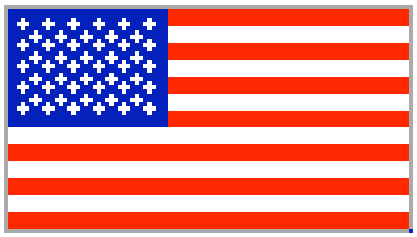

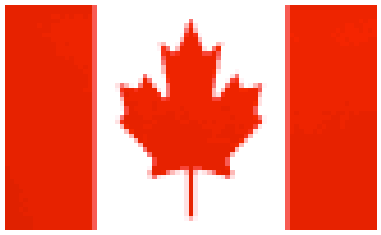

Maximum Performance (MaP)

Testing of Popular Toilet Models

Background

2003 – 2010

A Cooperative Canadian and American Project

by

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and

Koeller and Company

VERITEC Consulting Inc.

K&C

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Important: The original report detailing the development of Maximum Performance (MaP) testing of toilet fixtures was published in 2003. At that time, the test results for the initial group of toilet fixtures (about 40) were provided in that report. Since 2003, we have periodically updated (approximately every four to six months) the test results with new fixtures and made those results available free-of-charge on the websites of the Canadian Water and Wastewater Association (CWWA), the California Urban Water Conservation Council (CUWCC), the international Alliance for Water Efficiency (AWE) and Veritec Consulting Inc. (see web addresses below). A total of 16 different updated editions of the MaP report were published and posted in the six years since inception in 2003.

However, the list of MaP tested fixtures has increased to over 1,400 and updating this list on such an infrequent basis left many individuals with outdated information. As a result, the databases of fixtures (with performance results) is now updated weekly and made available in Excel format for filtering and sorting by the public and other users. Those Excel listings may be downloaded from:

For tank-type fixtures:
http://www.veritec.ca/mid.php?code=35&top=6&option=7&img=5

For commercial flushometer valve/bowl combinations:
http://www.veritec.ca/mid.php?code=34&top=6&option=7&img=5

Some individuals are not equipped to download and open Excel documents. As a result and until further notice, we will still provide PDF versions of: (1) the full tank-type toilet list, (2) the WaterSense HET list, and (3) the commercial flushometer valve/bow combinations list. Those lists may be generally found on these websites:

http://www.cwwa.ca/freepub_e.asp

http://www.cuwcc.org/MapTesting.aspx

http://www.a4we.org/Maximum_Performance_(MaP)_Testing.aspx

NOTE: Individual agencies, municipalities, green building organizations, publications, and manufacturers may link to these sites and/or use the MaP flush performance information included herein provided credit is given to the authors and publishers: Veritec and Koeller.

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Contributors

Initiated in 2003 by municipalities and other interested organizations in Canada and the U.S., the Maximum Performance (MaP) Testing program was a cooperative effort among Canadian and U.S. partners, including:

Canada

- Canadian Water and Wastewater Association (CWWA) – **LEAD AGENCY**
- B.C. Capital Regional District, Victoria, British Columbia
- B.C. Buildings Corporation, Victoria, British Columbia
- Canada Mortgage and Housing Corporation
- Calgary, Alberta
- Edmonton, Alberta
- Greater Vancouver Regional District, British Columbia
- Halifax, Nova Scotia
- Hamilton, Ontario
- Montreal, Quebec
- Ottawa, Ontario
- Region of Durham, Ontario
- Region of Halton, Ontario
- Region of Peel, Ontario
- Region of Waterloo, Ontario
- Toronto, Ontario
- Winnipeg, Manitoba

U.S.A.

- California Urban Water Conservation Council, Sacramento, California
- East Bay Municipal Utility District, Oakland, California
- Los Angeles Department of Water and Power, Los Angeles, California
- Seattle Public Utilities, Seattle, Washington
- Tampa Bay Water, Clearwater, Florida

We gratefully acknowledge the contributions from these participating organizations. Their support was vital to the success of MaP and its “penetration” into the North American marketplace as a valuable tool for consumers, specifiers, manufacturers, design professionals, builders, developers, and water providers.

Disclaimers

The information in this report and in the fixture listings is believed to be an accurate description of the units tested and the results obtained. Every effort was made to ensure the accuracy of the findings including, but not limited to, preparation of a detailed test protocol and third-party oversight of testing protocol implementation. Although the test protocol utilizes a media whose physical properties resemble typical human waste, the reader is reminded that there is an enormous variation in human waste from person to person, and from one day to another. Because of this variability, and because only a single unit of each model is tested, these results should not necessarily be considered as fully representative of the typical or average performance of the models tested. The results shown in this report should be viewed only as an indication of expected 'field' results for solid waste removal.

Neither the authors, reviewers, project supporters, original sponsoring partners, CWWA, CUWCC, AWE nor their employees make any warranty, guarantee, or representation, expressed or implied, with respect to the accuracy, truth, effectiveness, or usefulness of any information, method, or material in this document, or assume any liability of the use of any information, methods, or material disclosed herein, or for any damages arising from such use. Readers use this report at their own risk.

Neither the authors, reviewers, project supporters, original sponsoring partners, CWWA, CUWCC, AWE, nor their employees endorse products or manufacturers. Trade or manufacturers' names appear herein not as an endorsement but solely because they are considered important to the object of the project and the report.

Readers are invited to quote this report in whole or in part, but any changes made to the document must be approved by the authors. **CREDIT TO THE AUTHORS IS REQUIRED WHEN QUOTING FROM THIS REPORT OR THE FIXTURE LISTINGS.**

Readers are reminded that this report represents a 'snap shot' of the performance levels achieved by certain toilet fixtures at a particular time and with particular trim inside. Manufacturers sometimes make permanent or temporary changes to trim components or to model designs without changing the model names or model numbers. As such, changes to the models tested in this report may have occurred since the testing was completed.

The MaP Report **is not** intended to provide a comprehensive list of all makes and models of toilet fixtures available in the marketplace.

The results obtained during this testing program are not guarantees of performance.

The reader is reminded that there are criteria ***in addition*** to solids removal that should be considered when selecting a toilet model, e.g., bowl wash, availability of replacement parts, potential for leakage, noise, physical longevity, etc. MaP testing addresses only a single issue: the ability of a toilet model to completely remove solids in a single flush.

Both consumers and manufacturers are encouraged to provide feedback to the authors of this report, especially regarding issues such as incorrect model numbers, models that are listed but are no longer available, etc.

MaP Testing Protocol – Version 3

The **6th Edition** (January 2006) was the first report summarizing tests that used a new Version 2 MaP testing protocol which called for encased test media. Beginning with the 10th edition (July 2007), a new testing protocol (Version 3) offered the applicant the choice between the use of either encased or uncased (raw) test media. Uncased media was the original media used from 2003 through October 2005. Initial laboratory tests by Veritec indicated that, when testing with the two different media, no significant difference in test results occurs. Because toilet models are constantly evolving, however, it is possible that some discrepancy in the test results may occur when the two different types of test media are used. Therefore, the protocol was expanded to allow for either approach at the option of the applicant (manufacturer or other organization) submitting the product for test.

Readers are encouraged to read and become familiar with all aspects of the testing protocol, but the primary changes that were incorporated into the protocol beginning with the 6th Edition (January 2006) were as follows:

- Testing for water change-out (exchange) at flush volumes of 1.6 gallons (6 litres) was eliminated.
- Individual 50g test media specimens (soybean paste) were encased in a thin latex membrane (similar to a sausage) and can be reused several times. This made it easier and less expensive for manufacturers, laboratories and other organizations to complete MaP testing at their own facilities.
- Toilet models were required to successfully clear all test media from the fixture in a minimum of four of five attempts (vs. two of three attempts used in earlier test protocol).
- Testing was limited to attempts at following mass loadings: 250g, 300g, 350g, 400g, 500g, 600g, 800g, and 1,000g. No testing is completed with mass loadings exceeding 1,000g.

With the 10th Edition (July 2007), the following additional changes were made to the protocol and are reflected in Version 3:

- As noted above, the applicant for testing is given the choice of media (encased or uncased). Section 1.3.
- While encased media is still required to pass the “bridge test”, reuse of these media is now limited to 100 flushes, after which they may no longer be used for MaP testing. Section 3.2.7.
- The temperature of the media must be maintained during testing at 15 ±10^{o}C (59 ±18^{o}F). Section 3.2.5.

The newly revised MaP testing protocol, Version 3, is provided in **Appendix A**.

1.0 BACKGROUND

Although virtually all toilet models sold in Canada and the U.S. meet both the flush volume and performance requirements of the Canadian Standards Association (CSA) and the American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME), there remains some question as to whether models that meet the minimum certification requirements also meet the flushing performance expectations of the consumer. What's more, since certification testing offers only a pass/fail grading, it does not afford consumers an opportunity to distinguish between superior and marginal toilet models available in the marketplace.

Most toilet fixtures destined for residential and light commercial applications exceed customer performance expectations while flushing with no more than 6 litres (1.6 gallons). However, research concluded in 2003 that there were also some certified and commercially available models that did not meet customer expectations. There were two key concerns:

1) Fixtures that fail to meet the 6-litre maximum flush requirements of the CSA or the 1.6-gallon requirements of the ANSI/ASME[1] result in toilets that flush with either too much or too little water; and
2) Fixtures that do not flush effectively usually result in customer complaints and occasionally the need for double flushing.

Until 2003, however, there was no convenient way for the customer to readily distinguish between good and marginal performers. In addition, this lack of information on toilet performance levels created a negative perception regarding *all* 6-litre (1.6-gallon) fixtures.

Fortunately, the plumbing industry responded positively to the performance issues of the past. The fixtures available in the marketplace today are significantly better performers than those MaP tested as recently as 2003 and far superior to many of those produced in the early 1990s. Much of this improved performance can be attributed to the MaP test and its acceptance by the marketplace. Plumbing manufacturers are to be commended for developing and delivering outstanding toilet fixtures to the marketplace today.

Although other toilet performance studies have been completed, none of them was performed using test media as realistic as that used in MaP testing, nor did the other studies establish a quantifiable performance benchmark based on scientific data.

We developed the Maximum Performance (MaP) testing to identify how well popular toilets models perform bulk removal using a realistic test media, and to grade each toilet model based on this performance. A soybean paste having similar physical properties (density, moisture content) to human waste was used in combination with toilet paper as the test media. In addition to using a realistic test media, all toilet samples are adjusted, where possible, to their rated flush volume (typically 6 litres / 1.6 gallons) prior to testing to ensure a level playing field.

The original testing protocol required the soybean paste to be extruded through a 7/8-inch (22-mm) die and cut into 50-gram specimens (each specimen approximately 100 mm or 4 inches in length). Toilet models were subjected to progressively larger loadings (in 50-gram increments) until the unit failed to completely clear the bowl in two of three attempts, or to fully restore a minimum 50mm (2-in.) trap seal. Beginning with the **6th Edition**, the soybean paste media has been encased as described in the test protocol (Appendix A). However, organizations applying

[1] Certification testing is intended to ensure that each model meets a specific set of minimum requirements for health and safety, product integrity, and performance. There is no differentiation in certification between a toilet model that just meets the minimum requirements and one that surpasses those requirements.

to have a fixture tested are now given the option of choosing either the new encased test media OR the original uncased test media.

Beginning with the 4th Edition (May 2005), only a single sample of each toilet model was required to be submitted for testing (previous requirement was two samples). This change was made because of the relative consistency in model performance noted in earlier MaP testing and to better align MaP testing requirements with those of other standards and testing agencies.

The original MaP report (2003) contained information on replacement flapper interchangeability. That is no longer covered in these MaP reports. Information on checking and replacing toilet flappers can now be found on the web at: www.toiletflapper.org.

Whereas MaP testing is strictly performance-related, it is also considered important that those toilet models subsidized by water utilities (e.g., through rebate or other programs) sustain their water savings over the life of the fixture. The L.A. Supplemental Purchase Specification (SPS) was developed for this purpose in 2000 and may currently be found at:

http://www.cuwcc.org/WorkArea/showcontent.aspx?id=8176

The original minimum performance benchmark adopted by MaP was 250 grams (250g) of waste (plus toilet paper). That is, a toilet fixture should completely evacuate at least 250g of waste from the fixture in a single flush action. This value is based on the results of a British medical study (*Variability of Colonic Function in Healthy Subjects*) that identified 250g as the average maximum fecal size of the male participants in the study. Thus, any toilet that meets or exceeds the 250g performance threshold should meet customer expectations for flushing.

Overall, the MaP testing protocol has been very well-received by consumers, water providers, architects and engineers, specifiers, builders, retailers, and manufacturers alike. Many water agencies and municipalities in the U.S. and Canada consider the results of MaP testing when evaluating which toilet models to promote, subsidize, or rebate.

It is important to note that the U.S. Environmental Protection Agency (EPA) has adopted 350g of uncased MaP media (soy bean paste) as the minimum performance threshold for high-efficiency toilets (HETs) promoted within its WaterSense program. Furthermore, most water utilities currently adopting toilet replacement rebate and installation programs (with HETs) are also establishing their minimum performance threshold at 350g (some are as high as 500g). Therefore, for the sake of consistency, the requirements for UNAR (Uniform North American Requirements) for toilet fixtures, which is virtually identical to the EPA's WaterSense program[2] for high-efficiency models, has likewise adopted 350g as the minimum flushing performance threshold.

The EPA's WaterSense program does not post performance scores for toilet models certified as compliant with its specification; models are simply certified as meeting the WaterSense requirements on a pass-fail basis. Those requirements include the 350g threshold and other criteria. Independent of WaterSense, however, we will continue to perform and report on MaP testing results via reports such as this.

[2] Except that the WaterSense program confines its labeling to HETs ONLY. WaterSense and its toilet specification may be accessed at: http://www.epa.gov/watersense/

2.0 RECENT CHANGES AND NOTES

Important changes or notes related to the MaP testing program include the following:

1) Some fixture models are listed more than once, particularly if they are being marketed and sold through more than one distribution or retail channel. Such duplicate listings are made only upon the request of the manufacturer.

2) In accordance with the terms of MaP testing developed by the authors, MaP tests are considered to be valid for a period of four (4) years. All fixture models that were tested more than four years prior were deleted from the listings with the following exceptions: (a) Some previously tested models are re-tested and thereby retain their listing, (b) some models are certified by the manufacturer as being identical to the originally tested model and are re-tested at a future date, and (c) some models were discontinued by their manufacturer prior to the four-year cycle.

   As a result, and at the option of individual manufacturers, fixtures are periodically removed from the report because listings have been allowed to expire. Some fixture models are discontinued and some are been physically modified such that previous MaP scores no longer reflect the current model. In some cases, when the MaP listing expires on a WaterSense-certified toilet model and, while the line item in the report was not deleted, the MaP score was changed from its previously reported number to "NM" (for "not measured").

3.0 MAXIMUM PERFORMANCE (MAP) TEST

3.1 Critical Aspects of Test Program

MaP testing includes three significant advancements from earlier studies by others and from the national standards promulgated by CSA and ASME:

- Non-realistic test media (sponges, plastic balls and beads, kraft paper, etc.) were replaced with a combination of encased or uncased soybean paste and wads of toilet paper. Most agree that this media more accurately replicates "real-world" demands upon a toilet fixture.
- All models are adjusted to their rated volume, generally 6 litres (1.6 gallons) or 4.8 litres (1.28 gallons), prior to testing[3].
- As noted earlier, a minimum level of acceptable waste removal performance was identified.

[3] High-efficiency toilets (HETs) are adjusted to their rated volume where such adjustments are possible. In most cases, however, adjustability is not available. The flush volume of HETs may be as high as 4.8 litres (1.28 gallons) and even as low as 3.0 litres (0.8 gallons).

3.2 Minimum Level of Acceptable Performance - Medical Data

A British medical report[4] outlines the results of fecal tests completed on 10 male and 10 female subjects eating normal diets. The study identified the *average maximum*[5] fecal size of the male participants to be approximately 250g and the 95th percentile size to be 305g[6]. The *average maximum* for women was slightly less at 237g, with the 95th percentile at 275g. The *average* fecal size of all participants was 130g[7]. (NOTE: The selection of the 350g threshold by the U.S. EPA for its WaterSense Program was based upon achieving a 99.5 percentile threshold.)

Based on this medical study, it appears that for sanitary reasons, as well as for customer satisfaction, toilets should flush a *minimum* of approximately 250g of solids. For the purposes of this study, 250g was set as the initial performance benchmark.

3.3 Soybean Paste Test Media

Soybean paste was selected as a test media because its physical characteristics (density, moisture content) are reasonably similar to those of human waste. The test media has the following properties: moisture content 51.5 percent, pH 4.78, and density 1.16g/mL. Previous to the 6th Edition of the MaP report (January 2006), the media was extruded through a 7/8-inch (22mm) diameter die, each specimen being approximately four inches (100mm) long and weighing 50g (±5g). Beginning with that edition, a new test protocol encases the specimen in a thin latex membrane, enabling re-use of the specimen for multiple test runs. However, the organization submitting product for testing now has the option of specifying either the encased or the uncased media.

3.4 Media Source

Although several soy paste media with varying physical characteristics were evaluated during initial project development, the specific media used in the MaP testing is obtained in 20-kg (44-lb) containers from a single Canadian importer (the product originates in Japan). Readers wishing further information regarding the paste should contact Veritec directly.

3.5 Test Protocol

The current MaP test protocol (Version 3.0 - 2007) is included in **Appendix A**. All toilet fixtures are assembled, placed on the test stand, and connected to a municipal water supply (50 psi static pressure). Tank water levels are set to the waterline and flush volumes recorded. Adjustments are made, if necessary and where possible, to ensure all samples flush at their rated volume, generally 6 litres (1.6 gallons) for most fixtures, and less for HETs[8].

The ability of a toilet to completely remove 100 percent of waste in a single flush without plugging or clogging is considered by most consumers and users to be one of the most important performance criteria for a toilet. MaP testing is conducted by increasing the mass of test media added to the bowl in specific increments (as shown in the protocol) until it fails to pass 100 percent of the media in at least four of five attempts. Four loosely crumpled balls of toilet paper (six sheets each) are included in each test run. The toilet paper used in testing has the following specifications: single ply toilet paper conforming to ASME A112.19.14–2006, section 3.2.4.1.

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[4] J.B. Wyman, K.W. Heaton, A.P. Manning, and A.C.B. Wicks of the University Department of Medicine, Bristol Royal Infirmary, *Variability of colonic function in healthy subjects*, 1978.

[5] The average of the largest individual "samples" collected from each participant during the program.

[6] It would be expected that only 5% of male samples would be larger than 305g.

[7] A toilet only capable of flushing the *average* loading (130g) would be expected to plug/clog or fail about 50% of the time, therefore, the benchmark of 250g (average male maximum) was selected for this project.

[8] High-Efficiency Toilets – HETs function with an effective flush volume of 4.8 litres (1.28 gallons) or less per flush.

4.0 SUMMARY

The 2003 test program revealed a significant range in the flushing performance of certified toilet models, for example, half the models tested in 2003 failed to meet the 250g threshold – yet all of these toilets were certified as meeting the minimum standards set forth by CSA and ANSI/ASME.

The listing of MaP-tested fixtures is divided into two parts: (1) tank-type toilets, including gravity-fed and pressure- and power-assisted units and (2) commercial flushometer valve/bowl combinations. Two separate lists are provided at the websites shown at the front of this document.

Note that while flushometer valve/bowl combination fixtures have been tested to the Appendix A test protocol, this is **not the protocol that will eventually be applied to this type of fixture**. Because flushometer fixtures are usually installed in non-residential applications where demands upon the fixture are much greater than in domestic use, a new MaP testing protocol is being developed for non-residential applications. This new (and more rigorous) test protocol may include toilet seat covers, paper towels, and other items that are more reflective of the actual demand on non-residential toilet fixtures. When completed, all flushometer valve toilet fixtures will undergo testing to the new protocol and be reported separately. In addition, it is likely that many manufacturers will request that their pressure-assist fixtures be re-tested to the commercial MaP, since they are used widely in commercial applications.

5.0 RECOMMENDATIONS

Based upon the research conducted in 2003 and the very extensive test results obtained since that time, the authors continue to recommend that:

1. All toilet models be required to remove at least 250g of solids as part of qualification or certification for code-compliance.
2. Municipalities and other rebating agencies should only subsidize (rebate) toilet models that meet both the LADWP SPS and the MaP threshold. SPS-qualified gravity-fed toilets are more likely to sustain water savings over their physical lifetime. MaP tested toilets meeting the recommended threshold are more likely to result in a satisfied customer. Together, these requirements comprise the new Uniform North American Requirements (UNAR) for toilet fixtures. We recommend that all water providers consider using the UNAR specification and/or WaterSense for future toilet replacement programs. Further information on the UNAR and WaterSense specifications may be obtained from the authors.

Appendix A

Maximum Performance (MaP) Testing

Toilet Fixture Performance Testing Protocol

Version 3 - July 2007

1.0 Scope of MaP Testing

1.1 Toilet model maximum performance (MaP) level is identified as the maximum media loading (in discrete increments expressed in grams) at which toilet model successfully clears all media from fixture in at least four of five attempts.

1.2 Tests where toilet sample clogs, plugs, or fails to restore a minimum of a 2-in. (50mm) trap seal following each flushing test will be deemed a failed test.

1.3 MaP test media is comprised of either of the following:

1.3.1 One or more 50 ± 4g test specimen ("test specimen") consisting of soybean paste contained in latex casing (cased media), tied at each end forming a 'sausage', and four loosely crumpled balls of toilet paper ("paper"), or

1.3.2 One or more 50 ± 4g test specimen ("test specimen") consisting of extruded soybean paste (raw or uncased media) and four loosely crumpled balls of toilet paper ("paper").

1.4 Each test specimen shall be approximately 100 ± 13mm in length and 25 ± 6mm in diameter[9].

1.5 Unless otherwise specified all MaP testing will be completed using cased media, however, the client may choose, at their discretion, to have fixture samples tested with uncased test media.

2.0 Testing Protocol

2.1 Fixture Model Selection

2.1.1 A single randomly selected sample of each toilet model ("sample") is required for testing.

2.1.2 Toilet models that are not *certified* as provided shall be identified as a "Prototype Model".

2.2 Set-Up

2.2.1 Samples shall be assembled according to manufacturer's written instructions as contained within the product packaging, and placed on test apparatus (rig), ensuring tank and bowl are level.

2.2.2 Tank water level shall be adjusted to the level specified by manufacturer in the manufacturer's instructions (e.g., set to waterline).

2.2.3 Static water supply pressure shall be set to 50 ±3 PSIG.

2.2.4 Inlet water temperature shall be 15 ±10°C (59 ±18°F).

2.2.5 Samples shall be flushed a minimum of three times prior to commencement of testing.

2.2.6 Re-adjust tank water level to proper level if required.

2.3 Flush Volume Measurement

[9] approximately 4 ± 0.5 inches in length and 1 ± 0.25 inches in diameter

2.3.1 Measure and record flush volume of sample in accordance with ASME A112.19.2-2003, paragraphs 8.4.1 and 8.4.2.

2.3.2 Samples with measured flush volumes in excess of 0.5 litres (0.13 gallons) greater than their rated flush volume when adjusted to the indicated waterline shall be deemed to fail MaP testing requirements due to excessive flush volume.

2.3.3 Samples with measured flush volumes less than 0.5 litres (0.13 gallons) greater than their rated flush volume adjusted to the indicated waterline shall be adjusted, if possible, to their rated flush volume prior to performance testing.

2.3.4 Samples with measured flush volumes less than their rated flush volume shall be tested at their measured volume and this volume shall be recorded on test report.

2.4 Waste Extraction Test

2.4.1 Test specimens shall be formed such that they are roughly cylindrical in shape and uniform in diameter

2.4.2 A test specimen drop guide shall be placed across the top of the bowl, with a 50mm (2-in.) diameter opening aligned over centre of bowl sump. Drop guide may be made of plastic or other rigid material, to be no more than 12mm (0.5-in.) thick, and be of sufficient length to span top of toilet bowl.

2.4.3 Test specimens shall be freely dropped in a vertical orientation into bowl through opening in drop guide. Test specimen should be held in such a way that approximately half of the specimen protrudes through the opening in the drop guide prior to release into the bowl. Additional test specimens shall be added, as required, to achieve desired mass loading. Record total mass loading.

2.4.4 Remove drop guide and freely and randomly drop four balls of crumpled toilet paper over centre of bowl sump.

2.4.5 Wait 10 ± 1 seconds.

2.4.6 Flush sample. Collect discharged media in strainer or other suitable container positioned below toilet fixture.

2.4.7 Record test as Pass or Fail (test is a Fail if any waste remains in the bowl or trap, or if minimum 50mm (2-in.) trap seal has not been restored).

2.4.7.1 If cased media is used, remove (rinse) discharged toilet paper from test specimens, and prepare test specimens for further testing.

2.4.7.2 If uncased (raw) media is used, discard discharged media into garbage or other suitable container.

2.4.8 Flush sample to clean bowl and trapway and fully restore trap seal.

2.4.9 Increase (or decrease) mass loading, as required, based on the following intervals, and repeat waste extraction test until such time as the maximum loading has been reached as described in paragraph 2.4.11:

50g	100g	150g	200g	250g	300g	350g	400g	500g	600g	800g	1,000g

No testing shall be conducted at mass loading greater than 1,000g.

2.4.10 Record highest mass loading at which toilet test sample successfully removed all test media from fixture and restored minimum 2-in. trap seal in at least four of five attempts. This loading represents the maximum performance level for the test sample (i.e., the MaP score).

3.0 Test Media Specifications

3.1 Soybean paste nominal specifications: 35.5% water, 33.8% soybean, 18.5% rice, and 12.2% salt, and having a density of 1.15 ± 0.10 g/mL (i.e., density greater than water).

3.2 Cased Test Media:

3.2.1 Latex casing shall be made from non-lubricated latex condoms (LifeStyles® brand, purchased from Ansell Healthcare Products LLC, Dothan, AL 36303 USA).

3.2.2 Cord used to tie casing shall be 1.0mm diameter polymer cord that will not crack or harden with time (Stretch Magic Bead & Jewelry Cord, Pepperell Braiding Company, P.O. Box 1487, Peperell, MA 01463, 800-343-8114)

3.2.3 Each test specimen shall have a mass of 50 ± 4g.

3.2.4 Test specimens should be stored in air-tight containers and refrigerated when not in use. A damp sponge should be placed in bottom of container to prevent test specimen drying.

3.2.5 Temperature of test specimens during testing shall be shall be 15 ±10°C (59 ±18°F).

3.2.6 Test specimens that have been stored in a refrigerator shall be acclimatized by flushing each specimen a minimum of three times prior to conducting MaP testing.

3.2.7 Individual test specimens shall be discarded after 100 flushes or when it fails to span the clear distance of 76mm (3-in.) for minimum of 15 seconds when tested at room temperature (setup illustrated in Figure 1 below), whichever comes first.

3.2.8 Test specimens with rips, tears, punctures, etc. shall not be used.

3.2.9 Test specimens that are damaged in any way shall not be used.

3.2.10 Test specimens may contain small volumes of air, however, specimens that float shall not be used.

3.3 Toilet paper specifications:

- Each ball of paper is comprised of six sheets of single ply toilet paper conforming to ASME A112.19.14–2001, section 3.2.5.1.2

NOTE: Bulk test media (soybean paste) or cased test specimens (ready-to-use) may be purchased from:
Veritec Consulting Inc., 1495 Bonhill Road, Unit 12, Mississauga, Ontario, Canada L5T 1M2
Phone (905) 696-9391, ext. 105 - Fax (905) 696-9395 - Attn: Bill Gauley, P.Eng., Principal
bill@veritec.ca

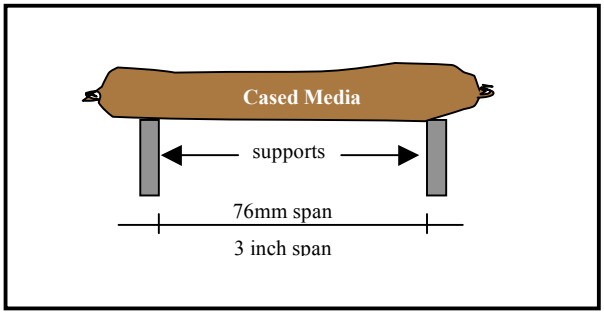

Figure 1

Glossary of Terms Used in the Fixture Lists

The following terms and acronyms are used in Appendices B and C:

ADA – Americans with Disabilities Act: Fixtures so-noted in the listings have a minimum bowl height of 16 inches from floor to top of the bowl rim; the toilet seat adds approximately one inch in height, giving the typical ADA fixture an effective bowl height of 17 inches. Note: While the designated fixtures meet bowl-height requirements of Americans with Disabilities Act, these listings do NOT imply or guarantee that such fixtures meet any other ADA requirements.

EL – Elongated toilet bowl

Gal or g - Gallons

HET – High-Efficiency Toilet: An HET is defined as a toilet fixture whose average or effective flush volume is equal to or less than 4.8 litres (1.28 gallons) per flush. Dual-flush toilets are classified as HETs because the ratio of reduced flushes (up to 4.1L-1.1G) to full flushes (up to 6.0L-1.6G) results in an effective flush volume below the qualifying threshold.

L – Litres (Liters)

MaP – Maximum Performance: Applies to toilet fixture flush performance; such performance is measured in grams (g).

RF – Round front toilet bowl

SPS – Supplementary Purchase Specification: The SPS, developed in 2000 by the City of Los Angeles Department of Water and Power and the International Association of Plumbing and Mechanical Officials, is designed to assure the sustainability of the toilet fixture's water savings characteristics; flapper durability (in concentrated chlorine) and maximum permitted flush volume are the main components of the SPS, although flapper durability was subsequently adopted into the ASME A112.19.5 national standard and is required of all fixtures whose tank trim includes a flapper-type flush valve seal.

WS – WaterSense Program (of the U.S. Environmental Protection Agency)