

TOILET FLAPPERS

Materials Integrity Tests



The Metropolitan Water District of Southern California
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Preface

Without the complete support of MWD's Corrosion Engineering group, this study could not have been conducted. The contributions of Mr. Bill Sleeper and Mr. Harvey Webster of that group were significant. Their expertise, advice, and work on this project were exceptionally valuable in carrying out the laboratory protocol, which they did in a very professional and thorough manner. We also thank Corrosion Engineering for again making their comprehensive laboratory facilities and excellent staff available for this study.

Since 1994, the Corrosion Engineering group has applied their resources to the investigation of toilet flappers on behalf of the water conservation community at large. This study, together with the two studies that preceded it, provides valuable information for both the water conservation community and the plumbing industry. We anticipate that these three studies will continue to stimulate improvements in product design by the industry and will be an important tool for those conservation professionals involved in developing purchase specifications.

Finally, we thank the following organizations and individuals for their contributions of flapper products to this series of tests:

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TABLE OF CONTENTS

Introduction	page 1
Metropolitan Water District of Southern California	1
Metropolitan's Toilet Replacement Programs and Requirements	1
Study Background	2
Water Conservation and ULF Toilets	2
ULF Toilets and Flapper Failure	2
Test Protocol	3
Corrosion Laboratory and Test Facility	3
Test Approach	4
Summary of Test Results	7
Overview	7
Microscopic Examination	7
Flapper Weight Gain	7
Flapper Leaks	7
Study Conclusions	11
Recommendations for Action	12

Tables

Table 1. Weight Gain of Flappers Immersed for 28 Days	8
Table 2. Flapper Leak Rates – Before and After Test	9
Table 3. Summary of Leak Test Results	10

Figures

Figure A. Build-up of Chemical Concentration	6
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Appendices

APPENDIX A - Listing of Flappers Tested

APPENDIX B - Test Protocol

APPENDIX C - Material Safety Data Sheets (MSDS) for Clorox[®] and 2000 Flushes[®]

APPENDIX D - Test Results - Weight Gain and Appearance – 2000 Flushes[®]

APPENDIX E - Test Results - Weight Gain and Appearance – Clorox[®]

APPENDIX F - Specimen Weight Gain Charts

APPENDIX G - Specimen Leak Rates

INTRODUCTION

Metropolitan Water District of Southern California

The Metropolitan Water District of Southern California (Metropolitan) is a consortium of 27 cities and water districts that provides drinking water to more than 17 million people in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino, and Ventura counties. Metropolitan provides an average of 60 percent of the tap water used in its 5,200 square mile service area.

Metropolitan was incorporated by the California State Legislature in 1928 to build the 242-mile-long Colorado River Aqueduct, a facility it still owns and operates. In addition, Metropolitan imports water from Northern California through the State Water Project. Metropolitan facilities also include five pumping plants, a distribution system having seven reservoirs, five water filtration plants, 43 pressure control structures, 15 power plants, and approximately 775 miles of large diameter pipelines. Currently nearing completion is the \$2 billion Eastside Reservoir Project in southwestern Riverside County, which will hold approximately 800,000 acre-feet of water, doubling Southern California's surface reservoir capacity.

Toilet Replacement Programs and Requirements

In the early 1990s, one of the longest droughts in California history (7 years) caused Metropolitan's allocated water supplies to be greatly limited. As a result, Metropolitan implemented a number of water conservation programs oriented to residential consumers, the most significant of which were the residential toilet retrofit programs. In these programs, customers were encouraged to replace their high volume, water-wasting toilets (with flush volumes of 3.5 gallons, 5 gallons, and higher) with new ultra-low-flush (ULF) toilets (1.6 gallons or less). Metropolitan and its participating member agencies used rebates, free distributions, vouchers, other toilet subsidies, and state and national legislation as the principal means of encouraging customers to retrofit their water-wasting toilets.

Toilet retrofit programs began with the onset of the drought and accelerated significantly in 1993, reaching their peak retrofit levels in 1995 (over 20,000 toilets per month). As of 1999, over 1.5 million residential toilets in Metropolitan's service have been replaced with new ULF toilets through water agency programs. In addition, the State of California mandated that, as of January 1, 1992, toilets installed in all new residential construction must be ULF toilets. As a further step, some communities also require that existing residences be retrofitted with ULF toilets upon their sale (known as "retrofit on resale" ordinances).

In growing recognition of the urgent need to conserve the state's water supplies, the California Urban Water Conservation Council (CUWCC) defined and developed a series of water conservation measures defined as Best Management Practices (BMPs). Member water agencies throughout California (including Metropolitan) then agreed through a joint memorandum-of-understanding to pursue the implementation of those BMPs. BMP No. 14, covering residential ULF toilets, calls for aggressive replacement programs in the urban areas and provides an objective method against which these programs are measured.

STUDY BACKGROUND

Water Conservation and ULF Toilets

To date, the retrofit of toilets in Metropolitan's service area has been the key strategy for achieving regional water conservation goals. The economics of the retrofit programs undertaken by Metropolitan are based upon a 20-year (or more) functional life of a ULF toilet. Therefore, for the projected water savings to be achieved, the ULF toilets must perform as designed for that entire period. This, in turn, demands that flush valve flappers and their readily available replacements (and similar closure mechanisms) continue to function at 1.6 gallons per flush throughout the 20-year lifetime of the toilet.

ULF Toilets and Flapper Failure

A typical tank-type porcelain toilet is believed to possess a useful life of at least 20 years. However the flush valve closure mechanism (usually a flapper) within the tank of these new ULF toilets may fail within 5 years, due either to normal "wear and tear" or to other factors introduced by the consumer. Failure leads to water leaks that could, unless corrected, substantially erode the water savings anticipated over the 20-year life.

Because of the importance of the flush valve flapper to the continuing performance of a toilet, Metropolitan undertook its own flapper materials testing program in 1994 to: (1) better understand seal failure mechanisms that lead to leakage; (2) identify durable materials that could be used to withstand the chemical attacks; and (3) provide a basis for better communication with flapper and toilet bowl cleaner manufacturers. The overall purpose of the testing program was to aid in understanding how to maximize the leak-free life of the flapper and related seals.

Therefore, Metropolitan began a study of flapper materials to identify the cause and magnitude of flapper failures on ULF toilets, specifically those failures related to chemical attack resulting from the consumers' use of in-tank bowl cleaners. The results of that study¹ indicated that certain in-tank bowl cleaners could cause severe warping, swelling, blistering, and cracking of the typical flapper, leading to a leaking flush valve.

While that study of 1994 flappers was underway, most manufacturers aggressively addressed the failure issue by investigating and testing new, more chemical-resistant materials for their flapper products. Many of these new materials have now found their way into the product marketplace. Manufacturers claim that the best of these flappers will readily withstand the attacks of bowl cleaning chemicals.

The durability of flappers available in the marketplace today appears to represent a very significant improvement over that of the 1994 flappers and, as such, Metropolitan determined that a new series of independent tests was required to verify the manufacturers' latest claims. Thus, the current series of materials tests was undertaken in early 1999 and concluded in October 1999. Manufacturers were requested to submit their very best, state-of-the-art flappers for testing

¹ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

by Metropolitan. Nine manufacturers responded by providing 16 different flapper models.² Appendix A provides a listing of those manufacturers and the products they submitted.

This report summarizes the findings resulting from that series of tests.

Test Protocol

Based upon the understanding of flapper failure gained through the earlier tests, a new test protocol was developed for this Program. The protocol was provided to the manufacturers for their review, comment, and recommendations. Changes were made as necessary and flapper testing began. As a “living” document, it was designed to change as more information became available. Consequently, it was revised periodically during the course of testing; the final version of the protocol is included here as Appendix B.

Corrosion Laboratory and Test Facility

All testing took place within Metropolitan's Corrosion Laboratory (Laboratory) in La Verne, California. That Laboratory performs ongoing tests of the materials used in various phases of water treatment and distribution. It is one of the few laboratories dedicated to long-term testing, and results from these tests are widely distributed and valued by the water utility industry. The Laboratory has, since 1994, tested toilets and internal trim in support of Metropolitan's Water Conservation Programs, including the earlier materials tests³ and the after-market compatibility tests.⁴

² Some flappers were not submitted by manufacturers until after testing had commenced. Therefore, some flappers were not subjected to the entire test protocol or were submitted too late for the tests with 2000 Flushes®.

³ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

⁴ *After-Market Toilet Flappers: A Study of Compatibility and Flush Volumes*, The Metropolitan Water District of Southern California, November 1998.

TEST APPROACH

The protocol (Appendix B) calls for testing the physical properties of formed flapper configurations in a simulated long-term environment of tap water (as a control) and chemical bowl cleaners. Tests were developed for up to 16 flappers under accelerated conditions, with solution concentrations maintained for 28 days as follows:

- Tap water
- Halogenating solution of bowl cleaner at 50 parts per million (ppm)
- Halogenating solution of bowl cleaner at 300 ppm
- Halogenating solution of bowl cleaner at 2,000 ppm

The halogenating solutions were prepared from two commonly used in-tank toilet bowl cleaners: Clorox[®] (uses halogenated methyl hydantoin) and 2000 Flushes[®] (uses calcium hypochlorite). Material Safety Data Sheets (MSDS) for each of the two products are included as Appendix C.

The purpose of the accelerated testing was to increase the severity of the chemical and physical environment to speed up chemical reactions that could cause flapper failure. Sixteen formed flappers were obtained from nine different manufacturers and suppliers. Refer to Appendix A for a listing of those firms and the products they submitted.

Specimens were identified as follows for each of the 16 flappers:

- Specimen #1 – Tap water control flapper (for test with 2000 Flushes[®])
- Specimen #2 – 50 ppm of 2000 Flushes[®]
- Specimen #3 – 300 ppm of 2000 Flushes[®]
- Specimen #4 – 2,000 ppm of 2000 Flushes[®]
- Specimen #5 – Tap water control flapper (for test with Clorox[®])
- Specimen #6 – 50 ppm of Clorox[®]
- Specimen #7 – 300 ppm of Clorox[®]
- Specimen #8 – 2,000 ppm of Clorox[®]

Prior to commencing chemical immersion tests, the new flappers were mounted on a standard flush valve and leak rates measured and recorded.⁵

Following the initial leak tests, the test protocol required immersion of the flappers in heated halogenating solutions for twenty-eight days maintained at 40° C (104° F) for the duration of the test. The solution in the containers was changed daily, from a stock supply, in order to ensure a constant concentration of the halogenating solution (at 50, 300, and 2,000 ppm). In this accelerated testing, the concentration of chlorine was considerably higher than the residual levels commonly maintained in water distribution systems (2 ppm for chloramine and 0.5 ppm for chlorine). However, at 2,000 ppm, it was also somewhat less than the ultimate concentration of chlorine that was reached in a separate test⁶ when a tablet of Clorox[®] (drop-in) toilet bowl

⁵ This leak test requirement was added to the protocol after testing had commenced. Therefore, some flappers subjected to the immersion test with 2000 Flushes[®] were not tested for leaks until after testing was concluded. However, in connection with the test with Clorox[®], four of each flapper were tested for leaks prior to immersion and, hence, a representative body of data exists with respect to leaks on flappers fresh "out of the box."

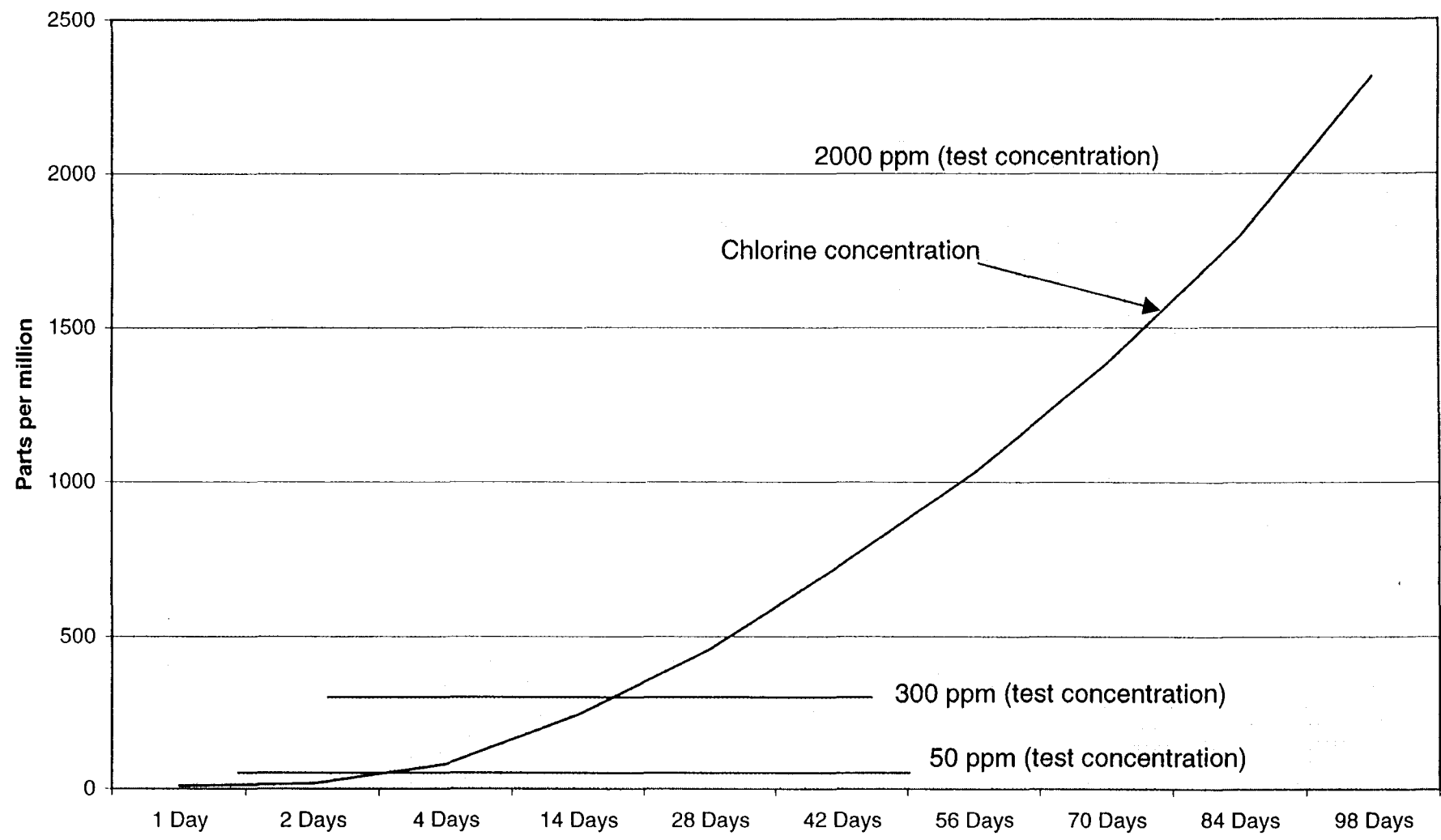
⁶ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

cleaner was placed in 1.6 gallons of water for an extended period of time. In that instance, after 14 weeks, the tablet fully dissolved and the chlorine concentration reached saturation at 2,312 ppm. The concentration build-up over those 14 weeks is illustrated in Figure A, on which the test concentrations of 50, 300 and 2,000 ppm are noted. (Note: Figure A indicates that the consumer/homeowner is inadvertently causing extremely harsh conditions leading to flapper failure if, before a very extended absence from the home, a tablet of toilet bowl cleaner is placed in the tank of a ULF toilet and the toilet is not flushed. For example, the concentration of 300 ppm is reached in only about two weeks.)

The test samples were analyzed at various intervals during the 28-day period for water absorption (swelling), surface condition, and changes in other physical properties. Swelling, which manifests itself in weight gain, and warping, usually cause a change in the valve dimensions, which could be expected to alter the sealing behavior of a flapper valve. Surface roughness, blisters, cracks, etc. as revealed by microscopic examination, could also cause leaks. Changes in these physical properties could lead to leaks by virtue of the material becoming too hard or too soft or by complete failure of the valve, wherein massive leakage occurs.

Finally, a leak test was again performed at the conclusion of the 28 days by mounting the flapper on a standard flush valve and measuring leakage (if any) over a period of one hour (minimum).

Figure A. BUILD-UP IN CHEMICAL CONCENTRATION
Clorox Drop-in Bowl Cleaner (1 tablet in 1.6 gallons of water)



SUMMARY OF TEST RESULTS

Note: The selection of only one specimen of each flapper for each series of leak and immersion tests does not provide a statistically valid representation of all flappers of each type. Therefore, the results shown in this report should be viewed only as a rough indication of the “real world” durability of flappers. To obtain statistically reliable results, a larger sample of these products would be required for the tests conducted.

Overview

Certain of the tested flappers were attacked by the halogenating agents of the drop-in bowl cleaners, while others appeared to successfully resist the cleaners. That is, the resistant flappers continued to perform and provide a flush valve seal (no leaks) after the severest immersion tests. Attacks upon the integrity of the flappers were evidenced by weight gain, distortion in shape, loss in physical properties, blistering, cracking, and surface tackiness, roughness, and erosion in various degrees. These changes frequently led to seal failure or leakage, the extent of which would depend upon the concentration of the halogenating agent, the exposure time, and the material's ability to withstand chemical attack.

Microscopic Examination

Microscopic examination of the flappers during the course of the testing revealed some samples had retained a smooth surface while others were very rough and blistered. As with previous studies, there was a correlation of the results of the microscopic examination with the degree of swelling and weight gain and the extent of physical property retention. Examination notes on the distortion and surface condition observed during the course of testing are included in Appendices D and E.

Flapper Weight Gain

While all of the flappers were affected by the bowl cleaners to some extent, a range in results was observed. Weight gain can relate directly to the flapper's ability to continue to form a flush valve seal. Weight gain results for flappers immersed in 2000 ppm solutions for 28 days varied significantly from flapper to flapper (refer to Table 1). Note that weight gain ranged from as low as 7.3 percent to as high as 71.9 percent for flappers immersed in a Clorox[®] solution. For 2000 Flushes[®], the range was from a low of 7.6 percent to a high of 63.9 percent. The increase in weight gain observed during the 28-day period is displayed in the charts within Appendix F.

Refer to Appendices D and E for further information on the weight gains measured during the 28-day course of the tests.

Flapper Leaks

Weight gain, as a precursor of a flapper's tendency to leak, was confirmed through the leak tests performed at the conclusion of the 28-day test period. Table 2 displays the leak rates for those test specimens subjected to the severest concentrations of 2000 Flushes[®] and Clorox[®]. Leak rates for the tap water, 50 ppm solution, and 300 ppm immersion tests are shown in Appendix G.

Table 3 illustrates the correlation between weight gain and flapper leak characteristics.

Table 1. Weight gain of flappers immersed for 28 days

Flapper Number.	Flapper Manufacturer And Identification	Percent Weight Gain Over 28 Days for 4 Specimens of Each Flapper			
		Specimen #1 in Tap Water	Specimen #4 in 2000 ppm of 2000 Flushes [®]	Specimen #5 in Tap Water	Specimen #8 in 2000 ppm of Clorox [®]
1	Mansfield Black (disc only)	1.3%	34.0%	1.1%	42.5%
2	Mansfield Red* (disc only)	unavailable – not measured	unavailable – not measured	unavailable – not measured	14.2%
3	Coast Ultra Blue	0.8%	13.2%	0.8%	8.5%
4	Lavelle Korky Plus	4.2%	16.5%	4.0%	23.3%
5	Lavelle EX-703	0.7%	33.4%	0.5%	58.9%
6	Lavelle Korky	2.6%	63.9%	2.3%	71.9%
7	Fluidmaster Bullseye**	2.6%	13.4%	2.8%	17.3%
8	Fluidmaster Bullseye Super**	2.8%	11.5%	2.8%	11.6%
9	Fluidmaster Bullseye Super Adjustable**	2.5%	10.6%	2.8%	9.6%
10	American Standard	2.2%	34.4%	1.5%	18.9%
11	Frugal Flush 1.6**	2.6%	13.4%	2.1%	10.0%
12	Frugal Flush 3.5	1.7%	11.6%	1.3%	6.6%
13	Niagara**	2.3%	9.9%	2.0%	9.8%
14	Toto (disk only)***	0.8%	44.6%	0.7%	39.6%
15	Hoov-R-Line Rigid**	4.4%	10.3%	2.7%	39.6%
16	Hoov-R-Line Clear	1.4%	7.6%	1.9%	7.3%

NOTE: Weight gain test results for tests at 50 ppm and 300 ppm may be found in Appendix D

*-Mansfield Red flapper disk was not available for the tests in 2000 Flushes or for certain tests in Clorox

**-Rigid parts removed prior to weighing (Clorox only)

***-Toto disc as installed on its Ultra-Max[®] line of toilets

Table 2. Flapper Leak Rates - Before and After Test

Fl. No.	Flapper Manufacturer and Identification	Leak Rates							
		Specimen #1		Specimen #4		Specimen #5		Specimen #8	
		Before Test*	After 28 days in Tap Water	Before Test*	After 28 days in 2000 ppm of 2000 Flushes®	Before Test	After 28 days in Tap Water	Before Test	After 28 days in 2000 ppm of Clorox®
1	Mansfield Black (disc only)	NM	2 ml/hr	NM	entire contents/ 5 seconds	0	25 ml/1 hr	10 ml/ 1 hr	entire contents/ 1 hr
2	Mansfield Red** (disc only)	NM	NM	NM	NM	NM	NM	<1ml/ 1 hr	0
3	Coast Ultra Blue	NM	0	NM	0	0	0	0	0
4	Lavelle Korky Plus	NM	25 ml/2 hrs	NM	0	<1ml/ 1 hr	3 ml/1 hr	<1ml/ 1 hr	entire contents/ 1 hr
5	Lavelle EX-703	NM	0	NM	entire contents/ 1 hr	<1ml/ 1 hr	<1ml/1 hr	0	entire contents/ 1 hr
6	Lavelle Korky	NM	132 ml/2 hrs	NM	entire contents/ 5 seconds	25 ml/ 1 hr	70 ml/1 hr	35 ml/ 1 hr	entire contents/ 5 min
7	Fluidmaster Bullseye	NM	113 ml/2 hrs	NM	0	0	0	0	0
8	Fluidmaster Bullseye Super	NM	0	NM	0	0	0	0	0
9	Fluidmaster Bullseye Super Adjustable	NM	0	NM	10 ml/1 hr	<1ml/ 1 hr	6 ml/1 hr	0	<1ml/1 hr
10	American Standard	NM	18 ml/ overnight	NM	entire contents/ 5 seconds	0	<1ml/1 hr	0	<1ml/1 hr
11	Frugal Flush 1.6	NM	50 ml/1 hr	NM	0	0	0	0	<1ml/1 hr
12	Frugal Flush 3.5	NM	400 ml/1 hr	NM	25 ml/overnight	5 ml/ 1 hr	23 ml/1 hr	100 ml/ 1 hr	not avail-broken
13	Niagara	NM	50 ml/1 hr	NM	500 ml/1 hr	1.75 lit/ 1 hr	600 ml/1 hr	<1ml/1 hr	<1ml/1 hr
14	Toto (disk only)***	NM	NM	NM	NM	NM	NM	NM	NM
15	Hoov-R-Line Rigid	0	650 ml/2 hrs	10 ml/ 2 hrs	entire contents/ 2 hrs	375 ml/ 1 hr	14 ml/1 hr	5 ml/ 1 hr	entire contents/ 5 min
16	Hoov-R-Line Clear	0	0	0	0	0	16 ml/1 hr	0	<1ml/1 hr

NOTE: Leak test data for tests at 50 ppm and 300 ppm may be found in Appendix F

*-Leak testing prior to immersion tests was not a part of the protocol during the tests with 2000 Flushes; "before test" leak testing was initiated with the Clorox testing

**-Mansfield Red flapper disk was not available for the tests with 2000 Flushes or for certain tests in Clorox

***-Toto disc as installed on its Ultra-Max® line of toilets; leak tests of this flapper were not performed due to unique installation requirements

NM – not measured

Table 3. Summary of Leak Test Results

	<i>Immersion for 28 days in 2,000 ppm solution of:</i>			
	<i>2000 Flushes[®]</i>		<i>Clorox[®]</i>	
	<i>Flapper Identification</i>	<i>Weight Gain</i>	<i>Flapper Identification</i>	<i>Weight Gain</i>
No Leak	3-Coast Ultra-Blue 4-LaVelle Korky Plus 7-Fluidmaster Bullseye 8-Fluidmaster Bullseye Super 11-Frugal Flush 1.6 16-Hoov-R-Line Clear	13.2% 16.5% 13.4% 11.5% 13.4% 7.6%	2-Mansfield Red 3-Coast Ultra-Blue 7-Fluidmaster Bullseye 8-Fluidmaster Bullseye Super	14.2% 8.5% 17.3% 11.6%
Minor Leak (<i><1ml/hour to 10ml/hour</i>)	9-Fluidmaster Bullseye Super Adjustable 12-Frugal Flush 3.5	10.6% 11.6%	9-Fluidmaster Bullseye Super Adjustable 10-American Standard 11-Frugal Flush 1.6 13-Niagara 16-Hoov-R-Line Clear	9.6% 18.9% 10.0% 9.8% 7.3%
Major Leak (<i>entire contents within 2 hours</i>)	1-Mansfield Black 5-LaVelle EX-703 6-LaVelle Korky 10-American Standard 13-Niagara 15-Hoov-R-Line Rigid	34.0% 33.4% 63.9% 34.4% 9.9% 10.3%	1-Mansfield Black 4-LaVelle Korky Plus 5-LaVelle EX-703 6-LaVelle Korky 15-Hoov-R-Line Rigid	42.5% 23.3% 58.9% 71.9% 39.6%
Leak rate not measured - information not available	2-Mansfield Red 14-Toto (disk only)	NM 44.6%	12-Frugal Flush 3.5 14-Toto (disk only)	6.6% 39.6%

NM-Weight gain not measured-flapper not available for this test

STUDY CONCLUSIONS

One of the recommendations resulting from the earlier series of flapper tests⁷ was that of testing "the newer materials used on flappers installed in 1998 products." This current series of tests, therefore, was designed to determine if improvements in flapper durability have been achieved by the manufacturers over the past five years. It was further intended that this study identify those specific products that can withstand the attack of in-tank chemical bowl cleaners as disclosed through application of the test protocol.

The results of the current testing cannot be directly compared with the results of the earlier tests⁸ and, as such, it can be stated only that there is a strong indication that significant materials improvements have occurred in the past five years. Using leak characteristics as a measure of durability, seven of the 16 flappers were leak-free after the 28-day 2000-ppm immersion test in Clorox[®] or 2000 Flushes[®] (refer to Table 3 on the previous page). At least three of those seven flappers withstood the tests with concentrated solutions of *both* products for that period. In addition to the seven leak-free flappers, five other flappers experienced only minor leaks after exposure to the chemicals. It is conceivable that further testing of other specimens of these same flapper products could prove that these flappers were also leak-free.

On the other end of the spectrum, at least four flappers exhibited major leaks after chemical exposure to *both* Clorox[®] and 2000 Flushes[®] while three others leaked after exposure to either of the two chemicals.

In conclusion, the majority of flappers tested performed satisfactorily after the severest exposure to bowl-cleaning chemicals, a marked improvement over the results obtained from the 1994-1995 tests. These results appear to demonstrate that the newer materials now being incorporated into flapper design are such that flapper failures due to in-tank bowl cleaners should be reduced once consumers replace their flappers with the newer products.

⁷ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

RECOMMENDATIONS

The improvements that have been incorporated into flapper materials compounding and design since 1994-1995 are noteworthy. Yet, further improvements are occurring as this report is published and, consequently, the findings contained herein will soon be out of date. The industry will likely develop and employ new materials compounds to make their flappers more durable and leak-free. It is also possible that new, more caustic bowl cleaning products will appear on store shelves as well, presenting new challenges to the plumbing industry. In view of this ever-changing conflict between flappers and the caustic chemicals attacking them, it is recommended that:

Toilet Design

1. Research and development continue and expand in the area of “flapperless” toilets. A few manufacturers are engaged in developing (and, in some cases, manufacturing) products with internal trim that does not rely upon traditional flush valves or elastomeric seals. These alternative designs have the potential to remove the traditional flapper as the “weak link” in toilet design and assure that the ultra-low-flush toilet remains water-efficient for its physical lifetime.
2. The plumbing industry, through the ASME/ANSI standards process, develop and adopt minimum standards and specifications for flush valves (original equipment and after-market) and other trim parts subject to degradation in various water environments. It is important that these be performance and durability standards and specifications *rather than* material specifications. Specifying the type of elastomer to be used in a valve would not necessarily ensure acceptable performance of that valve. Instead, the standards should focus on the performance and durability of the actual flapper product. (This recommendation originated with the prior materials study⁸ and is currently being considered within the ASME/ANSI standards process.)

Note: The Metropolitan Water District believes that durability standards are absolutely necessary and that the responsibility for all future testing against such standards rests with the manufacturers and the organizations authorized to certify compliance with standards. Consequently, it is likely that Metropolitan will no longer conduct durability tests in its own laboratories and will instead rely upon the industry to produce toilets and trim that successfully resist the attacks of in-tank bowl cleaners.

Bowl Cleaners

3. Literature be enclosed by the toilet manufacturers in new ULF toilet packaging, which describes the potential adverse effects of the use of halogenating bowl cleaners. This literature should (a) warn the customer about the consequences of the halogenating bowl

⁸ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

cleaners in their new toilet and (b) inform the customer of the need to flush the toilet at least once per day when using these products. Consideration should also be given to a program to inform all other homeowners of the consequences of using halogenating bowl cleaners in their toilets. (This recommendation originated with the prior materials study. The development and use of new packaging literature that informs the customer of these factors has been largely implemented by the manufacturers.)

4. Manufacturers explore toilet designs that would provide for storing the bowl cleaner in a separate compartment within (or adjacent to) the toilet that would introduce the bowl cleaner directly into the toilet bowl upon demand. Such a design could isolate the halogenating chemicals in the bowl cleaner from the elastomeric materials subject to degradation. (This recommendation originated with the prior materials study.)
5. A customer survey be conducted to determine how many households use in-tank bowl cleaners in order to: (a) estimate the number of real-world flapper valve failures; (b) estimate the water losses resulting from these failures; (c) determine the costs to customers for repair of the failing valves; and (d) design programs that will encourage customers to fix those leaking valves. (This recommendation originated with the prior materials study and has been partially implemented in Arizona. Additional studies are necessary, however, to define the problem if one exists.)

APPENDICES

APPENDIX A

Flapper Specimens Submitted for Testing

<i>Flapper No.</i>	<i>Manufacturer (1)</i>	<i>Flapper Identification</i>	<i>Part No. (2)</i>	<i>Universal Product Code-UPC (3)</i>	<i>Remarks</i>
1	Mansfield Plumbing Products, Inc.	Black (4)			Flapper (disc) is unique to Mansfield toilets; black disc is used in current OEM product.
2	Mansfield Plumbing Products, Inc.	Red (4)			Flapper (disc) is unique to Mansfield toilets; red disc is reported to be a prototype and is not currently used in OEM products.
3	Coast Foundry and Manufacturing Co.	Ultra Blue			
4	Lavelle Industries, Inc.	Korky Plus	2001x	0-49057-10149-0	
5	Lavelle Industries, Inc.	EX-703	EX-703		
6	Lavelle Industries, Inc.	Korky	54x	0-49057-10148-3	
7	Fluidmaster, Inc.	Bullseye	500	0-39961-00500-7	
8	Fluidmaster, Inc.	Bullseye Super	501	0-39961-00501-4	
9	Fluidmaster, Inc.	Bullseye Super Adjust-a-Flush	502	0-39961-00502-1	
10	American Standard, Inc.	none	6038.000B	0-33056-25626-8	Flapper is manufactured by American Standard for their OEM products.
11	Frugal Technologies	Frugal Flush 1.6		0-21449-97771-5 7-19894-00050-7	(made in Mexico) (made in USA) These were identical specimens and were treated as such during the testing.
12	Frugal Technologies	Frugal Flush 3.5		7-19894-00003-3	
13	Niagara Conservation Corp.	none	N3145		
14	Toto USA, Inc.	none			Flapper (disc) is unique to Toto Ultra-Max toilets and is used in their current OEM products.
15	Hoov-R-Line (Moen Incorporated)	Rigid (4)			
16	Hoov-R-Line (Moen Incorporated)	Clear (4)			

- Notes:
- (1) In some cases, the firm identified is the original equipment manufacturer (OEM) of the toilet and is not necessarily the direct manufacturer of the flapper.
 - (2) Part no. as assigned by the manufacturer on the product packaging; if no number is shown, then commercial flapper packaging was not available.
 - (3) Universal product code (UPC) as shown on the product packaging; if no UPC is shown, then commercial flapper packaging was not available.
 - (4) Identification shown has been assigned by MWD in the absence of an identification by the manufacturer.

TEST PROTOCOL
FORMED FLAPPER VALVE ACCELERATED TEST

1. Purpose

To test available toilet flapper valves in order to predict their useful life under adverse environmental conditions and rank those flapper valves according to their durability and longevity.

2. Scope

This project will test the physical and practical properties of currently available formed flapper valves in accelerated aging environments. Upon completion of testing, the various flapper valve participants will be ranked according to their ability to withstand drop-in bowl cleaners and other adverse environments encountered during their useful life.

3. Procedure

3.1 Leak Rate Test (to be performed prior to and at the end of the accelerated test)

3.1.1 Attach test specimen to valve seat in test apparatus. In this case, the apparatus consists of an 8-inch diameter clear PVC pipe attached to a flat piece of ¼-inch PVC flat stock and appropriately sealed. The valve seat is attached to the apparatus through the properly sized hole in the flat stock. The apparatus is then placed on top of a three-liter graduated beaker for the purpose of accurately monitoring and measuring any leaks.

3.1.2 Fill the test apparatus to the specified fill line. The fill line is to be set at 7-inches above the valve seat as this represents the lowest known water level in commercially available residential toilets.

3.1.3 Lift the specimen and “flush” the test apparatus. Fill and repeat 2 more times. This allows the specimen to be wetted and to find its “seat.”

3.1.4 Fill the test apparatus to the fill line to begin test. Prior to starting the test, wipe any water drops from bottom of the apparatus being careful not to disturb the seating of test specimen. Also dry any drops that may exist in the graduated beaker.

3.1.5 Start test. Test should run for a minimum of one hour.

3.1.6 At the conclusion of the test remove the test apparatus from the graduated beaker and inspect the beaker for any water that may have leaked from test apparatus. If the beaker is dry, report “No leaks”. If water is present, determine the volume from the graduations on the beaker. If the volume is too small to determine from

the large graduations on this size beaker, transfer the water to a smaller graduated beaker or cylinder for determination. Report the volume leaked as “xx ml/hr.” If the volume is still too small to determine report as “few drops.” If the test period was greater than one hour, either divide the water volume by the number of actual test hours to determine the rate per hour, or report the volume leaked as “xx ml/yy hrs.”

- 3.1.7 Repeat steps 3.1.1 – 3.1.6 at the conclusion of the “Accelerated Test.”
- 3.2 Accelerated Test
 - 3.2.1 Initially, stock solutions at two concentrations shall be made of the drop-in bowl cleaner to be tested. These concentrations shall be at 50 ppm and 300 ppm of total chlorine in a tap water solvent. Following the initial round of testing at these two concentrations, testing shall be repeated at other concentrations as determined during the course of testing. One of these concentrations shall be 2000 ppm.
 - 3.2.2 These stock solution(s) shall be analyzed initially upon preparation and at each solution change, at which time the concentration level shall be recorded. In the event that an analysis indicates that the concentration of the stock solution has changed by more than ten percent (10%) from that prepared in accordance with paragraph 3.2.1, the solution shall be discarded and a new stock solution prepared.
 - 3.2.3 The test specimen shall be inserted into a test vessel (jar or other suitable vessel) such that the sealing surface of the test specimen is not under physical stress. No more than one specimen per jar is allowed.
 - 3.2.4 The stock solution shall be added to the test vessel so as to completely cover the test specimen; fill the test vessel with the stock solution as completely as possible.
 - 3.2.5 The test vessel containing the stock solution and the test specimen shall then be placed in a mechanically convected oven or other device capable of maintaining the stated test temperature. Initially, this temperature shall be 40°C. Test results may warrant that tests at other temperatures be conducted.
 - 3.2.6 The solution in the test vessel shall be changed daily (as permitted) with fresh stock solution.
 - 3.2.7 The test specimen shall be removed from the test vessel according to the following schedule and examined for degradation:
 - (a) At 1,2 and 4 days following initial exposure of the test specimen to the solution.

(b) Subsequent inspections shall be carried out at appropriate intervals to establish a precise percent weight gain vs. exposure-time plot.

On those days as indicated above, the examinations shall take place at the same time as the solution is changed in the test vessel. The examination shall be conducted for each test specimen as described in section 3.3.

3.2.8 Steps 3.2.3 - 3.2.7 above shall be repeated for each specimen except that the stock solution shall be replaced by tap water and these specimens shall be viewed as the control specimens.

3.2.9 Duplicate samples shall be tested for each specimen, including the control specimens, to assist in verifying test accuracy.

3.3 Mechanical Properties Testing

3.3.1 Water Absorption (swelling)- A modified ASTM rubber swelling test (ASTM D 471) shall be used to determine water absorption. This test shall be used as a non-destructive means of assessing elastomer degradation.

3.3.1.1 If the test specimen is made of different materials, separate before exposure and determine all weights separately. Re-assemble for test.

3.3.1.2 Remove specimen and valve seat from test vessel. Remove the specimen from the valve seat. Shake as much fluid off as possible. Pat dry with a lint free towel.

3.3.1.3 Weigh the specimen(or parts) immediately. Record the weight.

3.3.1.4 Subtract the initial weight (which was taken before the test began) from the weight obtained in paragraph 3.3.1.3. Perform the following calculation to obtain the % weight gain:

$$\% \text{ Weight Gain} = \frac{\text{wet weight} - \text{initial weight}}{\text{initial weight}} \times 100\%$$

3.3.2 Surface Examination

3.3.2.1 The specimen shall be examined under a microscope at 30x magnification for surface cracking, blisters or other irregularities before the test begins. Specimen shall be extended for examination. All irregularities shall be noted.

3.3.2.2 The test specimen shall be examined under the microscope at the intervals indicated in paragraph 3.2.7. With the sealing surface dried as noted in paragraph 3.3.1.2 above, observe the specimen under the microscope. Extend specimen for examination. Note any new cracks, blisters or irregularities or the growth of existing ones. Describe irregularities and sizes.

3.3.3 Distortion

3.3.3.1 Before commencing tests, mount test specimen to valve seat.

3.3.3.2 With the flapper/seat combination in an upright position, visually examine the sealing surface of the valve seal. If the flapper protrudes from the valve seat, measure the protrusion and record the measurement.

3.3.3.3 At each of the indicated examination days as indicated in paragraph 3.2.7, repeat step 3.3.3.2 for each test specimen and record any changes.

3.4 Interpretation of Test Results

3.4.1 Exposure of each test specimen to the solution shall be continued until (a) the specimen reaches equilibrium percent weight gain or warpage or (b) surface property changes indicate that the specimen would fail to seal under typical toilet operating conditions.

3.4.2 At the conclusion of the tests, comparatively rank the specimen flappers as to durability in the testing solutions. In the absence of flapper failure, specimens will be ranked by percent weight gain and sealing surface degradation.



The Clorox Company
7200 Johnson Drive
Pleasanton, California 94588
Phone: 510-847-6100

Material Safety Data Sheet

I Product: CLOROX AUTOMATIC TOILET BOWL CLEANER													
Description: WHITE TABLET WITH CHLORINE ODOR													
Other Designations	Manufacturer												
	The Clorox Company 1221 Broadway Oakland, CA 94612												
Emergency Telephone Nos.													
For Medical Emergencies, call Rocky Mountain Poison Center: 1-800-446-1014 For Transportation Emergencies, call Chemtrec: 1-800-424-9300													
II Health Hazard Data	III Hazardous Ingredients												
<p>Direct contact with eyes may cause irreversible damage. Harmful if swallowed. Direct contact with mucous membranes may cause severe irritation or irreversible damage. Severe skin irritant. Prolonged contact with skin may cause irreversible damage.</p> <p>No medical conditions are known to be aggravated by exposure to this product.</p> <p>FIRST AID:</p> <p>EYE CONTACT: Flush eyes immediately with water for at least 15 minutes; then call a physician.</p> <p>INGESTION: Rinse mouth, and drink a glassful of water. Do not induce vomiting. Call a physician.</p> <p>SKIN CONTACT: Wash skin immediately with water for 15 minutes; then call a physician.</p> <p>INHALATION: Remove to fresh air. If irritation or breathing problems persist, call a physician.</p>	<table border="1"> <thead> <tr> <th>Ingredient</th> <th>Concentration</th> <th>Worker Exposure Limit</th> </tr> </thead> <tbody> <tr> <td>Bromochloro-5,5-dimethylhydantoin CAS # 126-06-7</td> <td>50 - 70%</td> <td>Not established.</td> </tr> <tr> <td>1,3-Dichloro-5,5-dimethylhydantoin CAS # 118-52-5</td> <td>20 - 40%</td> <td>0.2 mg/m³ - TLV-TWA* 0.4 mg/m³ - TLV-STEL^b</td> </tr> <tr> <td>1,3-Dichloro-5-ethyl-5-methylhydantoin CAS # 89415-87-2</td> <td>5 - 20%</td> <td>Not established.</td> </tr> </tbody> </table> <p>*TLV-TWA = ACGIH Threshold Limit Value - Time Weighted Average. ^bTLV-STEL = ACGIH Threshold Limit Value - Short-Term Exposure Limit.</p> <p>None of the materials in this product are on the IARC, OSHA, or NTP carcinogen lists.</p>	Ingredient	Concentration	Worker Exposure Limit	Bromochloro-5,5-dimethylhydantoin CAS # 126-06-7	50 - 70%	Not established.	1,3-Dichloro-5,5-dimethylhydantoin CAS # 118-52-5	20 - 40%	0.2 mg/m ³ - TLV-TWA* 0.4 mg/m ³ - TLV-STEL ^b	1,3-Dichloro-5-ethyl-5-methylhydantoin CAS # 89415-87-2	5 - 20%	Not established.
Ingredient	Concentration	Worker Exposure Limit											
Bromochloro-5,5-dimethylhydantoin CAS # 126-06-7	50 - 70%	Not established.											
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1,3-Dichloro-5-ethyl-5-methylhydantoin CAS # 89415-87-2	5 - 20%	Not established.											
IV Special Protection and Precautions	V Transportation and Regulatory Data												
<p>Hygienic Practices: Wash hands after direct contact. Do not wear product-contaminated clothing for prolonged periods.</p> <p>Engineering Controls: Not normally required if product is used as directed. However, if handling of product produces dust, local exhaust may be necessary.</p> <p>Personal Protective Equipment: Wear safety glasses or goggles and rubber gloves. Respiratory equipment is not normally required if product is used as directed. However, if handling of product produces dust, respiratory equipment may be necessary.</p>	<p>DOT Proper Shipping Name: Consumer Commodity ORM-D.</p> <p>IMO Proper Shipping Name: Dangerous goods in limited quantities of Class 5.1.</p> <p>IATA Proper Shipping Name: Oxidizing solid, n.o.s., Class 5.1, Packing Group II.</p> <p>EPA - SARA Title II/CERCLA: This product is a hazardous chemical reportable under Sections 311/312; contains no chemicals regulated under Section 313; and contains no chemicals which are regulated under Section 304/CERCLA.</p>												
VI Spill Procedures/Waste Disposal	VII Reactivity Data												
<p>Spill Procedures: Wear appropriate protective gear and respiratory protection. Sweep up material and place in a compatible container for disposal. Since material is toxic to fish, do not discharge into lakes, streams, ponds or public water unless in accordance with NPDES permit.</p> <p>Waste Disposal: Dispose of in accordance with all applicable federal, state, and local regulations.</p>	<p>Reacts with other household chemicals such as acid toilet bowl cleaners, rust removers, acids, vinegar, and ammonia-containing products to produce hazardous gases, such as chlorine/bromine and other chlorinated/brominated compounds. Avoid contact with strong alkalis.</p> <p>Material is an oxidizer. Avoid contact with readily-oxidizable materials.</p> <p>Stable under normal use and storage conditions.</p>												
VIII Fire and Explosion Data	IX Physical Data												
<p>Not flammable or explosive. Decomposes at 165°C. Do not use ABC-type fire extinguishers with fires involving this product.</p>													



BLOCK DRUG COMPANY, INC.

257 Cornelison Avenue Jersey City, N.J. 07302-9988
Telephone (201) 434-3000

MSDS012A

MATERIAL SAFETY DATA SHEET

24 HOUR EMERGENCY CHEMTREC TELEPHONE # (800) 424-9300

DATE PREPARED: August 16, 1991

I. GENERAL INFORMATION

PRODUCT NAME: 2000 Flushes Automatic Bowl Cleaner

PRODUCT CATEGORY: Toilet Bowl Cleaner

II. INGREDIENTS

HAZARDOUS INGREDIENTS:	%	CAS #	TLV	HAZARD DATA:
Calcium Hypochlorite	21-24	7778-54-3	None established	Oxidizer/Corrosive
Calcium Chlorate	0-1.6	10137-74-3	None established	Toxic/Potential Explosive
Calcium Chloride	0-1.6	10043-52-4	None established	Irritant
Calcium Hydroxide	0-1.3	1305-62-0	5mg/m ³	Corrosive
Calcium Carbonate	0-1.3	471-34-1	10mg/m ³	Irritant

III. HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE:

INHALATION: Irritating to the nose, mouth, throat, and lungs. May cause respiratory tract irritation with shortness of breath, wheezing, choking or chest pain. Asthma and respiratory and cardiovascular diseases may be aggravated by exposure.

EYES: Can cause severe irritation and/or burns. Direct contact may cause impairment of vision and corneal damage.

SKIN: Can cause severe irritation and/or burns.

INGESTION: Irritation and/or burns due to hypochlorite can occur to the entire gastrointestinal tract, characterized by nausea, vomiting, diarrhea, abdominal pain, bleeding, and/or ulceration. The inert base (marble chips), if ingested by small children, could cause choking by airway obstruction.

This compound is not known or reported to be carcinogenic by IARC, OSHA, NTP or EPA.

FIRST AID PROCEDURE:

EYES: Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Call a physician at once.

SKIN: Immediately flush with water for at least 15 minutes. Call a physician. If clothing comes in contact with the product, it should be removed immediately and laundered before reuse.

INGESTION: Immediately drink large quantities of water. Do not induce vomiting. Call a physician at once. Give nothing by mouth if unconscious or having convulsions.

INHALATION: Remove victim to fresh air. Support respiration if needed. Call a physician.

IV. SPECIAL PROTECTION INFORMATION

EYE PROTECTION: Avoid eye contact.

SKIN PROTECTION: Wear protective neoprene or PVC gloves when handling dry container contents.

RESPIRATORY PROTECTION: Avoid breathing dust.

VENTILATION: Use adequate ventilation.

V. FIRE & EXPLOSION HAZARD DATA

FLAMMABLE LIMITS: Non-flammable.

EXTINGUISHING MEDIA: Not applicable.

SPECIAL FIRE FIGHTING PROCEDURES: Use water to cool containers exposed to fire. Do not use dry extinguishers containing ammonium compounds.

UNUSUAL FIRE & EXPLOSION HAZARDS: Wear self-contained breathing apparatus (SCBA), as well as standard fire protective clothing.

VI. ENVIRONMENTAL PROTECTION PROCEDURES

SPILL RESPONSE: Neutralize before disposal. Contact CHEMTREC or manufacturer at 1-800-OLIN-911.

WASTE DISPOSAL METHOD: If this product becomes a waste, it is defined as a hazardous waste under 40 CFR 261 and has the following EPA hazardous waste number: D001.

As a hazardous solid waste, must be disposed of in accordance with local, state, and federal regulations in a permitted hazardous waste treatment, storage and disposal facility.

VII. SPECIAL PRECAUTIONS

HANDLING/STORAGE/TRANSPORTATION: Keep tightly sealed, store in a cool, dry well-ventilated area. Do not store above 52°C (125°F).

VIII. REACTIVITY DATA

STABILITY: Avoid high temperature and humidity.

INCOMPATIBILITY: Acids, other oxidizers, organic materials, nitrogen containing compounds and all corrosive liquids, flammables or combustible materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Chlorine gas

IX. PHYSICAL DATA

BOILING POINT (°F): Not applicable.

SPECIFIC GRAVITY (H₂O=1): Not applicable.

VAPOR PRESSURE (mm Hg): Not applicable.

% VOLATILE BY VOLUME: Not applicable.

VAPOR DENSITY (AIR = 1): Not applicable.

pH: @ 25°C=10.5-11.5 (1% solution)

SOLUBILITY IN WATER: (Granules only) 10% @25°with white residue. Decomposition temperature 177°C (350°F).

APPEARANCE & ODOR: White granules in inert marble chip base; chlorine odor.

The information provided in this Material Safety Data sheet has been compiled from our experience and data with similar, commercially available materials and is believed to be accurate. No guarantee of accuracy is made. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions and disposal procedures.

MSDS012A

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

INITIAL DATA

SAMPLE FOR 50 PPM CONCENTRATION

MANUFACTURER	INITIAL WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.456	NONE	SMOOTH; GRAININESS; DIE MARKS
3-COAST ULTRA BLUE	26.978	NONE	SMOOTH; SCRATCHES; DIE MARKS; MULTIPLE SMALL DEPRESSIONS
4-LAVELLE KORKY PLUS	31.182	NONE	SMOOTH; DIRECTIONAL DIE MARKS; BUBBLES @ 1:00
5-LAVELLE EX-703	32.722	NONE	SMOOTH; "BEACH MARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.924	NONE	SMOOTH; "BEACH MARKS" ALL AROUND CENTER; DEFORMITY @ 10:00
7-FLUIDMASTER BULLSEYE	28.452	NONE	SMOOTH; RANDOM POCKS.
8-BULLSEYE SUPER	28.013	SLIGHT=1mm	SMOOTH; CIRCULAR DIE MARKS
9-BULLSEYE SUPER ADJUST.	26.679	NONE	SMOOTH; CIRCULAR DIE MARKS
10-AMERICAN STANDARD	34.766	NONE	SMOOTH; SCRATCHES & SMALL POCK MARKS
11-FRUGAL FLUSH 1.6	33.174	NONE	SMOOTH; MOLDING MARKS
12-FRUGAL FLUSH 3.5	36.118	SLIGHT=1mm	BUMPY; RANDOM POCK MARKS
13-NIAGARA	31.057	NONE	SURFACE HAS A FINELY BUMPY ROUGH TEXTURE, AS IN FINE SANDPAPER. COLOR CLEAR
14-TOTO	16.319	NONE	MANY SURFACE SCRATCHES & SMALL BUMPS ALL AROUND
15-HOOV-R-LINE RIGID	3.621	1/4" @ FRONT	FINELY TEXTURED SURFACE. COLOR WHITE
16-HOOV-R-LINE CLEAR	31.094	NONE	FINELY TEXTURED SURFACE. COLOR CLEAR

SAMPLE FOR 300 PPM CONCENTRATION

MANUFACTURER	INITIAL WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.502	NONE	SMOOTH; GRAININESS; DIE MARKS
3-COAST ULTRA BLUE	26.660	NONE	SMOOTH; SCRATCHES; DIE MARKS; MULTIPLE SMALL DEPRESSIONS; SMALL MOLDING BUBBLES @ 10:00
4-LAVELLE KORKY PLUS	30.696	NONE	SMOOTH; DIRECTIONAL DIE MARKS; BUBBLES @ 11:30
5-LAVELLE EX-703	32.887	NONE	SMOOTH; "BEACH MARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.881	NONE	SMOOTH; "BEACH MARKS" ALL AROUND CENTER; BUBBLES RANDOMLY AROUND CIRCLE
7-FLUIDMASTER BULLSEYE	27.181	NONE	SMOOTH; RANDOM POCKS; SURFACE SCRATCHES
8-BULLSEYE SUPER	28.077	SLIGHT=1mm	SMOOTH; CIRCULAR DIE MARKS
9-BULLSEYE SUPER ADJUST.	26.672	NONE	SMOOTH; CIRCULAR DIE MARKS
10-AMERICAN STANDARD	34.808	NONE	SMOOTH; SCRATCHES & SMALL POCK MARKS
11-FRUGAL FLUSH 1.6	33.136	NONE	SMOOTH; MOLDING MARKS
12-FRUGAL FLUSH 3.5	36.174	NONE	BUMPY; GRAINY; RANDOM POCK MARKS
13-NIAGARA	31.343	NONE	SURFACE HAS A FINELY BUMPY ROUGH TEXTURE, AS IN FINE SANDPAPER. COLOR CLEAR
14-TOTO	18.378	NONE	MANY SURFACE SCRATCHES AND BUMPS ALL AROUND. SCRATCHES ARE RIDGES- RAISED RATHER THAN DEPRESSED
15-HOOV-R-LINE RIGID	3.596	1/4" @ FRONT	FINELY TEXTURED SURFACE. COLOR WHITE
16-HOOV-R-LINE CLEAR	30.946	NONE	FINELY TEXTURED SURFACE. COLOR CLEAR

ACCELERATED FORMED FLAPPER TEST - 2000 FLUSHES

DAY 1

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.501	4.456	1.0%	NONE	UNCHANGED
3-COAST ULTRA BLUE	27.050	26.978	0.3%	NONE	UNCHANGED
4-LAVELLE KORKY PLUS	31.361	31.182	0.6%	NONE	FORMATIONS OF WHITE, POWDERY RESIDUE AROUND SURFACE.
5-LAVELLE EX-703	32.800	32.722	0.2%	NONE	UNCHANGED
6-LAVELLE KORKY	32.015	31.924	0.3%	NONE	"GREASE " SPOTS RANDOMLY ABOUT. SHINY. DO NOT COME OFF WHEN "PATTING".
7-FLUIDMASTER BULLSEYE	28.594	28.452	0.5%	NONE	MOTTLED APPEARANCE (BUT NOT RAISED OR BUMPY).
8-BULLSEYE SUPER	28.151	28.013	0.5%	NONE	MOTTLED APPEARANCE.(SLIGHTLY DEPRESSED). SAME AS ADJUSTABLE FLAPPER SEE PHOTO FOR THAT FLAPPER.
9-BULLSEYE SUPER ADJUST.	27.030	26.679	1.3%	NONE	MOTTLED APPEARANCE. (SLIGHTLY DEPRESSED). SEE PHOTO.
10-AMERICAN STANDARD	34.980	34.766	0.6%	NONE	SURFACE MOTTLED OR POKED AS ABOVE. SEE PHOTO FOR THAT FLAPPER.
11-FRUGAL FLUSH 1.6	33.530	33.174	1.1%	NONE	SURFACE POKED AS ABOVE. ALL POKES ARE CIRCULAR & EXHIBIT ORIGINAL COLOR VS. FADING.
12-FRUGAL FLUSH 3.5	36.534	36.118	1.2%	NONE	UNCHANGED
13-NIAGARA	31.28	31.057	0.7%	NONE	BLOTCHY DEPRESSIONS RANDOMLY ABOUT. COLOR IS A MILKY WHITE(W/ PURPLE TINT)
14-TOTO	16.413	16.319	0.6%	NONE	UNCHANGED
15-HOOV-R-LINE RIGID	3.655	3.621	0.9%	NONE	UNCHANGED
16-HOOV-R-LINE CLEAR	31.282	31.094	0.6%	NONE	NO SURFACE CHANGE. COLOR IS OPAQUE MILKY WHITE

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.512	4.502	0.2%	NONE	UNCHANGED EXCEPT AREA UNDER HOLDER IS DARK AND GLOSSY. ELSEWHERE IT IS LIGHTER AND DULL.
3-COAST ULTRA BLUE	26.796	26.660	0.5%	NONE	COLOR BLOTCHES. BUT W/O THE SURFACE DEPRESSION SEEN IN OTHER SAMPLES.
4-LAVELLE KORKY PLUS	30.971	30.696	0.9%	NONE	GENERAL DISCOLORATION. SLIGHT BLISTERING ESPECIALLY EVIDENT IN CONTRAST TO AREA SITTING ON VALVE SEAT.
5-LAVELLE EX-703	33.070	32.887	0.6%	NONE	FADED COLOR RATHER THAN "BLEACHED". OTHERWISE UNCHANGED.
6-LAVELLE KORKY	32.148	31.881	0.8%	NONE	SLIGHTLY FADED. OTHERWISE UNCHANGED.
7-FLUIDMASTER BULLSEYE	27.408	27.181	0.8%	NONE	POCK MARKS ALL AROUND OUTER EDGE. UNLIKE OTHER SAMPLES THESE APPEAR "RAISED".
8-BULLSEYE SUPER	28.307	28.077	0.8%	NONE	UNCHANGED
9-BULLSEYE SUPER ADJUST.	27.039	26.672	1.4%	NONE	UNCHANGED
10-AMERICAN STANDARD	35.133	34.808	0.9%	NONE	COLOR BLOTCHES BUT NO SURFACE CHANGE.
11-FRUGAL FLUSH 1.6	33.549	33.136	1.2%	NONE	UNCHANGED
12-FRUGAL FLUSH 3.5	36.655	36.174	1.3%	NONE	SLIGHT BLEACHING AROUND EDGES, OTHERWISE SURFACE UNCHANGED. HOWEVER, PERFORATED AREA WHERE PLASTIC CONE ATTACHES IS BEGINNING TO PUCKER
13-NIAGARA	31.519	31.343	0.6%	NONE	SURFACE UNCHANGED. COLOR TURNING A MILKY WHITE.
14-TOTO	19.020	18.378	3.5%	1/16" ON TABLE	SURFACE IS COVERED W/ TINY, SWOLLEN BUMPS. SHARP EDGES ARE PUCKERING.
15-HOOV-R-LINE RIGID	3.628	3.596	0.9%	1/8" ON TABLE	UNCHANGED
16-HOOV-R-LINE CLEAR	31.113	30.946	0.5%	NONE	NO SURFACE CHANGE. COLOR IS A VERY OPAQUE YELLOW.

ACCELERATED FORMED FLAPPER TEST - 2000 FLUSHES

DAY 2

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.518	4.456	1.4%	NONE	UNCHANGED
3-COAST ULTRA BLUE	27.099	26.978	0.4%	NONE	COLOR BLOTCHES=POCK MARKS. MINOR DEPRESSIONS OVER ENTIRE SURFACE.
4-LAVELLE KORKY PLUS	31.525	31.182	1.1%	SLIGHT =1mm	BLEACHING OF COLOR. SOME WHITE RESIDUE PATCHES STILL PRESENT.
5-LAVELLE EX-703	32.898	32.722	0.5%	NONE	FADED COLOR. SURFACE UNCHANGED.
6-LAVELLE KORKY	32.121	31.924	0.6%	NONE	"GREASE" SPOTS GONE. SURFACE APPEARS UNAFFECTED EXCEPT FOR "FLAT" SHEEN.
7-FLUIDMASTER BULLSEYE	28.643	28.452	0.7%	NONE	MOTTLED POCK MARKS ARE NOW DEPRESSIONS ALL AROUND SURFACE EXCEPT @ BLACK RING RUNNING ERRATICALLY AROUND CENTER ALL MARKS CIRCULAR
8-BULLSEYE SUPER	28.262	28.013	0.9%	NONE	MOTTLING CONTINUES. INCREASE IN NUMBER BUT NOT IN SIZE OR SEVERITY.
9-BULLSEYE SUPER ADJUST.	27.044	26.679	1.3%	NONE	MOTTLING STILL. NO WORSE.
10-AMERICAN STANDARD	35.035	34.766	0.8%	NONE	SURFACE STILL MOTTLED OR POKED. NO WORSE.
11-FRUGAL FLUSH 1.6	33.64	33.174	1.4%	NONE	SURFACE SAME AS DAY 1.
12-FRUGAL FLUSH 3.5	36.538	36.118	1.1%	NONE	UNCHANGED.
13-NIAGARA	31.440	31.057	1.2%	NONE	DEPRESSIONS CONTINUE
14-TOTO	16.578	16.319	1.6%	NONE	SURFACE IS BECOMING ROUGH WITH SWOLLEN LITTLE BUMPS
15-HOOV-R-LINE RIGID	3.692	3.621	1.9%	1/16" ON TABLE	UNCHANGED.
16-HOOV-R-LINE CLEAR	31.402	31.094	1.0%	NONE	SOME BLOTCHY DEPRESSIONS RANDOMLY ABOUT

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.551	4.502	1.1%	NONE	SAME AS DAY 1.
3-COAST ULTRA BLUE	26.891	26.660	0.9%	NONE	SAME AS DAY 1. COLOR A BIT MORE BLEACHED.
4-LAVELLE KORKY PLUS	31.139	30.696	1.4%	NONE	GENERAL DISCOLORATION. "STONE WASH" EFFECT. SURFACE DIFFERENCE AT VALVE SEAT AREA NO LONGER EVIDENT
5-LAVELLE EX-703	33.243	32.887	1.1%	NONE	COLOR IS PINK. SURFACE UNCHANGED.
6-LAVELLE KORKY	32.357	31.881	1.5%	NONE	SAME AS DAY 1.
7-FLUIDMASTER BULLSEYE	27.473	27.181	1.1%	NONE	NO EVIDENCE OF POCK MARKS.
8-BULLSEYE SUPER	28.412	28.077	1.2%	NONE	UNCHANGED.
9-BULLSEYE SUPER ADJUST.	27.087	26.672	1.5%	NONE	UNCHANGED.
10-AMERICAN STANDARD	35.311	34.808	1.4%	NONE	SAME AS DAY 1.
11-FRUGAL FLUSH 1.6	33.623	33.136	1.4%	NONE	UNCHANGED.
12-FRUGAL FLUSH 3.5	36.779	36.174	1.6%	NONE	SAME AS DAY 1 EXCEPT OTHER "SLITS" ARE BEGINNING TO TEAR & PUCKER.
13-NIAGARA	31.600	31.343	0.8%	NONE	SURFACE UNCHANGED. COLOR IS A GREY-WHITE
14-TOTO	19.670	18.378	6.6%	SLIGHT	SIMILAR TO DAY 1. CONDITIONS WORSENING.
15-HOOV-R-LINE RIGID	3.657	3.596	1.7%	1/8" ON TABLE	UNCHANGED.
16-HOOV-R-LINE CLEAR	31.207	30.946	0.8%	NONE	NO SURFACE CHANGE. BECOMING MORE YELLOW.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

DAY 4

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.547	4.456	2.0%	NONE	BEGINNING TO SEE SMALL PEAKS OR BUMPS VERY RANDOMLY DISTRIBUTED.
3-COAST ULTRA BLUE	27.167	26.978	0.7%	NONE	SAME AS DAY 2
4-LAVELLE KORKY PLUS	31.833	31.182	2.0%	NONE	WHITE PATCHES NO LONGER EVIDENT.
5-LAVELLE EX-703	33.062	32.722	1.0%	NONE	SAME AS DAY 2
6-LAVELLE KORKY	32.36	31.924	1.3%	NONE	SAME AS DAY 2.
7-FLUIDMASTER BULLSEYE	28.766	28.452	1.1%	NONE	POCK MARKS ARE DEFINITE DEPRESSIONS RANDOMLY ABOUT SURFACE. DO NOT APPEAR TO BE DEEP ENOUGH TO AFFECT SEALING ABILITY.
8-BULLSEYE SUPER	28.442	28.013	1.5%	NONE	SAME AS DAY 2.
9-BULLSEYE SUPER ADJUST.	27.155	26.679	1.8%	NONE	SAME AS DAY 2.
10-AMERICAN STANDARD	35.172	34.766	1.2%	NONE	SAME AS DAY 2.
11-FRUGAL FLUSH 1.6	33.824	33.174	1.9%	NONE	SAME AS DAY 1.
12-FRUGAL FLUSH 3.5	36.662	36.118	1.5%	NONE	PERFORATED "SLITS" WHERE PLASTIC DOME ATTACHES BEGINNING TO PUCKER.
13-NIAGARA	31.558	31.057	1.6%	NONE	SAME AS DAY 2
14-TOTO	16.776	16.319	2.7%	NONE	SAME AS DAY 2
15-HOOV-R-LINE RIGID	3.72	3.621	2.7%	SLIGHT	NO CHANGE
16-HOOV-R-LINE CLEAR	31.506	31.094	1.3%	NONE	SAME AS DAY 2

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.633	4.502	2.8%	NONE	SAME AS DAY 1.
3-COAST ULTRA BLUE	27.043	26.660	1.4%	NONE	SAME AS DAY 2.
4-LAVELLE KORKY PLUS	31.401	30.696	2.2%	NONE	SAME AS DAY 2.
5-LAVELLE EX-703	33.609	32.887	2.1%	NONE	SAME AS DAY 2.
6-LAVELLE KORKY	32.918	31.881	3.2%	NONE	SURFACE SOMEWHAT "STICKY". IT GRABS TOWEL BUT DOES NOT LEAVE OR RETAIN RESIDUE.
7-FLUIDMASTER BULLSEYE	27.625	27.181	1.6%	NONE	SURFACE HAS OILY SHINE AND FEEL. LARGE POCK MARKS, SLIGHTLY RAISED.
8-BULLSEYE SUPER	28.603	28.077	1.8%	NONE	UNCHANGED.
9-BULLSEYE SUPER ADJUST.	27.314	26.672	2.4%	NONE	UNCHANGED.
10-AMERICAN STANDARD	35.62	34.808	2.3%	NONE	SAME AS DAY 1.
11-FRUGAL FLUSH 1.6	33.842	33.136	2.1%	NONE	UNCHANGED.
12-FRUGAL FLUSH 3.5	37.118	36.174	2.5%	NONE	SAME AS DAY 2.
13-NIAGARA	31.741	31.343	1.3%	NONE	SAME AS DAY 2.
14-TOTO	20.711	18.378	11.3%	SLIGHT	SIMILAR TO DAY 1 BUT CONDITIONS WORSE
15-HOOV-R-LINE RIGID	3.698	3.596	2.8%	SLIGHT	NO CHANGE
16-HOOV-R-LINE CLEAR	31.347	30.946	1.3%	NONE	SAME AS DAY 2.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

DAY 8

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.589	4.456	2.9%	NONE	SAME AS DAY 4
3-COAST ULTRA BLUE	27.295	26.978	1.2%	NONE	SAME AS DAY 2
4-LAVELLE KORKY PLUS	32.150	31.182	3.0%	NONE	SOME BLEACHED "BLOTCHES. NO SURFACE DEPRESSION.
5-LAVELLE EX-703	33.416	32.722	2.1%	NONE	SAME AS DAY 2
6-LAVELLE KORKY	32.853	31.924	2.8%	NONE	SURFACE FEELS GRABBY BUT LOOKS UNAFFECTED TO THE NAKED EYE. HOWEVER, AT 30X MAG. YOU CAN SEE MANY TINY BLISTERS WHICH CAN BE POPPED TO EXUDE WATER
7-FLUIDMASTER BULLSEYE	29.000	28.452	1.9%	NONE	SAME AS DAY 4, EXCEPT COLOR MORE BLEACHED.
8-BULLSEYE SUPER	28.760	28.013	2.6%	NONE	SAME AS DAY 2
9-BULLSEYE SUPER ADJUST.	27.313	26.679	2.3%	NONE	SAME AS DAY 2
10-AMERICAN STANDARD	35.455	34.766	1.9%	NONE	POCK MARK DEPRESSIONS. SAME AS DAY 2.
11-FRUGAL FLUSH 1.6	34.044	33.174	2.6%	NONE	POCK MARK DEPRESSIONS. SAME AS DAY 1.
12-FRUGAL FLUSH 3.5	36.832	36.118	1.9%	NONE	PUCKERING CONTINUES.
13-NIAGARA	31.723	31.057	2.1%	NONE	SAME AS DAY 2
14-TOTO	17.023	16.319	4.1%	NONE	SIMILAR TO DAY 2. ROSETTES OF BUMPS FORMING.
15-HOOV-R-LINE RIGID	3.758	3.621	3.6%	1/8"	NO CHANGE
16-HOOV-R-LINE CLEAR	31.64	31.094	1.7%	NONE	SAME AS DAY 2. COLOR IS GREY-WHITE

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.772	4.502	5.7%	NONE WHEN MOUNTED ON PLATFORM	SURFACE UNCHANGED BUT DISC NOW HAS A DECIDED WARP TO IT (ON TABLE).
3-COAST ULTRA BLUE	27.366	26.660	2.6%	NONE	SURFACE UNCHANGED.
4-LAVELLE KORKY PLUS	31.616	30.696	2.9%	NONE	UNCHANGED FROM DAY 2.
5-LAVELLE EX-703	34.434	32.887	4.5%	NONE	COLOR HAS FADED TO A "BUBBLE GUM PINK". SURFACE UNCHANGED TO THE EYE BUT FEELS "GRABBY" (NOT EXACTLY STICKY BUT "GRABBY").
6-LAVELLE KORKY	34.169	31.881	6.7%	NONE	SURFACE STILL GRABBY BUT LOOKS UNAFFECTED TO NAKED EYE. HOWEVER, AT 30X MAG YOU CAN SEE MANY TINY BLISTERS WHICH CAN BE POPPED TO EXPOSE WATER
7-FLUIDMASTER BULLSEYE	27.785	27.181	2.2%	NONE	LARGE, RAISED POCK MARKS STILL PRESENT. SURFACE STILL HAS OILY SHINE & FEEL. YELLOW RESIDUE CAME OFF ON TOWEL.
8-BULLSEYE SUPER	28.813	28.077	2.6%	NONE	SURFACE SPOTTED WITH TINY "BUMPS".
9-BULLSEYE SUPER ADJUST.	27.482	26.672	2.9%	NONE	UNCHANGED
10-AMERICAN STANDARD	36.336	34.808	4.2%	NONE	BLOTCHES SLIGHTLY RAISED.
11-FRUGAL FLUSH 1.6	34.176	33.136	3.0%	NONE	UNCHANGED
12-FRUGAL FLUSH 3.5	37.531	36.174	3.6%	NONE	SLITS & PUCKERING CONTINUES
13-NIAGARA	31.857	31.343	1.6%	NONE	SAME AS DAY 2
14-TOTO	21.927	18.378	16.2%	SLIGHT	SIMILAR TO DAY 1. BUT CONDITIONS WORSEN.
15-HOOV-R-LINE RIGID	3.748	3.596	4.1%	1/8"	NO CHANGE
16-HOOV-R-LINE CLEAR	31.452	30.946	1.6%	NONE	SAME AS DAY 2

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

DAY 14

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.670	4.456	4.8%	^{1/16"} ON PLATFORM, ^{1/4"} ON TABLE	BUMPS STILL PRESENT
3-COAST ULTRA BLUE	27.440	26.978	1.7%	NONE	POCK MARKS REMAIN. DO NOT APPEAR BIGGER OR DEEPER
4-LAVELLE KORKY PLUS	32.466	31.182	4.1%	NONE	SAME AS DAY 8
5-LAVELLE EX-703	33.938	32.722	3.7%	NONE	UNCHANGED FROM DAY 2
6-LAVELLE KORKY	33.479	31.924	4.9%	NONE	SAME AS DAY 8
7-FLUIDMASTER BULLSEYE	29.259	28.452	2.8%	NONE	SAME AS DAY 8
8-BULLSEYE SUPER	29.002	28.013	3.5%	NONE	SAME AS DAY 2
9-BULLSEYE SUPER ADJUST.	27.582	26.679	3.4%	NONE	SAME AS DAY 2
10-AMERICAN STANDARD	35.808	34.766	3.0%	NONE	POCK MARKS PERSIST
11-FRUGAL FLUSH 1.6	34.338	33.174	3.5%	NONE	UNCHANGED FROM DAY 1
12-FRUGAL FLUSH 3.5	36.990	36.118	2.4%	NONE	PUCKERING HAS NOT INCREASED
13-NIAGARA	31.961	31.057	2.9%	NONE	SAME AS DAY 2
14-TOTO	17.516	16.319	7.3%	SLIGHT	SIMILAR TO DAY 7. BUMPS WORSEN
15-HOOV-R-LINE RIGID	3.819	3.621	5.5%	SLIGHT	NO CHANGE
16-HOOV-R-LINE CLEAR	31.83	31.094	2.4%	NONE	SAME AS DAY 7

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.991	4.502	10.9%	^{1/8"} ON PLATFORM, ^{1/2"} ON TABLE	EDGE NOW HAS CURL
3-COAST ULTRA BLUE	27.741	26.660	4.1%	NONE	SURFACE A BIT MORE BLEACHED. OTHERWISE UNCHANGED.
4-LAVELLE KORKY PLUS	31.972	30.696	4.2%	NONE	SURFACE IS MOSTLY YELLOW. OTHERWISE SAME AS DAY 2
5-LAVELLE EX-703	35.716	32.887	8.6%	NONE	SAME AS DAY 8
6-LAVELLE KORKY	36.002	31.881	12.9%	NONE	SAME AS DAY 8 PLUS EDGE OF SURFACE IS PUCKERING
7-FLUIDMASTER BULLSEYE	28.045	27.181	3.2%	NONE	SURFACE EXUDING YELLOW, OILY FILM. THIS FILM CAN BE SCRAPED WITH A KNIFE
8-BULLSEYE SUPER	29.094	28.077	3.6%	NONE	SAME AS DAY 8
9-BULLSEYE SUPER ADJUST.	27.709	26.672	3.9%	NONE	SURFACE OILY AND SHINY
10-AMERICAN STANDARD	37.218	34.808	6.9%	NONE	SMALL BUMPS PRESENT WHICH WHEN SQUEEZED OOZE WATER
11-FRUGAL FLUSH 1.6	34.689	33.136	4.7%	NONE	SURFACE IS SLIGHTLY OILY. OTHERWISE UNCHANGED.
12-FRUGAL FLUSH 3.5	38.113	36.174	5.4%	NONE	SLITS & PUCKERING CONTINUE. BLEACHED COLOR AT EDGES & RIDGES.
13-NIAGARA	32.177	31.343	2.7%	NONE	SIMILAR TO DAY 2
14-TOTO	24.682	18.378	34.3%	^{1/8"} TABLE ^{1/4"} PLATFORM	SIMILAR TO DAY 1. MATERIAL IS CRUMBLING OFF OF EDGES
15-HOOV-R-LINE RIGID	3.845	3.596	6.9%	1/16" TABLE	NO CHANGE EXCEPT YELLOWING AROUND EDGES
16-HOOV-R-LINE CLEAR	31.704	30.946	2.4%	NONE	SAME AS DAY 2

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

DAY 28

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.875	4.456	9.4%	<small>3/8" ON PLATFORM, 3/4" ON TABLE</small>	EDGE CURL. DISTORTION. SURFACE VERY BUMPY. WATER CAN BE SQUEEZED FROM BUMPS.
3-COAST ULTRA BLUE	27.816	26.978	3.1%	NONE	SAME AS DAY 14
4-LAVELLE KORKY PLUS	32.897	31.182	5.5%	NONE	SAME AS DAY 14
5-LAVELLE EX-703	34.965	32.722	6.9%	NONE	SURFACE SMOOTH."BUBBLE GUM PINK" COLOR. SURFACE "GRABBY"-NOT STICKY. NO RESIDUE.
6-LAVELLE KORKY	34.719	31.924	8.8%	NONE	SURFACE BUMPY. SURFACE IS "GRABBY"-NOT STICKY. NO RESIDUE.
7-FLUIDMASTER BULLSEYE	29.715	28.452	4.4%	NONE	SAME AS DAY 14
8-BULLSEYE SUPER	29.426	28.013	5.0%	NONE	RELATIVELY UNCHANGED FROM DAY 2
9-BULLSEYE SUPER ADJUST.	27.810	26.679	4.2%	NONE	SAME AS DAY 14
10-AMERICAN STANDARD	36.452	34.766	4.8%	NONE	POCK MARKS PERSIST
11-FRUGAL FLUSH 1.6	34.826	33.174	5.0%	NONE	POCK MARKS PERSIST
12-FRUGAL FLUSH 3.5	37.227	36.118	3.1%	NONE	BASICALLY UNAFFECTED. MINOR PUCKERING.
13-NIAGARA	32.326	31.057	4.1%	NONE	DEPRESSIONS ARE STILL FOUND RANDOMLY ABOUT SURFACE
14-TOTO	18.247	16.319	11.8%	SLIGHT	SURFACE IS COVERED WITH SWOLLEN BUMPS
15-HOOV-R-LINE RIGID	3.888	3.621	7.4%	<small>1/16" TABLE AND PLATFORM</small>	SURFACE HAS MANY TINY BUMPS RANDOMLY ABOUT
16-HOOV-R-LINE CLEAR	32.007	31.094	2.9%	NONE	MOTTLED APPEARANCE. TINY DEPRESSIONS ACROSS SURFACE.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	5.410	4.502	20.2%	<small>1/2" ON PLATFORM, 3/4" ON TABLE</small>	EDGE CURLING SIGNIFICANTLY.SERIOUS DISTORTION FROM FLAT.
3-COAST ULTRA BLUE	28.486	26.660	6.8%	NONE	SAME AS DAY 14
4-LAVELLE KORKY PLUS	32.741	30.696	6.7%	NONE	SAME AS DAY 14
5-LAVELLE EX-703	38.395	32.887	16.7%	NONE	SAME AS DAY 8 WITH THE ADDITION OF THE "CONE HOLE" BEING PUCKERED.
6-LAVELLE KORKY	39.922	31.881	25.2%	NONE	SAME AS DAY 14. ALSO VERY SOFT.
7-FLUIDMASTER BULLSEYE	28.766	27.181	5.8%	NONE	SAME AS DAY 14
8-BULLSEYE SUPER	29.842	28.077	6.3%	NONE	SURFACE SMOOTH. OILY TEXTURE.
9-BULLSEYE SUPER ADJUST.	28.382	26.672	6.4%	NONE	SURFACE HAS CHALKY, OILY FILM.
10-AMERICAN STANDARD	39.123	34.808	12.4%	NONE	SAME AS DAY 14
11-FRUGAL FLUSH 1.6	35.638	33.136	7.6%	NONE	SURFACE UNCHANGED EXCEPT FOR WHITE GRANULAR "SALTS" ON SURFACE.
12-FRUGAL FLUSH 3.5	39.333	36.174	8.7%	NONE	SLITS & PUCKERING CONTINUE. SURFACE SMOOTH W/ CHALKY FEEL- BUT NO RESIDUE
13-NIAGARA	32.690	31.343	4.3%	NONE	SIMILAR TO DAY 2. COLOR IS CREAMY WHITE.
14-TOTO	29.511	18.378	60.6%	1/4 - 1/2"	SURFACE SWOLLEN. EDGES CRUMBLING. ENTIRE UNIT WARPED.
15-HOOV-R-LINE RIGID	3.975	3.596	10.5%	<small>1/8" TABLE AND PLATFORM</small>	SURFACE RIDGES APPEAR PUFFY. COLOR UNCHANGED.
16-HOOV-R-LINE CLEAR	32.127	30.946	3.8%	NONE	SIMILAR TO DAY 2. COLOR IS LIGHT, CREAMY, YELLOW.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

INITIAL DATA
SAMPLE FOR TAP WATER

MANUFACTURER	INITIAL WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.386	NONE	SMOOTH; GRAININESS; DIE MARKS VISIBLE
3-COAST ULTRA BLUE	26.938	NONE	SMOOTH; SCRATCHES; DIE MARKS; OCCASIONAL OCCLUSION. DARK SPOT @ 8:00.
4-LAVELLE KORKY PLUS	29.982	SLIGHT BEND @ HINGES	SMOOTH. DIE MARK RUNNING PERPENDICULAR ACROSS SURFACE. OCCASIONAL TINY YELLOW SPOT
5-LAVELLE EX-703	32.542	SLIGHT BEND @ HINGES	SMOOTH; "BEACH MARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.763	SLIGHT BEND @ HINGES	SOME SCRATCHES. "MARKS" ALL AROUND CENTER HAVE SLIGHT BUMPINESS.
7-FLUIDMASTER BULLSEYE	26.823	NONE	SMOOTH. CONCENTRIC, CIRCULAR DIE MARKS. OCCASIONAL OCCLUSION.
8-BULLSEYE SUPER	27.870	NONE	SEVERAL SMALL OCCLUSIONS WITHIN A "SHINY" SPOT @ 5:00.
9-BULLSEYE SUPER ADJUST.	26.702	NONE	CIRCULAR, UNIFORM, SHARP DIE MARKS.
10-AMERICAN STANDARD	34.729	NONE	SURFACE SCRATCHES. SMALL DEPRESSIONS. VOIDS OR POCK MARKS ALL AROUND.
11-FRUGAL FLUSH 1.6	33.348	NONE	SMOOTH; SURFACE MARKS AND SCRATCHES.
12-FRUGAL FLUSH 3.5	36.094	NONE	FLAT, TINY BUMPS ALL AROUND
13-NIAGARA	33.228	NONE	SLIGHTLY ROUGH, AS FINE SANDPAPER.
14-TOTO	16.581	NONE	SCRATCHES & DIE MARKS.
15-HOOV-R-LINE RIGID	3.572	1/4" @ FRONT	FINELY TEXTURED SURFACE. COLOR WHITE.
16-HOOV-R-LINE CLEAR	30.918	NONE	FINELY TEXTURED SURFACE. COLOR TRANSLUCENT.

SAMPLE FOR 2000 PPM CONCENTRATION

MANUFACTURER	INITIAL WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.378	NONE	SMOOTH; GRAININESS; DIE MARKS VISIBLE
3-COAST ULTRA BLUE	26.681	NONE	SMOOTH; SCRATCHES; DIE MARKS; OCCASIONAL OCCLUSION. DARK SPOT @ 8:00.
4-LAVELLE KORKY PLUS	29.872	SLIGHT BEND @ HINGES	SMOOTH. DIE MARK RUNNING PERPENDICULAR ACROSS SURFACE. OCCASIONAL TINY YELLOW SPOT
5-LAVELLE EX-703	32.411	SLIGHT BEND @ HINGES	SMOOTH; "BEACH MARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.830	NONE	SOME SCRATCHES. "MARKS" ALL AROUND CENTER HAVE SLIGHT BUMPINESS.
7-FLUIDMASTER BULLSEYE	27.250	NONE	SMOOTH. CONCENTRIC, CIRCULAR DIE MARKS. OCCASIONAL OCCLUSION.
8-BULLSEYE SUPER	27.669	NONE	SEVERAL SMALL OCCLUSIONS WITHIN A "SHINY" SPOT @ 1:00.
9-BULLSEYE SUPER ADJUST.	26.669	NONE	CIRCULAR, UNIFORM, SHARP DIE MARKS.
10-AMERICAN STANDARD	34.839	NONE	SURFACE SCRATCHES. SMALL DEPRESSIONS. VOIDS OR POCK MARKS ALL AROUND.
11-FRUGAL FLUSH 1.6	33.098	NONE	SMOOTH; SURFACE MARKS AND SCRATCHES.
12-FRUGAL FLUSH 3.5	35.988	NONE	FLAT, TINY BUMPS ALL AROUND
13-NIAGARA	33.373	NONE	SLIGHTLY ROUGH, AS FINE SANDPAPER. BROWN SPOT @ 6:00
14-TOTO	16.721	NONE	SCRATCHES & DIE MARKS.
15-HOOV-R-LINE RIGID	3.603	1/4" @ FRONT	FINELY TEXTURED SURFACE. COLOR WHITE.
16-HOOV-R-LINE CLEAR	30.659	NONE	FINELY TEXTURED SURFACE. COLOR TRANSLUCENT.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

**DAY 1
TAP WATER**

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.392	4.386	0.1%	NONE	UNCHANGED
3-COAST ULTRA BLUE	26.995	26.938	0.2%	NONE	UNCHANGED
4-LAVELLE KORKY PLUS	30.146	29.982	0.5%	NONE	UNCHANGED
5-LAVELLE EX-703	32.568	32.542	0.1%	NONE	UNCHANGED
6-LAVELLE KORKY	31.856	31.763	0.3%	BEND @ HINGES	UNCHANGED
7-FLUIDMASTER BULLSEYE	26.936	26.823	0.4%	NONE	UNCHANGED
8-BULLSEYE SUPER	28.006	27.870	0.5%	NONE	UNCHANGED
9-BULLSEYE SUPER ADJUST.	26.826	26.702	0.5%	NONE	UNCHANGED
10-AMERICAN STANDARD	34.874	34.729	0.4%	NONE	FLAT COLOR BLOTCHES ALL AROUND
11-FRUGAL FLUSH 1.6	33.588	33.348	0.7%	NONE	UNCHANGED
12-FRUGAL FLUSH 3.5	36.364	36.094	0.7%	NONE	UNCHANGED
13-NIAGARA	33.350	33.228	0.4%	NONE	BEGINNING TO TURN OPAQUE
14-TOTO	16.594	16.581	0.1%	NONE	COLOR BLOTCHES - 1 SIDE ONLY. SIDE W/O "6"
15-HOOV-R-LINE RIGID	3.575	3.572	0.1%	1/16" ON TABLE	NO CHANGE
16-HOOV-R-LINE CLEAR	31.020	30.918	0.3%	NONE	SURFACE UNCHANGED. COLOR TURNING TO A MILKY WHITE.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.491	4.378	2.6%	NONE	WHITE GRANULAR SPECKS ALL OVER SURFACE. OTHERWISE UNCHANGED.
3-COAST ULTRA BLUE	27.026	26.681	1.3%	NONE	SURFACE BLEACHED. COVERED W/ TINY BUMPS.
4-LAVELLE KORKY PLUS	30.512	29.872	2.1%	NONE	SURFACE BLEACHED OR "STONE-WASHED". OTHERWISE UNCHANGED.
5-LAVELLE EX-703	32.808	32.411	1.2%	BEND @ HINGES	SURFACE HAS FADED TO "BUBBLE GUM" PINK. SURFACE HAS RANDOM, TINY BLISTERS.
6-LAVELLE KORKY	32.532	31.830	2.2%	BEND @ HINGES	SURFACE FEELS SMOOTH BUT @ 30X MAG. THERE ARE MANY PUFFY BUMPS GIVING IT A ROUGH LOOK.
7-FLUIDMASTER BULLSEYE	27.612	27.250	1.3%	NONE	FEW, RANDOM, TINY BUMPS OR BLISTERS SPREAD AROUND.
8-BULLSEYE SUPER	28.045	27.669	1.4%	NONE	UNCHANGED (EXCEPT MARK IS NOT VISIBLE).
9-BULLSEYE SUPER ADJUST.	27.032	26.669	1.4%	NONE	TINY BLISTERS RANDOMLY SPREAD.
10-AMERICAN STANDARD	35.348	34.839	1.5%	NONE	COLOR BLOTCHES AROUND. APPEAR FLAT.
11-FRUGAL FLUSH 1.6	33.648	33.098	1.7%	NONE	TINY BUMPS RANDOMLY ABOUT.
12-FRUGAL FLUSH 3.5	36.781	35.988	2.2%	NONE	UNCHANGED EXCEPT FOR COLOR FADE.
13-NIAGARA	33.797	33.373	1.3%	NONE	COLOR HAS YELLOWED AND BECOME OPAQUE. OTHERWISE UNCHANGED.
14-TOTO	17.329	16.721	3.6%	NONE	SURFACE HAS MANY TINY DEPRESSIONS.
15-HOOV-R-LINE RIGID	3.646	3.603	1.2%	1/8" ON TABLE	NO APPARENT SURFACE CHANGE BUT COLOR IS BEGINNING TO YELLOW
16-HOOV-R-LINE CLEAR	31.000	30.659	1.1%	NONE	SURFACE UNCHANGED. COLOR IS A VERY OPAQUE YELLOW

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

APPENDIX D

DAY 2
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.399	4.386	0.3%	NONE	UNCHANGED
3-COAST ULTRA BLUE	27.003	26.938	0.2%	NONE	UNCHANGED
4-LAVELLE KORKY PLUS	30.287	29.982	1.0%	NONE	UNCHANGED
5-LAVELLE EX-703	32.571	32.542	0.1%	NONE	UNCHANGED
6-LAVELLE KORKY	31.963	31.763	0.6%	BEND @ HINGES	UNCHANGED
7-FLUIDMASTER BULLSEYE	26.956	26.823	0.5%	NONE	UNCHANGED
8-BULLSEYE SUPER	28.087	27.870	0.8%	NONE	UNCHANGED
9-BULLSEYE SUPER ADJUST.	26.876	26.702	0.7%	NONE	UNCHANGED
10-AMERICAN STANDARD	34.898	34.729	0.5%	NONE	SAME AS DAY 1
11-FRUGAL FLUSH 1.6	33.603	33.348	0.8%	NONE	UNCHANGED
12-FRUGAL FLUSH 3.5	36.484	36.094	1.1%	NONE	UNCHANGED
13-NIAGARA	33.411	33.228	0.6%	NONE	OPAQUENESS CONTINUES. BLOTCHES ALL AROUND SURFACE.
14-TOTO	16.599	16.581	0.1%	NONE	UNCHANGED
15-HOOV-R-LINE RIGID	3.588	3.572	0.4%	1/8" ON TABLE	UNCHANGED
16-HOOV-R-LINE CLEAR	31.045	30.918	0.4%	NONE	SURFACE UNCHANGED. VERY OPAQUE WHITE COLOR.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.592	4.378	4.9%	NONE	EDGES BEGINNING TO CURVE UP.
3-COAST ULTRA BLUE	27.356	26.681	2.5%	NONE	TINY BUMPS CONTINUE.
4-LAVELLE KORKY PLUS	31.028	29.872	3.9%	NONE	DIE MARKS APPEAR TO BE SWELLING. HAS NOT AFFECTED OVERALL SURFACE APPEARANCE.
5-LAVELLE EX-703	33.358	32.411	2.9%	BEND @ HINGES	SAME AS DAY 1
6-LAVELLE KORKY	33.498	31.830	5.2%	BEND @ HINGES	SAME AS DAY 1 EXCEPT EDGES ARE BECOMING "PUFFY".
7-FLUIDMASTER BULLSEYE	27.859	27.250	2.2%	NONE	SAME AS DAY 1
8-BULLSEYE SUPER	28.365	27.669	2.5%	NONE	SEVERAL TINY BUMPS ABOUT.
9-BULLSEYE SUPER ADJUST.	27.332	26.669	2.5%	NONE	UNCHANGED
10-AMERICAN STANDARD	36.095	34.839	3.6%	NONE	UNCHANGED
11-FRUGAL FLUSH 1.6	34.324	33.098	3.7%	NONE	SAME AS DAY 1
12-FRUGAL FLUSH 3.5	37.216	35.988	3.4%	NONE	COLOR CONTINUES TO FADE. OTHERWISE UNCHANGED.
13-NIAGARA	34.098	33.373	2.2%	NONE	YELLOW WORSENING. SURFACE IS LOSING PLIABILITY.
14-TOTO	18.113	16.721	8.3%	NONE	BOTH SIDES HAVE TINY BUMPS & DEPRESSIONS. EDGES ARE PUCKERING.
15-HOOV-R-LINE RIGID	3.677	3.603	2.1%	1/16" ON TABLE	UNCHANGED
16-HOOV-R-LINE CLEAR	31.176	30.659	1.7%	NONE	SURFACE UNCHANGED. COLOR CONTINUES TO YELLOW.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

APPENDIX D

DAY 4
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.400	4.386	0.3%	NONE	UNCHANGED
3-COAST ULTRA BLUE	27.015	26.938	0.3%	NONE	UNCHANGED
4-LAVELLE KORKY PLUS	30.343	29.982	1.2%	NONE	UNCHANGED
5-LAVELLE EX-703	32.565	32.542	0.1%	BEND @ HINGES	UNCHANGED
6-LAVELLE KORKY	32.031	31.763	0.8%	BEND @ HINGES	UNCHANGED
7-FLUIDMASTER BULLSEYE	26.999	26.823	0.7%	NONE	UNCHANGED
8-BULLSEYE SUPER	28.101	27.870	0.8%	NONE	UNCHANGED
9-BULLSEYE SUPER ADJUST.	26.947	26.702	0.9%	NONE	UNCHANGED
10-AMERICAN STANDARD	34.916	34.729	0.5%	NONE	SAME AS DAY 1
11-FRUGAL FLUSH 1.6	33.653	33.348	0.9%	NONE	SAME AS DAY 1
12-FRUGAL FLUSH 3.5	36.443	36.094	1.0%	NONE	SAME AS DAY 1
13-NIAGARA	33.449	33.228	0.7%	NONE	SIMILAR TO DAY 2 BUT BECOMING MORE OPAQUE.
14-TOTO	16.609	16.581	0.2%	NONE	SAME AS DAY 1
15-HOOV-R-LINE RIGID	3.596	3.572	0.7%	1/16" ON TABLE	UNCHANGED
16-HOOV-R-LINE CLEAR	31.089	30.918	0.6%	NONE	SAME AS DAY 2

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.654	4.378	6.3%	NONE ON TABLE	EDGE CURL CONTINUES.
3-COAST ULTRA BLUE	27.566	26.681	3.3%	NONE	TINY BUMPS CONTINUE BUT SOME ARE BECOMING LARGER.
4-LAVELLE KORKY PLUS	31.360	29.872	5.0%	BEND @ HINGES	DIE MARKS ARE ALMOST NON-EXIST. DUE TO SWELLING BUT SURFACE STILL APPEARS SMOOTH & FLAT.
5-LAVELLE EX-703	33.675	32.411	3.9%	BEND @ HINGES	COLOR FADE CONTINUES OTHERWISE UNCHANGED.
6-LAVELLE KORKY	34.135	31.830	7.2%	BEND @ HINGES	SURFACE APPEARS SIMILAR TO DAY 1. BUT "PUFFINESS" IS INCREASING & SURFACE FEELS "GRABBY".
7-FLUIDMASTER BULLSEYE	28.038	27.250	2.9%	NONE	BEGINNING TO SEE "POCK MARK" DEPRESSIONS.
8-BULLSEYE SUPER	28.493	27.669	3.0%	NONE	SAME AS DAY 2.
9-BULLSEYE SUPER ADJUST.	27.495	26.669	3.1%	NONE	SAME AS DAY 1.
10-AMERICAN STANDARD	36.409	34.839	4.5%	NONE	SAME AS DAY 1.
11-FRUGAL FLUSH 1.6	34.552	33.098	4.4%	NONE	SAME AS DAY 1.
12-FRUGAL FLUSH 3.5	37.426	35.988	4.0%	NONE	SAME AS DAY 2.
13-NIAGARA	34.252	33.373	2.6%	NONE	SAME AS DAY 2.
14-TOTO	18.514	16.721	10.7%	NONE	SAME AS DAY 2.
15-HOOV-R-LINE RIGID	3.719	3.603	3.2%	1/16" ON TABLE	NO APPARENT CHANGE
16-HOOV-R-LINE CLEAR	31.393	30.659	2.4%	NONE	SAME AS DAY 2.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

APPENDIX D

Page 12 of 14

DAY 7
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.414	4.386	0.6%	NONE	BLOTCHES RANDOMLY ABOUT, LIKE MEASLES.
3-COAST ULTRA BLUE	27.050	26.938	0.4%	NONE	DARK BLOTCHES RANDOMLY ABOUT.
4-LAVELLE KORKY PLUS	30.576	29.982	2.0%	BEND @ HINGES	SAME AS DAY 1 EXCEPT FOR MINOR COLOR FADE.
5-LAVELLE EX-703	32.588	32.542	0.1%	BEND @ HINGES	UNCHANGED.
6-LAVELLE KORKY	32.219	31.763	1.4%	BEND @ HINGES	UNCHANGED.
7-FLUIDMASTER BULLSEYE	27.122	26.823	1.1%	NONE	UNCHANGED.
8-BULLSEYE SUPER	28.214	27.870	1.2%	NONE	APPEARS TO BE SOME SORT OF FILM ALL OVER SURFACE. NOT GREASY.
9-BULLSEYE SUPER ADJUST.	27.050	26.702	1.3%	NONE	SAME FILM ON SURFACE AS BULLSEYE SUPER.
10-AMERICAN STANDARD	35.076	34.729	1.0%	NONE	SAME AS DAY 1.
11-FRUGAL FLUSH 1.6	33.774	33.348	1.3%	NONE	SIMILAR TO DAY 1 BUT ALSO HAS A SURFACE FILM SIMILAR TO ONE FOUND ON BULLSEYE SUPER.
12-FRUGAL FLUSH 3.5	36.515	36.094	1.2%	NONE	SIMILAR TO DAY 1 BUT ALSO HAS A SURFACE FILM SIMILAR TO ONE FOUND ON BULLSEYE SUPER.
13-NIAGARA	33.523	33.228	0.9%	NONE	TOTALLY OPAQUE WHITE W/ PURPLISH TINT. ALSO BLOTCHES AROUND SURFACE.
14-TOTO	16.621	16.581	0.2%	NONE	SURFACE FILM. RUBS OFF.
15-HOOV-R-LINE RIGID	3.607	3.572	1.0%	SLIGHT	NO CHANGE
16-HOOV-R-LINE CLEAR	31.144	30.918	0.7%	NONE	SAME AS DAY 2

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.906	4.378	12.1%	1/8" ON PLATFORM 1/4" ON TABLE	EDGE CURL. SMALL BUMPS RANDOMLY ABOUT.
3-COAST ULTRA BLUE	28.210	26.681	5.7%	NONE	SAME AS DAY 4.
4-LAVELLE KORKY PLUS	31.993	29.872	7.1%	BEND @ HINGES	SAME AS DAY4 (EXCEPT TOTALLY YELLOW).
5-LAVELLE EX-703	35.587	32.411	9.8%	BEND @ HINGES	SAME AS DAY4.
6-LAVELLE KORKY	37.967	31.830	19.3%	SEVERE BEND @ HINGES	SIMILAR TO DAY 4 BUT SYMPTOMS HAVE GROWN WORSE.
7-FLUIDMASTER BULLSEYE	28.549	27.250	4.8%	NONE	EXUDING A YELLOW, OILY FILM ALL OVER. SOME SMALL, MINOR BUMPS.
8-BULLSEYE SUPER	28.989	27.669	4.8%	NONE	TINY BUMPS PERSIST. COLOR FADING SOMEWHAT.
9-BULLSEYE SUPER ADJUST.	27.916	26.669	4.7%	NONE	SAME AS DAY 1 (ALTHOUGH SOME COLOR FADE)
10-AMERICAN STANDARD	38.167	34.839	9.6%	NONE	VERY TINY BUMPS ALL AROUND SURFACE.
11-FRUGAL FLUSH 1.6	35.256	33.098	6.5%	NONE	SURFACE SIMILAR TO DAY 1. COLOR HAS FADED. CONE AND ADJUSTABLE PARTS ARE DISTORTED.
12-FRUGAL FLUSH 3.5	38.316	35.988	6.5%	NONE	SAME AS DAY 2.
13-NIAGARA	34.736	33.373	4.1%	NONE	PROGRESSION FROM DAY 2.
14-TOTO	19.930	16.721	19.2%	NONE	SYMPTOMS FROM DAY 2 ARE WORSENING.
15-HOOV-R-LINE RIGID	3.768	3.603	4.6%	SLIGHT	NO CHANGE
16-HOOV-R-LINE CLEAR	31.585	30.659	3.0%	NONE	SAME AS DAY 2.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

DAY 14
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.430	4.386	1.0%	NONE	SAME AS DAY 7. THE BLOTCHES SEEM TO BE IN SOME KIND OF SURFACE FILM.
3-COAST ULTRA BLUE	27.103	26.938	0.6%	NONE	BLOTCHES NO LONGER APPARENT.
4-LAVELLE KORKY PLUS	30.900	29.982	3.1%	NONE	SAME AS DAY 1 (EXCEPT MINOR COLOR FADE).
5-LAVELLE EX-703	32.632	32.542	0.3%	NONE	UNCHANGED
6-LAVELLE KORKY	32.443	31.763	2.1%	NONE	UNCHANGED
7-FLUIDMASTER BULLSEYE	27.296	26.823	1.8%	NONE	BLOTCHES ALL OVER SURFACE. LOOKS LIKE SURFACE FILM BUT DOES NOT RUB OFF.
8-BULLSEYE SUPER	28.396	27.870	1.9%	NONE	SAME AS DAY 7.
9-BULLSEYE SUPER ADJUST.	27.137	26.702	1.6%	NONE	SAME AS DAY 7.
10-AMERICAN STANDARD	35.226	34.729	1.4%	NONE	SAME AS DAY 1.
11-FRUGAL FLUSH 1.6	33.966	33.348	1.9%	NONE	SAME AS DAY 7.
12-FRUGAL FLUSH 3.5	36.646	36.094	1.5%	NONE	SAME AS DAY 7.
13-NIAGARA	33.724	33.228	1.5%	NONE	SAME AS DAY 7.
14-TOTO	16.638	16.581	0.3%	NONE	SAME AS DAY 7.
15-HOOV-R-LINE RIGID	3.646	3.572	2.1%	SLIGHT	NO CHANGE EXCEPT YELLOWING AROUND EDGES
16-HOOV-R-LINE CLEAR	31.255	30.918	1.1%	NONE	SAME AS DAY 2

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	5.245	4.378	19.8%	1/4" ON PLATFORM, 1/2" ON TABLE	SAME AS DAY 7.
3-COAST ULTRA BLUE	29.015	26.681	8.7%	NONE	COLOR FADING. OTHERWISE SAME AS DAY 4.
4-LAVELLE KORKY PLUS	33.169	29.872	11.0%	BEND @ HINGES	SAME AS DAY 7.
5-LAVELLE EX-703	38.298	32.411	18.2%	BEND @ HINGES	OVERALL SURFACE UNCHANGED. BUT COLOR HAS FADED TO LIGHT PINK & ALL SHARP, MOLDED EDGES ARE DISTORTED.
6-LAVELLE KORKY	42.893	31.830	34.8%	APPROX. 1/4"	SURFACE VERY BUMPY. EDGES DISTORTED.
7-FLUIDMASTER BULLSEYE	29.385	27.250	7.8%	NONE	OILY FILM IS NOW THICK & STICKY- GREASE LIKE. SURFACE APPEARS UNHARMED.
8-BULLSEYE SUPER	29.804	27.669	7.7%	NONE	SAME AS DAY 7.
9-BULLSEYE SUPER ADJUST.	28.598	26.669	7.2%	NONE	SAME AS DAY 1.
10-AMERICAN STANDARD	41.080	34.839	17.9%	BEND @ HINGES	SAME AS DAY 7.
11-FRUGAL FLUSH 1.6	36.373	33.098	9.9%	NONE	SAME AS DAY 7.
12-FRUGAL FLUSH 3.5	39.171	35.988	8.8%	NONE	SAME AS DAY 2.
13-NIAGARA	35.549	33.373	6.5%	BEND @ HINGES	COLOR IS MORE WHITE THAN YELLOW. SURFACE IS STILL SLIGHTLY ROUGH.
14-TOTO	21.481	16.721	28.5%	NONE	SAME AS DAY 7.
15-HOOV-R-LINE RIGID	3.855	3.603	7.0%	SLIGHT	NO CHANGE
16-HOOV-R-LINE CLEAR	32.129	30.659	4.8%	NONE	SAME AS DAY 2. YELLOWING INCREASED.

ACCELERATED FORMED FLAPPER TEST WITH 2000 FLUSHES

DAY 28
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	4.445	4.386	1.3%	NONE	BLOTCHES GONE. VERY THIN FILM OF SOME TYPE ON SURFACE. NOT DETRIMENTAL.
3-COAST ULTRA BLUE	27.166	26.938	0.8%	NONE	SAME AS DAY 14. NO APPARENT DAMAGE.
4-LAVELLE KORKY PLUS	31.230	29.982	4.2%	NONE	SAME AS DAY 7.
5-LAVELLE EX-703	32.767	32.542	0.7%	NONE	UNCHANGED
6-LAVELLE KORKY	32.594	31.763	2.6%	NONE	UNCHANGED
7-FLUIDMASTER BULLSEYE	27.521	26.823	2.6%	NONE	SEVERAL SMALL BUMPS AROUND SURFACE. SURFACE APPEARS BLOTCHY. BLOTCHES LOOK ROUGH.
8-BULLSEYE SUPER	28.650	27.870	2.8%	NONE	FILM PERSISTS. BLOTCHES IN FILM. MANY TINY BUMPS ON SURFACE.
9-BULLSEYE SUPER ADJUST.	27.378	26.702	2.5%	NONE	FILM PERSISTS. BLOTCHES IN FILM. MANY TINY BUMPS ON SURFACE.
10-AMERICAN STANDARD	35.505	34.729	2.2%	NONE	BLOTCHES SEEM TO HAVE SOME HEIGHT NOW. VERY MINIMAL. WAXY FILM ON SURFACE.
11-FRUGAL FLUSH 1.6	34.219	33.348	2.6%	NONE	SAME AS DAY 7.
12-FRUGAL FLUSH 3.5	36.716	36.094	1.7%	NONE	SAME AS DAY 7.
13-NIAGARA	33.988	33.228	2.3%	NONE	SAME AS DAY 7.
14-TOTO	16.708	16.581	0.8%	NONE	SAME AS DAY 7.
15-HOOV-R-LINE RIGID	3.73	3.572	4.4%	SLIGHT	NO CHANGE. YELLOWING AROUND EDGES
16-HOOV-R-LINE CLEAR	31.353	30.918	1.4%	NONE	SAME AS DAY 2.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK	5.867	4.378	34.0%	3/8" ON PLATFORM 3/4" ON TABLE	SEVERE EDGE CURL. SMALL BUMPS ON SURFACE.
3-COAST ULTRA BLUE	30.216	26.681	13.2%	NONE	SAME AS DAY 4 EXCEPT COLOR FADE.
4-LAVELLE KORKY PLUS	34.814	29.872	16.5%	BEND @ HINGES	SAME AS DAY 7.
5-LAVELLE EX-703	43.248	32.411	33.4%	BEND @ HINGES	SAME AS DAY 14.
6-LAVELLE KORKY	52.185	31.830	63.9%	1/2" WARP	VERY PUFFY & BUMPY. BUMPS EXUDE WATER WHEN PRICKED & SQUEEZED.
7-FLUIDMASTER BULLSEYE	30.894	27.250	13.4%	NONE	FILM NOT SO APPARENT. FEW SMALL BUMPS. OTHERWISE APPEARS GOOD COND.
8-BULLSEYE SUPER	30.858	27.669	11.5%	NONE	SAME AS DAY 7.
9-BULLSEYE SUPER ADJUST.	29.485	26.669	10.6%	NONE	SAME AS DAY 1 EXCEPT SLIGHT COLOR FADE.
10-AMERICAN STANDARD	46.810	34.839	34.4%	5/16" WARP	SURFACE COVERED WITH TINY BUMPS WHICH OOZE FLUID WHEN SCRAPPED.
11-FRUGAL FLUSH 1.6	37.549	33.098	13.4%	NONE	SAME AS DAY 7.
12-FRUGAL FLUSH 3.5	40.157	35.988	11.6%	NONE	SAME AS DAY 2.
13-NIAGARA	36.687	33.373	9.9%	BEND @ HINGES	SAME AS DAY 14.
14-TOTO	24.181	16.721	44.6%	1/10" PLATFORM & TABLE 1/8" TABLE	SYMPTOMS FROM DAY 2 HAVE WORSENERD. BUMPS EXUDE FLUID WHEN SCRAPPED.
15-HOOV-R-LINE RIGID	3.975	3.603	10.3%	1/16" PLATFORM	SOME PUFFINESS TO THE TEXTURE @ 30x. NO COLOR CHANGE.
16-HOOV-R-LINE CLEAR	32.993	30.659	7.6%	NONE	SURFACE HAS A FEW TINY BUMPS RANDOMLY ABOUT. COLOR IS A LIGHT, CREAMY YELLOW.

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

INITIAL DATA
SAMPLE FOR 50 PPM CONCENTRATION

MANUFACTURER	INITIAL DRY WT.(GRMS.)	INITIAL WET WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.474	4.474	NONE	SMOOTH, GRAININESS, LOOKS ALMOST "CRYSTALLINE"
3-COAST ULTRA BLUE	26.638	26.659	NONE	SMOOTH, SCRATCHES, DIE MARKS, OCCASIONAL OCCLUSION
4-LAVELLE KORKY PLUS	29.995	30.045	SLIGHT BEND @ HINGES	VERY RED. SMOOTH, DIE MARKS RUNNING PARALLEL ALL ACROSS FACE.
5-LAVELLE EX-703	32.553	32.569	SLIGHT BEND @ HINGES	VERY SMOOTH. "BEACH MARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.322	31.367	SLIGHT BEND @ HINGES	SLIGHT BUMPINESS OR ROUGHNESS TO SURFACE. SCRATCHES ALL ABOUT. "BEACH MARKS" ALL AROUND CENTER.
7-FLUIDMASTER BULLSEYE *	22.245	22.275	NONE	CONCENTRIC DIE MARKS. SCRATCHES ACROSS SURFACE. MANY TINY BUMPS ACROSS SURFACE.
8-BULLSEYE SUPER *	22.669	22.701	NONE	FINELY TEXTURED SURFACE AS IN FINE SANDPAPER. SMALL OCCLUSIONS RANDOMLY ABOUT.
9-BULLSEYE SUPER ADJUST*	19.199	19.217	NONE	CIRCULAR, UNIFORM, SHARP DIE MARKS. OCCASIONAL SCRATCH.
10-AMERICAN STANDARD	34.825	34.857	NONE	SURFACE SMOOTH WITH RANDOM SCRATCHES, TINY BUMPS AND "POCK MARKS" OR DEPRESSIONS.
11-FRUGAL FLUSH 1.6 *	29.233	29.271	NONE	SMOOTH, STRAIGHT DIE MARKS. SCRATCHES.
12-FRUGAL FLUSH 3.5	36.138	36.286	NONE	BUMPY, TEXTURED SURFACE.
13-NIAGARA *	31.049	31.068	NONE	CLEAR SURFACE. SLIGHTLY ROUGH AS IN FINE SANDPAPER.
14-TOTO *	16.740	16.751	NONE	SIDE W/MOLDED NUMBER HAS RANDOM BUMPS, SCRATCHES & DIE MARKS. OTHER SIDE SMOOTHER.
15-HOOV-R-LINE RIGID *	3.566	3.564	SLIGHT	FINELY TEXTURED SURFACE. WHITE COLOR.
16-HOOV-R-LINE CLEAR	31.181	31.196	NONE	TEXTURED SURFACE AS IN FINE SANDPAPER. CLEAR COLOR.

SAMPLE FOR 300 PPM CONCENTRATION

MANUFACTURER	INITIAL DRY WT.(GRMS.)	INITIAL WET WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.289	4.293	NONE	SMOOTH, GRAININESS. LOOKS ALMOST "CRYSTALLINE".
2-MANSFIELD RED*	4.929	4.939	NONE	SMOOTH, GRAININESS. LOOKS ALMOST "CRYSTALLINE".
3-COAST ULTRA BLUE	26.679	26.696	NONE	SMOOTH, SCRATCHES, DIE MARKS, OCCASIONAL OCCLUSION.
4-LAVELLE KORKY PLUS	30.167	30.213	SLIGHT BEND @ HINGES	DIE MARKS RUNNING PARALLEL ACROSS FACE. MANY TINY BUMPS CAUSING "GRAININESS".
5-LAVELLE EX-703	32.485	32.493	SLIGHT BEND @ HINGES	OCCASIONAL OCCLUSION, EXTREMELY TINY "GRAINS" OR BUMPS ACROSS ENTIRE SURFACE.
6-LAVELLE KORKY	31.426	31.435	SEVERE BEND @ HINGE	"BEACH MARKS" ALL AROUND CENTER. SMOOTH. MANY SMALL, DARK SPOTS @ 11:00
7-FLUIDMASTER BULLSEYE *	22.415	22.439	SLIGHT	CONCENTRIC DIE MARKS. FEW SCRATCHES. MANY TINY BUMPS ACROSS SURFACE.
8-BULLSEYE SUPER *	22.967	22.986	NONE	FINELY TEXTURED SURFACE. CAN SEE CONCENTRIC DIE OR MOLD MARKS. RANDOM, TINY OCCLUSIONS.
9-BULLSEYE SUPER ADJUST*	19.230	19.273	NONE	FINELY TEXTURED. CONCENTRIC MOLD MARKS CLEAR & SHARP. NO BUMPS OR OCCLUSIONS NOTICED.
10-AMERICAN STANDARD	34.779	34.825	NONE	SURFACE SMOOTH W/ MANY RANDOM SCRATCHES, TINY BUMPS & POCKMARKS.
11-FRUGAL FLUSH 1.6 *	29.420	29.459	NONE	SMOOTH. STRAIGHT DIE MARKS. RANDOM SCRATCHES.
12-FRUGAL FLUSH 3.5	36.211	36.322	NONE	BUMPY, TEXTURED SURFACE.
13-NIAGARA *	31.145	31.161	NONE	CLEAR SURFACE. SLIGHTLY ROUGH AS IN FINE SANDPAPER.
14-TOTO *	16.731	16.731	NONE	RANDOM BUMPS, SCRATCHES AND DIE MARKS.
15-HOOV-R-LINE RIGID *	3.539	3.534	NONE	FINELY TEXTURED SURFACE. WHITE COLOR.
16-HOOV-R-LINE CLEAR	31.217	31.233	NONE	TEXTURED SURFACE AS IN FINE SANDPAPER. CLEAR COLOR.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

APPENDIX E

Page 2 of 14

DAY 1

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.497	4.474	0.5%	NONE	NO CHANGE
3-COAST ULTRA BLUE	26.722	26.659	0.2%	NONE	COLOR LIGHTENING. MANY CIRCULAR "POCK MARK" DEPRESSIONS AROUND SURFACE.
4-LAVELLE KORKY PLUS	30.193	30.045	0.5%	SLIGHT BEND @ HINGES	COLOR LIGHTENING. RIDGES ON SURFACE BEGINNING TO BECOME "PUFFY".
5-LAVELLE EX-703	32.672	32.569	0.3%	SLIGHT BEND @ HINGES	COLOR LIGHTENING. OTHERWISE NO CHANGE.
6-LAVELLE KORKY	31.568	31.367	0.6%	SLIGHT BEND @ HINGES	NO CHANGE.
7-FLUIDMASTER BULLSEYE	22.394	22.275	0.5%	NONE	NO CHANGE.
8-BULLSEYE SUPER *	22.814	22.701	0.5%	NONE	SURFACE HAS A CLOUDY HAZE AROUND EDGE. SMALL POCK MARK DEPRESSIONS. RIDGES BECOMING PUFFY.
9-BULLSEYE SUPER ADJUST*	19.347	19.217	0.7%	NONE	SURFACE HAS A CLOUDY HAZE RANDOMLY ABOUT. SMALL POCK MARK DEPRESSIONS.
10-AMERICAN STANDARD	35.036	34.857	0.5%	NONE	RANDOM POCK MARKS IN A HAZY FILM ON SURFACE.
11-FRUGAL FLUSH 1.6 *	29.439	29.271	0.6%	NONE	HEAVILY POCK MARKED IN A HAZY SURFACE FILM. SPECIMEN APPEARS "STONE WASHED".
12-FRUGAL FLUSH 3.5	36.492	36.286	0.6%	NONE	COLOR LIGHTENING. OTHERWISE UNCHANGED.
13-NIAGARA *	31.238	31.068	0.5%	NONE	COLOR HAS BECOME "MILKY" WHITE. MANY TINY POCK MARK DEPRESSIONS.
14-TOTO *	16.833	16.751	0.5%	NONE	SIDE W/O NUMBER HAS MANY RANDOM "MOON CRATERS" DEPRESSIONS WITH RAISED LIPS. OTHER SIDE UNCHANGED.
15-HOOV-R-LINE RIGID *	3.598	3.564	1.0%	1/8"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.4	31.196	0.7%	NONE	MILKY WHITE. RANDOM POCK MARK DEPRESSIONS.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.338	4.293	1.0%	NONE	NO CHANGE.
2-MANSFIELD RED*	5.008	4.939	1.4%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	26.810	26.696	0.4%	NONE	SURFACE APPEARS UNCHANGED EXCEPT FOR A MOTTLED APPEARANCE IN COLORING.
4-LAVELLE KORKY PLUS	30.476	30.213	0.9%	SLIGHT BEND @ HINGES	RIDGES ARE PUFFY. COLOR HAS TAKEN ON A BLEACHED "STONEWASHED" EFFECT.
5-LAVELLE EX-703	32.742	32.493	0.8%	SLIGHT BEND @ HINGES	SURFACE UNCHANGED EXCEPT FOR COLOR FADE TO "BUBBLEGUM" COLOR.
6-LAVELLE KORKY	31.736	31.435	1.0%	SLIGHT BEND @ HINGES	SURFACE UNCHANGED EXCEPT FOR VERY SLIGHT TACKY FEEL.
7-FLUIDMASTER BULLSEYE	22.678	22.439	1.1%	NONE	DEVELOPING A FEW POCKMARKS ON SURFACE.
8-BULLSEYE SUPER *	23.212	22.986	1.0%	NONE	CONCENTRIC RINGS BECOMING SLIGHTLY PUFFY.
9-BULLSEYE SUPER ADJUST*	19.468	19.273	1.0%	NONE	RIDGES BECOMING PUFFY.
10-AMERICAN STANDARD	35.126	34.825	0.9%	NONE	SURFACE UNCHANGED EXCEPT FOR A THUMBNAIL SIZE AREA @ 6:00 WHICH HAS BECOME ROUGH & BUMPY.
11-FRUGAL FLUSH 1.6 *	29.712	29.459	0.9%	NONE	COLOR FADE TO BLUE-GREEN WITH MOTTLING IN COLOR. SURFACE STILL SMOOTH.
12-FRUGAL FLUSH 3.5	36.626	36.322	0.8%	NONE	NO SURFACE CHANGE. COLOR IS GREY-GREEN.
13-NIAGARA *	31.353	31.161	0.6%	NONE	SURFACE UNCHANGED. COLOR IS MILKY WHITE.
14-TOTO *	17.207	16.731	2.8%	SLIGHT	SIDE W/ NUMBER HAS NUMEROUS PIN HOLE DEPRESSIONS. OTHER SIDE DOES NOT.
15-HOOV-R-LINE RIGID *	3.576	3.534	1.2%	1/16"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.405	31.233	0.6%	NONE	NO SURFACE CHANGE. COLOR IS DARK, OPAQUE YELLOW.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 2

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.515	4.474	0.9%	NONE	NO CHANGE
3-COAST ULTRA BLUE	26.797	26.659	0.5%	NONE	CLOUDY HAZE AROUND SURFACE W/ POCK MARK DEPRESSIONS.
4-LAVELLE KORKY PLUS	30.366	30.045	1.1%	SLIGHT BEND @ HINGES	"STONE WASH" EFFECT. OTHERWISE UNCHANGED.
5-LAVELLE EX-703	32.848	32.569	0.8%	SLIGHT BEND @ HINGES	FADING TO A "BUBBLEGUM" COLOR. OTHERWISE NO CHANGE.
6-LAVELLE KORKY	31.722	31.367	1.1%	SLIGHT BEND @ HINGES	SLIGHT FADING. OTHERWISE UNCHANGED.
7-FLUIDMASTER BULLSEYE	22.526	22.275	1.1%	NONE	SURFACE HAZY, CLOUDY W/RANDOM "POCK MARKS".
8-BULLSEYE SUPER *	22.972	22.701	1.2%	NONE	SURFACE HAZY, CLOUDY W/RANDOM "POCK MARKS".
9-BULLSEYE SUPER ADJUST*	19.458	19.217	1.2%	NONE	SURFACE HAZY, CLOUDY W/RANDOM "POCK MARKS".
10-AMERICAN STANDARD	35.168	34.857	0.9%	NONE	RANDOM POCK MARKS & SMALL BLEACHED SPOTS.
11-FRUGAL FLUSH 1.6 *	29.570	29.271	1.0%	NONE	SIMILAR TO DAY 1. PROCESS CONTINUING.
12-FRUGAL FLUSH 3.5	36.562	36.286	0.8%	NONE	COLOR STILL LIGHTENING. POCK MARKS ALL AROUND.
13-NIAGARA *	31.324	31.068	0.8%	NONE	SIMILAR TO DAY 1.
14-TOTO *	17.001	16.751	1.5%	NONE	MOON CRATERS BECOMING MORE PUFFY. OTHER SIDE DEVELOPING CRATERS TOO.
15-HOOV-R-LINE RIGID *	3.629	3.564	1.8%	SLIGHT	NO CHANGE TO SURFACE. DISTORTION IS NOT AS SEVERE & SEEMS TO BE BASED ON WHICH SIDE FACES TOWARD MOUNT.
16-HOOV-R-LINE CLEAR	31.493	31.196	0.9%	NONE	SURFACE SIMILAR TO DAY 1. COLOR IS CHANGING TO YELLOW.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.395	4.293	2.3%	NONE	NO CHANGE.
2-MANSFIELD RED*	5.058	4.939	2.4%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	26.936	26.696	0.9%	NONE	MANY TINY BUMPS ALL AROUND SURFACE.
4-LAVELLE KORKY PLUS	30.785	30.213	1.9%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
5-LAVELLE EX-703	33.13	32.493	1.9%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
6-LAVELLE KORKY	32.205	31.435	2.4%	SLIGHT BEND @ HINGES	SOME BUMPS & PUFFINESS. SLIGHTLY TACKY.
7-FLUIDMASTER BULLSEYE	22.757	22.439	1.4%	NONE	SIMILAR TO DAY 1.
8-BULLSEYE SUPER *	23.338	22.986	1.5%	NONE	SIMILAR TO DAY 1.
9-BULLSEYE SUPER ADJUST*	19.565	19.273	1.5%	NONE	FEW TINY, RANDOM BUMPS. RIDGES PUFFY.
10-AMERICAN STANDARD	35.241	34.825	1.2%	NONE	MANY TINY BUMPS ALL AROUND SURFACE.
11-FRUGAL FLUSH 1.6 *	29.839	29.459	1.3%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	36.828	36.322	1.4%	NONE	SIMILAR TO DAY 1.
13-NIAGARA *	31.444	31.161	0.9%	NONE	SIMILAR TO DAY 1.
14-TOTO *	17.737	16.731	5.7%	SLIGHT	PINHOLE DEPRESSIONS ON BOTH SIDES.
15-HOOV-R-LINE RIGID *	3.607	3.534	2.0%	1/16"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.508	31.233	0.9%	NONE	NO SURFACE CHANGE. COLOR DARK, OPAQUE YELLOW.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

APPENDIX E

DAY 3

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.525	4.474	1.1%	NONE	SLIGHT COLOR FADE. OTHERWISE UNCHANGED.
3-COAST ULTRA BLUE	26.828	26.659	0.6%	NONE	SIMILAR TO DAY 2 W/FURTHER COLOR FADE.
4-LAVELLE KORKY PLUS	30.425	30.045	1.2%	SLIGHT BEND @ HINGES	SURFACE RIDGES BECOMING "PUFFY". SOME SMALL POCK MARK DEPRESSIONS AROUND SURFACE.
5-LAVELLE EX-703	32.876	32.569	0.9%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
6-LAVELLE KORKY	31.756	31.367	1.2%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
7-FLUIDMASTER BULLSEYE	22.569	22.275	1.3%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	23.045	22.701	1.5%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	19.501	19.217	1.5%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.205	34.857	1.0%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	29.623	29.271	1.2%	NONE	SIMILAR TO DAY 1 BUT WORSENING.
12-FRUGAL FLUSH 3.5	36.615	36.286	0.9%	NONE	SIMILAR TO DAY 2.
13-NIAGARA *	31.36	31.068	0.9%	NONE	SIMILAR TO DAY 1.
14-TOTO *	17.143	16.751	2.3%	NONE	SIMILAR TO DAY 2.
15-HOOV-R-LINE RIGID *	3.642	3.564	2.1%	SLIGHT	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.52	31.196	1.0%	NONE	SIMILAR TO DAY 1. YELLOW WORSENS.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.428	4.293	3.0%	NONE	NO CHANGE.
2-MANSFIELD RED*	5.095	4.939	3.1%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	26.963	26.696	1.0%	NONE	TINY BUMPS PERSIST. COLOR IS MOTTLED.
4-LAVELLE KORKY PLUS	30.940	30.213	2.3%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1. CONDITIONS WORSEN.
5-LAVELLE EX-703	33.439	32.493	2.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
6-LAVELLE KORKY	32.631	31.435	3.7%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
7-FLUIDMASTER BULLSEYE	22.825	22.439	1.7%	NONE	SIMILAR TO DAY 1, BUT EXUDING AN OILY FILM.
8-BULLSEYE SUPER *	23.386	22.986	1.7%	NONE	SIMILAR TO DAY 1.
9-BULLSEYE SUPER ADJUST*	19.629	19.273	1.8%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.320	34.825	1.4%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	29.926	29.459	1.6%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	36.955	36.322	1.7%	NONE	SIMILAR TO DAY 1.
13-NIAGARA *	31.498	31.161	1.1%	NONE	SIMILAR TO DAY 1.
14-TOTO *	18.060	16.731	7.4%	SLIGHT	SIMILAR TO DAY 2.
15-HOOV-R-LINE RIGID *	3.628	3.534	2.6%	1/16"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.567	31.233	1.1%	NONE	SIMILAR TO DAY 2.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 7

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.592	4.474	2.6%	NONE	SURFACE UNCHANGED EXCEPT FOR AN OCCASIONAL BUMP ON SURFACE.
3-COAST ULTRA BLUE	26.929	26.659	1.0%	NONE	POCK MARKS PERSIST. GENERAL "BLEACHING" OF COLOR.
4-LAVELLE KORKY PLUS	30.696	30.045	2.1%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 3. GENERAL COLOR FADE.
5-LAVELLE EX-703	33.312	32.569	2.2%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
6-LAVELLE KORKY	32.162	31.367	2.5%	SLIGHT BEND @ HINGES	SURFACE FEATURES BECOMING "PUFFY". SURFACE HAS A "GRABBY" FEEL TO IT.
7-FLUIDMASTER BULLSEYE	22.731	22.275	2.0%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	23.244	22.701	2.3%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	19.656	19.217	2.2%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.427	34.857	1.6%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	29.819	29.271	1.8%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	36.791	36.286	1.4%	NONE	SIMILAR TO DAY 2.
13-NIAGARA *	31.500	31.068	1.4%	NONE	SIMILAR TO DAY 1.
14-TOTO *	17.397	16.751	3.7%	NONE	SIMILAR TO DAY 2.
15-HOOV-R-LINE RIGID *	3.703	3.564	3.8%	SLIGHT	NO CHANGE TO SURFACE. SLIGHT YELLOWING.
16-HOOV-R-LINE CLEAR	31.711	31.196	1.6%	NONE	SIMILAR TO DAY 1. YELLOWING WORSENING.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.583	4.293	6.3%	NONE	NO CHANGE.
2-MANSFIELD RED*	5.193	4.939	4.9%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	27.141	26.696	1.6%	NONE	SIMILAR TO DAY 3.
4-LAVELLE KORKY PLUS	31.242	30.213	3.3%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
5-LAVELLE EX-703	34.794	32.493	6.6%	SLIGHT BEND @ HINGES	SURFACE BUMPS AND RIDGES SWOLLEN. COLOR LIGHT PINK. SLIGHTLY TACKY.
6-LAVELLE KORKY	33.993	31.435	7.5%	SLIGHT BEND @ HINGES	BUMPS AND PUFFINESS WORSEN. SURFACE IS VERY TACKY.
7-FLUIDMASTER BULLSEYE	22.982	22.439	2.4%	NONE	FEW SMALL BUMPS. OILY FILM PRESENT.
8-BULLSEYE SUPER *	23.621	22.986	2.7%	NONE	SIMILAR TO DAY 1.
9-BULLSEYE SUPER ADJUST*	19.836	19.273	2.8%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.611	34.825	2.2%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	30.214	29.459	2.5%	NONE	MANY TINY BUMPS RANDOMLY ABOUT. COLOR PEAGREEN.
12-FRUGAL FLUSH 3.5	37.36	36.322	2.8%	NONE	SURFACE ROUGH & GRAINY.
13-NIAGARA *	31.747	31.161	1.8%	NONE	SIMILAR TO DAY 1.
14-TOTO *	18.683	16.731	10.4%	SLIGHT	SIMILAR TO DAY 1.
15-HOOV-R-LINE RIGID *	3.708	3.534	4.7%	1/8"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.728	31.233	1.6%	NONE	SIMILAR TO DAY 2.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 14

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.673	4.474	4.4%	NONE	A FEW SMALL BUMPS AROUND SURFACE. OTHERWISE UNCHANGED.
3-COAST ULTRA BLUE	27.028	26.659	1.4%	NONE	SIMILAR TO DAY 8.
4-LAVELLE KORKY PLUS	30.928	30.045	2.9%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 3. COLOR FADE CONTINUES.
5-LAVELLE EX-703	33.982	32.569	4.3%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
6-LAVELLE KORKY	32.658	31.367	4.1%	SLIGHT BEND @ HINGES	SURFACE FEATURES "PUFFY". SURFACE IS "STICKY" OR "TACKY", BUT DOES NOT IMPART STICKINESS.
7-FLUIDMASTER BULLSEYE	22.914	22.275	2.9%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	23.432	22.701	3.2%	NONE	SIMILAR TO DAY 2. OVERALL "BLEACH" EFFECT.
9-BULLSEYE SUPER ADJUST*	19.829	19.217	3.2%	NONE	SIMILAR TO DAY 2. A LITTLE MORE "BLEACHED".
10-AMERICAN STANDARD	35.578	34.857	2.1%	NONE	SIMILAR TO DAY 2. SURFACE HAS A "GRABBY" FEEL.
11-FRUGAL FLUSH 1.6 *	30.052	29.271	2.7%	NONE	POCK MARKS STILL PRESENT BUT FILM IS GONE. SURFACE FEELS "CHALKY". HAS TURNED GREEN.
12-FRUGAL FLUSH 3.5	37.066	36.286	2.1%	NONE	POCK MARKS MOSTLY GONE. COLOR IS A BLEACHED BLUE-GREEN. SURFACE FEELS "DRY".
13-NIAGARA *	31.631	31.068	1.8%	NONE	POCK MARKS GONE. SURFACE APPEARS UNCHANGED. MILKY WHITE APPEARANCE.
14-TOTO *	17.856	16.751	6.6%	NONE	ALL SURFACE FEATURES APPEAR VERY "PUFFY". MOON CRATERS NOT AS DISTINGUISHABLE.
15-HOOV-R-LINE RIGID *	3.765	3.564	5.6%	SLIGHT	SIMILAR TO DAY 8.
16-HOOV-R-LINE CLEAR	31.866	31.196	2.1%	NONE	YELLOWING HAS BECOME "MUSTARD" YELLOW. OTHERWISE UNCHANGED.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.807	4.293	12.0%	1/16"	EDGE CURL. FEW SMALL BUMPS RANDOMLY ABOUT.
2-MANSFIELD RED*	5.232	4.939	5.9%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	27.489	26.696	3.0%	NONE	SIMILAR TO DAY 3.
4-LAVELLE KORKY PLUS	31.962	30.213	5.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1 EXCEPT COLOR IS TOTALLY YELLOW.
5-LAVELLE EX-703	36.001	32.493	10.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 7.
6-LAVELLE KORKY	34.365	31.435	9.3%	SLIGHT BEND @ HINGES	VERY TACKY. BLACK, STICKY RESIDUE ON VALVE SEAT. BUMPY, PUFFY SURFACE.
7-FLUIDMASTER BULLSEYE	23.320	22.439	3.9%	NONE	SIMILAR TO DAY 7.
8-BULLSEYE SUPER *	23.949	22.986	4.2%	NONE	RINGS PUFFY. A FEW RANDOMLY SPACED TINY BUMPS.
9-BULLSEYE SUPER ADJUST*	20.082	19.273	4.2%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	36.074	34.825	3.6%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	30.589	29.459	3.8%	NONE	SIMILAR TO DAY 7.
12-FRUGAL FLUSH 3.5	37.900	36.322	4.3%	NONE	SIMILAR TO DAY 7.
13-NIAGARA *	32.087	31.161	3.0%	NONE	SIMILAR TO DAY 1.
14-TOTO *	19.437	16.731	16.2%	SLIGHT	SMALL DEPRESSIONS ON BOTH SIDES. COLOR FADED TO GREY.
15-HOOV-R-LINE RIGID *	3.787	3.534	7.2%	1/8"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.999	31.233	2.5%	NONE	SIMILAR TO DAY 2.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 28

50 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.938	4.474	10.4%	3/16"	SURFACE IS A VERY LIGHT GRAY. A FEW SMALL BUMPS SCATTERED ABOUT.
3-COAST ULTRA BLUE	27.328	26.659	2.5%	NONE	SOME POCK MARKS STILL EXIST, BUT TINY, LITTLE BUMPS OR BLISTERS COVER SURFACE. COLOR BLEACHED.
4-LAVELLE KORKY PLUS	31.432	30.045	4.6%	SLIGHT BEND @ HINGES	SURFACE RIDGES ARE ALMOST INDISCERNIBLE DUE TO PUFFINESS. POCK MARKS GONE. COLOR "STONED WASHED".
5-LAVELLE EX-703	34.991	32.569	7.4%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2 IN APPEARANCE. SURFACE IS "GRABBY" OR "TACKY".
6-LAVELLE KORKY	33.505	31.367	6.8%	SLIGHT BEND @ HINGES	SURFACE SWOLLEN & PUFFY. SURFACE STICKY WITH A BLACK "PASTE" COMING OFF WHEN TOUCHED.
7-FLUIDMASTER BULLSEYE	23.274	22.275	4.5%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	23.680	22.701	4.3%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	20.014	19.217	4.1%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.955	34.857	3.2%	NONE	SIMILAR TO DAY 2. SURFACE HAS "GRABBY" OR "TACKY" FEEL.
11-FRUGAL FLUSH 1.6 *	30.417	29.271	3.9%	NONE	SIMILAR TO DAY 14.
12-FRUGAL FLUSH 3.5	37.380	36.286	3.0%	NONE	SIMILAR TO DAY 14.
13-NIAGARA *	31.985	31.068	3.0%	NONE	RANDOM POCK MARKS. OTHERWISE SURFACE UNCHANGED. MILKY WHITE APPEARANCE.
14-TOTO *	18.757	16.751	12.0%	NONE	SIMILAR TO DAY 14.
15-HOOV-R-LINE RIGID *	3.872	3.564	8.6%	1/8"	SIMILAR TO DAY 8.
16-HOOV-R-LINE CLEAR	32.097	31.196	2.9%	NONE	SIMILAR TO DAY 14.

300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	5.349	4.293	24.6%	1/4"	SIMILAR TO DAY 14.
2-MANSFIELD RED*	5.294	4.939	7.2%	NONE	COLOR FADED BUT SURFACE APPEARS UNCHANGED.
3-COAST ULTRA BLUE	28.011	26.696	4.9%	NONE	SURFACE HAS MANY TINY BUMPS. SURFACE COLOR IS MOTTLED BLUE W/ YELLOW-BROWN.
4-LAVELLE KORKY PLUS	32.861	30.213	8.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1. COLOR YELLOW, SLIGHTLY TACKY.
5-LAVELLE EX-703	38.576	32.493	18.7%	SLIGHT BEND @ HINGES	APPEARANCE UNDER MICROSCOPE SIMILAR TO DAY 7. BUT SPECIMEN SEEMS TO BE "PEELING" OR SHEDDING OUTER SKIN.
6-LAVELLE KORKY	36.192	31.435	15.1%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 14 BUT MORE EXTREME. OUTER LAYERS ARE LITERALLY CRUMBLING & PEELING AWAY.
7-FLUIDMASTER BULLSEYE	23.973	22.439	6.8%	NONE	SIMILAR TO DAY 7.
8-BULLSEYE SUPER *	24.564	22.986	6.9%	NONE	SIMILAR TO DAY 14. SLIGHTLY TACKY.
9-BULLSEYE SUPER ADJUST*	20.587	19.273	6.8%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	37.033	34.825	6.3%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	31.266	29.459	6.1%	NONE	SIMILAR TO DAY 7. SLIGHTLY TACKY.
12-FRUGAL FLUSH 3.5	38.805	36.322	6.8%	NONE	SIMILAR TO DAY 7. COLOR LIGHT BLUE-GREEN.
13-NIAGARA *	32.710	31.161	5.0%	NONE	SIMILAR TO DAY 1 EXCEPT SURFACE SLIGHTLY TACKY.
14-TOTO *	20.240	16.731	21.0%	NONE	SIMILAR TO DAY 14. CHALKY RESIDUE RUBS OFF.
15-HOOV-R-LINE RIGID *	3.869	3.534	9.5%	1/8"	SURFACE APPEARS UNCHANGED BUT DIMENSIONALLY SPECIMEN IS LARGER.
16-HOOV-R-LINE CLEAR	32.572	31.233	4.3%	NONE	SIMILAR TO DAY 2.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

INITIAL DATA
SAMPLE FOR TAP WATER

MANUFACTURER	INITIAL DRY WT.(GRMS.)	INITIAL WET WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.482	4.483	NONE	SMOOTH, GRAININESS, LOOKS ALMOST CRYSTALLINE
3-COAST ULTRA BLUE	26.647	26.662	NONE	SMOOTH, SCRATCHES, DIE MARKS, OCCASIONAL OCCLUSION
4-LAVELLE KORKY PLUS	30.422	30.505	SLIGHT BEND @ HINGES	VERY RED. SMOOTH. DIE MARKS RUNNING PARALLEL ALL ACROSS FACE
5-LAVELLE EX-703	32.184	32.195	SLIGHT BEND @ HINGES	VERY SMOOTH. "BEACH MARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.322	31.365	SLIGHT BEND @ HINGES	SLIGHT BUMPINESS OR ROUGHNESS TO SURFACE. SCRATCHES ALL ABOUT. "BEACH MARKS" ALL AROUND CENTER
7-FLUIDMASTER BULLSEYE *	22.325	22.354	NONE	CONCENTRIC DIE MARKS. SCRATCHES ACROSS SURFACE. MANY TINY BUMPS ACROSS SURFACE.
8-BULLSEYE SUPER *	22.601	22.630	NONE	FINELY TEXTURED SURFACE AS IN FINE SANDPAPER. SMALL OCCLUSIONS RANDOMLY ABOUT.
9-BULLSEYE SUPER ADJUST*	19.228	19.261	NONE	CIRCULAR, UNIFORM SHARP DIE MARKS. OCCASIONAL SCRATCH.
10-AMERICAN STANDARD	34.924	34.962	NONE	SURFACE SMOOTH W/ RANDOM SCRATCHES, TINY BUMPS AND "POCK MARKS" OR DEPRESSIONS.
11-FRUGAL FLUSH 1.6 *	29.234	29.287	NONE	SMOOTH, STRAIGHT DIE MARKS. SCRATCHES.
12-FRUGAL FLUSH 3.5	35.705	35.796	NONE	BUMPY, TEXTURED SURFACE.
13-NIAGARA *	31.339	31.355	NONE	CLEAR SURFACE. SLIGHTLY ROUGH AS IN FINE SANDPAPER.
14-TOTO *	16.778	16.794	NONE	SIDE W/ MOLDED NUMBER HAS RANDOM BUMPS, SCRATCHES AND DIE MARKS. OTHER SIDE SMOOTHER.
15-HOOV-R-LINE RIGID *	3.563	3.559	NONE	FINELY TEXTURED SURFACE. WHITE COLOR.
16-HOOV-R-LINE CLEAR	30.869	30.884	NONE	TEXTURED SURFACE. AS IN FINE SANDPAPER. CLEAR COLOR.

SAMPLE FOR 2000 PPM CONCENTRATION

MANUFACTURER	INITIAL DRY WT.(GRMS.)	INITIAL WET WT.(GRMS.)	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.408	4.402	NONE	SMOOTH, GRAININESS. LOOKS ALMOST "CRYSTALLINE".
2-MANSFIELD RED*	4.985	4.995	NONE	SMOOTH, GRAININESS. LOOKS ALMOST "CRYSTALLINE".
3-COAST ULTRA BLUE	26.780	26.800	NONE	SMOOTH, SCRATCHES, DIE MARKS, OCCASIONAL OCCLUSION.
4-LAVELLE KORKY PLUS	30.202	30.247	SLIGHT BEND @ HINGES	DIE MARKS RUNNING PARALLEL ACROSS FACE. MANY TINY BUMPS CAUSING "GRAININESS".
5-LAVELLE EX-703	32.618	32.624	SLIGHT BEND @ HINGES	OCCASIONAL OCCLUSION. EXTREMELY TINY "GRAINS" OR BUMPS ACROSS ENTIRE SURFACE. "BEACHMARKS" ALL AROUND CENTER.
6-LAVELLE KORKY	31.660	31.671	SEVERE BEND @ HINGE	SMOOTH. "BEACHMARKS ALL AROUND CENTER.
7-FLUIDMASTER BULLSEYE *	22.321	22.364	SLIGHT	CONCENTRIC DIE MARKS, FEW SCRATCHES, MANY TINY BUMPS ACROSS SURFACE.
8-BULLSEYE SUPER *	22.869	22.914	NONE	FINELY TEXTURED. CONCENTRIC MOLD MARKS VERY CLEAR AND SHARP. RANDOM TINY BUMPS & OCCLUSIONS.
9-BULLSEYE SUPER ADJUST*	19.196	19.217	NONE	FINELY TEXTURED. CONCENTRIC MOLD MARKS VERY CLEAR AND SHARP.
10-AMERICAN STANDARD	34.803	34.808	NONE	SURFACE SMOOTH W/ MANY RANDOM SCRATCHES, TINY BUMPS & "POCKMARKS".
11-FRUGAL FLUSH 1.6 *	29.155	29.195	NONE	SMOOTH. STRAIGHT DIE MARKS. RANDOM SCRATCHES.
12-FRUGAL FLUSH 3.5	36.162	36.272	NONE	BUMPY, TEXTURED SURFACE.
13-NIAGARA *	31.214	31.234	NONE	CLEAR SURFACE. SLIGHTLY ROUGH AS IN FINE SANDPAPER
14-TOTO *	16.386	16.386	NONE	RANDOM BUMPS, SCRATCHES & DIE MARKS.
15-HOOV-R-LINE RIGID *	3.561	3.556	NONE	FINELY TEXTURED SURFACE. WHITE COLOR.
16-HOOV-R-LINE CLEAR	30.917	30.932	NONE	TEXTURED SURFACE AS IN FINE SANDPAPER. CLEAR COLOR.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

**DAY 1
TAP WATER**

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.486	4.483	0.1%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	26.700	26.662	0.1%	NONE	NO CHANGE.
4-LAVELLE KORKY PLUS	30.644	30.505	0.5%	SLIGHT BEND @ HINGES	RIDGES SLIGHTLY PUFFY. OTHERWISE UNCHANGED.
5-LAVELLE EX-703	32.197	32.195	0.0%	SLIGHT BEND @ HINGES	NO CHANGE.
6-LAVELLE KORKY	31.492	31.365	0.4%	SLIGHT BEND @ HINGES	SLIGHT COLOR FADE. POCK MARK DEPRESSIONS RANDOMLY ABOUT.
7-FLUIDMASTER BULLSEYE	22.427	22.354	0.3%	NONE	NO CHANGE.
8-BULLSEYE SUPER *	22.723	22.630	0.4%	NONE	NO CHANGE.
9-BULLSEYE SUPER ADJUST*	19.339	19.261	0.4%	NONE	RIDGES ON DIE MARKS BECOMING PUFFY. A FEW RANDOM POCK MARKS.
10-AMERICAN STANDARD	35.079	34.962	0.3%	NONE	TINY POCK MARKS RANDOMLY ABOUT.
11-FRUGAL FLUSH 1.6 *	29.369	29.287	0.3%	NONE	NO CHANGE.
12-FRUGAL FLUSH 3.5	36.030	35.796	0.7%	NONE	NO CHANGE.
13-NIAGARA *	31.460	31.355	0.3%	NONE	COLOR IS AN OPAQUE GRAY. SMALL POCK MARKS RANDOMLY ABOUT SURFACE.
14-TOTO *	16.795	16.794	0.0%	NONE	NO CHANGE.
15-HOOV-R-LINE RIGID *	3.572	3.559	0.4%	1/8"	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.002	30.884	0.4%	NONE	MILKY WHITE. OTHERWISE UNCHANGED.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.556	4.402	3.5%	NONE	SOME TINY BUMPS BEGINNING. EDGES ARE STARTING TO CURL.
2-MANSFIELD RED*	5.156	4.995	3.2%	NONE	SURFACE UNCHANGED.
3-COAST ULTRA BLUE	27.198	26.800	1.5%	NONE	MANY TINY BUMPS ACROSS SURFACE. COLOR HAS FADED SIGNIFICANTLY.
4-LAVELLE KORKY PLUS	31.162	30.247	3.0%	SLIGHT BEND @ HINGES	BUMPS AND RIDGES ARE BECOMING PUFFY. MODERATE TACKINESS. COLOR HAS FADED TO YELLOW-ORANGE.
5-LAVELLE EX-703	33.990	32.624	4.2%	SLIGHT BEND @ HINGES	BUMPS AND RIDGES SLIGHTLY PUFFY. MODERATE TACKINESS. COLOR HAS FADED TO BUBBLEGUM PINK.
6-LAVELLE KORKY	33.153	31.671	4.7%	SEVERE BEND @ HINGE	EDGES DISTORTING. BUMPS & RIDGES PUFFY. SLIGHT TACKINESS.
7-FLUIDMASTER BULLSEYE	22.777	22.364	1.8%	NONE	NO CHANGE.
8-BULLSEYE SUPER *	23.379	22.914	2.0%	NONE	NO CHANGE.
9-BULLSEYE SUPER ADJUST*	19.605	19.217	2.0%	NONE	NO CHANGE.
10-AMERICAN STANDARD	35.372	34.808	1.6%	NONE	NO CHANGE.
11-FRUGAL FLUSH 1.6 *	29.702	29.195	1.7%	NONE	TINY BUMPS RANDOMLY ABOUT. COLOR FADING TO A GREY-GREEN.
12-FRUGAL FLUSH 3.5	36.943	36.272	1.8%	NONE	NO CHANGE IN SURFACE. COLOR IS PEA-GREEN. SOLUTION COLOR HAS CHANGED TO A DARK YELLOW.
13-NIAGARA *	31.665	31.234	1.4%	NONE	NO SURFACE CHANGE. COLOR IS OPAQUE YELLOW.
14-TOTO *	17.036	16.386	4.0%	SLIGHT	SIDE W/ MOLDED NUMBER LOOKS LIKE SURFACE OF THE MOON- EXTENSIVE CRATERING. OTHER SIDE SMOOTHER.
15-HOOV-R-LINE RIGID *	3.663	3.556	3.0%	NONE	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.345	30.932	1.3%	NONE	NO SURFACE CHANGE. COLOR DARK, OPAQUE YELLOW.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

**DAY 2
TAP WATER**

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.494	4.483	0.2%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	26.716	26.662	0.2%	NONE	SURFACE COVERED WITH OILY FILM WHICH CAN BE RUBBED OFF.
4-LAVELLE KORKY PLUS	30.748	30.505	0.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY1.
5-LAVELLE EX-703	32.218	32.195	0.1%	SLIGHT BEND @ HINGES	NO CHANGE.
6-LAVELLE KORKY	31.561	31.365	0.6%	SLIGHT BEND @ HINGES	SIMILAR TO DAY1.
7-FLUIDMASTER BULLSEYE	22.495	22.354	0.6%	NONE	NO CHANGE.
8-BULLSEYE SUPER *	22.748	22.630	0.5%	NONE	OILY SURFACE FILM WITH POCK MARKS IN IT.
9-BULLSEYE SUPER ADJUST*	19.373	19.261	0.6%	NONE	RIDGES BECOMING PUFFY.
10-AMERICAN STANDARD	35.147	34.962	0.5%	NONE	POCK MARKS ALL AROUND SURFACE.
11-FRUGAL FLUSH 1.6 *	29.395	29.287	0.4%	NONE	NO CHANGE.
12-FRUGAL FLUSH 3.5	35.977	35.796	0.5%	NONE	SLIGHT COLOR FADE. OTHERWISE UNCHANGED.
13-NIAGARA *	31.455	31.355	0.3%	NONE	SIMILAR TO DAY1.
14-TOTO *	16.792	16.794	0.0%	NONE	NO CHANGE.
15-HOOV-R-LINE RIGID *	3.577	3.559	0.5%	SLIGHT	NO CHANGE TO SURFACE. DISTORTION IS GREATLY REDUCED & SEEMS TO BE BASED ON WHICH SIDE FACES TOWARD MOUNT.
16-HOOV-R-LINE CLEAR	31.022	30.884	0.4%	NONE	SIMILAR TO DAY1.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.669	4.402	6.1%	NONE	SIMILAR TO DAY 1.
2-MANSFIELD RED*	5.240	4.995	4.9%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	27.417	26.800	2.3%	NONE	BUMPS AND COLOR FADE CONTINUE.
4-LAVELLE KORKY PLUS	31.875	30.247	5.4%	SLIGHT BEND @ HINGES	BUMPS AND RIDGES HAVE NEARLY FUSED. COLOR FADE TO YELLOW. MODERATELY TACKY.
5-LAVELLE EX-703	35.386	32.624	8.5%	SLIGHT BEND @ HINGES	BUMPS AND RIDGES HAVE NEARLY FUSED. COLOR FADE TO BUBBLEGUM PINK CONTINUES. MODERATELY TACKY.
6-LAVELLE KORKY	34.761	31.671	9.8%	SEVERE BEND @ HINGE	SIMILAR TO DAY 1. CONDITIONS WORSEEN.
7-FLUIDMASTER BULLSEYE	23.109	22.364	3.3%	NONE	SURFACE UNCHANGED BUT BEGINNING TO EXUDE AN OILY FILM.
8-BULLSEYE SUPER *	23.659	22.914	3.3%	NONE	SIMILAR TO DAY 1.
9-BULLSEYE SUPER ADJUST*	19.845	19.217	3.3%	NONE	RIDGES BECOMING SLIGHTLY PUFFY.
10-AMERICAN STANDARD	35.761	34.808	2.7%	NONE	NO CHANGE.
11-FRUGAL FLUSH 1.6 *	30.070	29.195	3.0%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	37.389	36.272	3.1%	NONE	SIMILAR TO DAY 1. SOLUTION DISCOLORED AGAIN.
13-NIAGARA *	31.971	31.234	2.4%	NONE	SIMILAR TO DAY 1.
14-TOTO *	17.763	16.386	8.4%	SLIGHT	CRATERING ON BOTH SIDES. BEGINNING TO DEVELOP RANDOM BUMPS. SLIGHTLY TACKY.
15-HOOV-R-LINE RIGID *	3.746	3.556	5.3%	NONE	FEW RANDOM BUMPS 1 SIDE ONLY.
16-HOOV-R-LINE CLEAR	31.595	30.932	2.1%	NONE	SIMILAR TO DAY 1.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 4

TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.492	4.483	0.2%	SLIGHT	NO CHANGE.
3-COAST ULTRA BLUE	26.713	26.662	0.2%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	30.777	30.505	0.9%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
5-LAVELLE EX-703	32.200	32.195	0.0%	SLIGHT BEND @ HINGES	NO CHANGE.
6-LAVELLE KORKY	31.616	31.365	0.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
7-FLUIDMASTER BULLSEYE	22.487	22.354	0.6%	NONE	NO CHANGE.
8-BULLSEYE SUPER *	22.792	22.630	0.7%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	19.428	19.261	0.9%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.123	34.962	0.5%	NONE	SIMILAR TO DAY 2.
11-FRUGAL FLUSH 1.6 *	29.439	29.287	0.5%	NONE	NO CHANGE.
12-FRUGAL FLUSH 3.5	35.988	35.796	0.5%	NONE	SIMILAR TO DAY 2.
13-NIAGARA *	31.518	31.355	0.5%	NONE	SIMILAR TO DAY 1.
14-TOTO *	16.800	16.794	0.0%	NONE	NO CHANGE.
15-HOOV-R-LINE RIGID *	3.578	3.559	0.5%	SLIGHT	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.046	30.884	0.5%	NONE	NO CHANGE.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.752	4.402	8.0%	NONE	SIMILAR TO DAY 1.
2-MANSFIELD RED*	5.285	4.995	5.8%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	27.604	26.800	3.0%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	32.309	30.247	6.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
5-LAVELLE EX-703	36.565	32.624	12.1%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
6-LAVELLE KORKY	36.215	31.671	14.3%	SEVERE BEND @ HINGE	SIMILAR TO DAY 1. CONDITIONS WORSEN.
7-FLUIDMASTER BULLSEYE	23.362	22.364	4.5%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	23.856	22.914	4.1%	NONE	SMALL BUMPS RANDOMLY ABOUT. RIDGES BECOMING SOMEWHAT PUFFY.
9-BULLSEYE SUPER ADJUST*	19.991	19.217	4.0%	NONE	RIDGES BECOMING MORE PUFFY.
10-AMERICAN STANDARD	36.063	34.808	3.6%	NONE	NO CHANGE.
11-FRUGAL FLUSH 1.6 *	30.287	29.195	3.7%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	37.738	36.272	4.0%	NONE	SIMILAR TO DAY 1 IN ALL ASPECTS EXCEPT HARD PLASTIC CONE IS "SHEDDING A SKIN".
13-NIAGARA *	32.204	31.234	3.1%	NONE	SIMILAR TO DAY 1.
14-TOTO *	18.246	16.386	11.4%	SLIGHT	SIMILAR TO DAY 2.
15-HOOV-R-LINE RIGID *	3.806	3.556	7.0%	1/4"	SURFACE SIMILAR TO DAY 2. SPECIMEN FEELS HARDER OR "STIFFER".
16-HOOV-R-LINE CLEAR	31.763	30.932	2.7%	NONE	SIMILAR TO DAY 1.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 7
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.507	4.483	0.5%	NONE	SURFACE HAS CLOUDY FILM WITH POCK MARK DEPRESSIONS.
3-COAST ULTRA BLUE	26.761	26.662	0.4%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	31.032	30.505	1.7%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
5-LAVELLE EX-703	32.226	32.195	0.1%	SLIGHT BEND @ HINGES	NO CHANGE.
6-LAVELLE KORKY	31.737	31.365	1.2%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
7-FLUIDMASTER BULLSEYE	22.985	22.354	2.8%	NONE	HAS A RING OF "RAISED" POCK MARKS AROUND EDGE.
8-BULLSEYE SUPER *	22.893	22.630	1.2%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	19.496	19.261	1.2%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.228	34.962	0.8%	NONE	OILY FILM W/ POCK MARKS ALL AROUND SURFACE.
11-FRUGAL FLUSH 1.6 *	29.549	29.287	0.9%	NONE	SURFACE COVERED W/ OILY FILM WHICH RUBS OFF.
12-FRUGAL FLUSH 3.5	36.148	35.796	1.0%	NONE	SIMILAR TO DAY 2.
13-NIAGARA *	31.591	31.355	0.8%	NONE	SIMILAR TO DAY 1.
14-TOTO *	16.798	16.794	0.0%	NONE	NO CHANGE.
15-HOOV-R-LINE RIGID *	3.59	3.559	0.9%	SLIGHT	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.096	30.884	0.7%	NONE	SIMILAR TO DAY 1.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	5.045	4.402	14.6%	NONE	SIMILAR TO DAY 1.
2-MANSFIELD RED*	5.379	4.995	7.7%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	27.992	26.800	4.4%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	33.518	30.247	10.8%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2. COLOR YELLOW.
5-LAVELLE EX-703	40.599	32.624	24.4%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2. COLOR LIGHT PINK.
6-LAVELLE KORKY	41.413	31.671	30.8%	SEVERE BEND @ HINGE	SIMILAR TO DAY 1. CONDITIONS WORSEN.
7-FLUIDMASTER BULLSEYE	24.030	22.364	7.4%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	24.294	22.914	6.0%	NONE	SIMILAR TO DAY 3. SLIGHT COLOR FADE.
9-BULLSEYE SUPER ADJUST*	20.283	19.217	5.5%	NONE	RIDGES PUFFY. FEW RANDOM BUMPS ABOUT.
10-AMERICAN STANDARD	37.117	34.808	6.6%	NONE	NO CHANGE.
11-FRUGAL FLUSH 1.6 *	30.728	29.195	5.3%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	38.608	36.272	6.4%	NONE	SIMILAR TO DAY 3 EXCEPT SOLUTION IS NOT DISCOLORED.
13-NIAGARA *	32.784	31.234	5.0%	NONE	SIMILAR TO DAY 1.
14-TOTO *	19.417	16.386	18.5%	NONE	SIMILAR TO DAY 2.
15-HOOV-R-LINE RIGID *	4.016	3.556	12.9%	*U*SHAPED 1/8"	SURFACE RIDGES PUFFY. SPECIMEN HAS HARDENED. INNER & OUTER EDGES CURLING.
16-HOOV-R-LINE CLEAR	32.203	30.932	4.1%	NONE	SIMILAR TO DAY 1.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

**DAY 14
TAP WATER**

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.510	4.483	0.6%	NONE	SIMILAR TO DAY 8.
3-COAST ULTRA BLUE	26.790	26.662	0.5%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	31.261	30.505	2.5%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1. SOME COLOR FADE.
5-LAVELLE EX-703	32.252	32.195	0.2%	SLIGHT BEND @ HINGES	NO CHANGE.
6-LAVELLE KORKY	31.912	31.365	1.7%	SLIGHT BEND @ HINGES	POCK MARKS NOT VISIBLE. SURFACE FEATURES "PUFFY". SURFACE "GRABBY".
7-FLUIDMASTER BULLSEYE	22.712	22.354	1.6%	NONE	SIMILAR TO DAY 8.
8-BULLSEYE SUPER *	23.021	22.630	1.7%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	19.591	19.261	1.7%	NONE	SIMILAR TO DAY 2.
10-AMERICAN STANDARD	35.349	34.962	1.1%	NONE	SIMILAR TO DAY 8.
11-FRUGAL FLUSH 1.6 *	29.637	29.287	1.2%	NONE	SIMILAR TO DAY 8.
12-FRUGAL FLUSH 3.5	36.180	35.796	1.1%	NONE	HAS AN OILY, WHITE FILM WHICH CAN BE RUBBED OFF.
13-NIAGARA *	31.695	31.355	1.1%	NONE	SIMILAR TO DAY 1.
14-TOTO *	16.830	16.794	0.2%	NONE	NO CHANGE.
15-HOOV-R-LINE RIGID *	3.597	3.559	1.1%	SLIGHT	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.215	30.884	1.1%	NONE	SIMILAR TO DAY 1.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	5.492	4.402	24.8%	NONE	SIMILAR TO DAY 1.
2-MANSFIELD RED*	5.518	4.995	10.5%	NONE	NO CHANGE.
3-COAST ULTRA BLUE	28.557	26.800	6.6%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	35.226	30.247	16.5%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2.
5-LAVELLE EX-703	44.667	32.624	36.9%	SEVERE BEND @ HINGE	SIMILAR TO DAY 2. CONDITIONS WORSEN.
6-LAVELLE KORKY	47.869	31.671	51.1%	SEVERE BEND @ HINGE	SIMILAR TO DAY 1. CONDITIONS WORSEN.
7-FLUIDMASTER BULLSEYE	24.918	22.364	11.4%	NONE	SIMILAR TO DAY 2.
8-BULLSEYE SUPER *	24.944	22.914	8.9%	NONE	SIMILAR TO DAY 3.
9-BULLSEYE SUPER ADJUST*	20.676	19.217	7.6%	NONE	SIMILAR TO DAY 7.
10-AMERICAN STANDARD	38.728	34.808	11.3%	NONE	SOME OBLONG BLOTCHES ON SURFACE. THESE APPEAR TO BE RAISED BUT OTHERWISE NOT DIFFERENT FROM REMAINDER.
11-FRUGAL FLUSH 1.6 *	31.400	29.195	7.6%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	39.111	36.272	7.8%	NONE	SIMILAR TO DAY 3 EXCEPT ADJUSTABLE CONE IS SPLIT.
13-NIAGARA *	33.502	31.234	7.3%	NONE	SIMILAR TO DAY 1.
14-TOTO *	20.856	16.386	27.3%	SLIGHT	SIMILAR TO DAY 2. FADING TO GREY.
15-HOOV-R-LINE RIGID *	4.324	3.556	21.6%	"U" SHAPED 1/8"	SIMILAR TO DAY 7.
16-HOOV-R-LINE CLEAR	32.676	30.932	5.6%	NONE	SIMILAR TO DAY 1.

* HARD PARTS REMOVED PRIOR TO WEIGHING

ACCELERATED FORMED FLAPPER TEST WITH CLOROX

DAY 28
TAP WATER

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	4.532	4.483	1.1%	NONE	SIMILAR TO DAY 8.
3-COAST ULTRA BLUE	26.874	26.662	0.8%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	31.714	30.505	4.0%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 1.
5-LAVELLE EX-703	32.342	32.195	0.5%	SLIGHT BEND @ HINGES	NO CHANGE.
6-LAVELLE KORKY	32.089	31.365	2.3%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 14.
7-FLUIDMASTER BULLSEYE	22.986	22.354	2.8%	NONE	SURFACE COVERED W/ RAISED, TINY BUMPS.
8-BULLSEYE SUPER *	23.258	22.630	2.8%	NONE	SIMILAR TO DAY 2.
9-BULLSEYE SUPER ADJUST*	19.808	19.261	2.8%	NONE	SIMILAR TO DAY 2. OILY FILM ON SURFACE.
10-AMERICAN STANDARD	35.494	34.962	1.5%	NONE	SIMILAR TO DAY 8.
11-FRUGAL FLUSH 1.6 *	29.915	29.287	2.1%	NONE	SURFACE HAS RANDOM POCK MARKS & MANY TINY BUMPS.
12-FRUGAL FLUSH 3.5	36.273	35.796	1.3%	NONE	SIMILAR TO DAY 14.
13-NIAGARA *	31.982	31.355	2.0%	NONE	SIMILAR TO DAY 1. SURFACE FEELS "CHALKY".
14-TOTO *	16.914	16.794	0.7%	NONE	TINY BUMPS RANDOMLY ABOUT. OTHERWISE UNCHANGED.
15-HOOV-R-LINE RIGID *	3.654	3.559	2.7%	SLIGHT	NO CHANGE.
16-HOOV-R-LINE CLEAR	31.461	30.884	1.9%	NONE	SIMILAR TO DAY 1.

2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT.(GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
1-MANSFIELD BLACK *	6.274	4.402	42.5%	1/16"	SIMILAR TO DAY 14.
2-MANSFIELD RED*	5.702	4.995	14.2%	NONE	SLIGHT COLOR FADE. OTHERWISE UNCHANGED.
3-COAST ULTRA BLUE	29.076	26.800	8.5%	NONE	SIMILAR TO DAY 2.
4-LAVELLE KORKY PLUS	37.306	30.247	23.3%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2. VERY TACKY.
5-LAVELLE EX-703	51.830	32.624	58.9%	SLIGHT BEND @ HINGES	SIMILAR TO DAY 2. CONDITIONS WORSEN.
6-LAVELLE KORKY	54.440	31.671	71.9%	HINGES BROKE	SPECIMEN VERY DISTORTED. HINGE LOOPS HAVE DETERIORATED & BROKEN. SURFACE DISTORTED AND ROUGH.
7-FLUIDMASTER BULLSEYE	26.228	22.364	17.3%	NONE	SIMILAR TO DAY 2. OILY FILM MINIMAL.
8-BULLSEYE SUPER *	25.571	22.914	11.6%	NONE	SIMILAR TO DAY 3.
9-BULLSEYE SUPER ADJUST*	21.064	19.217	9.6%	NONE	SIMILAR TO DAY 7.
10-AMERICAN STANDARD	41.380	34.808	18.9%	1/16" PUSHED OFF EARS	SIMILAR TO DAY 14.
11-FRUGAL FLUSH 1.6 *	32.120	29.195	10.0%	NONE	SIMILAR TO DAY 1.
12-FRUGAL FLUSH 3.5	38.680	36.272	6.6%	NONE	"CONE" BROKEN INTO PIECES. COMPLETELY DESTROYED. SURFACE REMAINS UNCHANGED.
13-NIAGARA *	34.305	31.234	9.8%	NONE	SIMILAR TO DAY 1.
14-TOTO *	22.88	16.386	39.6%	1/8"	BLACK RESIDUE COMES OFF ON FINGERS. CRATERING GETTING WORSE. MORE ON ONE SIDE.
15-HOOV-R-LINE RIGID *	4.964	3.556	39.6%	1/4"	SIMILAR TO DAY 7. CONDITIONS EXTREME.
16-HOOV-R-LINE CLEAR	33.182	30.932	7.3%	NONE	SIMILAR TO DAY 1.

* HARD PARTS REMOVED PRIOR TO WEIGHING

SPECIMEN WEIGHT GAIN CHARTS

The figures on the following pages display the increase in weight gain of each of the specimens over the 28-day period of immersion:

- Figure 1. Specimen #1 Weight Gain (tap water control for 2000 Flushes[®] test)
- Figure 2. Specimen #2 Weight Gain – 50 ppm of 2000 Flushes[®]
- Figure 3. Specimen #3 Weight Gain – 300 ppm of 2000 Flushes[®]
- Figure 4. Specimen #4 Weight Gain – 2,000 ppm of 2000 Flushes[®]
- Figure 5. Specimen #5 Weight Gain (tap water control for Clorox[®] test)
- Figure 6. Specimen #6 Weight Gain – 50 ppm of Clorox[®]
- Figure 7. Specimen #7 Weight Gain – 300 ppm of Clorox[®]
- Figure 8. Specimen #8 Weight Gain – 2,000 ppm of Clorox[®]

The reader should note that the vertical scale on these eight figures varies significantly from figure to figure.

LEAK RATES - 2000 FLUSHES TEST**TAP WATER TEST**

	<i>Leak Rate Before Test</i>	<i>Leak Rate After Test</i>	<i>Retest (if applicable)</i>
1 - Mansfield Black	N/A	2ml/1hr.	50ml/overnight
3 - Coast Ultra-Blue	N/A	no leaks	-
4 - Lavelle Korky Plus	N/A	25ml/2hrs.	no leaks
5 - Lavelle EX-703	N/A	no leaks	-
6 - Lavelle Korky	N/A	132ml/2hrs.	-
7 - Fluidmaster Bullseye	N/A	113ml/2hrs.	-
8 - Fluidmaster Bullseye Super	N/A	no leaks	-
9 - Fluidmaster Bullseye Adjustable	N/A	no leaks	-
10 - American Standard	N/A	18 ml/overnight	no leaks
11 - Frugal Flush 1.6	N/A	50ml/1hr.	entire contents overnight
12 - Frugal Flush 3.5	N/A	400ml/1hr.	entire contents overnight
13 - Niagara	N/A	50ml/1hr.	1000ml/overnight
14 - Toto	N/A	N/A	N/A
15 - Hoov-R-Line Rigid	no leaks	650ml/2hrs.	-
16 - Hoov-R-Line Clear	no leaks	no leaks	0

2,000 PPM TEST

	<i>Leak Rate Before Test</i>	<i>Leak Rate After Test</i>	<i>Retest (if applicable)</i>
1 - Mansfield Black	N/A	entire contents/5sec.	-
3 - Coast Ultra-Blue	N/A	no leaks	-
4 - Lavelle Korky Plus	N/A	no leaks	-
5 - Lavelle EX-703	N/A	entire contents/1hr.	-
6 - Lavelle Korky	N/A	entire contents/5sec.	-
7 - Fluidmaster Bullseye	N/A	no leaks	-
8 - Fluidmaster Bullseye Super	N/A	no leaks	-
9 - Fluidmaster Bullseye Adjustable	N/A	10ml/1hr.	200ml/overnight
10 - American Standard	N/A	entire contents/5sec.	-
11 - Frugal Flush 1.6	N/A	no leaks	-
12 - Frugal Flush 3.5	N/A	25ml/overnight	-
13 - Niagara	N/A	500ml/1hr.	entire contents overnight
14 - Toto	N/A	N/A	N/A
15 - Hoov-R-Line Rigid	10ml/2hrs.	3 litres(entire contents)/2hrs.	-
16 - Hoov-R-Line Clear	no leaks	no leaks	-

LEAK RATES -CLOROX TEST**TAP WATER TEST**

	<i>Leak Rate Before Test</i>	<i>Leak Rate After Test</i>	<i>Retest (if applicable)</i>
1 - Mansfield Black	no leaks	25ml/1hr.	-
3 - Coast Ultra-Blue	no leaks	no leaks	-
4 - Lavelle Korky Plus	<1ml/1hr.	3ml/1hr.	-
5 - Lavelle EX-703	<1ml/1hr.	<1ml/1hr.	-
6 - Lavelle Korky	25ml/1hr.	70ml/1hr.	-
7 - Fluidmaster Bullseye	no leaks	no leaks	-
8 - Fluidmaster Bullseye Super	no leaks	no leaks	-
9 - Fluidmaster Bullseye Adjustable	<1ml/1hr.	6ml/1hr.	-
10 - American Standard	no leaks	<1ml/1hr.	-
11 - Frugal Flush 1.6	no leaks	no leaks	-
12 - Frugal Flush 3.5	5ml/1hr.	23ml/1hr.	-
13 - Niagara	1.75litres/1hr.	600ml/1hr.	-
14 - Toto	Not available	Not available	-
15 - Hoov-R-Line Rigid	375ml/1hr.	14ml/1hr.	-
16 - Hoov-R-Line Clear	no leaks	16ml/1hr.	-

50 PPM TEST

	<i>Leak Rate Before Test</i>	<i>Leak Rate After Test</i>	<i>Retest (if applicable)</i>
1 - Mansfield Black	<1ml/1hr.	35ml/1hr.	-
3 - Coast Ultra-Blue	<1ml/1hr.	no leaks	-
4 - Lavelle Korky Plus	no leaks	2ml/1hr.	-
5 - Lavelle EX-703	<1ml/1hr.	no leaks	-
6 - Lavelle Korky	<1ml/1hr.	2ml/1hr.	-
7 - Fluidmaster Bullseye	no leaks	<1ml/1hr.	-
8 - Fluidmaster Bullseye Super	37ml/1hr.	<1ml/1hr.	-
9 - Fluidmaster Bullseye Adjustable	<1ml/1hr.	no leaks	-
10 - American Standard	no leaks	<1ml/1hr.	-
11 - Frugal Flush 1.6	<1ml/1hr.	no leaks	-
12 - Frugal Flush 3.5	1.5litres/1hr.	2.5litres/1hr.	-
13 - Niagara	250ml/1hr.	<1ml/1hr.	-
14 - Toto	Not available	Not available	-
15 - Hoov-R-Line Rigid	500ml/1hr.	58ml/1hr.	-
16 - Hoov-R-Line Clear	no leaks	no leaks	-

300 PPM TEST

	<i>Leak Rate Before Test</i>	<i>Leak Rate After Test</i>	<i>Retest (if applicable)</i>
1 - Mansfield Black	no leaks	entire contents/5 minutes	-
2 - Mansfield Red	<1ml/1hr.	25ml/1hr.	-
3 - Coast Ultra-Blue	no leaks	no leaks	-
4 - Lavelle Korky Plus	15ml/1hr.	150ml/1hr.	-
5 - Lavelle EX-703	10ml/1hr.	no leaks	-
6 - Lavelle Korky	400ml/1hr.	400ml/1hr.	-
7 - Fluidmaster Bullseye	<1ml/1hr.	12ml/1hr.	-
8 - Fluidmaster Bullseye Super	no leaks	no leaks	-
9 - Fluidmaster Bullseye Adjustable	no leaks	<1ml/1hr.	-
10 - American Standard	10ml/1hr.	10ml/1hr.	-
11 - Frugal Flush 1.6	no leaks	no leaks	-
12 - Frugal Flush 3.5	<1ml/1hr.	10ml/1hr.	-
13 - Niagara	5ml/1hr.	15ml/1hr.	-
14 - Toto	Not Available	Not Available	-
15 - Hoov-R-Line Rigid	50ml/1hr.	95ml/1hr.	-
16 - Hoov-R-Line Clear	no leaks	<1ml/1hr.	-

2,000 PPM TEST

	<i>Leak Rate Before Test</i>	<i>Leak Rate After Test</i>	<i>Retest (if applicable)</i>
1 - Mansfield Black	10ml/1hr.	entire contents/1hr.	-
2 - Mansfield Red	<1ml/1hr.	no leaks	-
3 - Coast Ultra-Blue	no leaks	no leaks	-
4 - Lavelle Korky Plus	<1ml/1hr.	entire contents/1hr.	-
5 - Lavelle EX-703	no leaks	entire contents/1hr.	-
6 - Lavelle Korky	35ml/1hr.	entire contents/5min	-
7 - Fluidmaster Bullseye	no leaks	no leaks	-
8 - Fluidmaster Bullseye Super	no leaks	no leaks	-
9 - Fluidmaster Bullseye Adjustable	no leaks	<1ml/1hr.	-
10 - American Standard	no leaks	<1ml/1hr.	-
11 - Frugal Flush 1.6	no leaks	<1ml/1hr.	-
12 - Frugal Flush 3.5	100ml/1hr.	Not avail - cone broken	-
13 - Niagara	<1ml/1hr.	<1ml/1hr.	-
14 - Toto	Not available	Not available	-
15 - Hoov-R-Line Rigid	5ml/1hr.	entire contents/5min	-
16 - Hoov-R-Line Clear	no leaks	<1ml/1hr.	-

Note: *entire contents* amounts to 3 liters

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