air-jetted bathtubs and suction fittings used in hydromassage bathtub systems that incorporate a bathtub and circulation pump. The circulation pump can be with or without

- (a) a piping system; and
- (b) induction of air (which can be achieved by integral suction or through an air pump).

#### **1.2**

This Standard does not cover

- (a) spas and hot tubs covered in CAN/CSA-C22.2 No. 218.1 and UL 1563;
- (b) portable hydromassage products covered in CSA Electrical Bulletin 1268 and CSA Electrical Bulletin 1270; and
- (c) hydrotherapy bathtubs or patient bathing systems for institutional use.

#### **1.3**

In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (nonmandatory) to define their application.

#### **1.4**

SI units are the units of record in Canada. In this Standard, the inch/pound units are shown in parentheses. The values stated in each measurement system are equivalent in application; however, each system is to be used independently. Combining values from the two measurement systems can result in non-conformance with this Standard.

All references to gallons are to U.S. gallons.

For information on the conversion criteria used in this Standard, see [Annex A](#).

### **2 Reference publications**

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

#### **ASME/CSA (The American Society of Mechanical Engineers/Canadian Standards Association)**

ASME A112.18.1-2011/CAN/CSA-B125.1-11  
*Plumbing supply fittings*

ASME A112.18.2/CSA-B125.2-11  
*Plumbing waste fittings*

ASME A112.19.1-2008/CSA B45.2-08  
*Enamelled cast iron and enamelled steel plumbing fixtures*

**CSA (Canadian Standards Association)**

CAN/CSA-B45.5-02 (R2008)  
*Plastic plumbing fixtures (a part of CAN/CSA-B45 Series-02 (R2008), Plumbing fixtures)*

B137 Series-09  
*Thermoplastic pressure piping compendium*

B137.1-09  
*Polyethylene (PE) pipe, tubing, and fittings for cold-water pressure services*

B137.5-09  
*Crosslined polyethylene (PEX) tubing systems for pressure applications*

C22.1-09  
*General requirements — Canadian Electrical Code, Part I, Safety standard for electrical installations*

CAN/CSA-C22.2 No. 218.1-M89 (R2006)  
*Spas, hot tubs, and associated equipment*

C22.2 No. 218.2-93 (R2008)  
*Hydromassage bathtub appliances*

Electrical Bulletin No. 1268 (May 1980)  
*Requirements for household, cord-connected, portable air pump hydromassage units for use with bathtubs*

Electrical Bulletin No. 1270 (May 1980)  
*Requirements for household, cord-connected, portable water pump hydromassage units for use with bathtubs*

**ASTM International (American Society for Testing and Materials)**

D2444-99 (2010)  
*Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)*

D2564-04 (2009)e1  
*Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems*

F876-10  
*Standard Specification for Crosslinked Polyethylene (PEX) Tubing*

**IAPMO (International Association of Plumbing and Mechanical Officials)**

PS033-2010b  
*Flexible PVC Hose for Pools, Hot Tubs, Spas and Jetted Bathtub*

IAPMO/ANSI Z124.1.2-2005  
*Plastic Bathtub and Shower Units*

**NFPA (National Fire Protection Association)**

70 (2011)  
National Electrical Code

**UL (Underwriters Laboratories Inc.)**

1795-2009  
Standard for Hydromassage Bathtubs

1563-2009  
Standard for Electric Spas, Equipment Assemblies, and Associated Equipment

### 3 Definitions and abbreviations

#### 3.1 Definitions

The following definitions shall apply in this Standard:

**Accessible** — accessible by removing an access panel, door, or similar obstruction, using tools.

**Circulation system** — the inlets, outlets, pumps, air induction systems, valves, piping or tubing, fittings, and other appurtenances used to circulate water from a hydromassage bathtub system.

**Note:** *The circulation system can be factory or field assembled, and it can be independent or interconnected.*

**Disintegrate** — to lose any material from a fitting, exclusive of plating or finish.

**Fixture** — a device that receives water, waste matter, or both and directs these substances into a drainage system.

**Hydromassage bathtub system** — a plumbing system that incorporates one or both of the following:

- (a) water jets, with or without air introduced by integral suction. The water jets include a water recirculation system with self-draining piping and a water pump; and
- (b) an air induction system that introduces air into the system through jets using a blower or air pump.

**Note:** *A hydromassage bathtub system can be piped or unpiped (e.g., a pipeless whirlpool bathtub).*

**Jet** — a fitting that creates a high-velocity stream of water with or without induction of air.

**Pipeless whirlpool bathtub** — a bathtub equipped with one or more unitized jet/suction fittings to circulate water without piping and discharge the water after each use.

**Plumbing appurtenance** — a manufactured device, prefabricated assembly, or field assembly of component parts that is an adjunct to the basic piping system and plumbing fixture.

**Note:** *An appurtenance demands no additional water supply, nor does it add any discharge load to a fixture or the drainage system.*

**Standard liquid detergent** — a mixture of 8.0% tetrapotassium pyrophosphate, 7.0% ethoxylated-alkyl-phenol, 8.0% sodiumxylenesulfonate, 1.5% butyl cellosolve, and 75.5% water, measured by volume.

**Notes:**

*The following commercial products are acceptable:*

- (a) tetrapotassium pyrophosphate: Monsanto TKPP;
- (b) ethoxylated-alkyl-phenol: Monsanto Sterox NJ or Rohm & Haas Triton X-100;
- (c) sodiumxylenesulfonate: Stepan Chemical Co. Stepan SXS; and
- (d) butyl cellosolve: 2-butoxy ethanol.

**Unitized jet/suction fitting** — an apparatus with a means for circulating water in a whirlpool bathtub without routing the water through the circulation system.

## 3.2 Abbreviations

The following abbreviations shall apply in this Standard:

<b>ABS</b>	— acrylonitrile-butadiene-styrene
<b>CPVC</b>	— chlorinated polyvinylchloride
<b>GFCI</b>	— ground fault circuit interrupter
<b>ID</b>	— inside diameter
<b>OD</b>	— outside diameter
<b>PEX</b>	— crosslinked polyethylene
<b>PVC</b>	— polyvinylchloride

## 4 General requirements

### 4.1 Electrical components

The electrical components of hydromassage bathtubs shall comply with CSA C22.2 No. 218.2 or UL 1795.

### 4.2 Plumbing fixtures

Plastic bathtubs shall comply with CAN/CSA-B45.5 or IAPMO/ANSI Z124.1.2. Enamelled cast iron and enamelled steel bathtubs shall comply with ASME A112.19.1/CSA B45.2.

### 4.3 Plumbing supply fittings

Plumbing supply fittings shall comply with ASME A112.18.1/CSA B125.1 and plumbing waste fittings shall comply with ASME A112.18.2/CSA B125.2.

### 4.4 Piping and tubing

#### 4.4.1 Copper

Copper water tubes shall be not less than Type M.

#### 4.4.2 Plastic

##### 4.4.2.1

Acrylonitrile-butadiene-styrene (ABS) and polyvinylchloride (PVC) piping and tubing may be rigid or flexible. Fittings and rigid tubing shall be at least Schedule 40.

##### 4.4.2.2

Chlorinated polyvinylchloride (CPVC) piping shall be at least SDR-PR.

##### 4.4.2.3

Crosslinked polyethylene (PEX) tubing shall comply with the dimensional tolerances specified in the appropriate PEX standard.

#### 4.4.3 Flexible hoses

Flexible hoses shall comply with IAPMO PS033.

#### 4.4.4 Alternative materials

Piping made of alternative materials shall be acceptable if it meets all of the performance requirements of this Standard.

#### **4.5 Solvent cements for use with flexible piping**

Solvent cements used in the assembly of the recirculation piping of hydromassage bathtubs shall

- (a) be used in accordance with the solvent cement manufacturer's instructions; and
- (b) be suitable for jointing flexible PVC pipe to rigid PVC fittings.

#### **4.6 Suction fittings**

Suction fittings shall comply with [Clauses 5.3](#) and [5.4](#).

#### **4.7 Circulation system installation**

##### **4.7.1**

Rigid and flexible piping and tubing shall be installed to allow for drainage of the water from the circulation system in accordance with [Clause 5.2](#). Flexible tubing shall be provided with support to reduce sagging in accordance with the tubing manufacturer's instructions.

##### **4.7.2**

Pumps shall be connected to the circulation system in such a way that they can be removed, repaired, or replaced.

##### **4.7.3**

When a self-draining volute is not provided, a means to drain the pump volute, e.g., 6.4 mm (0.24 in) ID tubing, shall be provided. The volute drain opening in a self-draining pump shall be not less than 4.8 mm (0.1875 in) ID.

##### **4.7.4**

The separation between multiple suction fittings shall be at least 305 mm (12 in). The fittings shall be in different planes.

##### **4.7.5**

The circulation system shall be watertight. Leakage from the circulation system during testing shall be cause for rejection.

#### **4.8 Pump or blower**

The location of the pump or blower shall be determined by the manufacturer. A means to fasten the pump or blower shall be provided.

#### **4.9 Field-assembled or retrofitted bathtubs**

Field-assembled or retrofitted bathtubs shall meet the requirements of this Standard.

#### **4.10 Backflow prevention**

Backflow prevention shall be provided in accordance with the applicable plumbing code for

- (a) bathtubs with submerged inlets;
- (b) potable water flush systems; or
- (c) hydraulic seat lifts.

#### **4.11 Suction fitting assemblies (whirlpool bathtubs only)**

Suction fitting assemblies shall be designed so that tools are required for disassembly. Standard slotted screws shall not be used for affixing grates and covers to the suction fitting body.

## 4.12 Suction fitting cover apertures

Suction fitting cover apertures shall not allow the passage of a 7.87 mm (0.31 in) circular rod with an applied force of 22 N (5 lbf).

# 5 Testing

## 5.1 Installation

Hydromassage bathtub systems shall be installed in accordance with the manufacturer's instructions. When installation tolerances are specified, the hydromassage system shall be tested in the least favourable slope for drainage, but within the manufacturer's specifications.

## 5.2 Water retention in whirlpool or air-jetted bathtubs

### 5.2.1 General

Water retention in whirlpool or air-jetted bathtubs may be evaluated using the chlorine test specified in [Clause 5.2.4](#) or the volumetric test specified in [Clause 5.2.5](#).

### 5.2.2 Preconditioning

The specimen shall be preconditioned as follows:

- (a) Fill the specimen with water at  $57 \pm 3$  °C ( $135 \pm 5$ °F) until the jets are completely covered and it can be properly operated.
- (b) Circulate the water for  $2 \text{ hr} \pm 10 \text{ min}$  and ensure that the water temperature is maintained at not less than  $54$  °C ( $130$ °F).
- (c) Drain the specimen and allow it to cool to ambient temperature.

### 5.2.3 Performance

Hydromassage bathtubs shall not allow retention of water in excess of 44 mL (1.5 fl oz) for each jet and suction fitting. The water retention for air-jetted hydromassage bathtubs shall not exceed 400 mL (13.5 fl oz), regardless of the number of air jets. Sampling shall be performed in accordance with [Annex B](#).

For combination whirlpool and air-jetted bathtubs, the water volumes shall be cumulative.

A whirlpool bathtub with four jets and one suction fitting shall be considered to satisfy the requirements of this Clause if the residual water does not exceed 220 mL (7.5 fl oz).

The maximum residual water in combination four jet, one suction fitting whirlpool and air-jetted bathtubs shall be 620 mL (21 fl oz).

### 5.2.4 Chlorine test

#### 5.2.4.1

The following requirements shall apply:

- (a) The procedure shall be conducted within a 1 h time interval.
- (b) The quality of the water used in the chlorine method shall have a total organic content no greater than 5 mg/L and a pH between 6 and 8, with the pH variation during the test no greater than  $\pm 0.1$ .
- (c) The original chlorine level shall be accurately measured to within  $\pm 0.05$  mg/L, recorded, and factored out of the test reading.

#### 5.2.4.2

To prepare the chlorine solution, approximately 2% of the water in the hydromassage system shall be removed, and the chlorine compound shall be dissolved into the water removed. The quantity of chlorine compound shall be as specified in Table 1, with the concentration of the chlorine compound accurate

within  $\pm 0.5\%$ . Measurement of the chlorine compound shall be within  $\pm 0.1$  g. The tester shall ensure that the compound is completely dissolved and shall carefully add the prepared solution to the hydromassage system, avoiding spillage.

#### **5.2.4.3**

A cover shall be placed over the hydromassage system to prevent loss of water due to turbulence or splashing. The hydromassage system shall be run for a period of 2 min as follows:

- (a) For a whirlpool system, the system shall be run for 2 min continuously.
- (b) For an air bath system, the system shall be run for 30 s and allowed to settle for 30 s. This cycle shall be repeated a total of two times.

#### **5.2.4.4**

At the completion of the 2 min, the hydromassage system shall be shut off, and the water within the system shall be allowed to drain completely for an additional 2 min. Then, with a non-porous rubber squeegee, all the remaining water in the basin shall be scraped into the drain.

#### **5.2.4.5**

The hydromassage system shall be refilled with the same total volume of fresh water to the nearest  $\pm 10$  mL (0.338 oz) as determined in [Clause 5.2.4.7](#). The procedure outlined in [Clause 5.2.4.3](#) shall be repeated.

#### **5.2.4.6**

A sample of the water in the hydromassage system shall be tested for free chlorine using a suitable chlorine colorimeter. The chlorine colorimeter shall be accurate to within  $\pm 5\%$ , using the DPD (N, N-diethyl-p-phenylenediamine) indicator method. A period of more than 1 min shall not be allowed to elapse before taking the free chlorine reading. The original chlorine reading of the tap water shall be subtracted from the chlorine reading to obtain the final free chlorine concentration. The volume of water retained in the hydromassage system shall be determined by using Table 2.

#### **5.2.4.7**

With the drain closed, the hydromassage system shall be filled with water at  $24 \pm 3$ EC ( $75 \pm 5$ EF) to a level at least 6 cm (2.4 in) above the highest jet. The quantity of water shall be measured to the nearest 10 mL (0.338 oz).

**Table 1**  
**Preparation of chlorine solution**  
(See [Clause 5.2.4.2.](#))

Amount of water in bathtub, L	Amount of chlorine, g			
	100%	62%*	55%*	32.5%*
20	2	3.2	3.6	6.1
40	8	12.9	14.6	24.7
60	18	29.1	32.8	55.3
80	32	51.7	58.2	98.5
100	50	80.6	90.9	153.8
120	72	116.1	130.9	221.4
140	98	158.1	178.2	301.4
160	128	206.4	232.7	393.8
180	162	261.2	294.5	498.5
200	200	322.5	363.6	615.6
220	242	390.0	440.1	744.6
240	288	464.6	523.6	886.1
260	338	545.1	614.5	1039.9
280	392	632.3	712.7	1206.0
300	450	725.8	818.2	1384.6
320	512	825.8	930.9	1575.5
340	578	932.2	1050.9	1778.4
360	648	1045.2	1178.2	1994.0
380	722	1164.6	1312.8	2221.6
400	800	1290.4	1454.6	2461.5

\*Where chlorine concentration is not one of the above, use the 100% column and divide by the new percentage to obtain the new mass of chlorine required.

**Table 2**  
**Residual water comparison**  
(See Clause 5.2.4.6.)

Chlorine reading, ppm	Residual water, L	Chlorine reading, ppm	Residual water, L
3.0	0.568	1.5	0.284
2.9	0.549	1.4	0.265
2.8	0.530	1.3	0.246
2.7	0.511	1.2	0.227
2.6	0.492	1.1	0.208
2.5	0.473	1.0	0.189
2.4	0.454	0.9	0.170
2.3	0.435	0.8	0.151
2.2	0.416	0.7	0.132
2.1	0.397	0.6	0.114
2.0	0.379	0.5	0.095
1.9	0.360	0.4	0.076
1.8	0.341	0.3	0.057
1.7	0.322	0.2	0.038
1.6	0.303	0.1	0.019

**Note:** Where chlorinated tap water is used, the chlorination reading of the water shall be factored out of the test reading.

## 5.2.5 Volumetric test

### 5.2.5.1 Set-up

The hydromassage system shall be installed in accordance with the manufacturer's instructions. When installation tolerances are specified, the hydromassage system shall be tested in the least favourable slope for drainage, but within the manufacturer's specifications.

### 5.2.5.2 Procedure

The volumetric test shall be conducted as follows:

- (a) Place a cover over the specimen to prevent loss of water due to turbulence or splashing.
- (b) Operate the specimen for 2 min as follows:
  - (i) whirlpool systems: 2 min continuously; or
  - (ii) air-jetted systems: 30 s, followed by 30 s of non-operation to allow the water to settle. Repeat this cycle once.
- (c) At the end of the 2 min period, shut off the specimen and allow the water in the specimen to drain completely for 2 min.
- (d) Once the specimen is drained, tip it to empty the remaining water into a container.

- (e) Push any water that still remains in the specimen into the container using a non-porous rubber squeegee.
- (f) Measure the volume of water collected in the container (i.e., the retained water) to the nearest 10 mL (0.34 fl. oz).

### 5.3 Physical tests for suction fittings (whirlpool bathtubs only)

#### 5.3.1 General

The physical tests for suction fittings specified in Clauses 5.3.3 to 5.3.5 shall be conducted to establish the structural performance of each model of suction fitting supplied as original equipment on a whirlpool bathtub. It shall not be necessary to conduct these tests on previously rated suction fittings.

#### 5.3.2 Test conditions

##### 5.3.2.1 Laboratory room temperature

The tests shall be conducted at a laboratory room temperature of  $23 \pm 2$  °C ( $73.4 \pm 3$ °F).

##### 5.3.2.2 Conditioning

Specimens shall be submerged in water at  $23 \pm 2$  °C ( $73.4 \pm 3$ °F) for at least 2 h before testing. Testing shall be performed immediately after conditioning.

##### 5.3.2.3 Number of specimens

A minimum of six fittings shall be tested in each test. If one fitting fails the test, the test shall be repeated with six new fittings. No failures shall occur in the second set of fittings (i.e., not more than one specimen of the twelve specimens shall fail).

##### 5.3.2.4 Test fixture

The specimen shall be installed in a rigid test fixture capable of supporting the specimen in a manner similar to the actual installation.

##### 5.3.2.5 Load apparatus

A point load machine capable of reading 2.3 kg (5 lb) increments and equipped with a  $51 \pm 0.8$  mm ( $2 \pm 0.03$  in) diameter steel tup with a  $51 \pm 13$  mm ( $2 \pm 0.5$  in) radius nose shall be used. The load speed shall be 5.1 to 6.4 mm/min (0.20 to 0.25 in/min).

#### 5.3.3 Surface evaluation

##### 5.3.3.1 Surface examination procedure

After each physical test in Clauses 5.3.4, 5.3.5, and 5.3.6, the surface shall be examined in accordance with Clause 5.3.3.1 and shall meet the performance requirements of Clause 5.3.3.2.

The surface examination shall be conducted as follows:

- (a) Wash the specimen with a solution of standard liquid detergent and water, rinse with water, and dry.  
**Note:** *To hasten drying, surfaces can be wiped with a clean chamois leather or a clean, absorbent, lint-free material.*
- (b) Rub the entire finished surface of the specimen with a sponge and a 50% solution of water and water-soluble black or blue-black ink (if the specimen is white). When inspecting specimens that are not white, use ink of an appropriate contrasting colour.
- (c) Rinse the ink immediately from the surface with water and dry the surface before examination.
- (d) Examine the surface of the specimen for defects and blemishes with the unaided eye from a distance of between 300 and 610 mm (1 and 2 ft) using a light source of partially diffused artificial light giving an illuminance on the surface of  $1615 \pm 540$  lx ( $150 \pm 50$  ft-candles).

**Note:** "Unaided eye" includes vision assisted by corrective lenses normally worn by the person examining the specimen.

### 5.3.3.2 Performance

The specimen shall be free from cracks, chipped areas, and blisters. Seams, flow lines, and knit lines in the specimen shall not be considered cracks.

### 5.3.4 Deflection test

#### 5.3.4.1 Procedure

The centre of the fitting face shall be subjected to a point load of  $68 \pm 2.3$  kg ( $150 \pm 5$  lb) using the apparatus specified in [Clause 5.3.2.5](#).

#### 5.3.4.2 Performance

The specimen shall not disintegrate. Deflection exceeding 8 mm (0.35 in) at the  $68 \pm 2.3$  kg ( $150 \pm 5$  lb) load shall be deemed a failure.

### 5.3.5 Shear load test

#### 5.3.5.1 General

The shear load test shall be conducted on any vertically mountable suction fitting whose horizontal edge extends perpendicularly 13 mm (0.5 in) or more from the vertical mounting plane. If the fitting has a rounded or tapered surface, the fitting shall be tested if the angle of taper is  $30^\circ$  to the vertical surface or less, regardless of the installation orientation (see [Figure 1](#)).

#### 5.3.5.2 Procedure

A  $46 \pm 1.5$  kg ( $100 \pm 3$  lb) load shall be applied to the specimen parallel to the mounting plane using the apparatus specified in [Clause 5.3.2.5](#).

#### 5.3.5.3 Performance

The grating or cover shall remain in place and the specimen shall not disintegrate.

### 5.3.6 Vacuum and point impact test

#### 5.3.6.1 Procedure

The vacuum and point impact test shall be conducted as follows:

- (a) Cover the specimen with a 0.51 mm (20 mil) plastic film or other suitable material.
- (b) Connect the specimen outlet to a vacuum system and subject it to a 724 mm Hg (28.5 in Hg) vacuum within  $60 \pm 5$  s.
- (c) Maintain the vacuum for  $5 \text{ min} \pm 10 \text{ s}$ .
- (d) Remove the plastic film and the vacuum.
- (e) Strike the centre of the specimen with an energy of 20 J (15 lbf-ft) in accordance with ASTM D2444, using the apparatus specified in [Clause 5.3.2.5](#) and dropping the tup from a height of 0.9 m (3 ft).
- (f) Repeat Items (a) to (d).
- (g) Remove the specimen from the test fixture.

#### 5.3.6.2 Performance

The grating or cover shall remain in place and the specimen shall not disintegrate.

## 5.4 Hair entanglement test for suction fittings

### 5.4.1 General

Suction fittings in whirlpool bathtubs shall be tested for hair entanglement in accordance with [Clauses 5.4.2 to 5.4.4](#). [Clause 5.4.3](#) establishes a flow rating for suction fittings and [Clause 5.4.4](#) tests the suction fitting when installed in the bathtub. Sampling shall be performed in accordance with [Annex B](#).

The test shall be conducted on suction fittings supplied as original equipment on hydromassage bathtub systems. It shall not be necessary to conduct the test on suction fittings which are already in compliance with this Standard .

One fitting in the bathtub shall be selected at random and the test shall be conducted with the pump operating at its highest speed.

### 5.4.2 Test preparation

#### 5.4.2.1

The test fixture shall comprise a test tank, with baffles, a support for the pull structure, and a pull cylinder mechanism (see [Figures 2 to 5](#) ).

The test cylinder shall be affixed to the fixture as shown in [Figure 6](#).

The support structure shown in [Figure 4](#) shall be made of wood or similar materials to provide a rigid test apparatus.

A properly grounded pump capable of providing a flow rate at least 25% greater than the manufacturer's fitting flow rate shall be used.

A 2 hp pump has been found to be suitable for fittings up to 51 mm (2 in) in diameter. For fittings larger than 51 mm (2 in) in diameter, the manufacturer's recommended pump shall be used for testing.

#### 5.4.2.2

##### 5.4.2.2.1

Natural, medium to fine, straight, light-coloured human hair that weighs  $57 \pm 3$  g ( $2 \pm 0.11$  oz) and is 400 mm (16 in) long shall be affixed to a wooden dowel with a diameter of 25 mm (1 in) and a length of 300 mm (12 in). The hair shall be trimmed evenly.

A means for attaching a scale shall be provided on the opposite end of the dowel.

When tangles in the hair cannot be removed, a new sample of hair shall be used.

##### 5.4.2.2.2

The following steps shall be performed:

- (a) the hair shall be cleaned thoroughly in a 10% solution by volume of alpha olefin sulfonate and water and rinsed in clear water before use;
- (b) the hair then shall be saturated for at least 2 min in the test tank;
- (c) after saturation, the free end of the hair shall be placed approximately 300 mm (12 in) in front of the suction fitting and 50 mm (2 in) above of the face of the fitting, as illustrated in [Figure 7\(a\)](#); and
- (d) the hair shall be cleaned after every ten pulls.

##### 5.4.2.3

A scale with an accuracy of 100 g (0.25 lb) shall be used to determine the pull against the entanglement.

**Note:** A Chatillon scale, model number 791-10, has been found acceptable.

### 5.4.3 Test with the fitting affixed to the test fixture

#### 5.4.3.1 Procedure

The test for a fitting affixed to the test fixture shall be conducted as follows:

- (a) Install the specimen in accordance with manufacturer's installation instructions through the side wall of the test tank, in the vertical position, and connected to a 90° elbow the same size as the fitting outlet located on the outside and as close to the fitting as possible. Attach Schedule 40 plastic pipe of the same size as the fitting socket as shown in Figure 2. The distance from the suction fitting to the first baffle should be at least 400 mm (16 in).
- (b) Connect the pump inlet to the Schedule 40 plastic pipe (using adapters if necessary).
- (c) Fill the test tank with water at  $32 \pm 6$  °C ( $90 \pm 10$ °F) to a depth  $300 \pm 13$  mm ( $12 \pm 0.5$  in) above the top edge of the suction cover.
- (d) Activate the pump and regulate the flow to 38 L/min (10 gpm) less than the fitting manufacturer's recommended flow rate. If the fitting rating is not known, start the test at 95 L/min (25 gpm).
- (e) Slowly lower the hair towards the fitting and feed the ends of the hair into the fitting in the direction of the intake flow as illustrated in Figure 7(b). Continue feeding the hair into the fitting while moving the dowel from side to side in a sweeping motion as illustrated in Figure 7(c). Reduce the magnitude of the sweeping motion with each pass of the dowel.
- (f) Feed the hair into the fitting for  $35 \pm 25$  s and then hold the dowel end against the fitting for  $30 \pm 5$  s as illustrated in Figure 7(d). Release the dowel and allow it to float freely for  $30 \pm 5$  s.
- (g) With the pump still operating, measure the force necessary to free the hair from the fitting using the scale specified in Clause 5.4.2.3. Attach the dowel to the scale and pull the scale and dowel in a vertical orientation, as illustrated in Figure 7(e), by activating the pneumatic hair removal mechanism.
- (h) Measure and record the force of the entanglement.
- (i) Repeat Items (e) to (h) ten times.
- (j) Increase the flow rate by 19 L/min (5 gpm) increments and repeat Items (e) to (h) ten times at each flow rate until test failure occurs (see Clause 5.4.3.2), brushing the hair before each set of repetitions to keep it tangle free.
- (k) When test failure occurs, retest the specimen using 3.8 L/min (1 gpm) increments up to the flow rate at which failure occurred to determine its best performance value.

#### 5.4.3.2 Performance

The pulling force to remove the dowel test assembly shall be less than 22 N (5 lbf) when tested ten times. A pull of 22 N (5 lbf) or greater, including the weight of the saturated test apparatus, on any one of the ten pulls, shall be deemed a failure, and shall be as follows:

If one failure in ten pulls occurs, the test shall be repeated ten more times. All additional pulls shall pass before moving to the next flow rate value. The highest passing flow rate shall be divided by 1.25 to determine the maximum allowable flow rating of the fitting.

### 5.4.4 Test with the fitting affixed to the bathtub

#### 5.4.4.1 Procedure

The test for a fitting affixed to the bathtub shall be conducted as follows:

- (a) Install the specimen in the bathtub in accordance with the manufacturer's instructions.
- (b) Fill the bathtub to 25 mm (1 in) below the drain overflow or 6 cm (2.4 in) below the rim of the tub with water at  $32 \pm 10$  °C ( $90 \pm 50$ °F).
- (c) Activate the pump and direct the flow of the jets away from the fitting.
- (d) Place the free end of the hair approximately 300 mm (12 in) in front of the fitting and 50 mm (2 in) above the face of the fitting.
- (e) Slowly lower the hair towards the fitting and feed the ends of the hair into the fitting in the direction of the intake flow as illustrated in Figure 7(b). Continue feeding the hair into the fitting while moving the dowel from side to side in a sweeping motion as illustrated in Figure 7(c). Reduce the magnitude of the sweeping motion with each pass of the dowel.

- (f) Feed the hair into the fitting for not less than 15 s and not more than 60 s and then hold the dowel end against the fitting for  $30 \pm 5$  s as illustrated in Figure 7(d).
- (g) With the pump still operating, measure the force necessary to free the hair from the fitting using the scale specified in Clause 5.4.2.3. Attach the dowel to the scale and pull the scale and dowel in a vertical orientation.
- (h) Measure and record the force of the entanglement.
- (i) Repeat Items (d) to (f) ten times.

#### 5.4.4.2 Performance

The pulling force to remove the dowel test assembly shall be less than 22 N (5 lbf) when tested ten times. A pull of 22 N (5 lbf) or greater, including the weight of the saturated test apparatus, on any one of the ten pulls, shall be deemed a failure.

For pipeless whirlpool bathtubs, the unitized jet/suction fitting shall not pull the hair into its opening holes.

## 6 Markings and installation instructions

### 6.1 General

#### 6.1.1

Factory-assembled whirlpool or air-jetted bathtubs, circulation systems, and suction fittings shall be marked with the manufacturer's name or registered trademark or, in the case of private labelling, the name of the customer for whom the fixture or device was manufactured.

#### 6.1.2

Markings shall be permanent, legible, and visible after installation.

**Note:** See Clauses 6.2 to 6.4 for additional marking requirements.

### 6.2 Factory-assembled whirlpool or air-jetted bathtubs

Factory-assembled whirlpool or air-jetted bathtubs shall have an adequately sized label that is affixed to a visible surface adjacent to the waste and overflow, is printed in 5 mm (0.2 in) high letters of a contrasting colour; and reads as follows: "Bathtub shall be tested. Fill the bathtub with water to overflow during rough inspection and inspect for leaks."

### 6.3 Field assemblies and retrofitted bathtubs (whirlpool bathtubs only)

#### 6.3.1

Piping systems that are field assembled or retrofitted shall be marked with an adequately sized label containing

- (a) the circulation system manufacturer's name, address, and telephone number;
- (b) the installer's name, address, and telephone number; and
- (c) the date of installation.

The label shall be affixed in a location that is visible after installation.

#### 6.3.2

Assembled units shall have an adequately sized label that is affixed to a visible surface adjacent to the waste and overflow, is printed in 5 mm (0.2 in) high letters of a contrasting colour; and reads as follows: "Bathtub shall be tested. Fill the tub with water to overflow during rough inspection and inspect for leaks."

## 6.4 Suction fittings (whirlpool bathtubs only)

Suction fittings shall be marked with the model number and maximum flow rate, expressed in L/min (gpm).

## 6.5 Installation instructions

### 6.5.1 General

Installation instructions in accordance with Clauses 6.5.2 to 6.5.7 shall be provided for every hydromassage bathtub system.

### 6.5.2 Factory-assembled whirlpool or air-jetted bathtubs

Installation instructions for factory-assembled whirlpool or air-jetted bathtubs shall include warnings specifying potential dangers or damage to the bathtub during installation.

### 6.5.3 Roughing-in dimensions

Roughing-in dimensions for the water supply and drainage piping shall be provided.

### 6.5.4 Service access and controls

Service access shall be provided for pump or motor removal and the recommended minimum dimensions for access shall be specified. If the bathtub is equipped with an air volume control, the control shall be accessible to the final user.

### 6.5.5 Electrical

Information shall be provided pertaining to the safe installation of electrical components and lighting in accordance with the *Canadian Electrical Code, Part 1*, or the NFPA's *National Electrical Code*. The instructions shall include a warning that the ground fault circuit interrupter (GFCI) protection needs to be installed in accordance with the applicable code.

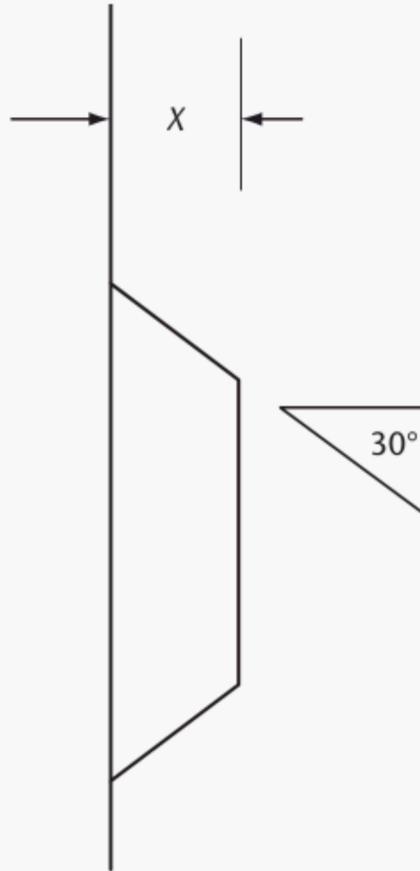
### 6.5.6 Operation, use, and care instructions

Instructions and precautionary warnings on the operation, use, and care of the hydromassage bathtub system by the final user shall be provided.

### 6.5.7 Flushing instructions

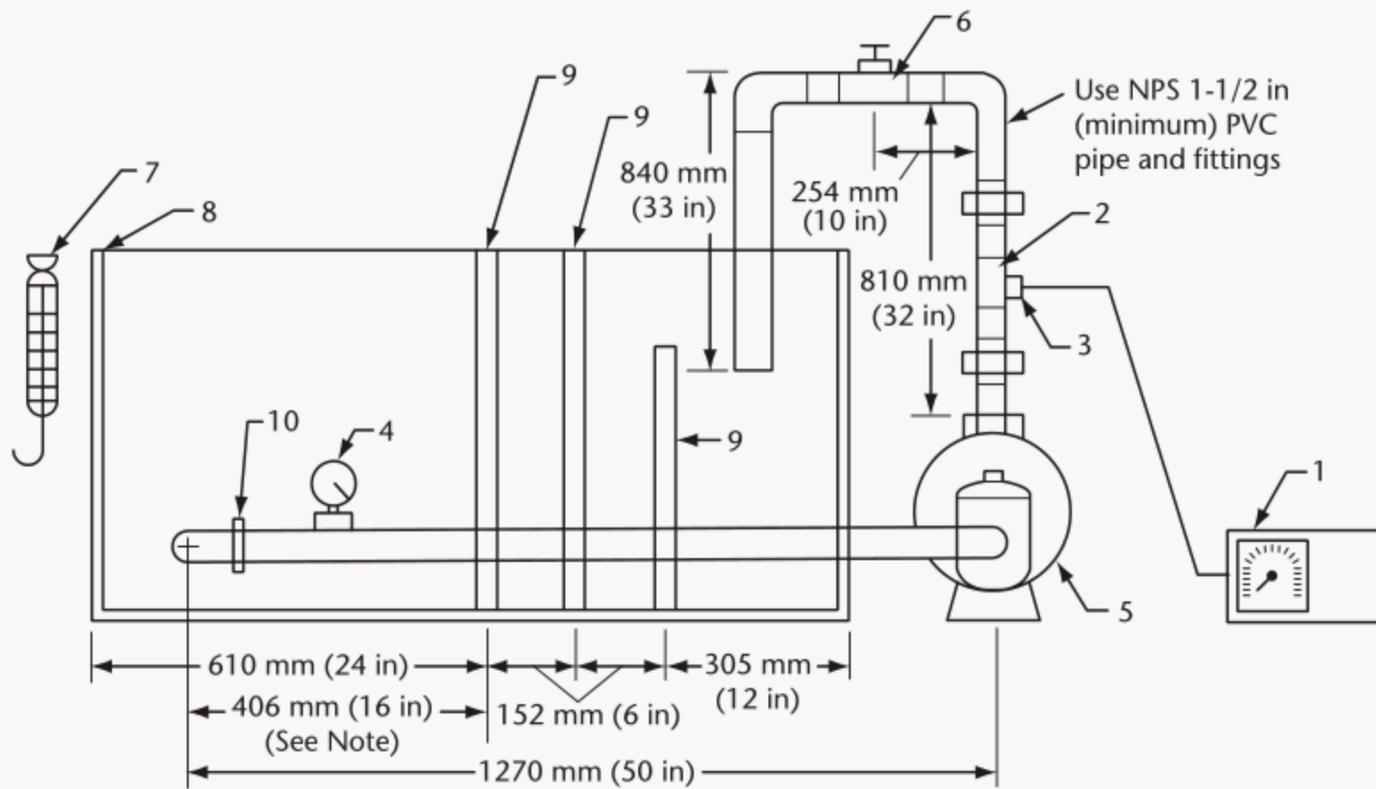
The instructions shall contain a notice to flush the hydromassage bathtub system plumbing system periodically.

**Note:** *Flushing should be performed every 90 d.*



**Note:** Testing shall be performed if the distance  $X$  exceeds 13 mm (0.5 in) or if the angle at the top of the fitting is  $30^\circ$  or less.

**Figure 1**  
**Shear load test**  
(See [Clause 5.3.5.1.](#))

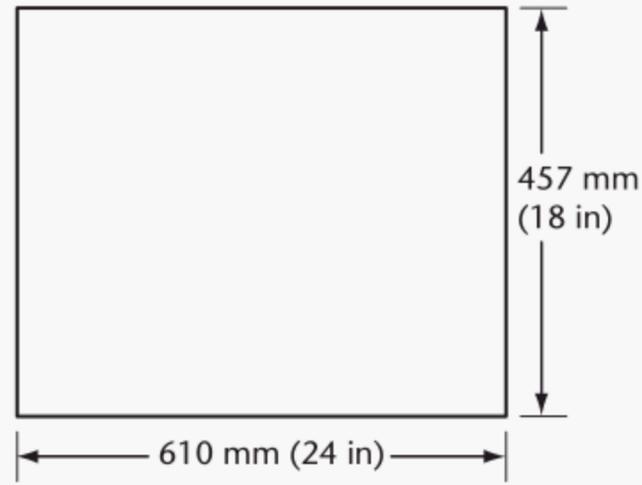


Item no.	Description
1	Flow meter
2	Return feed line (positive pressure)
3	Tapped tee for flow meter connection
4	Pressure gauge
5	Pump
6	Control valve
7	Force meter scale
8	Test tank
9	Baffles
10	Suction fitting

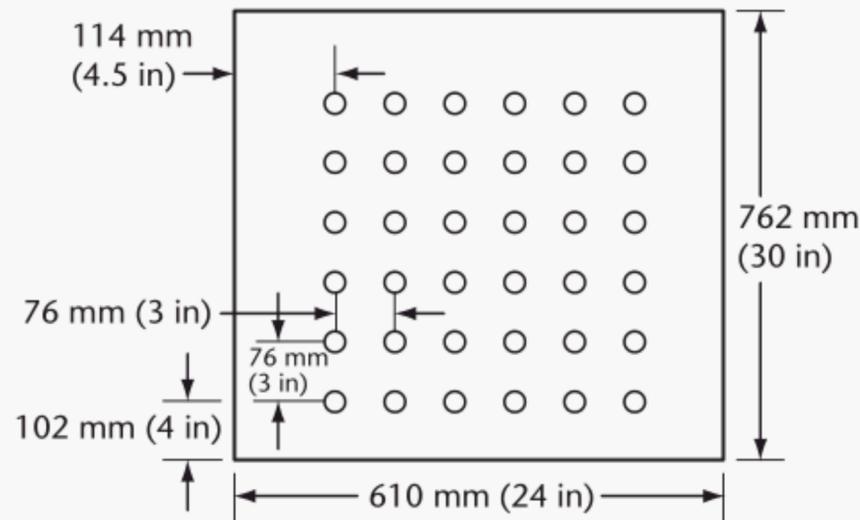
**Note:** A Schedule 40 pipe that is the same size as the suction fitting but at least 400 mm (16 in) long shall be used.

## Figure 2 Test tank

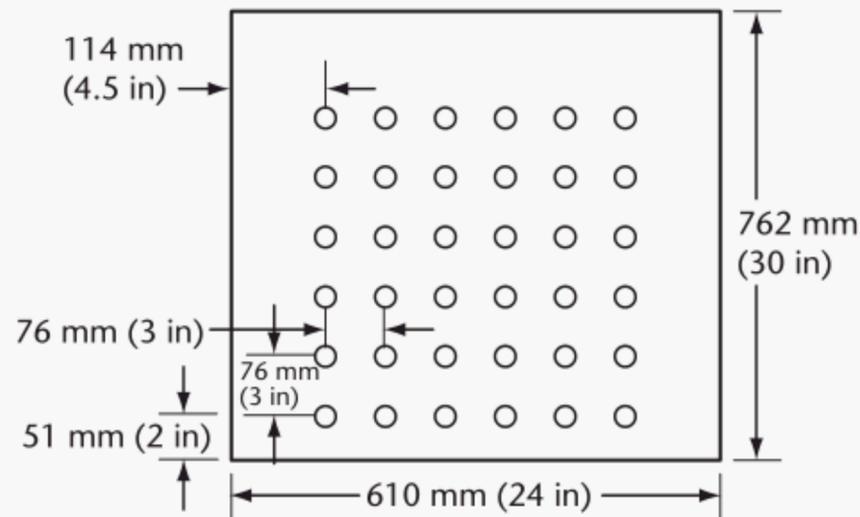
(See [Clauses 5.4.2.1](#) and [5.4.3.1.](#))



**(a) Baffle option 1: No holes**



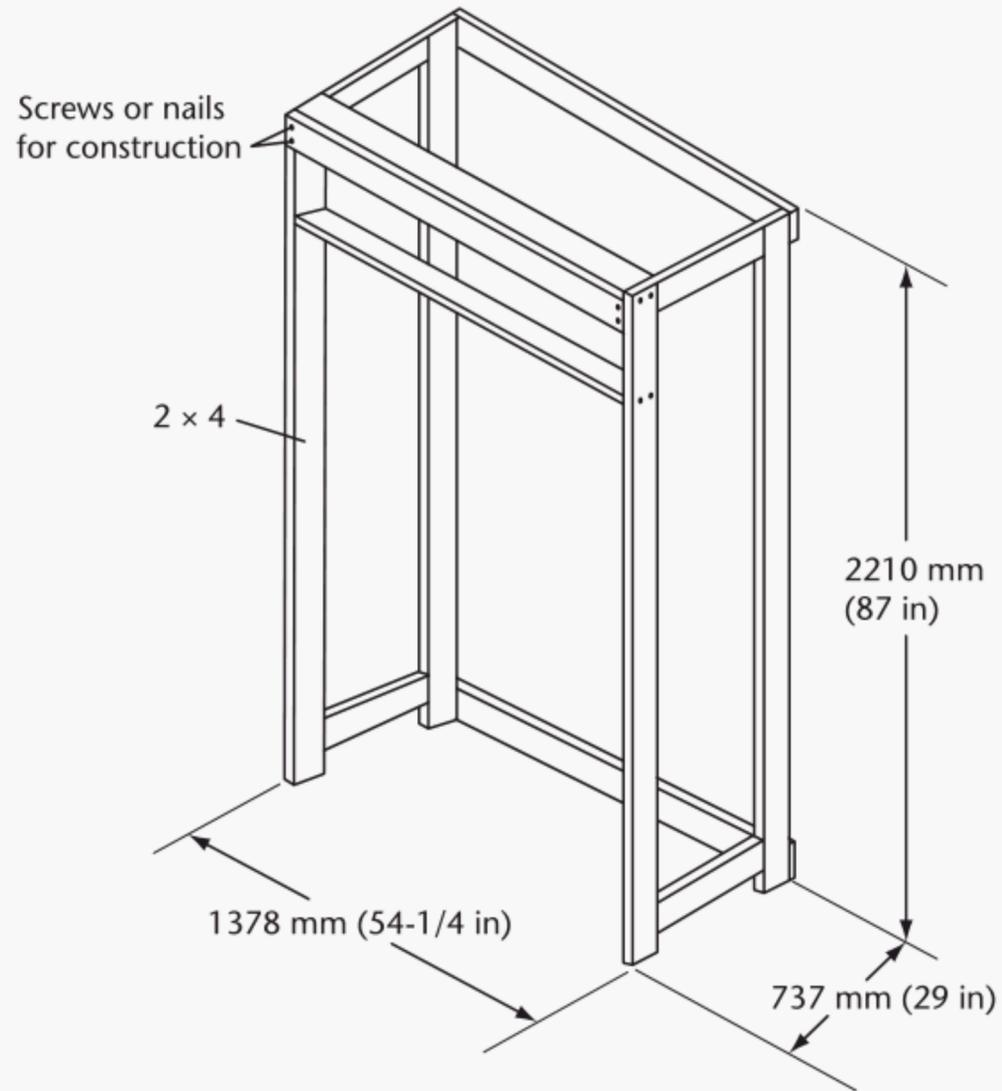
**(b) Baffle option 2: Thirty-Six 25 mm (1 in) holes starting 102 mm (4 in) from bottom edge**



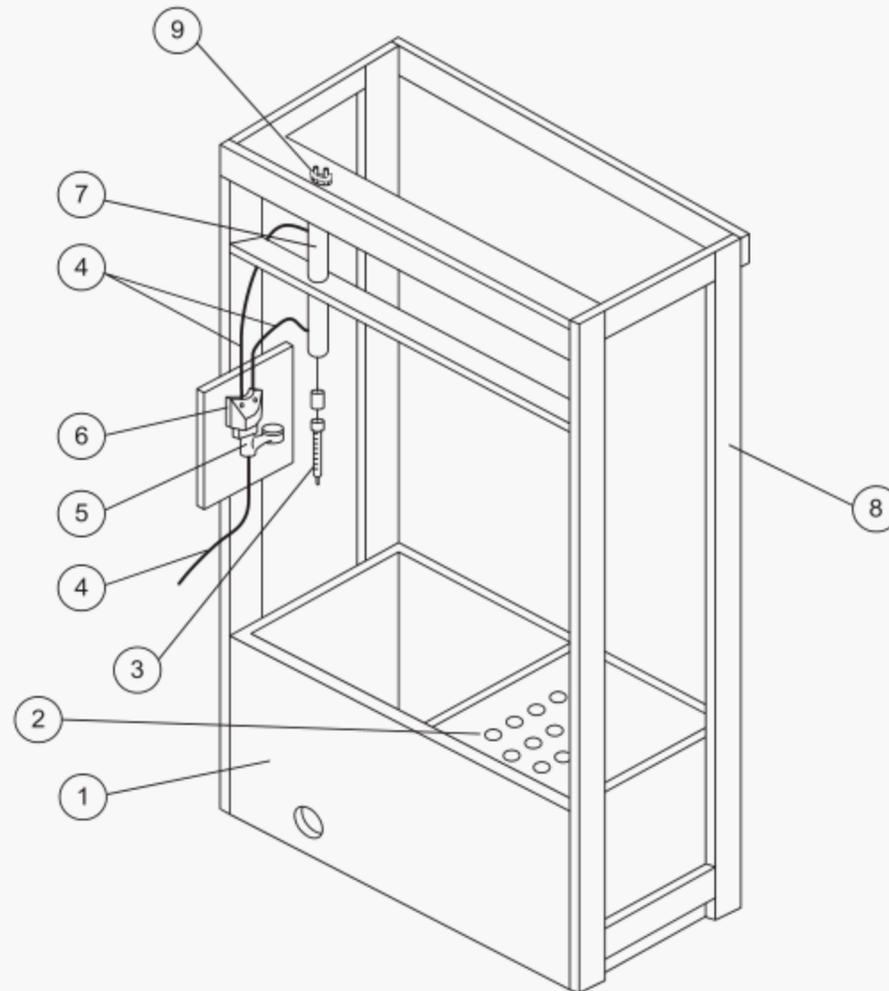
**(c) Baffle option 3: Thirty-Six 25 mm (1 in) holes starting 51 mm (2 in) from bottom edge**

**Figure 3  
 Baffles**

(See [Clause 5.4.2.1](#) and [Figure 5](#).)

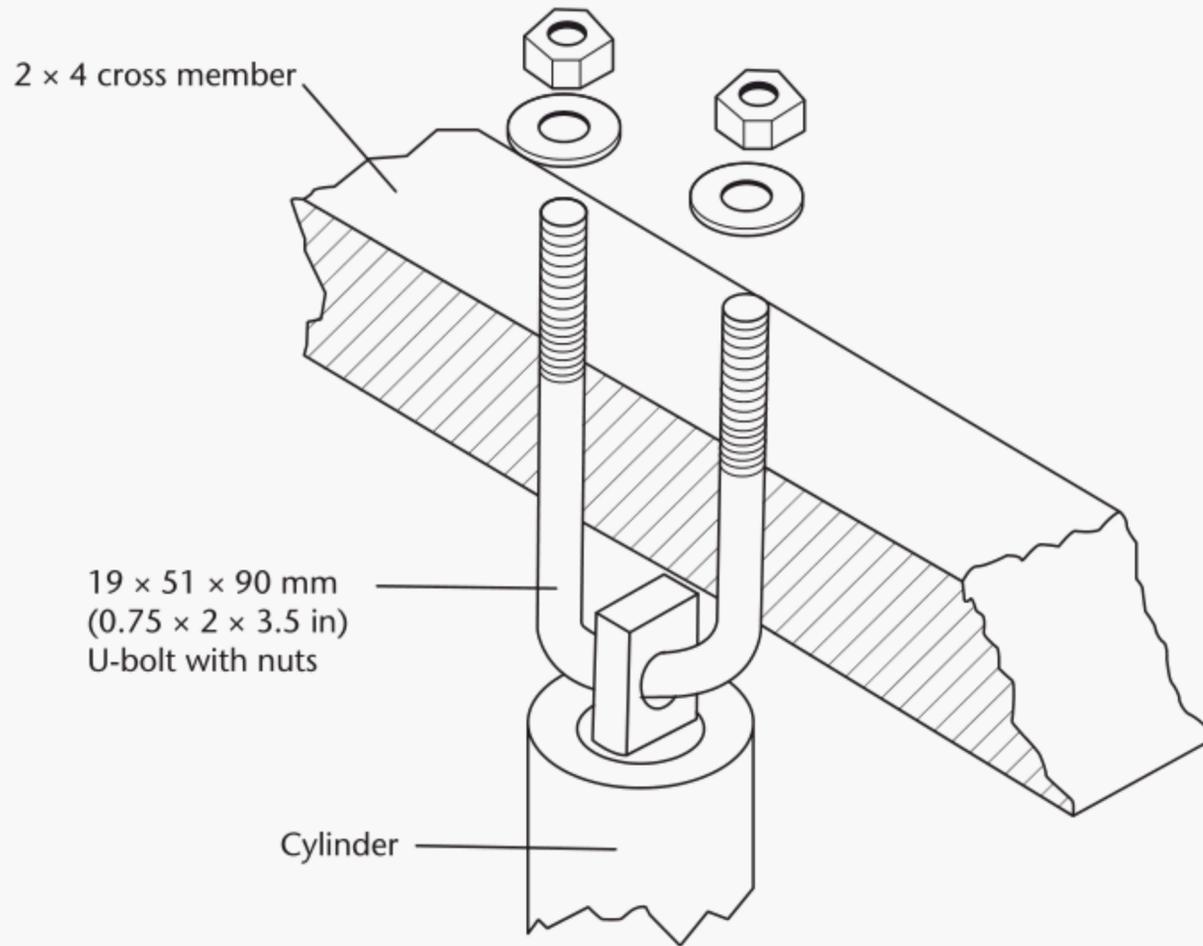


**Figure 4**  
**Pull structure**  
(See [Clause 5.4.2.1](#) and [Figure 5](#).)

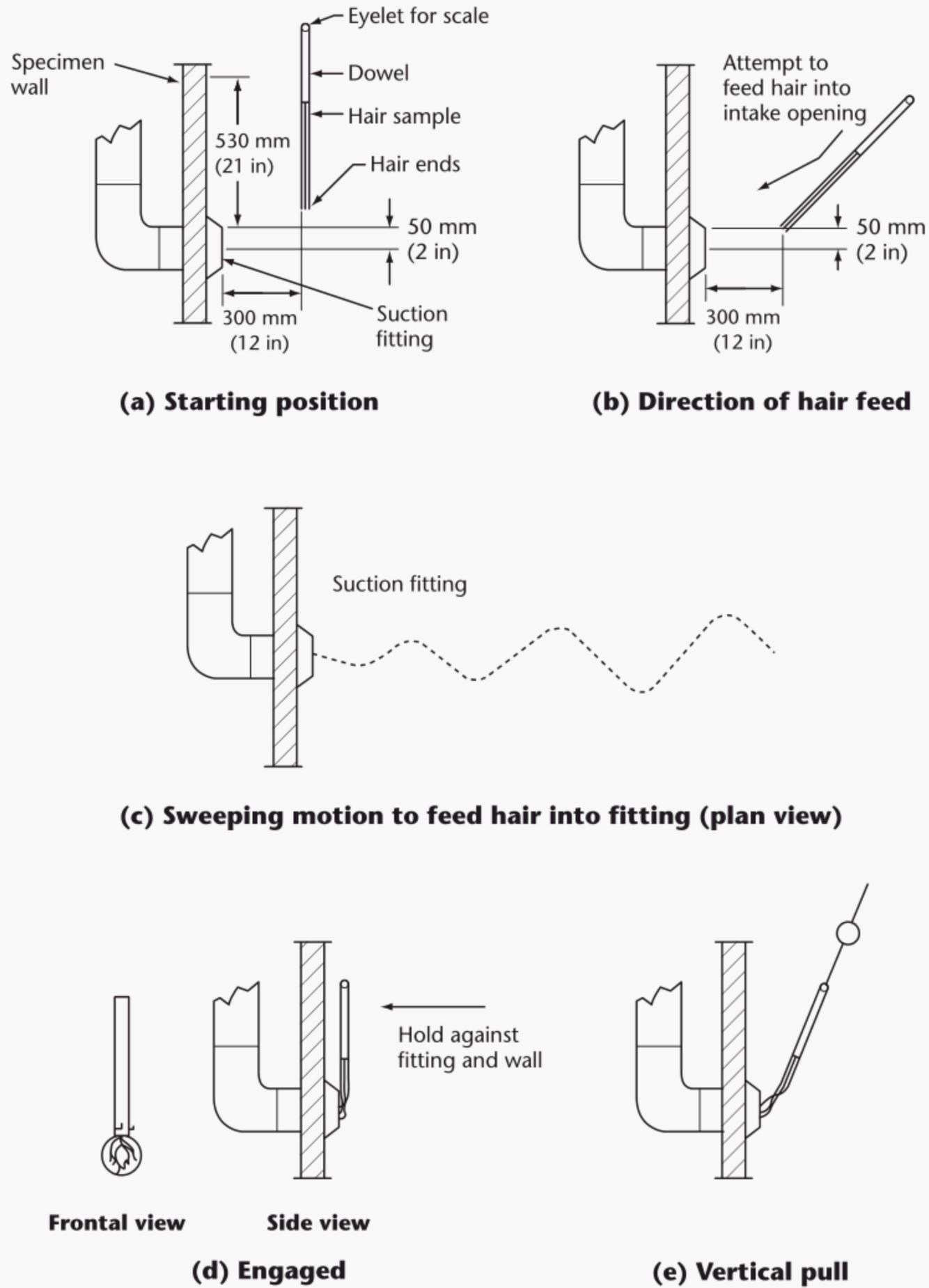


Item no.	Description
1	Test tank (13 mm [0.5 in]). Outside dimensions are 1220 × 610 × 760 mm (48 × 24 × 30 in).
2	Baffle (fitted to tank) (see <a href="#">Figure 3</a> )
3	Scale for measuring pull force
4	Air hose (6.3 mm [0.25 in] ID × 13 mm [0.5 in] OD)
5	Filter regulator
6	Manual control valve, flow control valve, and exhaust muffler
7	Cylinder (28.6 mm [1.12 in] bore × 508 mm [20 in] stroke)
8	Cylinder and equipment structure (see <a href="#">Figure 4</a> )
9	Test cylinder assembly connection: 19 × 51 × 90 mm (0.75 × 2 × 3.5 in) U-bolt with nuts (see <a href="#">Figure 6</a> )

**Figure 5**  
**Test equipment with puller assembly**  
(See [Clause 5.4.2.1.](#))



**Figure 6**  
**Test cylinder assembly**  
(See [Clause 5.4.2.1](#) and [Figure 5](#).)



**Figure 7**  
**Test procedure**  
 (See [Clauses 5.4.2.2](#), [5.4.3.1](#) and [5.4.4.1](#).)

## Annex A (informative)

# Unit conversion and rounding criteria

**Note:** This Annex is not a mandatory part of this Standard.

### A.1 Conversion rules

The following conversion rules are used in this Standard:

- (a) Zeros to the left of the first non-zero digit are not significant.
- (b) If the number is greater than 1, all zeros to the right of the decimal point are significant.
- (c) In multiplication and division, the original number with the smallest number of significant digits determines the number of significant digits in the product or quotient.
- (d) If an exact constant is used (e.g., 3 ft = 1 yd), it does not affect the number of significant digits in the calculated value.
- (e) If inexact constants are used (e.g.,  $\pi = 3.1416$ ), the constant with at least one more significant digit than the smallest number of significant digits in the original data is used.

### A.2 Rounding criteria

The following rounding rules are used in this Standard:

- (a) The digits that follow the last significant digit are dropped if the first digit is less than 5.
- (b) If the first digit dropped is greater than 5, the preceding digit is increased by 1.
- (c) If the first digit dropped is 5 and there are non-zero digits following the 5, the preceding digit is increased by 1.
- (d) If the first digit dropped is 5 and there are only zeros following the 5, the digit is rounded to the even number (e.g., for three significant digits, 1.655000 becomes 1.66, 1.625000 becomes 1.62).
- (e) For maximums and minimums, rounding is performed within the range of the maximum and minimum values in a way that does not violate the original limits.

## Annex B (normative)

# Random sampling method for testing bathtubs

**Note:** This Annex is a mandatory part of this Standard.

### B.1

Representative samples of hydromassage bathtubs shall be tested in accordance with the parameters specified in [Table B.1](#), to verify compliance with the performance requirements specified in [Clause 5](#).

**Table B.1**  
**Random sampling parameters**  
(See [Clause B.1](#))

Sample number	Bathtub volume*	Number of jets	Pump size†
1	Largest	Largest	Largest
2	Largest	Smallest	Smallest
3	Smallest	Largest	Largest
4	Smallest	Smallest	Smallest

\*The volume of water is measured when the bathtub is filled to the overflow.

†The pump size is determined by the flow (L/min or gpm).

**Note:** This table does not require that a minimum number of models be tested and shall not apply when a manufacturer submits four or fewer models for testing.

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*The Canadian Standards Association (CSA) prints its publications on Rolland Enviro100, which contains 100% recycled post-consumer fibre, is EcoLogo and Processed Chlorine Free certified, and was manufactured using biogas energy.*



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