

# **TOILET FLAPPERS**

## **Materials Integrity Tests**

Supplement to Report dated January 2000

by



The Metropolitan Water District  
of Southern California  
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## STUDY BACKGROUND

This report is a supplement to the original report prepared by the Metropolitan Water District of Southern California (Metropolitan) titled *Toilet Flappers - Materials Integrity Tests, January 2000*. That original report presented test results and recommendations from an extensive 1999 study of toilet flappers and their durability when exposed to two different in-tank drop-in bowl cleaners: Clorox Automatic<sup>®</sup> and 2000 Flushes<sup>®</sup>. During the year 2000, an additional series of tests was conducted with the product Vanish<sup>®</sup> Drop-Ins Clear. This supplement presents the test results from that series of tests.

Important factors to note in the Vanish<sup>®</sup> tests are:

- 15 different flapper models<sup>1</sup> were included, most of which were also a part of the 1999 testing. Appendix A provides a listing of those manufacturers and the products they submitted.
- The test protocol was identical to that employed in the original test (consult Appendix B of that report).
- Test subjects were immersed in concentrated solutions at 300 parts per million (ppm) and 2,000 ppm, identical to the 1999 testing. Test subjects were not, however, tested again at 50 ppm. In addition, they were not tested again in tap water, having already undergone that test series in 1999.
- Testing took place within Metropolitan's Corrosion Laboratory (Laboratory) in La Verne, California, as it had for the 1999 series.

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<sup>1</sup> Three flappers submitted for the earlier (1999) tests were not included in the tests with Vanish<sup>®</sup> Drop-Ins Clear, while two additional flappers were added for the 2000 series of tests.

## TEST APPROACH

The test protocol 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. Tap water tests were completed in 1999, along with tests in Clorox<sup>®</sup> and 2000 Flushes<sup>®</sup>. In 2000, additional tests were conducted with the product Vanish<sup>®</sup> Drop-Ins Clear, manufactured by S.C. Johnson & Son, Inc. of Racine, WI. In accordance with the protocol, tests simulated accelerated conditions, with solution concentrations maintained for 28 days as follows:

- Halogenating solution of Vanish<sup>®</sup> bowl cleaner at 300 ppm
- Halogenating solution of Vanish<sup>®</sup> bowl cleaner at 2,000 ppm

A Material Safety Data Sheet (MSDS) for Vanish<sup>®</sup> Drop-Ins Clear is included as Appendix H within this supplementary report.

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. Fifteen formed flappers were obtained from ten different manufacturers and suppliers.

Several flappers performed poorly in the previous 1999 series of tests. Because of limited space within the test oven, those flappers were withdrawn and not included in the 2000 test. They were:

- 1 - Mansfield Black
- 5 - LaVelle EX-703
- 6 - Lavelle Korky

These were replaced with new (previously untested by MWD) flappers provided by Legend and American Standard as follows:

- 17 - Legend
- 18 - American Standard B

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

Following these initial leak tests, the flappers were immersed 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 300 and 2,000 ppm).

In accordance with the protocol, the test flappers 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).

## 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 possible 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 agents of Vanish® Drop-Ins Clear to a greater degree than others. Whereas some of the flappers were able to withstand a 28-day immersion in a 300 ppm solution, all of the tested flappers leaked to one degree or another after immersion at 2000 ppm of the product. Refer to Table 4.

### Microscopic Examination

As with the previous tests in 1999, 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. Examination notes on the distortion and surface condition observed during the course of testing are included in Appendix J.

### Flapper Weight Gain

While all of the flappers were affected by the bowl cleaners to some extent, a wide range in results was observed. Weight gain results for flappers immersed in both 300 ppm and 2000 ppm solutions of Vanish® Drop-Ins Clear for 28 days are displayed in Table 5. Note that weight gain ranged from as low as 19.3 percent to as high as 93.6 percent for flappers immersed in the 2000 ppm solution.

Refer to Appendix J for further information on the weight gains measured during the 28-day course of the tests.

### Flapper Leaks vs. Weight Gain

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 6 displays the weight gains and leak rates for those test specimens subjected to the severest concentrations of 2000 Flushes®, Clorox®, and Vanish® Drop-Ins Clear.

**Table 4. Weight Gain of Flappers Immersed for 28 Days - Vanish Drop-Ins Clear**

**% WEIGHT GAIN IN 300 PPM CONCENTRATION**

D A Y	2	3	4	7	8	9	10	11	12	13	14	15	16	17	18
	MANS- FIELD (RED)	COAST ULTRA BLUE	LAVELLE KORKY PLUS	FLUID- MASTER BULLSEYE	FLUIDM. BULLSEYE SUPER	FLUIDM. BULLSEYE ADJUSTABLE	AMERICAN STANDARD	FRUGAL FLUSH 1.6	FRUGAL FLUSH 3.5	NIAGARA	TOTO	HOOV-R- LINE RIGID	HOOV-R- LINE CLEAR	LEGEND	AMERICAN STANDARD "B"
1	1.5	0.8	1.7	1	1	0.8	1.2	0.9	0.7	0.7	4.1	1.5	0.7	1.6	
2	2.7	1.6	3	1.9	1.8	1.5	2.3	1.5	1.8	2.2	5.6	2.7	1.1	2.7	
3	3.2	2.1	3.7	2.3	2	2	2.8	1.8	2.3	1.4	6.2	3.5	1.3	3.2	1.5
7	4.9	3.4	4.6	3.4	3.2	3.1	4.6	2.7	3.9	2.2	9.8	5.6	1.8	5.1	
14	6.5	5.7	8.8	5.7	5	5.7	7.5	5.1	6.3	3.8	14.4	9.9	3.2	7.7	4
28	9.7	12.9	19.4	14.9	11.5	13	17.5	11	10	8.5	30	19.8	7.6	13.3	11.5

**% WEIGHT GAIN IN 2000 PPM CONCENTRATION**

D A Y	2	3	4	7	8	9	10	11	12	13	14	15	16	17	18
	1-MANS- FIELD (RED)	COAST ULTRA BLUE	LAVELLE KORKY PLUS	FLUID- MASTER BULLSEYE	FLUIDM. BULLSEYE SUPER	FLUIDM. BULLSEYE ADJUSTABLE	AMERICAN STANDARD	FRUGAL FLUSH 1.6	FRUGAL FLUSH 3.5	NIAGARA	TOTO	HOOV-R- LINE RIGID	HOOV-R- LINE CLEAR	LEGEND	AMERICAN STANDARD "B"
1	4.2	2.5	5.8	2.4	2.4	2.3	3	2	3	2	5.9	2.6	1.9	8.4	
2	6.4	4.4	9.2	4.4	4.2	4.6	5.3	3.9	4.4	3.5	10.1	3.8	3.2	12.7	
3	7.7	6.5	12.6	6.9	6.2	6.4	8	5.7	5.6	4.6	14.8	5	4.3	14.5	4.3
7	8.7	12.1	19.8	13	10.6	10.7	15.2	9.9	8	7.1	28.4	8.2	7	18.6	
14	13.3	26.2	36.9	27.4	21	22.4	30.7	20.6	14.5	13.9	51	15.9	15.1	26.3	16.2
28	19.3	63	66	61.8	46.5	49.3	65.3	42		26.3	93.6	28.3	32.4	34.6	40.9



**Table 5. Flapper Leak Rates - Before and After Test  
(Vanish Drop-Ins Clear)**

**300 PPM CONCENTRATION**

MANUFACTURER	INITIAL LEAK RATE (ml/hr)	FINAL LEAK RATE (ml/hr)
2 - MANSFIELD (RED)	35	FEW DROPS
3 - COAST ULTRA BLUE	FEW DROPS	80
4 - LAVELLE KORKY PLUS	NONE	250
7 - FLUIDMASTER BULLSEYE	FEW DROPS	10
8 - BULLSEYE SUPER	NONE	NONE
9 - BULLSEYE SUPER ADJUST.	NONE	NONE
10 - AMERICAN STANDARD	NONE	LEAKED ENTIRE CONTENTS
11 - FRUGAL FLUSH 1.6	NONE	10
12 - FRUGAL FLUSH 3.5	1750	LEAKED ENTIRE CONTENTS
13 - NIAGARA	NONE	NONE
14 - TOTO	N/A	N/A
15 - HOOV-R-LINE RIGID	50	1000
16 - HOOV-R-LINE CLEAR	NONE	FEW DROPS
17 - LEGEND	N/A	10
18-AMERICAN STANDARD "B"	FEW DROPS	LEAKED ENTIRE CONTENTS

**2000 PPM CONCENTRATION**

MANUFACTURER	INITIAL LEAK RATE (ml/hr)	FINAL LEAK RATE (ml/hr)
2 - MANSFIELD (RED)	5	7
3 - COAST ULTRA BLUE	NONE	LEAKED ENTIRE CONTENTS
4 - LAVELLE KORKY PLUS	FEW DROPS	LEAKED ENTIRE CONTENTS
7 - FLUIDMASTER BULLSEYE	NONE	LEAKED ENTIRE CONTENTS
8 - BULLSEYE SUPER	5	LEAKED ENTIRE CONTENTS
9 - BULLSEYE SUPER ADJUST.	NONE	LEAKED ENTIRE CONTENTS
10 - AMERICAN STANDARD	NONE	LEAKED ENTIRE CONTENTS
11 - FRUGAL FLUSH 1.6	NONE	LEAKED ENTIRE CONTENTS
12 - FRUGAL FLUSH 3.5	ENTIRE CONTENTS	FLAPPER DESTROYED
13 - NIAGARA	1750	100
14 - TOTO	N/A	N/A
15 - HOOV-R-LINE RIGID	125	LEAKED ENTIRE CONTENTS
16 - HOOV-R-LINE CLEAR	NONE	LEAKED ENTIRE CONTENTS
17 - LEGEND	N/A	LEAKED ENTIRE CONTENTS
18-AMERICAN STANDARD "B"	NONE	LEAKED ENTIRE CONTENTS

Table 6. Summary of Leak Test Results

	Immersion for 28 days in 2,000 ppm solution of:					
	2000 Flushes®		Clorox®		Vanish Drop-Ins Clear®	
	Flapper Identification	Wt. Gain	Flapper Identification	Wt. Gain	Flapper Identification	Wt. Gain
<b>No Leak</b>	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%		
<b>Minor Leak</b> ( <i>&lt;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%	2-Mansfield Red	19.3%
<b>Major Leak</b> ( <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%	3-Coast Ultra-Blue 4-LaVelle Korky Plus 7-Fluidmaster Bullseye 8-Fluidmaster Bullseye Super 9-Fluidmaster Bullseye Super Adjustable 10-American Standard 11-Frugal Flush 1.6 12-Frugal Flush 3.5 13-Niagara 15-Hoov-R-Line Rigid 16-Hoov-R-Line Clear 17-Legend 18-American Standard B	63.0% 66.0% 61.8% 46.5% 49.3% 65.3% 42.0% 26.3% 28.3% 32.4% 34.6% 40.9%
<b>Leak rate not meas. -info. not available</b>	2-Mansfield Red 14-Toto (disk only) 17-Legend 18-American Std B	NM 44.6% NM NM	12-Frugal Flush 3.5 14-Toto (disk only) 17-Legend 18-American Std B	6.6% 39.6% NM NM	1-Mansfield Black 5-LaVelle EX-703 6-LaVelle Korky 14-Toto (disk only)	NM NM NM 93.6%

## STUDY CONCLUSIONS

One of the recommendations resulting from the earlier series of flapper tests<sup>2</sup> was that of testing "the newer materials used on flappers installed in 1998 products." This current series of tests (including the 1999 tests in Clorox<sup>®</sup> and 2000 Flushes<sup>®</sup>) 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.

There is a strong indication that significant materials improvements have occurred in the period since testing began in 1994. Whereas flapper durability when exposed to Clorox<sup>®</sup> and 2000 Flushes<sup>®</sup> has been shown to be markedly improved, the durability within the accelerated environment of Vanish<sup>®</sup> Drop-Ins Clear is quite different. When exposed to this latter product, none of the flappers withstood that exposure; to one degree or another, all flappers leaked at the end of the 28-day period.

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<sup>2</sup> *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

## RECOMMENDATIONS FOR ACTIONS

To a large measure, the recommendations contained within the original report of January 2000 have been acted upon. For example:

### **Toilet Design**

1. "Flapperless" toilets are being manufactured and marketed in the U.S. These products either totally eliminate the elastomeric seal within the toilet's flush valve or they substantially change the flush valve design to: (1) reduce or eliminate the seal surface area exposed to bowl cleaners or (2) enclose the flush valve mechanism within a container or vessel that is virtually tamper-proof.
2. The ASME/ANSI A112.19.5 national standards project team, working together with various manufacturers of bowl cleaners and chemicals, is currently progressing toward a standard that could provide some assurance of compatibility between flappers and in-tank bowl cleaners.

### **Bowl Cleaners**

3. The toilet fixture manufacturers have, to a large extent, implemented the recommendations on warning consumers of the consequences of using halogenating bowl cleaners. Similarly, bowl cleaner manufacturers' product literature now contains statements advising the consumer to flush the toilet at least once per day when these cleaners are used.
4. Some fixture manufacturers have either already implemented or are investigating tank designs that isolate the bowl cleaning chemicals from the elastomeric materials in the tank.
5. Customer surveys are still required in order to (1) assess the magnitude of flapper failure in the field due to bowl cleaner use and (2) design cost-effective programs to encourage customers to replace flappers and repair toilet leaks.

**ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR  
INITIAL DATA**

**SAMPLE FOR 300 PPM CONCENTRATION**

MANUFACTURER	INITIAL WT. (GRMS.)	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	4.961	NONE	SURFACE SMOOTH. ONE SIDE SHOWS WIDELY SPACED CONCENTRIC RINGS (GROOVES).
3 - COAST ULTRA BLUE	26.784	NONE	SMOOTH; SCRATCHES;
4 - LAVELLE KORXY PLUS	29.797	NONE	SURFACE HAS MANY RIDGES. LIKE LOOKING AT FINGERPRINT.
7 - FLUIDMASTER BULLSEYE	22.373	NONE	SMOOTH. CONCENTRIC, CIRCULAR DIE MARKS. OCCASIONAL OCCLUSION.
8 - BULLSEYE SUPER	22.680	NONE	FINELY TEXTURED SURFACE. CONCENTRIC DIE MARKS VERY CLEAR & SHARP. RANDOM TINY BUMPS & OCCLUSIONS.
9 - BULLSEYE SUPER ADJUST.	19.357	NONE	FINELY TEXTURED SURFACE. CONCENTRIC DIE MARKS VERY CLEAR & SHARP. RANDOM TINY BUMPS & OCCLUSIONS.
10 - AMERICAN STANDARD	34.785	NONE	SURFACE SMOOTH W/MANY RANDOM SCRATCHES, TINY BUMPS & "POCK MARKS".
11 - FRUGAL FLUSH 1.6	29.358	NONE	SMOOTH. STRAIGHT DIE MARKS. RANDOM SCRATCHES.
12 - FRUGAL FLUSH 3.5	36.309	NONE	BUMPY, TEXTURED SURFACE.
13 - NIAGARA	31.275	NONE	SLIGHTLY ROUGH, AS FINE SANDPAPER. CLEAR COLOR.
14 - TOTO	16.281	NONE	RANDOM BUMPS, SCRATCHES & DIE MARKS.
15 - HOOV-R-LINE RIGID	3.548	NONE	FINELY TEXTURED SURFACE. COLOR WHITE.
16 - HOOV-R-LINE CLEAR	30.705	NONE	TEXTURED SURFACE AS IN FINE SANDPAPER. CLEAR COLOR.
17 - LEGEND	11.701	NONE	CONCENTRIC DIE MARKS. RANDOM "POCK MARKS".
18-AMERICAN STANDARD "B"	33.140	NONE	SURFACE SMOOTH W/ MANY RANDOM SCRATCHES, TINY BUMPS & "POCK MARKS"

**SAMPLE FOR 2000 PPM CONCENTRATION**

MANUFACTURER	INITIAL WT. (GRMS.)	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.036	NONE	SURFACE SMOOTH. ONE SIDE SHOWS WIDELY SPACED CONCENTRIC RINGS(GROOVES).
3 - COAST ULTRA BLUE	26.622	NONE	SMOOTH; SCRATCHES;
4 - LAVELLE KORXY PLUS	30.307	NONE	SURFACE HAS MANY RIDGES. LIKE LOOKING AT FINGERPRINT.
7 - FLUIDMASTER BULLSEYE	22.457	NONE	SMOOTH. CONCENTRIC, CIRCULAR DIE MARKS. OCCASIONAL OCCLUSION.
8 - BULLSEYE SUPER	22.737	NONE	FINELY TEXTURED SURFACE. CONCENTRIC DIE MARKS VERY CLEAR & SHARP. RANDOM TINY BUMPS & OCCLUSIONS.
9 - BULLSEYE SUPER ADJUST.	19.350	NONE	FINELY TEXTURED SURFACE. CONCENTRIC DIE MARKS VERY CLEAR & SHARP. RANDOM TINY BUMPS & OCCLUSIONS.
10 - AMERICAN STANDARD	34.842	NONE	SURFACE SMOOTH W/MANY RANDOM SCRATCHES, TINY BUMPS & "POCK MARKS".
11 - FRUGAL FLUSH 1.6	29.518	NONE	SMOOTH. STRAIGHT DIE MARKS. RANDOM SCRATCHES.
12 - FRUGAL FLUSH 3.5	36.010	NONE	BUMPY, TEXTURED SURFACE.
13 - NIAGARA	31.240	NONE	SLIGHTLY ROUGH, AS FINE SANDPAPER. CLEAR COLOR.
14 - TOTO	16.942	NONE	RANDOM BUMPS, SCRATCHES & DIE MARKS.
15 - HOOV-R-LINE RIGID	3.570	1/16"	FINELY TEXTURED SURFACE. COLOR WHITE.
16 - HOOV-R-LINE CLEAR	30.686	NONE	TEXTURED SURFACE AS IN FINE SANDPAPER. CLEAR COLOR.
17 - LEGEND	11.787	NONE	CONCENTRIC DIE MARKS. RANDOM "POCK MARKS".
18-AMERICAN STANDARD "B"	33.156	NONE	SURFACE SMOOTH W/ MANYRANDOM SCRATCHES, TINY BUMPS & "POCK MARKS".

## ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR

## DAY 1

## 300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.037	4.961	1.5%	NONE	SIMILAR TO INITIAL.
3 - COAST ULTRA BLUE	26.996	26.784	0.8%	NONE	COLOR BEGINNING TO FADE. MANY TINY BUMPS RANDOMLY ABOUT.
4 - LAVELLE KORKY PLUS	30.290	29.797	1.7%	NONE	SURFACE RIDGES BECOMING PUFFY. COLOR FADING. SURFACE BEGINNING TO FEEL "GRABBY".
7 - FLUIDMASTER BULLSEYE	22.606	22.373	1.0%	NONE	SURFACE HAS OILY FILM. SEVERAL DEPRESSIONS RANDOMLY ABOUT.
8 - BULLSEYE SUPER	22.913	22.680	1.0%	NONE	COLOR FADING. SURFACE APPEARS UNCHANGED EXCEPT FOR CONCENTRIC GROOVE FROM VALVE SEAT.
9 - BULLSEYE SUPER ADJUST.	19.503	19.357	0.8%	NONE	SURFACE RIDGES BECOMING SOMEWHAT SWOLLEN. OTHERWISE UNCHANGED.
10 - AMERICAN STANDARD	35.194	34.785	1.2%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	29.636	29.358	0.9%	NONE	SEVERAL TINY BUMPS. SMALL DROPS OF FLUID RELEASED UPON EXTENSION.
12 - FRUGAL FLUSH 3.5	36.578	36.309	0.7%	NONE	SURFACE UNCHANGED. COLOR FADING.
13 - NIAGARA	31.489	31.275	0.7%	NONE	SURFACE UNCHANGED. COLOR BECOMING OPAQUE.
14 - TOTO	16.953	16.281	4.1%	NONE	SCRATCHES & BUMPS BECOMING SWOLLEN & PUFFY. "MOON CRATERS" DEVELOPING ON SIDE W/O NUMBER 7.
15 - HOOV-R-LINE RIGID	3.600	3.548	1.5%	1/16"	SURFACE UNCHANGED.
16 - HOOV-R-LINE CLEAR	30.922	30.705	0.7%	NONE	SURFACE UNCHANGED. COLOR LIGHT, OPAQUE YELLOW.
17 - LEGEND	11.884	11.701	1.6%	NONE	DIE MARKS BECOMING PUFFY. SURFACE "GRABBY". SMALL BUMPS "ERUPTING."
18 - AMERICAN STANDARD "B"	N/A	N/A	N/A	N/A	N/A

## 2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT.(GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.249	5.036	4.2%	NONE	SIMILAR TO INITIAL.
3 - COAST ULTRA BLUE	27.287	26.622	2.5%	NONE	COLOR BEGINNING TO FADE. MANY TINY BUMPS RANDOMLY ABOUT.
4 - LAVELLE KORKY PLUS	32.063	30.307	5.8%	NONE	SURFACE RIDGES BECOMING PUFFY. COLOR FADING. SURFACE BEGINNING TO FEEL "GRABBY".
7 - FLUIDMASTER BULLSEYE	22.995	22.457	2.4%	NONE	SURFACE HAS OILY FILM, RANDOM DEPRESSIONS, CONCENTRIC GROOVE-APPARENTLY HAS TAKEN A SET FROM VALVE SEAT.
8 - BULLSEYE SUPER	23.293	22.737	2.4%	NONE	COLOR FADING. VALVE SEAT GROOVE. MANY TINY BUMPS RANDOMLY ABOUT.
9 - BULLSEYE SUPER ADJUST.	19.800	19.350	2.3%	NONE	SURFACE RIDGES BECOMING SOMEWHAT SWOLLEN. VALVE SEAT GROOVE PRESENT.
10 - AMERICAN STANDARD	35.881	34.842	3.0%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	30.116	29.518	2.0%	NONE	SEVERAL TINY BUMPS. SMALL DROPS OF FLUID RELEASED UPON EXTENSION. WHITE CONE IS BECOMING SWOLLEN.
12 - FRUGAL FLUSH 3.5	37.075	36.010	3.0%	NONE	WHITE CONE BECOMING SWOLLEN. SURFACE UNCHANGED. COLOR IS FADING.
13 - NIAGARA	31.856	31.240	2.0%	NONE	SURFACE UNCHANGED. COLOR IS OPAQUE YELLOWISH.
14 - TOTO	17.947	16.942	5.9%	NONE	SCRATCHES & BUMPS SWOLLEN & PUFFY. MANY LITTLE "HOLES" & "BUBBLES" OR BUMPS.
15 - HOOV-R-LINE RIGID	3.664	3.570	2.6%	1/16"	SURFACE UNCHANGED.
16 - HOOV-R-LINE CLEAR	31.278	30.686	1.9%	NONE	A NUMBER OF SMALL, HARD, WHITE BUMPS HAVE APPEARED. COLOR IS LIGHT, OPAQUE YELLOW.
17 - LEGEND	12.783	11.787	8.4%	SLIGHT	RIDGES AND BUMPS ARE VERY PUFFY & SWOLLEN. SURFACE GRABBY. STUCK TO TOWEL.
18 - AMERICAN STANDARD "B"	N/A	N/A	N/A	N/A	N/A

## ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR

DAY 2

## 300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.095	4.961	2.7%	NONE	SURFACE UNCHANGED.
3 - COAST ULTRA BLUE	27.225	26.784	1.6%	NONE	SIMILAR TO DAY 1.
4 - LAVELLE KORKY PLUS	30.699	29.797	3.0%	NONE	SIMILAR TO DAY 1.
7 - FLUIDMASTER BULLSEYE	22.792	22.373	1.9%	NONE	SIMILAR TO DAY 1.
8 - BULLSEYE SUPER	23.082	22.680	1.8%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST.	19.650	19.357	1.5%	NONE	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	35.592	34.785	2.3%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	29.812	29.358	1.5%	NONE	SIMILAR TO DAY 1.
12 - FRUGAL FLUSH 3.5	36.950	36.309	1.8%	NONE	SIMILAR TO DAY 1.
13 - NIAGARA	31.965	31.275	2.2%	NONE	SIMILAR TO DAY 1.
14 - TOTO	17.185	16.281	5.6%	NONE	SIMILAR TO DAY 1.
15 - HOOV-R-LINE RIGID	3.644	3.548	2.7%	1/16"	SURFACE UNCHANGED.
16 - HOOV-R-LINE CLEAR	31.033	30.705	1.1%	NONE	SIMILAR TO DAY 1.
17 - LEGEND	12.022	11.701	2.7%	NONE	SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	N/A	N/A	N/A	N/A	N/A

## 2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.356	5.036	6.4%	NONE	SURFACE SLIGHTLY PUFFY.
3 - COAST ULTRA BLUE	27.801	26.622	4.4%	NONE	SIMILAR TO DAY 1. COLOR FADE CONTINUES.
4 - LAVELLE KORKY PLUS	33.103	30.307	9.2%	NONE	SIMILAR TO DAY 1.
7 - FLUIDMASTER BULLSEYE	23.450	22.457	4.4%	NONE	SIMILAR TO DAY 1.
8 - BULLSEYE SUPER	23.694	22.737	4.2%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST.	20.239	19.350	4.6%	NONE	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	36.687	34.842	5.3%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	30.670	29.518	3.9%	NONE	SIMILAR TO DAY 1. ATTACK ON CONE CONTINUES.
12 - FRUGAL FLUSH 3.5	37.609	36.010	4.4%	NONE	SIMILAR TO DAY 1. ATTACK ON CONE CONTINUES.
13 - NIAGARA	32.320	31.240	3.5%	NONE	SURFACE UNCHANGED. COLOR IS YELLOW.
14 - TOTO	18.660	16.942	10.1%	SLIGHT	SIMILAR TO DAY 1.
15 - HOOV-R-LINE RIGID	3.704	3.570	3.8%	SLIGHT	MANY TINY BUMPS PRESENT.
16 - HOOV-R-LINE CLEAR	31.674	30.686	3.2%	NONE	SIMILAR TO DAY 1.
17 - LEGEND	13.283	11.787	12.7%	SLIGHT	SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	N/A	N/A	N/A	N/A	N/A

## ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR

## DAY 3

## 300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.121	4.961	3.2%	NONE	SURFACE BECOMING PUFFY. RINGS DISAPPEARING.
3 - COAST ULTRA BLUE	27.337	26.784	2.1%	NONE	SIMILAR TO DAY 1.
4 - LAVELLE KORKY PLUS	30.887	29.797	3.7%	NONE	SIMILAR TO DAY 1.
7 - FLUIDMASTER BULLSEYE	22.885	22.373	2.3%	NONE	SIMILAR TO DAY 1. CONDITIONS WORSEN.
8 - BULLSEYE SUPER	23.132	22.680	2.0%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST.	19.748	19.357	2.0%	NONE	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	35.770	34.785	2.8%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	29.897	29.358	1.8%	NONE	SIMILAR TO DAY 1. CONE IS WORSENING.
12 - FRUGAL FLUSH 3.5	37.150	36.309	2.3%	NONE	SIMILAR TO DAY 1.
13 - NIAGARA	31.716	31.275	1.4%	NONE	SIMILAR TO DAY 1.
14 - TOTO	17.295	16.281	6.2%	NONE	SIMILAR TO DAY 1.
15 - HOOV-R-LINE RIGID	3.673	3.548	3.5%	1/8"	SURFACE UNCHANGED. MORE DISTORTION.
16 - HOOV-R-LINE CLEAR	31.093	30.705	1.3%	NONE	SURFACE UNCHANGED. COLOR LIGHT, OPAQUE YELLOW.
17 - LEGEND	12.076	11.701	3.2%	NONE	SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	33.637	33.140	1.5%	NONE	SURFACE UNCHANGED. OILY FILM PRESENT.

## 2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.424	5.036	7.7%	NONE	SIMILAR TO DAY 2.
3 - COAST ULTRA BLUE	28.352	26.622	6.5%	NONE	SIMILAR TO DAY 1.
4 - LAVELLE KORKY PLUS	34.139	30.307	12.6%	NONE	SIMILAR TO DAY 1. CONDITIONS WORSEN.
7 - FLUIDMASTER BULLSEYE	24.014	22.457	6.9%	NONE	SIMILAR TO DAY 1. VERY OILY SURFACE.
8 - BULLSEYE SUPER	24.153	22.737	6.2%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST.	20.594	19.350	6.4%	NONE	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	37.617	34.842	8.0%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	31.189	29.518	5.7%	NONE	SIMILAR TO DAY 1.
12 - FRUGAL FLUSH 3.5	38.026	36.010	5.6%	NONE	SIMILAR TO DAY 1. ATTACK ON CONE CONTINUES.
13 - NIAGARA	32.667	31.240	4.6%	NONE	SIMILAR TO DAY 1. COLOR IS MILKY YELLOW.
14 - TOTO	19.448	16.942	14.8%	SLIGHT	SIMILAR TO DAY 1. MANY BUMPS WHICH EXUDE FLUID WHEN "PRICKED".
15 - HOOV-R-LINE RIGID	3.747	3.570	5.0%	1/8"	SURFACE UNCHANGED. SHAPE BECOMING OBLONG & MORE DISTORTED.
16 - HOOV-R-LINE CLEAR	31.997	30.686	4.3%	NONE	SIMILAR TO DAY 1.
17 - LEGEND	13.5	11.787	14.5%	SLIGHT	SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	34.586	33.156	4.3%	NONE	SURFACE UNCHANGED.



## ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR

## DAY 7

## 300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.202	4.961	4.9%	NONE	SIMILAR TO DAY 3.
3 - COAST ULTRA BLUE	27.697	26.784	3.4%	NONE	SIMILAR TO DAY 1. COLOR FADE SEVERE.
4 - LAVELLE KORKY PLUS	31.166	29.797	4.6%	NONE	SIMILAR TO DAY 1.
7 - FLUIDMASTER BULLSEYE	23.135	22.373	3.4%	NONE	SIMILAR TO DAY 1. OILY FILM COMES OFF ON DRYING TOWEL - YELLOWY.
8 - BULLSEYE SUPER	23.408	22.680	3.2%	NONE	SIMILAR TO DAY 1. OILY FILM ON SURFACE.
9 - BULLSEYE SUPER ADJUST.	19.966	19.357	3.1%	NONE	SIMILAR TO DAY 1. OILY FILM ON SURFACE.
10 - AMERICAN STANDARD	36.370	34.785	4.6%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	30.155	29.358	2.7%	NONE	SIMILAR TO DAY 1. CONE WORSENING. OILY FILM ON SURFACE.
12 - FRUGAL FLUSH 3.5	37.721	36.309	3.9%	NONE	SURFACE UNCHANGED. COLOR FADE CONTINUES.
13 - NIAGARA	31.958	31.275	2.2%	NONE	SIMILAR TO DAY 1.
14 - TOTO	17.877	16.281	9.8%	NONE	SIMILAR TO DAY 1.
15 - HOOV-R-LINE RIGID	3.748	3.548	5.6%	1/16"	SURFACE UNCHANGED. SHAPE DISTORTED.
16 - HOOV-R-LINE CLEAR	31.273	30.705	1.8%	NONE	SURFACE UNCHANGED. COLOR SOLID YELLOW.
17 - LEGEND	12.296	11.701	5.1%	NONE	SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	N/A	N/A	N/A	N/A	N/A

## 2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.472	5.036	8.7%	NONE	SIMILAR TO DAY 2.
3 - COAST ULTRA BLUE	29.834	26.622	12.1%	NONE	SIMILAR TO DAY 1. COLOR FADE SEVERE.
4 - LAVELLE KORKY PLUS	36.295	30.307	19.8%	NONE	SIMILAR TO DAY 1.
7 - FLUIDMASTER BULLSEYE	25.382	22.457	13.0%	NONE	SIMILAR TO DAY 1.
8 - BULLSEYE SUPER	25.141	22.737	10.6%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST.	21.423	19.350	10.7%	NONE	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	40.149	34.842	15.2%	1/8" VALVE SEAT	SURFACE APPEARS UNCHANGED. NO TACK. SHAPE IS BEGINNING TO DISTORT.
11 - FRUGAL FLUSH 1.6	32.448	29.518	9.9%	NONE	SIMILAR TO DAY 1. ATTACK ON CONE IS SEVERE.
12 - FRUGAL FLUSH 3.5	38.882	36.010	8.0%	NONE	SIMILAR TO DAY 1. ATTACK ON CONE IS SEVERE.
13 - NIAGARA	33.467	31.240	7.1%	1/8" VALVE SEAT	SIMILAR TO DAY 1. COLOR IS SOLID WHITE.
14 - TOTO	21.754	16.942	28.4%	1/8" FROM TABLE	SIMILAR TO DAY 1 BUT CONDITIONS WORSEN. SURFACE "GRABBY".
15 - HOOV-R-LINE RIGID	3.864	3.570	8.2%	1/16" VALVE SEAT	SURFACE RELATIVELY UNCHANGED. NO TACK. SHAPE IS OBLONG AND DISTORTED.
16 - HOOV-R-LINE CLEAR	32.849	30.686	7.0%	NONE	SIMILAR TO DAY 1. COLOR IS SOLID WHITE. SURFACE FEELS "CHALKY".
17 - LEGEND	13.981	11.787	18.6%	NONE	SURFACE VERY TACKY. STUCK TO PAPER TOWEL WHILE DRYING. OTHERWISE SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	N/A	N/A	N/A	N/A	N/A

**ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR**  
**DAY 14**  
**300 PPM CONCENTRATION**

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGH T GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.281	4.961	6.5%	NONE	SIMILAR TO DAY 3.
3 - COAST ULTRA BLUE	28.299	26.784	5.7%	NONE	SIMILAR TO DAY 1.
4 - LAVELLE KORXY PLUS	32.430	29.797	8.8%	NONE	SIMILAR TO DAY 1.
7 - FLUIDMASTER BULLSEYE	23.657	22.373	5.7%	NONE	SIMILAR TO DAY 1. SURFACE FILM VERY OILY.
8 - BULLSEYE SUPER	23.806	22.680	5.0%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST	20.452	19.357	5.7%	NONE	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	37.380	34.785	7.5%	NONE	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	30.858	29.358	5.1%	NONE	SIMILAR TO DAY 7.
12 - FRUGAL FLUSH 3.5	38.607	36.309	6.3%	NONE	SIMILAR TO DAY 7.
13 - NIAGARA	32.467	31.275	3.8%	NONE	SIMILAR TO DAY 1. SURFACE TACKY.
14 - TOTO	18.625	16.281	14.4%	NONE	SIMILAR TO DAY 1.
15 - HOOV-R-LINE RIGID	3.898	3.548	9.9%	1/8"	SIMILAR TO DAY 7.
16 - HOOV-R-LINE CLEAR	31.676	30.705	3.2%	NONE	SIMILAR TO DAY 7.
17 - LEGEND	12.604	11.701	7.7%	NONE	SIMILAR TO DAY 1.
18-AMERICAN STANDARD "B"	34.481	33.140	4.0%	NONE	SIMILAR TO DAY 7. OILY FILM IS SIMILAR TO THAT FOUND ON BULLSEYE.

**2000 PPM CONCENTRATION**

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGH T GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.706	5.036	13.3%	NONE	SIMILAR TO DAY 2.
3 - COAST ULTRA BLUE	33.602	26.622	26.2%	1/8-1/4"	SURFACE APPEARS UNCHANGED BUT SHAPE IS SEVERELY DISTORTED.
4 - LAVELLE KORXY PLUS	41.480	30.307	36.9%	SLIGHT	SIMILAR TO DAY 1. SOME SHAPE DISTORTION.
7 - FLUIDMASTER BULLSEYE	28.610	22.457	27.4%	1/16"	SURFACE SIMILAR TO DAY 1. SHAPE BEGINNING TO DISTORT.
8 - BULLSEYE SUPER	27.511	22.737	21.0%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST	23.685	19.350	22.4%	SLIGHT	SIMILAR TO DAY 1.
10 - AMERICAN STANDARD	45.523	34.842	30.7%	1/4"	SURFACE APPEARS UNCHANGED BUT SHAPE IS SEVERELY DISTORTED.
11 - FRUGAL FLUSH 1.6	35.607	29.518	20.6%	1/16"	SIMILAR TO DAY 1. ATTACK ON CONE IS SEVERE. COLOR IS NOW GRAY-BROWN.
12 - FRUGAL FLUSH 3.5	41.235	36.010	14.5%	SLIGHT	SURFACE APPEARS UNCHANGED. CONE IS IN SEVERE DISTRESS.
13 - NIAGARA	35.591	31.240	13.9%	1/4"HINGE BEND	SIMILAR TO DAY 7.
14 - TOTO	25.586	16.942	51.0%	1/2" TABLE	SIMILAR TO DAY 7. SEVERE DISTORTION.
15 - HOOV-R-LINE RIGID	4.138	3.570	15.9%	1/8"	SIMILAR TO DAY 7.
16 - HOOV-R-LINE CLEAR	35.31	30.686	15.1%	SLIGHT	SURFACE IS BLISTERED WITH MANY TINY BUMPS WHICH "POP" WHEN SQUEEZED & YIELD FLUID.
17 - LEGEND	14.89	11.787	26.3%	1/16" TABLE	SIMILAR TO DAY 7.
18-AMERICAN STANDARD "B"	38.534	33.156	16.2%	1/4"	SURFACE APPEARS UNCHANGED BUT SHAPE IS BEGINNING TO DISTORT.

## ACCELERATED FORMED FLAPPER TEST WITH VANISH DROP-INS CLEAR

## DAY 28

## 300 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	5.443	4.961	9.7%	NONE	SIMILAR TO DAY 3.
3 - COAST ULTRA BLUE	30.227	26.784	12.9%	NONE	SIMILAR TO DAY 1. COLOR LIGHT BLUE.
4 - LAVELLE KORKY PLUS	35.564	29.797	19.4%	NONE	SIMILAR TO DAY 14. SURFACE VERY "TACKY"
7 - FLUIDMASTER BULLSEYE	25.696	22.373	14.9%	NONE	SIMILAR TO DAY 1. OILY FILM PRESENT.
8 - BULLSEYE SUPER	25.287	22.680	11.5%	NONE	SIMILAR TO DAY 1.
9 - BULLSEYE SUPER ADJUST	21.872	19.357	13.0%	NONE	SIMILAR TO DAY 1. SURFACE "TACKY"
10 - AMERICAN STANDARD	40.877	34.785	17.5%	SLIGHT	SURFACE UNCHANGED.
11 - FRUGAL FLUSH 1.6	32.590	29.358	11.0%	NONE	SIMILAR TO DAY 7. CONE IN GREAT DISTRESS.
12 - FRUGAL FLUSH 3.5	39.938	36.309	10.0%	NONE	SIMILAR TO DAY 7. CONE SHOWING SEVERE DEGRADATION.
13 - NIAGARA	33.932	31.275	8.5%	HINGE BEND	SIMILAR TO DAY 1.
14 - TOTO	21.166	16.281	30.0%	NONE	SIMILAR TO DAY 1.
15 - HOOV-R-LINE RIGID	4.250	3.548	19.8%	1/8"	TOP LAYER BEGINNING TO CRACK AND DELAMINATE. SHAPE ELONGATED.
16 - HOOV-R-LINE CLEAR	33.036	30.705	7.6%	NONE	SIMILAR TO DAY 14. SURFACE VERY "TACKY"
17 - LEGEND	13.259	11.701	13.3%	NONE	SIMILAR TO DAY 1. SURFACE VERY STICKY.
18-AMERICAN STANDARD "B"	36.962	33.140	11.5%	HINGE BEND	SURFACE UNCHANGED. OILY FILM PRESENT.

## 2000 PPM CONCENTRATION

MANUFACTURER	PAT DRY WT. (GRMS.)	INITIAL WT. (GRMS.)	% WEIGHT GAIN	DISTORTION	SURFACE APPEARANCE
2 - MANSFIELD (RED)	6.010	5.036	19.3%	NONE	SIMILAR TO DAY 2.
3 - COAST ULTRA BLUE	43.403	26.622	63.0%	1/2"	SIMILAR TO DAY 14.
4 - LAVELLE KORKY PLUS	50.313	30.307	66.0%	1/8"	VERY PUFFY. LARGE BLISTERS OR PUSTULES NEAR FRONT EDGE-DO NOT BLEED FLUID WHEN PRICKED.
7 - FLUIDMASTER BULLSEYE	36.335	22.457	61.8%	1/2"	SURFACE FEATURES INDISTINGUISHABLE. SURFACE LOOKS DULL. FEW BUMPS.
8 - BULLSEYE SUPER	33.305	22.737	46.5%	1/4"	SURFACE FEATURES NOT VISIBLE. SURFACE LOOKS DULL, SMOOTH, FEW BUMPS.
9 - BULLSEYE SUPER ADJUST	28.891	19.350	49.3%	1/4"	SURFACE SIMILAR TO DAY 1. SHAPE GREATLY DISTORTED.
10 - AMERICAN STANDARD	57.578	34.842	65.3%	1/2"	SIMILAR TO DAY 14.
11 - FRUGAL FLUSH 1.6	41.922	29.518	42.0%	1/4"	SIMILAR TO DAY 14. EXCEPT SHAPE IS DISTORTED & CONE MECHANISM FALLS FREELY OUT OF FLAPPER.
12 - FRUGAL FLUSH 3.5	NA	36.010	NA	1/4"	CONE DISINTEGRATED FROM FLAPPER. FLAPPER SURFACE DISTORTED. UNABLE TO WEIGH !!!
13 - NIAGARA	39.470	31.240	26.3%	1/2"HINGE BEND	SLIGHT BEND @ HINGES CAUSING IT TO LIFT FROM SEAT BUT SEALING SURFACE NOT VISIBLY DISTORTED.
14 - TOTO	32.807	16.942	93.6%	1 1/8" TABLE	SURFACE VERY SWOLLEN & BUMPY. SPECIMEN IS CURLED UP LIKE A TACO.
15 - HOOV-R-LINE RIGID	4.581	3.570	28.3%	1/8"	TOP LAYER BEGINNING TO DELAMINATE. CRACKS OR GROOVES ALL ACROSS SURFACE. SHAPE ELONGATED & DISTORTED.
16 - HOOV-R-LINE CLEAR	40.615	30.686	32.4%	1/4"	SIMILAR TO DAY 14. SHAPE DISTORTED. BEND @ HINGES.
17 - LEGEND	15.87	11.787	34.6%	NONE	SIMILAR TO DAY 7.
18-AMERICAN STANDARD "B"	46.706	33.156	40.9%	1/2"	SURFACE APPEARS UNCHANGED BUT SHAPE IS SEVERELY DISTORTED.