International Water Services Flushability Group

Publicly Available Specification (PAS) 3: 2020 Disintegration Test Methods – Slosh Box

IWSFG.org

International Wastewater Services Flushability Group

IWSFG PAS 3: 2020 – Disintegration Test Methods – Slosh Box

Foreword

The International Wastewater Services Flushability Group (IWSFG) is an international coalition of national and regional wastewater services associations and organizations and individual wastewater services.

The work of preparing the specifications is carried out by various drafting groups comprising volunteers designated by the principal and the supporting participants of the group. They participate on a voluntary basis, without remuneration of any kind.

The criteria for flushability and the appropriate test methods are the product of a global consensus of the coalition members and reflect test methods and criteria to ensure a product labelled as flushable will not impact drain lines, various onsite treatment and wastewater collection and treatment systems as well as the downstream environment. The IWSFG recommends that the PAS documents are adopted in entirety without modification. It should be noted that Japan has adopted the 2018 version of these PAS documents except toilet and drain line clearance to address specific local circumstances.

It is acknowledged that the majority of this document is due to the long-standing work of industry experts working with wastewater representatives over many years. Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The IWSFG shall not be held responsible for identifying any or all such patent rights.

The PAS 3 2020 Slosh Box test and several of the annexes for it are based substantially on the INDA/EDANA Guidelines for Assessing the Flushability of Disposable Nonwoven Products, Edition 4 for Determining Flushability - Edition 4, FG502.R1 (18) – Slosh Box Test for Disintegration and its associated Supplemental Guidance Documents. INDA has granted the IWSFG written permission to use this material.

Version Control

Version	Date	Changes
PAS3 - 2018	June 2018	Initial PAS documents, formulated by water industry experts, and incorporating modifications based on public comments.
PAS3-2020	December 2020	General Changes: • Added Version Control • Updated Version Date to reflect IWSFG 2020 and INDA/EDANA reference to reflect Edition 4 • An updated logo – providing additional text along with a clearer tick mark and an internal view of the toilet. Section 10.2 - Preconditioning: Added alternative methods and requirements for rinsing. Added holding/incubating the product at 20°C for 30 minutes prior to testing. The temperature control provides better controlled conditions during the preconditioning step . Section 10.3 – Test Procedure: Changed residual product transfer procedure and added detail to the sieving/rinsing language: changed test water temperature from 15°C to 20°C Section 11 – Acceptance Criteria: Changed the pass-through percentage from 95% to 80% to account for variability in the sieving process. Added explanatory text and chart for clarity Annex 1 – Sources: Added sections on showerheads Annex 2 – Preconditioning: – Modified pictures and text to reflect changes in Section 10.2 Annex 4 – Pre-rising procedures for Initial Dry Mass: Added alternative methods Added Annex 8: Alternative Residual Recovery Method

Contents

1 Introduction

This document provides a description of the test method and threshold criteria for determining if a product will disintegrate sufficiently to be compatible with wastewater transport systems. The document is designed to be used in conjunction with IWSFG PAS1: 2020 Criteria for Recognition as a Flushable Product and IWSFG PAS2: 2020 Terms and Definitions for Determination of Flushability.

2 Purpose

The purpose of this test is to assess the disintegration performance of a material when it is subjected to hydraulic forces typically found in continuous flow conditions in small diameter (8 inch/200 mm) wastewater transport systems, after a product is flushed: i.e., ratio of forces equivalent to a Reynolds number of 20,000.

3 Scope

This Specification applies to all products that:

1. A manufacturer may wish to identify as being flushable; or
2. Because of the location of their use in the toilet or bathroom or likely contamination by human excreta are likely to be flushed through a toilet into a drain line and wastewater transport and treatment system.

Dry toilet paper is out of scope of this document.

4 References

4.1 Normative References

IWSFG PAS 2:2020 Terms and Definitions for Determination of Flushability

INDA/EDANA Guidelines for Assessing the Flushability of Disposable Nonwoven Products, Edition 4, FG501.1(18) Toilet and Drainline Clearance Test [1]

4.2 Informative References or Annexes

Annex 1 – Sources of Apparatus and Pictures of a Typical Installation

Annex 2 – Pre-rinse and Conditioning Procedure Slosh Box Disintegration Test

Annex 3 – Slosh Box Angle Measurement Procedure

Annex 4 – Procedure for Pre-Rinsing Test Specimens for Determining Initial Dry Mass

Annex 5 – Sieving and Recovery of Specimen Residues

Annex 6 – Drying and Weighing of Specimens and Specimen Residues

Annex 7 – Sample Recommended Test Report Template for Slosh Box Disintegration Test

Annex 8 – Test Procedures for the Alternate Approach for Recovering Material from the Slosh Box

5 Terms and Definitions

All relevant terms and definitions are in IWSFG PAS 2:2020 Terms and Definitions for Determination of Flushability.

6 Principles

The test is used to demonstrate a specimen's potential to disintegrate in water when subjected to the hydraulic forces described in Section 2.

7 Apparatus

7.1 Slosh box design parameters

The design parameters for the slosh box are:

1. The slosh box test apparatus comprises one or more (typically 3) plastic testing boxes having inside dimensions of: L: 18" (45.72cm) x W: 12" (30.48cm) x H: 6.5 -12" (16.51-30.48cm), secured to a horizontal surface.
2. The horizontal surface shall be capable of being oscillated (i.e., rocked forward and backward) by a rotating cam and lever mechanism.
3. The testing boxes may be equipped with a drain for emptying and a clear lid to control any splashing and to allow observation of articles in the box during the test.

The slosh box apparatus shall be secured to a mounting bench or shall be sufficiently stable so that movement during the oscillating function is minimized.

(See Annex 1 for photographs)

7.2 Functional parameters

The functional parameters for the slosh box are:

1. The platform should rock to both sides at 11 ° (+/- 0.5°) from the horizontal. The horizontal angle of rock for both directions should be confirmed using a digital level and recorded in the test report.
2. The speed of the cam shall be 18 rpm using the adjustable speed controller and recorded in the test report.

7.3 Other equipment

1. Equipment to fill and measure the volume of tap water in the boxes and to receive the liquid drained from the boxes.
2. A perforated plate screen with round holes, compliant with ISO 3310-2 with apertures of 25 mm.
3. A thermometer or other device for measuring water temperature.

4. A stopwatch or other suitable timing device.

8 Preparation

8.1 Sample acquisition

When conducting a test to support a flushable claim, the sample used for testing shall be the same as products offered in the intended market. A sample includes sufficient number of specimens (e.g., packages) to conduct the intended tests. The testing laboratory may receive samples from their manufacturers or intended distributers.

The test report shall clearly indicate the method of sample acquisition.

8.2 Number of test pieces

A specimen is a single test piece used for each test. Five specimens are required to complete a set of five replicate testing. An additional five specimens are needed for the initial dry mass calculation. For the testing and the initial dry mass calculation it is recommended that, where possible, specimens should be obtained at least from two distinct packages or rolls of a sample. The specimens removed from the sample packages should alternately be allocated to the testing, and the initial dry mass calculation for a total of five from each package. The specimens should be obtained from bottom, middle, and upper sections of the packages that appear as a stack, while the specimens should be obtained from beginning, middle, and ending parts of a roll. This is to ensure that the specimens are broadly representative.

Caution is necessary not to damage delicate specimens when removing from their package. Cutting open the package with scissors and removing the entire block of wipes is the preferred method for removing the specimens, which should be removed just before the start of the pre-conditioning step of the testing.

8.3 Unit Dose

The following requirements apply to specimens to be tested.

8.4 Moist tissues

The specimen shall be one sheet.

8.5 Other products

For other products, it is one specimen taken from the package in accordance with the guidelines presented in section 8.2 of this document.

9 Storage and conditioning

9.1 Storage of samples

Samples shall be stored under ambient laboratory conditions in the manufacturer's original packaging. When possible, it is recommended to use fresh samples for each new test. If the samples have been removed from the manufacturer's original packaging, the samples shall be identified and stored for archival purposes as follows:

1. Dry specimens should be returned to their packaging and should be placed in resealable plastic bags.
2. Moist specimens should be returned to their packages, e.g. hard-plastic container or soft-plastic package.
3. In case of hard-plastic containers, the box should be closed and then the box should be placed in a resealable plastic bag to minimize any exposure to ambient air.
4. Soft-plastic packages should be closed tightly while squeezing air out of the package, and then should be placed in resealable plastic bags to minimize potential exposure to ambient air.

9.2 Conditioning for the test

This test requires a pre-conditioning step (see Section 10.2 and Annex 2)

10 Procedures

10.1 Summary

The test consists of five agitation replicates (one agitation step equals a single specimen per box – if a triplex slosh box is being used it is considered three agitation replicates at one specimen per box). The agitation step is preceded by a preconditioning step as described in Section 10.2. After each agitation, observations are made and quantitative analysis undertaken to determine whether the specimen has met the test requirement for disintegration. Test specimens are placed in the slosh box containing 4L of water, which will be oscillated at the designated speed (18rpm) for the designated duration. The slosh box contents are transferred via pitcher onto a 25 mm perforated sieve and the upper surface of the sieve is rinsed at the designated flow and duration. The top and underside surfaces of the sieve are examined visually for snagged residuals. Photographs of the sieve's top surface should be taken both pre- and post-rinse operation. Quantitative analysis of the retained residuals from the five (5) test specimens is performed to see if the sample will pass the slosh-box disintegration test.

10.2 Pre-rinse and Conditioning

Test samples must be pre-rinsed to remove lotions prior to slosh box testing. The INDA/EDANA Supplementary Guideline SG001.R1(18) Pre-rinsing of Test Specimens and (PAS) 3: 2018 Annex 2 describes an alternative pre-rinse method that has been amended for this test. Pre-rinse and condition the test samples as follows:

10.2.1 Toilet and Drain Line Method

1. Equipment

a) Use a toilet and drain line with catch basket before the drain (see FG501.R1 (18) for this setup – see Normative Reference Section 4.1 for document information).
b) It is recommended to use a toilet with a flush volume of 3 L to 6 L.

2. Procedure (See Annex 2 for photographs)
   a) Prior to adding any material to the toilet bowl or initiating a flush, ensure that the toilet has stopped running and that the water in the bowl is at a normal level.
   b) When adding a specimen (e.g., a wipe), place it in the center of the toilet bowl and allow sufficient time, typically 15 seconds, for it to become fully saturated with water before flushing the toilet.
   c) Retrieve the specimen from the drainline, or before they enter the basket, or as soon as practically possible, to prevent any disintegration during this step.
   d) When necessary, use additional and water-only flushes to move the specimen out of the drain line for collection.
   e) Allow the water to drain, remove the specimen and incubate (hold) in a dry container for 30 minutes at 20°C ± 2°C before immediately placing into the slosh box for testing.

10.2.2 Bucket Transfer Method

1. Equipment
   a) Two containers capable of holding 5L of water
   b) Small strainer
2. Procedure
   a) Fill a 5L container with 5L of tap water. The tap water must be adjusted to have the following characteristics (Test Water):
      i. Temperature 20°C ± 2°C (use ice, or warm water to adjust if necessary)
      ii. Hardness in the range 50-200 mg/L as $CaCO_3$ (use distilled water to adjust).
   b) Gently submerge the test specimens in the water using a small strainer. No more than three specimens should be placed together at one time in a single container with 5L of water.
   c) After 30 seconds, gently pour the test samples from one 5L container into another. Pour with the rims of the containers almost together and with the second container upright at rest.
   d) After a further 30 seconds, remove the test specimens from the 5L container with the small strainer and incubate (hold) in a dry container for 30 minutes at 20°C ± 2°C before immediately placing into the slosh box for testing.

10.2.3 Bucket Swirling Method

1. Equipment
   a) Container(s) capable of holding 20L of water (e.g. 5 gallon plastic buckets)
   b) Small strainer
2. Procedure
   a) Fill the container(s) with tap water
      i. Temperature 20°C ± 2°C (use ice, or warm water to adjust if necessary)

ii. Hardness in the range 50-200 mg/L as $CaCO_3$ (use distilled water to adjust).

b) Submerge no more than three test specimens at a time in the water and swirl them for about 15 seconds

c) Remove the test specimens from the container with the small strainer and incubate (hold) in a dry container for 30 minutes at 20°C ± 2°C before immediately placing into the slosh box for testing.

10.3 Test Set-Up

1. Allow the test water to reach 20°C ± 2°C.
2. With power to the unit securely off, verify the attachment of the slosh box(es) to the oscillating table. Fill each box with 4 L of tap water.
3. Prior to starting a test sequence, verify that the cam is running at 18 rpm by measuring the time to complete 18 oscillations using a stopwatch and making any fine adjustments to the cam speed dial as needed. Record on report.
4. Make sure the oscillation angle has been checked in the last 30 days and is within the prescribed tolerance.
   a) If the last angle measurement check is within the last 30 days, record the angle measurements for both the left and right oscillations from the last check and the date on the report.
   b) If the last angle measurement is more than 30 days old, check the angles using the procedure in Annex 3 – Slosh Box Angle Measurement Procedure. If the measurement is not within the specified tolerance in Section 7.2, adjust the machinery per the manufacturer's specifications, or do not use for testing.

10.4 Test Procedures

1. Measure the temperature of the test water and room and record on the test report. Make sure the water temperature is within the 20°C ± 2°C tolerance.
2. Place a single preconditioned specimen into each box, place lids on the boxes (optional) and oscillate the mixture for the required time.
3. After the prescribed agitation process, stop the oscillations and measure and record the water temperature of each test box.
4. Bring the slosh box to a halt parallel to the base. Photograph the contents of each box following the procedures in Annex 7, Section A7.4.
5. Remove each box from the oscillating platform and slowly pour the contents into a suitable pitcher (e.g., a 5-L pitcher or a beaker).
6. Rinse the box as necessary to remove all of its contents and add to the pitcher.
7. Alternatively, recover the material in the box using the procedures described in Annex 8.
8. Before pouring the contents of the pitcher, a stir rod shall be used to re-suspend the solids in the pitcher as follows: Swirl the contents gently and clockwise until all the particles are re-suspended and then, stir the pitcher counterclockwise to homogenize the mixture.

9. Pour the pitcher contents by constantly moving the pitcher over the entire surface of the sieve, with the pitcher lip 10 cm ± 2 cm from the sieve surface, evenly pouring the entire contents in 10 - 15 seconds. This step is to ensure that solid particles do not accumulate and clog any hole on the sieve.
10. Take a photograph of the unrinsed top sieve surface.
11. Take the showerhead. Turn on the faucet and adjust the regulator to a flow rate of 4 L per minute (See Annex 5).
12. Hold the showerhead spray nozzle between 10 +/-2 cm above the top surface of the sieve, constantly moving the spray over the entire sieve surface with a continuous circular movement of 60 ± 5 rotations per minute, without stopping or concentrating the spray on any specific area. Do not purposely force the passage of any material through the sieve by concentrating the spray on one location.
13. Stop the rinsing after one minute.
14. Observe if there are remains of the specimen on the top surface of the sieve.
15. Take photographs of the upper surface of the sieve.
16. Collect the remaining solids from both sides of the sieve, by hand and/or by using forceps and/or by backwashing the material into a fine mesh sieve (a 125 µm mesh sieve according to ISO 3310-1 or finer is suitable).
17. Transfer these materials into labeled drying pans or tared weigh boats to determine their dry weight (See Annexes 5 and 6).

10.5 Test Termination

Upon completion of five agitation procedures, the box(es) shall be drained and cleared of any residues from the test articles.

10.6 Calculations

The percentage of mass that disintegrated (operationally defined by the ability to pass through the 25 mm sieve) is calculated using the following equation:

$$\text{\% Disintegration} = \left[1 - \frac{\text{total dry mass of solids retained on the sieve (g)}}{\text{total initial dry mass of sample (g)}} \right] \times 100$$

- Where the ***Total dry mass of the solids retained on the sieve*** equals the dry mass, in grams, of all solid particles retained on the sieve from the five tests
- Where ***Total initial dry mass of the sample*** equals the sum of five specimens that were dried in their lotion-free state in accordance with Annex 4.

10.6.1 Example:

Individual test results for dry mass of all solids retained on the sieve: test1 = 0.78 g; test2 = 0.81 g; test3 = 0.77 g; test4 = 0.80 g; test5 = 0.79 g

Total dry mass of the solids retained on the sieve = 0.*78 g + 0.81 g + 0.77 g + 0.80 g + 0.79 g*

Total dry mass of the solids retained on the sieve = *3.95 g*

10.6.2 Example:

Individual specimen initial dry mass of the sample: specimen1 = 1.47 g; specimen2 = 1.46 g; specimen3 = 1.48 g; specimen4 = 1.45 g; specimen5 = 1.49 g

Total initial dry mass of the sample = *1.47 g + 1.46 g + 1.48 g + 1.45 g + 1.49 g*

Total initial dry mass of the sample = *7.35 g*

11 Acceptance Criteria

To be acceptable:

The percentage of the ***Total initial dry mass of the sample*** (as described in IWSFG 2020: PAS 3 passing through the 25 mm sieve for the five test specimens after 30 minutes of testing shall be greater than 80%. This result shall be supported with visual examination and pictures of solids on the sieve, as described in IWSFG 2020: PAS 3.

Disintegration test summary					
Preconditioning step	**Test water temperature**	**Water Volume**	**RPM**	**Test duration (min)**	**Percentage pass through 25mm sieve**
Per IWSFG PAS3 Section 10.2	20°C ± 2°C	4L	18	30	80%

Example (using the example data from Section 10.6):

% Disintegration = [1 - (*Total dry mass of all solids retained on the sieve* / *Total initial dry mass of the five specimens*)] x 100

% Disintegration = [1 - (3.95 g / 7.35 g)] x 100 = **46.26%**

12 Test Report

The test report should include the following information:

1. A reference to this test procedure
2. The date and location of testing
3. Name of tester
4. The complete identification of the tested product, the original dimensions and the total initial dry mass of five (5) specimens
5. The initial and ending water temperature
6. The initial and ending room temperatures
7. The RPM and Rock Angle Measurement data
8. Any departure from the procedure and any circumstances
9. Copies of photographs taken during the procedure
10. The test results, including:
    a) The percentage of dry mass which passed through the 25 mm sieve after 1 minute of rinsing.

b) A final statement indicating whether the product passed or failed the test.

A recommended Sample Test Report for the testing of wipes is shown in Annex 7. A template in Microsoft Word and Excel can be downloaded from www.iwsfg.org.

13 Variability

For statistical reliability of the test procedures, the test is conducted with five separate specimens of a sample.

The oscillating cam should be checked every 30 days for correct operation. If necessary, adjustments should be made to assure an oscillation of 11° (± 0.5 degrees).

The operating speed of the oscillating cam should be checked before each test session for the correct operating speed of 18 rpm. If necessary, adjustments should be made to assure that condition.

The temperature of the test water should be checked prior to, and after, each agitation sequence to make sure it falls within the 20°C ± 2°C tolerance.

14 Bibliography

1. *Guidelines for Assessing the Flushability of Disposable Nonwoven Products. A Process for Assessing the Compatibility of Disposable Nonwoven Products with Plumbing and Wastewater Infrastructure*. FG501.R1(18), INDA, Edition 4, June 2018.
2. ISO 3310-2:2013 *Test sieves -- Technical requirements and testing -- Part 2: Test sieves of perforated metal plate*

Annex 1– Sources of Apparatus and Pictures of a Typical Installation

(Informative)

Substantially based on INDA GD4 FG502.R1(18) Appendix I and Used by Permission of INDA

A1.1 Slosh Box Sources

Slosh boxes are available from:

- Techpap SAS - BP 251 - 38044 Grenoble CEDEX 9 – France (see: http://www.techpap.com/slosh- box,lab-device,36.html)
- Lenzing Instruments GmbH & Co. KG, A-4851 Gampern, Austria. (See: http://www.lenzing- instruments.com/produkt.infos/slosh-box-100.pdf)
- Tri-County Machining, W4719 County Rd O, Appleton, WI 54913
- Phone: 001 (920) 954-1800 https://tricountymachining.com/
- Item #1051612 for the 3 tank unit
- Item #1020816 for the 1 tank unit

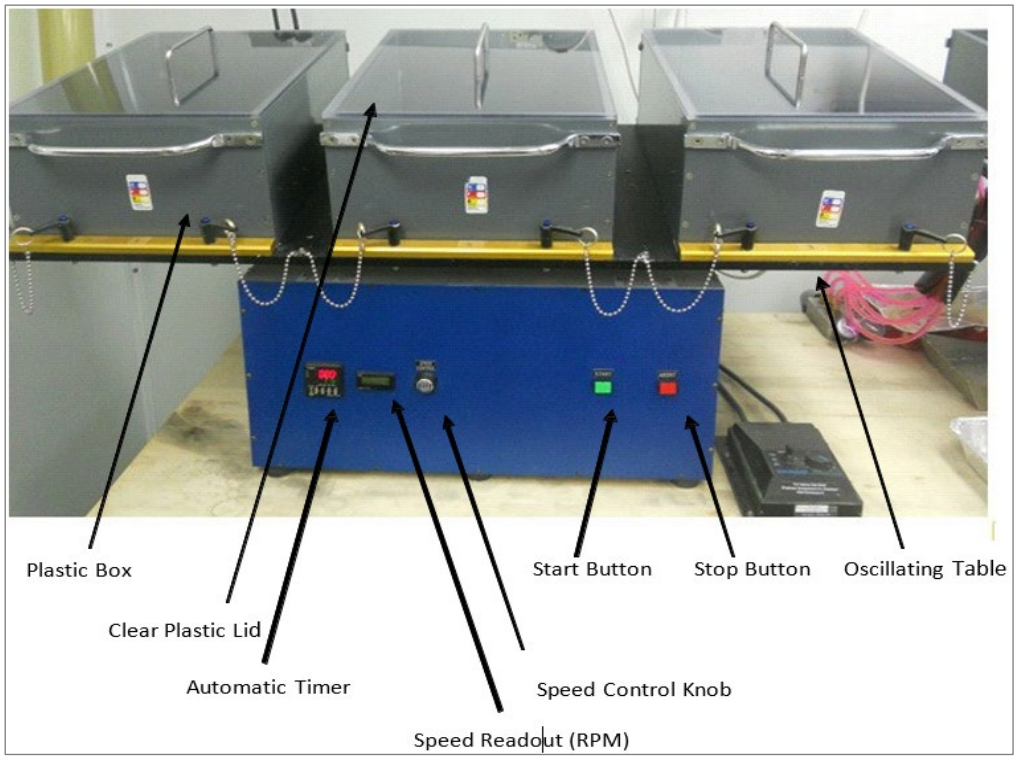


Figure A1.1 Photograph of a Triple Slosh Box Apparatus (Photo source INDA)

A1.2 Shower Head Sources

This information is given for the convenience of users of this document and does not constitute an endorsement by IWSFG of the company named. Equivalent products may be used if they can be shown to lead to the same results.

Peerless shower head Model 76114WH.

Figure A1.2 — Peerless shower head Model 76114WH

Annex 2 – Pre-Rinse and Conditioning Procedure for Slosh Box

Disintegration Test

NOTE: A wipe specimen (sheet) is used for example purposes only

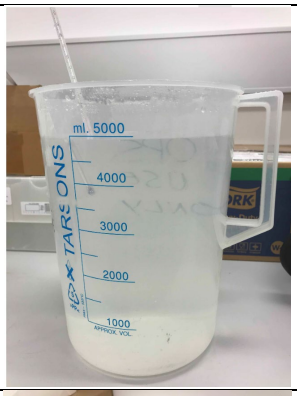
A2.1 Drain Line Method

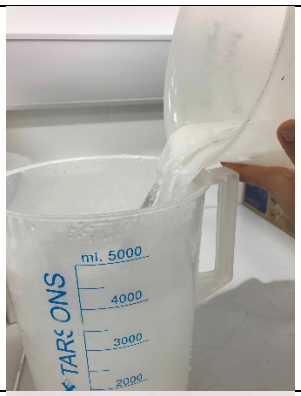
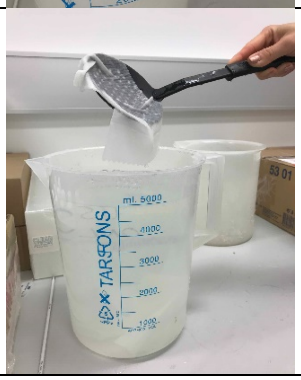
Step #	Description	Picture
1	Preconditioning step – Wipe specimen is placed in toilet and let sit for 15 seconds before flushing (3-6.0 L)	
2	Wipe specimen is transiting through drain line	
3	Wipe specimen at the end of the pipe	

4	Remove the specimen(s) from drainline and place in a dry container.	
5	Place container in an incubator and hold at 20°C ± 2°C for 30 minutes	

Source IWSFG Member

A2.2 Bucket Transfer Method

Step #	Description	Picture
1	Fill a 5L container with tap water. The tap water must be adjusted to have the following characteristics (Test Water): a) Temperature 20°C ± 2°C (use ice or warm water to adjust if necessary) b) Hardness in the range 50-200 mg/L as $CaCO_3$ (use distilled water to adjust).	
2	Gently submerge the test specimens in the water using a small strainer. No more than three specimens should be placed together at one time in a single container with 5L of water	

3	After 30 seconds, gently pour the test specimens from one 5 L container into another. Pour with the rims of the containers almost together and with the second container upright at rest.	
4	After a further 30 seconds, remove the test specimens from the 5 L container with the small strainer.	
5	Incubate (hold) in a dry container for 30 minutes at 20°C ± 2°C before immediately placing into the slosh box for testing.	Source IWSFG Member

Annex 3 – Slosh Box Angle Measurement Procedure

(Normative)

A3.1 Illustrated Procedure

Step #	Description	Picture
1	Turn speed down to the minimum that will keep it moving. This prevents bounce at the end of each cycle that can skew the reading.	
2	Place a small digital level capable of reading degrees to the tenth (0.1) centered on the rocking table.	
3	Allow the table to go all the way to the right and record the angle of tilt in degrees indicated on the level.	

4	Allow the table to go all the way to the left and record the angle of tilt in degrees indicated on the level.	
5	Close up of level.	
6	Record the date of the measurement and degrees for both the right and left tilts. Make sure the Slosh Box is within the tolerance 11.0 degrees +/- 0.5 degrees (10.5 to 11.5 degrees). If the measurement is not within the specified tolerance, adjust the machinery per the manufacturers specifications, or do not use for testing.	See Example Worksheet below Source IWSFG Member

A3.2 Slosh Box Angle Measurement Worksheet

Date	04/10/2020
Name of Person performing measurement	Joe Smith
Slosh Box ID	1234
Left Tilt Angle (to the 0.1 degree)	11.2
Right Tilt Angle (to the 0.1 degree)	11.3
Were any adjustments required? **If "Yes" please note what they were.**	No

Annex 4 - Procedure for Pre-rinsing Test Specimens for Determining Initial Dry Mass (Informative)

Substantially Based on INDA GD4 SG001.R1(18) and Used by Permission of INDA

A4.1 Introduction

This annex describes the approach for pre-rinsing test specimens to remove water soluble lotions or other additives from the specimens before using them in the determination of initial dry mass. The method involves flushing the specimens down a toilet and through a drain line using tap water. This approach simulates the actual rinsing process that occurs when a product is flushed on its way to a wastewater transport system. Alternative methods not using a toilet and drainline are described in sections A4.3.2 and A4.3.3.

A4.2 Test Specimen Selection

Select specimens in accordance with Sections 8.1 and 8.2

A4.3 Pre-rinse Procedure

A4.3.1 Toilet and Drainline Method

1. Equipment
   a) Use a toilet and drainline with catch basket before the drain (see FG501.R1 (18) or Annex 2 for this setup. It is recommended to use a toilet with a flush volume of 3 L to 6 L.
2. Procedure (See Annex 2 for photographs)
   a) Prior to adding any material to the toilet bowl or initiating a flush, ensure that the toilet has stopped running and that the water in the bowl is at a normal level.
   b) When adding a specimen (e.g. a wipe sheet), place it in the center of the toilet bowl and allow sufficient time, typically 15 seconds, for it to become fully saturated with water before flushing the toilet.
   c) Retrieve the specimen from the drainline, or before they enter the basket, or as soon as practically possible, to prevent any disintegration during this step.
   d) When necessary, use additional and water-only flushes to move the specimen out of the drain line for collection.
   e) Allow the water to drain, remove the specimen and place in a weighing container

A4.3.2 Bucket Transfer Method

1. Equipment
   a) Two containers capable of holding 5L of water
   b) Strainer
2. Procedure

a) Fill a 5L container with 5L of tap water.
b) Gently submerge the test specimens in the water using a small strainer. No more than three specimens should be placed together at one time in a single container with 5L of water.
c) After 30 seconds, gently pour the test specimens from one 5L container into another. Pour with the rims of the containers almost together and with the second container upright at rest.
d) After a further 30 seconds, remove the test specimens from the 5L container with the small strainer and place them in a weighing container

A4.3.3 Bucket Swirling Method

1. Equipment
   a) Container capable of holding 20L of water (e.g. 5 gallon plastic buckets)
2. Procedure
   a) Fill the container with tap water.
   b) Submerge no more than 3 the test specimens at a time in the water and swirl them for about 15 seconds.
   c) Remove the test specimens and place in a weighing container.

Annex 5 - Sieving and Recovery of Specimen Residues

(Informative)

Substantially based on INDA GD4 SG004.R1(18) and used by permission of INDA.

A5.1 Introduction

This Annex describes the sieving, rinsing and recovery of specimen residues from the various disintegration tests. Once a disintegration test is complete, the test liquid containing solids of a test specimen is poured onto a 25-mm sieve to capture large size (>25 mm) solids. These procedures are used to rinse small solids (<25 mm) through the sieve and recover the residues for gravimetric analysis.

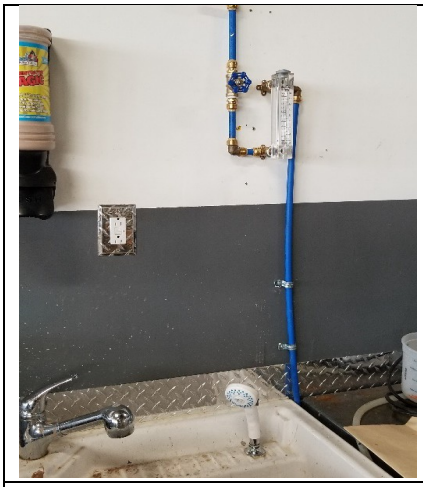
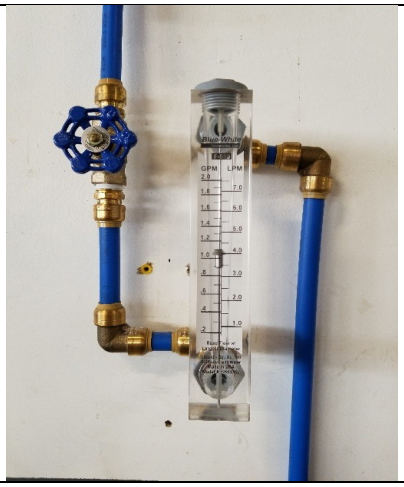
A5.2 Equipment

1. Peerless shower head model 76114WH with hose assembly (pictured at right), or similar, attached to a faucet (tap) with a graduated flow regulator adjusted to deliver 4L per minute
2. 4 L beaker (recommended)
3. Stopwatch or other timing device
4. Fine mesh hand sieve
5. Forceps
6. Drying pans

Photo Source: INDA

A5.3 Procedure

1. Turn on the faucet and adjust the regulator to a flow rate of 4 L per minute.
2. The flow rate can be determined by measuring the volume delivered to a suitable container with graduations after a specified time period. For example, it should take exactly 60 seconds to deliver 4 L of water to the 4 L mark on a beaker. Once the flow is adjusted, this measurement should be repeated at least three times and should vary less than 5%.
3. When transferring the contents from a disintegration test to the sieve, pour the contents of the test vessels slowly while distributing them over the complete surface of the sieve.
4. With the handheld showerhead spray nozzle held 10 cm (4”) above the top surface, gently rinse smaller material through the sieve. Constantly move the spray over the entire surface without concentrating the spray on any specific areas. Do not force the passage of any material through the sieve.
5. After one minute of rinsing, quantitatively recover all the retained material from both sides of the sieve using forceps or by backwashing the material into a smaller sieve and then using forceps.
6. Transfer this material into labelled drying pans or tared weigh boats to determine their dry weight (see Annex 6).

	
Flow Regulator and Shower Head Rinse Apparatus	Close-up of the flow regulator
	
Close-up of Showerhead	Rinsing Sieve - 10 cm +/- 2 cm distance between sieve and showerhead
	
Picture of forceps being used to remove retained small residuals from the sieve	Recovered material in a pre-weighed pan Source IWSFG Member

Annex 6 – Gravimetric Analyses of Specimens and Residues

(Informative) Substantially based on INDA GD4 SG002.R1(18) and Used by Permission of INDA

A6.1 Equipment

1. Oven capable of maintaining a constant temperature between 40° and 105°C
2. Weighing dishes
3. Forceps
4. Desiccator
5. Analytical balance (reads to 2 decimal places)
6. Specimens

A6.2 Procedure

A6.2.1 Loss of Mass Calculation Procedure

1. If there are residual fragments at the end of any of the 5 tests, collect them using the procedures described in Annex 5 prior to determining their dry weight.
2. Set the oven to a temperature appropriate for the chemical and physical properties of the test specimen – this is typically 105°C.
3. Place residual fragments of the five specimens in a pre-weighed (tared) aluminum weigh boat.
4. Dry the residual fragments in the oven for 24 hours.
5. Transfer the dry solids from the oven into a desiccator and allow them to cool.
6. Weigh the dry solids and record their weights.
7. Return the solids to the oven for approximately 30 minutes and again allow them to cool in the desiccator and determine their weights.
8. Repeat this process as necessary until the weight of solids reach constant weights.
9. Record the total weight of residuals from tests 1-5.
10. Calculate the loss of mass using the Loss of Mass worksheet set out in Annex 7.2.

A6.2.2 Initial Dry Mass Calculation Procedure

1. Select five specimens of a test product in accordance with Annex 4, Section A.4.2.
2. Specimens with water soluble lotions or additives should be pre-rinsed using the procedures described in Annex 4 prior to determining their dry weight.
3. Set the oven to a temperature appropriate for the chemical and physical properties of the specimen – this is typically 105 °C.
4. Place the specimens to be analyzed in an oven-safe weighing dish.
5. Dry the specimens in the oven for 24 hours.
6. Transfer the dry specimens from the oven into a desiccator and allow them to cool.

7. Weigh the specimens and record the weights.
8. Return the dry specimens to the oven for approximately 30 minutes and again allow them to cool in the desiccator and determine their weights.
9. Repeat this process as necessary until the specimens reach constant weights.
10. Record the initial total weight of the five specimens in the Loss of Mass Worksheet set out in section A7.2

Annex 7 – Test Report Template for Slosh Box Disintegration Test

A7.1 General Information

IWSFG PAS 3 Slosh Box Test for Disintegration Report	
Product Information	
Product Name	Brand X Flushable Wipe
Manufacturer	Brand X Manufacturing
Size L x W (cm)	17.8 cm X 12.7 cm
Product Supplied By	Brand X Manufacturing
Facility Information	
Test Facility Name	JKL Test Laboratory
Test Date	21-May-18
Test Time	11:25 AM
Technician Name	Joe Smith
Rock Angle Measurement Information	
Date of Last Measurement	17-May-18
Measurement in degrees to the right	11.2
Measurement in degrees to the right	11.3
Test Information	
RPM	18
Water Volume	4 Liters
Time	30 Minutes
Test Results	
Total Dry Mass of Retained fraction from the 25 mm sieve from 5 Individual tests	**3.95**
Initial Dry Mass of 5 Individual Specimens Prepared in Accordance with Annex 4	**7.35**
Percentage Passing through the 25mm sieve	**46.26%**
Test Result (PASS/FAIL)	**FAIL**

A7.2 Loss of Mass Calculation Data Input Sheet

Data Input Sheet

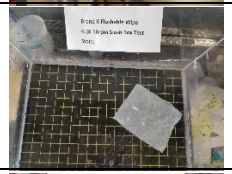
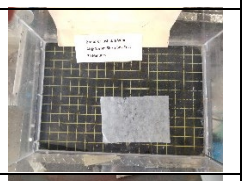
Total Dry Mass of Retained fraction from the 25 mm sieve from 5 Individual tests

Specimen #	Pan Tare (g)	Pan Tare + Dry Mass of Retained fraction from the 25 mm sieve	Net Dry Mass of Retained fraction from the 25 mm sieve		Starting Water Temp (°C) Start	Ending Water Temp (°C)	Lab Temp (°C) - Start	Lab Temp (°C) - End
1	1.92	2.7	0.78		14.0	15.5	21.4	21.4
2	1.92	2.73	0.81		14.0	15.5	21.4	21.4
3	1.92	2.69	0.77		14.0	15.5	21.4	21.4
4	1.92	2.72	0.8		14.1	15.7	21.4	21.4
5	1.92	2.71	0.79		14.1	15.7	21.4	21.4
Total (g)			**3.95**					

Initial Dry Mass of 5 Individual Specimens Prepared in Accordance with Annex 4

Specimen #	Initial Dry Mass
1	1.47
2	1.46
3	1.48
4	1.45
5	1.49
Total (g)	**7.35**

A7.3 Picture Record

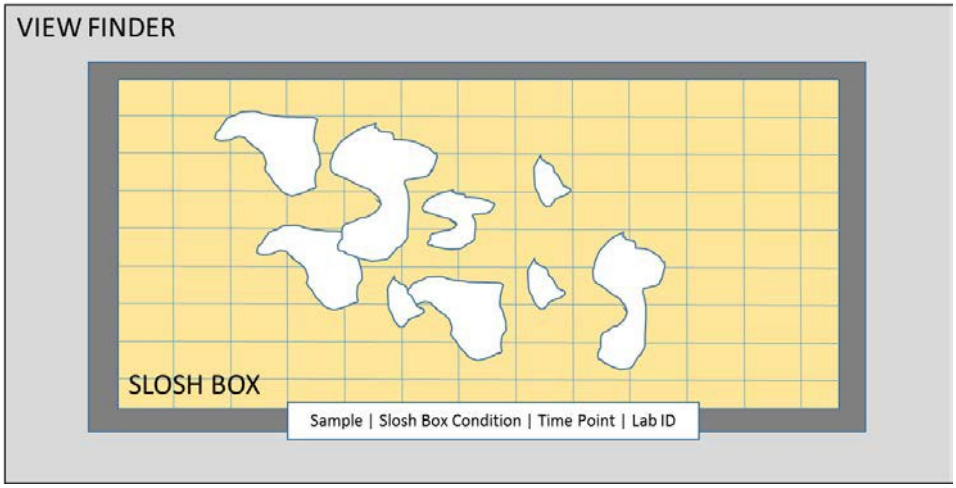
	NOTES	PICTURES SPECIMEN 1	PICTURES SPECIMEN 2	PICTURES SPECIMEN 3	PICTURES SPECIMEN 4	PICTURES SPECIMEN 5
Product Pictures	**NOTE: A wipe is used for example purposes only**					
Start						
After 30 Minutes	***Very little disintegration***					
Sieve Not Rinsed						
Sieve Rinsed Top - after 60 Seconds	***Residual left on sieve***					

A7.4 Photography Hints

A7.4.1 Photography

Photograph specimens at the specified time points for comparison of results across laboratories. Some tips for taking good photos of samples:

- Move the slosh mechanism so that the base of the box is in the horizontal plane before taking photograph.
- Carefully and gently spread any residual pieces across the full base of the box, which will ease visual identification of residual pieces.
- The camera should be located at the same place for every shot, but not every camera is the same (so it may not be possible to indicate where each lab should take the shot). The best would be to position the camera at a point above the center of the box where the entire box is in the field of view of the camera – this may depend on the type of camera being used. It is also important to have the sample ID in the image. Preferably, the box in the viewfinder would look like this:



In addition, it is imperative that the image is in good focus. It is recommended to shoot the image with adequate lighting using an f/stop that allows a good depth of focus. In essence, if the residual pieces are floating above the grid, you want to be sure the residual pieces and grid are sharp in the image – shooting at a higher f/stop allows an increased depth of focus but it also requires more light to expose the image. Different cameras will require different lighting and different f/stops. It is recommended to take several photos to get an adequate image before starting on the experiment.

Image quality is also important. Please ensure the image is at least 300 dpi and shot at the highest resolution setting for the camera.

A7.4.2 Install 1” Reference Grid

To ensure all material is observed in the photographs with the same reference point, a 1” grid should be inserted or permanently placed at the bottom of each box before taking pictures. The grid should be visible

in the photograph and should not affect the flow of liquid in the box. For example, a 1” wire grid should not be used. Using a permanent marker to draw the grid on the floor of the Slosh Box is acceptable. A yellow paint pen provides excellent contrast on a dark colored box and good contrast against the specimen color.

Annex 8 – Test Procedures for the Alternative Approach for Recovering Material from the Slosh Box

(Informative) Substantially based on INDA GD4 FG502.R1(18) Appendix I and Used by Permission of INDA

A8.1 Equipment

1. Strainer (see photo in Section A.8.3).
2. Larger pitcher capable of holding at least 4L of tap water.
3. Smaller pitcher capable of holding 0.5 L of tap water.

A8.2 Procedure

1. Use the start/stop buttons to position the front of the boxes downward so the contents are concentrated in the front of the boxes.
2. Fill the large pitcher with 3.5 L of tap water.
3. Fill the smaller pitcher with 0.5 L of tap water to be used for rinsing the strainer.
4. Use a strainer (Photo 1) to recover the sample and relatively large residual fragments from the box (Photo 2). Dip the strainer and transfer its contents into the pitcher containing 4 L of water, swirling as necessary to release the residuals (Photo 3). *Repeat this process until <u>all recoverable material</u> has been removed from the box.*

   Note: There may be some small residual fibers remaining in the box that can't be recovered using the strainer. These fibers can be discarded when rinsing the box prior to testing another replicate.
5. Place the strainer (upside down) over the 4 L pitcher and gently rinse any material retained on the strainer into the pitcher using the smaller pitcher (Photo 4).

A8.3 Photographs of Alternative Procedure

Photo 1: Example of strainer used for collection of residual solid pieces.

Photo 2: Collecting residual pieces with strainer from the box.

Photo 3: Transferring small solids from strainer to larger pitcher of water.

Photo 4: Rinsing the strainer of residual fibers at end of collection process.