

TOILET FLAPPERS

After-Market Toilet Flappers: A Study of Compatibility and Flush Volumes

by



The Metropolitan Water District
of Southern California
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TABLE OF CONTENTS

Introduction	page 1
Metropolitan Water District of Southern California	1
Metropolitan's Toilet Replacement Program	1
Study Background	3
Water Conservation and ULF Toilets	3
ULF Toilets and Flapper Failure	3
Flapper Replacement by the Consumer	3
Studying After-Market Flappers	3
Test Protocol	4
Corrosion Laboratory and Test Facility	4
Test Approach	5
Summary of Test Results	6
1994-1995 Model ULF Toilets	6
1997-1998 Model ULF Toilets	6
Study Conclusions	8
Recommendations for Action	10

Tables

- Table 1. After-Market Toilet Flapper Listing
- Table 2. ULF Toilet Listing
- Table 3. Summary of Water Consumption - 1994-95 Toilet Models
- Table 4. Individual Flapper Performance on 1994-95 Toilet Models
- Table 5. Summary of Water Consumption - 1997-98 Toilet Models
- Table 6. Individual Flapper Performance on 1997-98 Toilet Models

Appendices

APPENDIX A - Test Protocol for Volume Testing of ULF Toilets

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Preface

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- Crane Plumbing
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- Fluidmaster, Inc.
- Frugal Technologies, Inc.
- Niagara Conservation Corporation
- Toto U.S.A., Inc.
- Vitromex/St. Thomas Creations

INTRODUCTION

Metropolitan Water District of Southern California

The Metropolitan Water District of Southern California (Metropolitan) is a California public agency. Metropolitan is a consortium of 27 cities and water districts that provides drinking water to more than 16 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 under construction 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 drought 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 regional 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, 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 1998, over 1.3 million old 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 mandated 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 a yardstick 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 maintain their initial performance for that period. This, in turn, demands that flush valve flappers continue to function at 1.6 gallons per flush throughout the 20-year lifetime.

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 device (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.

In 1994, 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.

Flapper Replacement by the Consumer

Most consumers, upon discovering a leak in their toilet (whether resulting from normal "wear and tear" or from the use of an in-tank bowl cleaner), will attempt to locate a replacement flapper that stops the leak. When consumers look for such a replacement, will they be able to: (1) find a flapper that is physically compatible with the flush valve (it fits the valve and does not leak); and (2) determine that the replacement flapper maintains the 1.6 gallons per flush (gpf) characteristic of the original flapper in the ULF toilet? Whereas a consumer may easily locate a flapper that is physically compatible, they may not be able to discern whether the flapper meets the second requirement (a 1.6 gallon flush). Furthermore, once having satisfied the first requirement, many consumers may not be aware of the 1.6 gallon criteria or may even prefer a flapper that exceeds 1.6 gallons per flush.

Studying After-Market Flappers

To answer these questions and determine the performance of available flush valve closure designs, Metropolitan undertook to test replacement (after-market) flappers available (in 1997 and 1998) to consumers at major retail chains in Southern California. A total of 50 different

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

replacement flappers or flush valve sealing mechanisms were purchased from Home Depot, HomeBase, Orchard Supply Hardware (OSH), Ace Hardware Stores, and True Value Hardware Stores (refer to Table 1).

A total of 24 different ULF toilets were obtained for the tests, all of which were round-front units at the lower end of each manufacturer's price range. Of the 24 complete units, 7 were toilets manufactured and sold in 1994 and 1995 and 17 were manufactured in 1997 and 1998. One of the 17 was a prototype unit not currently available to the consumer. All of the other 16 are or were available in the general stream of commerce in Southern California. Table 2 provides a complete listing of the ULF toilets.

Of the 50 flappers, 30 were physically compatible with the 17 new 1997-1998 ULF toilets. Those 30 flappers were subjected to tests designed to answer the following study questions:

1. Which flappers are functionally and physically compatible with *each* of the ULF toilets?
2. What is the leakage rate for each flapper when installed on each of the ULF toilets?
3. For each compatible flapper, what is the water consumption per flush when installed on each ULF toilet?

In addition to testing after-market flappers, original-equipment manufacturers' (OEM) flappers, as installed on the new 1997-1998 test toilets², were subjected to the tests as well.

Test Protocol

Considering the requirements identified above, a test protocol was developed for the study, included here as Appendix A.

Corrosion Laboratory and Test Facility

Metropolitan's Corrosion Laboratory (Laboratory) in La Verne, California, 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 recent flapper materials tests³ and the tests described in this report.

To carry out the tests necessary to answer the questions, Metropolitan constructed and installed a specially designed toilet test rack in its Corrosion Laboratory. The test rack, which includes the appropriate drain line and drain line connections, accommodates five toilets. The entire test rack facility simulates a "real world" residential installation and complies with the provisions of the Uniform Plumbing Code. Tests were conducted with static water pressure set at 50 pounds per square inch.

² The 17 brand new ULF toilets (manufactured in 1997 and 1998) were first tested for flapper compatibility and flush volume with the OEM trim before being fitted with the after-market flappers.

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

TEST APPROACH

The protocol calls for testing both OEM and after-market flappers in each of the toilets listed in Table 2. Testing consisted first of installing each toilet (bowl and matching tank) on the test facility in accordance with the manufacturer's instructions. (For 1997-1998 models, the next step involved testing each toilet with its OEM flush mechanism, recording any flapper leakage that may be present and recording the flush volume over five flush cycles. This OEM test was not performed on the 1994-1995 models, because the OEM flappers had previously been tested in the materials integrity tests⁴ and were no longer available.)

Next, the after-market replacement flapper (from the list included here on Table 1) was installed, the tank was filled,⁵ and adjustments were made to: (1) the flapper, as called for by the manufacturer of the replacement product, and (2) the fill level of the tank as prescribed by the toilet manufacturer. Leakage (if any) was then measured over a one-half hour period (one hour for 1995 toilet models) and recorded. The toilet was next flushed with each replacement flapper installed and the water flowing in to refill the tank was measured using a digital flowmeter. The flush test was repeated four additional times for each installation, and the results recorded and averaged. For adjustable flappers, tests were performed at both the maximum and minimum adjustment settings.

⁴ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

⁵ Only after-market flappers and closure seals that were physically compatible with the particular toilet were installed and tested. Of the total of 50 flappers and closure seals, only 48 were available at the time the 1994-1995 toilets were tested, of which 25 were physically compatible with those toilets. Flappers 49 and 50 (as listed on Table 1) were added in time for the tests of the 1997-1998 toilets.

SUMMARY OF TEST RESULTS

Note: The selection of only one of each ULF toilet and one each of the after-market flappers available on retail shelves does not provide a statistically valid representation of all ULF toilets of a given toilet model or all after-market flappers. Therefore, the results shown below should be viewed only as a rough indication of the “real world” performance of toilets and flappers. To obtain statistically reliable results, a larger sample of each of these products would be required for the tests conducted.

1994-1995 Model ULF Toilets

Test results related to the 1994-1995 models are shown on Table 3. Table 3 indicates the range of flush volume for each of the flappers found to be physically compatible with each of the seven ULF toilets. In the case of the four adjustable flappers tested, all four flappers permitted six of the ULF toilets⁶ to flush at more than 1.6 gallons when set to their maximum volume setting. In the case of the non-adjustable flappers, flush volumes ranged from a low of 2.37 gallons to a high of 6.42 gallons when installed on the six compatible ULF toilets. Thus, none of the after-market replacement flappers performed at the original 1.6 gpf on these six toilets.

Table 4 provides individual flush volume data for each compatible flapper (adjustable and non-adjustable) or closure seal with each 1994-1995 ULF toilet included in the tests.

1997-1998 Model ULF Toilets

Water consumption “out of the box”

Test results for the 1997-1998 models indicate that most toilets of the type tested (standard round-front), when removed from their factory carton and set up in accordance with OEM manufacturer’s instructions, consume less than 1.75 gallons per flush (gpf). Consumption amounts for the 1997-1998 models tested fell into the following profile (refer to Table 5):

<u>Gallons per flush with OEM trim</u>	<u>No. of ULF Toilets</u>
1.6 gpf or less	7
1.61 to 1.75 gpf	5
1.75 to 2.00 gpf	1
2.00 to 2.25 gpf	<u>1</u>
Total	14

Consumer shopping for a replacement flapper

Study findings also disclosed that rarely will the consumer be able to easily find the replacement (after-market) flapper that maintains the flush characteristics of their OEM toilet. A consumer visiting one of the five major retailers noted in Table 1 will usually find an array of flappers that is confusing and, in some cases, misleading⁷.

⁶ The Mansfield 130-160 did not accept any of the traditional flappers.

⁷ Flapper packaging labeled as “universal” seldom contains a flapper universally fitting an array of toilets.

After-market flapper performance in large tanks

For the 14 ULF toilets with an effective tank capacity⁸ in excess of 1.6 gallons, installation of the wrong flapper could result in water consumption amounts as high as 4.4 gallons for non-adjustable flappers and 3.4 gallons for adjustable flappers (refer to Table 5). Consequently, the water savings previously attributed to programs involving the retrofit of residential toilets could be overstated. Refer to Table 6 for individual flush volume data for each compatible flapper or closure seal with each 1997-1998 toilet.

After-market flapper performance in 1.6-gallon tanks

For the three toilets with an effective tank capacity of 1.6 gallons,⁸ fewer replacement flappers were available, but the non-adjustable flappers that fit those toilets generally flushed at less than 2.0 gpf. However, a large number of those non-adjustable flappers caused the toilet to flush at less than 1.0 gpf and the resulting incomplete flush severely affected toilet performance.⁹ Likewise, adjustable flappers did not function well within these three toilets; none provided the full 1.6-gallon flush and, in the case of two of the toilets, they failed to provide sufficient water for a complete flush, regardless of the adjustable flapper setting. Again, refer to Table 6 for individual data on each ULF toilet and each compatible flapper.

⁸ Three of the 17 tested 1997-1998 toilets contained a “bucket” within the tank to reduce the amount of water available to the flush valve. The “effective” tank capacity of these units is deemed to be 1.6± gallons, although the “buckets” are not entirely tamper-proof and could be modified to increase the tank capacity.

⁹ Some of the non-adjustable flappers, when installed in the “bucket” toilets, would not open completely when the flush lever was tripped and would close before 1.6 gallons of water passed through the flush valve.

STUDY CONCLUSIONS

Replacement toilet flappers must be physically compatible with the internal toilet tank mechanism, and be functionally capable of consistently delivering a 1.6-gallon flush. The study results clearly identify a problem in the latter area. Generally, study results reveal the following:

- For most ULF toilets, after-market replacement flappers that maintain the flush characteristics of the OEM toilets are rarely available at retail stores frequented by consumers. Each of the major chain hardware and building supply stores offers a wide choice of after-market replacement flappers. The available product, however, is not necessarily functionally nor physically compatible with the entire array of installed ULF toilet models.

This can be attributed to (1) the vast number of flappers that would be required to fit every ULF toilet model and (2) the limited available shelf space at the retail point-of-purchase.

- Each after-market flapper performed differently in the different ULF toilet models tested, as illustrated in Tables 3 through 6. Therefore, each flapper may be uniquely suited to only a few ULF toilet models and cannot necessarily be classified as “universal.”

Determining the causes of variations in the flush volume performance of each after-market flapper was not within the scope of this study. However, the variations from toilet to toilet can probably be attributed to the different tank capacities, different head pressures resulting from tank dimensions, physical and hydraulic characteristics of the flush valve, and other similar factors.

- The packaging (or labeling) of after-market replacement flappers does not necessarily lead the consumer to the correct choice for their own ULF toilet. Labeling after-market replacement flappers as “universal” or “fits 1.6 gpf toilets” can lead the consumer to believe that purchasing and installing that product will restore their ULF toilet to its original performance at 1.6 gpf. Rather, the study results show that rarely does the replacement flapper, when correctly installed, perform at 1.6 gpf (refer to Tables 3 through 6).

Although not included within the scope of this study, consumers have reported to the study team that they frequently must return to the retail outlet several times to exchange their previous flapper purchase for another flapper before they have found the one that fits the flush valve and provides a complete flush. The study results indicate that although the consumer may finally install a compatible flapper that results in a satisfactory flush, the likelihood of achieving a 1.6-gallon flush is slim.

- Though they may be physically compatible with certain ULF toilet models, the after-market flappers that are available through the major retail outlets do not all deliver 1.6-gallon flushes (refer to Tables 3 through 6). For example, non-adjustable after-market flappers, when

installed on 19 of the 24 ULF toilets studied¹⁰, resulted in flushes ranging between 1.4 and 6.4 gallons.

Determining the causes of variations in the flush volume performance of each after-market flapper was not within the scope of this study. However, as indicated earlier, these variations can probably be attributed to tank dimensions and capacities, and to the hydraulic characteristics of the various ULF toilet models.

- Adjustable flappers sold as after-market replacements for OEM flappers can generally deliver 1.6 gpf if adjusted (or set) to the correct orifice opening. Most adjustable flappers, however, are pre-set within their packaging to the opening that would cause the ULF toilet to flush with the most water (i.e., the “high” setting as noted in Tables 3 and 5).¹¹

The consumer could be expected to remove the replacement flapper from the packaging, install it on the flush valve, and flush the toilet (possibly without reading the instructions and adjusting the flapper setting). If, upon installation, the toilet proved to flush satisfactorily, the consumer would make no adjustments to the flapper, thus leaving it to flush at the “high” setting, usually in excess of 1.6 gallons. (Refer to Tables 3 and 5 for the measured “high” settings on the adjustable flappers.)

¹⁰ Excluding the two Mansfield toilets, which use a non-typical flush valve, and the “bucket” toilets (Niagara N2202TP, St. Thomas Eclipse 6201.110, and Eljer 141-0120).

¹¹ Excludes Fluidmaster flapper #50, which was set at the middle setting, approximately halfway between “low” and “high.”

RECOMMENDATIONS FOR ACTIONS

Background on Flapper Failure and Replacement Demand

The physical or useful life of toilet flappers is generally estimated at five (5) years. The use of in-tank bowl cleaners containing halogenating chemicals¹² can significantly shorten the useful life. Laboratory tests verify the susceptibility of many flapper materials to some bowl cleaning agents.¹³ However, the conclusions resulting from those tests are estimates only. There is no conclusive data that identifies the magnitude of flapper failure in the field (either through normal wear or because of accelerated deterioration due to the bowl cleaners). Therefore, a series of in-residence field surveys and physical inspections of installed toilets is required to ascertain:

- the extent of consumer use of in-tank bowl cleaners and what type and how often they are used;
- the frequency of toilet flapper replacement by the consumer and the consumer's source of the replacement flapper;
- the current physical condition of the installed toilet flapper(s);
- the make and age of the surveyed toilet(s); and
- any other information pertinent to toilet flapper durability.

Such a study is currently being sponsored by the City of Los Angeles Department of Water and Power. That study is designed to examine toilet flapper failure and toilet performance within 100 randomly selected households in the city, each of which installed a ULF toilet under one of the City's toilet replacement programs. Field work is approximately 60 percent complete.

Another such study is being sponsored by the Cities of Phoenix and Tucson, Arizona, in cooperation with the United States Bureau of Reclamation and the University of Arizona. In that study, older (in excess of five years of age) ULF toilets will be inspected for physical condition. The necessary field work on this study has not yet commenced.

Recommendations for Actions

Together with gathering information on "real world" failures through field studies, additional follow-on efforts are required to encourage the plumbing industry and retail marketplace to:

- extend the life of flappers through materials durability specifications;
- assure the availability to the consumer of the correct replacement flappers through a set of standards and practices that reduce the vast number of flapper choices now facing the consumer;

¹² The consumers' use of in-tank bowl cleaners is largely a phenomena of the 1990s. In recent years, successful marketing by several major firms of a variety of bowl cleaner brands has contributed to the accelerated use of these products.

¹³ *Toilet Flapper Materials Integrity Tests*, The Metropolitan Water District of Southern California, May 1998.

- develop a consumer-friendly part identification system similar to that, for example, used for common vehicle parts (batteries, wiper blades, fan belts, oil filters, etc.), wherein the consumer has access to a parts replacement catalog that identifies toilet models and the appropriate replacement flapper for each model, and
- explore and adopt innovative and improved toilet designs, considering:
 - flush valve/flapper materials impervious to chemical attack,¹⁴
 - mechanisms that introduce the concentrated cleaning chemicals directly into the bowl, rather than via the tank water,¹⁵ and
 - flush valve designs that do not use traditional flappers.¹⁶

Metropolitan will continue to be represented on and participate in the work of the Codes and Standards Committee of the American Society of Mechanical Engineers (ASME)¹⁷ ANSI A112.19.2/19.6 Vitreous China Plumbing Fixtures Project Team. Within this group are represented all of the major porcelain and internal trim (including flappers) manufacturers. Metropolitan's goal is to stimulate and encourage an industry-led effort toward design, compatibility, and labeling standards for ULF toilets and after-market flappers that would ensure that the 1.6 gpf standard is met after flapper replacement.

¹⁴ Some trim manufacturers claim to have significantly improved the durability of flappers in the past several years; studies now underway by Metropolitan will subject these materials to new durability tests.

¹⁵ At least two OEM toilet manufacturers have designs that will allow the consumer to use in-tank bowl cleaners that flow to the bowl through such a mechanism, thereby limiting or eliminating the exposure of flush valve seals (e.g., flappers) to halogenating chemicals.

¹⁶ Several manufacturers are proposing standard gravity toilets without traditional flappers.

¹⁷ The ASME is the author of plumbing standards published by the American National Standards Institute (ANSI); those ASME/ANSI standards were adopted by reference and are cited in the Energy Policy Act of 1992, the law which, among other things, codified into Federal law a set of national standards for toilets' maximum water use.

Table 1. Toilet Flapper Listing

Track'g Number	Manufacturer/ Distributor	Name or Identification	Mfr's Part Number	Universal Product Code	Retail shelf price at:					Specially designated for installation in:	Remarks
					Home Depot	HomeBase	True-Value	Ace	OSH		
1	Fill Pro	Flapjack Flapper Tank Ball	RPFP001	34449-011297		\$2.89	\$4.29	\$2.99			
2	Lee Meyers	Gard-O-Flapper	BTB-1	36549-001085					\$4.99		
3	Lee Meyers	Flush Valve	BTB41	36549-020413					\$1.99		
4	Lee Meyers	Tank Ball - Eljer	B270	36549-026361					\$2.49	Eljer	
5	Lee Meyers	Amer Std Seat Disk	B1702	36549-027160					\$1.99	American Standard	
6	Lee Meyers	Multi-Fit	BTB54	36549-027252					\$3.19		
7	Lee Meyers	Kohler Flapper	BKL95	36549-027825					\$4.99	Kohler	Adjustable flapper
8	Lee Meyers	Mansfield	B210C	36549-027863					\$1.99	Mansfield	
9	Danco	Replacement Disc-Am Stan	80412	37155-804122	\$2.64					American Standard	
10	Danco	Flapper for Kohler	80812	37155-808120	\$3.67			\$4.69		Kohler	
11	Danco	Premium	88442	37155-884421			\$3.19				
12	Home Plumber	Toilet Flapper	25017	39166-802920		\$2.19					
13	Home Plumber	Weighted Tank Ball	25019	39166-802944		\$1.69					
14	Home Plumber	Screw-on Disk-Amer Std	25021	39166-802968		\$2.19				American Standard	
15	Home Plumber	Toilet Flapper	825017	39166-808175		\$2.99					
16	Fluidmaster	Replacement Flapper	558	39961-000385			\$3.99	\$2.99	\$3.49		
17	Fluidmaster	Super Flapper	501X	39961-015013	\$4.35	\$4.29*	\$4.79**	\$3.99*	\$4.79**		*-Model 501;**-Model 500
18	Moen	Snap-On Disc-Amer Stand	7524C	41193-025258	\$3.40					American Standard	
19	Mansfield	Flush Valve	630-0030	46587-000088	\$1.78					Mansfield	
20	Lavelle	Korky Orig. Flapper Tank Ball	54BP	49057-005491	\$3.46		\$3.29	\$2.99	\$3.49		
21	Lavelle	Crane Flapper Tank Ball	57BP	49057-005798			\$5.39	\$3.69	\$3.79	Crane	
22	Lavelle	Kohler Repi Flapper Tank Ball	58BP	49057-005897				\$3.69		Kohler	
23	Lavelle	Korky Low Pro Tank Ball	92BP	49057-009291	\$3.91						
24	Lavelle	Korky Plus	2001BP	49057-200193			\$5.49	\$3.99			

Table 1. Toilet Flapper Listing

Track'g Number	Manufacturer/ Distributor	Name or Identification	Mfr's Part Number	Universal Product Code	Retail shelf price at:					Specially designated for installation in:	Remarks
					Home Depot	HomeBase	True-Value	Ace	OSH		
25	True Val Mstr Plumb	Flapper Tank Ball	838J	52088-862056			\$3.19				
26	Lincoln Prod.	Toilet Flapper	1044	54374-057351		\$3.89				Kohler	
27	Melard	Flapper Tank Ball	16198	71862-016195	\$2.31						
28	Melard	Seat Disc for Amer Standrd	1636	71862-016362	\$2.97						
29	Kirkhill	Rx Deluxe Toilet Flapper	13631	76883-136310			\$9.79				
30	Kirkhill	Pignose Tank Ball	B-1400	76883-13637			\$4.29				
31	Harvey's	Tankmaster Toilet Tank Flap'r	91425	78864-914252			\$2.99				
32	Harvey's	Tankmaster Toilet Tank Ball	91450	78864-914504			\$1.79				
33	Ace	Flapper With Pull Strap	43749	82901-437499				\$2.77			
34	Ace	Seat Disc for Amer Std	45213	82901-452133				\$2.49		American Standard	
35	Ace	Flapper With SS Chain	46677	82901-466772				\$3.77			
36	Ward	Toilet Flapper w/chain	4-290	85546-013646			\$2.99				
37	Ward	Toilet Flapper	4-291	85546-013653			\$2.49				
38	Ward	Eljer Flapper	4-299	85546-013677			\$2.79			Eljer	
39	Ward	Screw-on Disc - Amer Std	4-300	85546-013684			\$2.49			American Standard	
40	Ward	Screw-on Disc - Amer Std	4-301	85546-01369			\$2.49			American Standard	
41	Ward	Toilet Flapper Tank Ball	4-320	85546-013714			\$3.49				
42	Ward	Kohler Flapper with Chain	4-287	85546-241193			\$4.29			Kohler	
43	Solder Seal Gunk	Heavy Duty Tank Ball	B274	86815-543911			\$3.79				
44	Watermaster	Toilet Tank Ball	227116	none shown			\$1.79				
45	Frugal Technologies	Universal Repl Flapper for 1.6	none	19894-000507							Adjustable flapper
46	Hunter	Toilet Tank Flapper-Universal	525C	49306-525014							
47	Hunter	Toilet Mizer Flapper	414C	49306-41401							Adjustable flapper
48	Frugal Technologies	Frugal Flush	none	19894-000033							Adjustable flapper
49	Lee Meyers	Flapper Tank Ball for Kohler	B-262V	36549-026378					\$3.69	Kohler	
50	Fluidmaster	Bulls Eye Adjust-A-Flush Flap	502	39961-005021	\$3.69						Adjustable flapper

Revised: May 13, 1998

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Table 2. ULF Toilet Listing

1994-1995 model ULF Toilets used for testing replacement flapper performance

<i>Brand</i>	<i>Model¹</i>
1) American Standard Inc.	Colony, 2188.012
2) Briggs Industries, Inc.	Abingdon, 4775
3) Crane Plumbing	3-662
4) Kohler Company	Wellworth Lite, K3421
5) Mansfield Plumbing Products, Inc.	130-160
6) Toto Kiki U.S.A., Inc.	CST703
7) Vitromex/St. Thomas Creations	Eclipse Marathon

1997-1998 model ULF Toilets used for testing replacement flapper performance

<i>Brand</i>	<i>Model¹</i>	<i>Part Numbers</i>
1) American Standard	Colony	2188.012 (w/3038.012 bowl & 4092.012 tank)
2) Briggs	Abingdon II/ Altima ³	4275 (w/4875 bowl & 4420 tank)
3) Crane	New Galaxy Elite	3-782 (w/3-352 bowl & 3-742 tank)
4) Crane	Metro	3-668 (w/3-645 bowl & 3-696 tank)
5) Eljer	Savoy ²	091-0120 (131-1120-00 bowl & 141-0120-00 tank)
6) Kohler	Wellworth	3423 (w/4277 bowl & 4620 tank)
7) Mansfield	Alto	130-160 (w/130 bowl & 160 tank)
8) Niagara	Ultimate Flush	N2202
9) Niagara	Ultimate Flush ²	N2202TP (includes bucket)
10) Peerless		7160
11) Sterling		402015 (w/404015 bowl & 404515 tank)
12) Toto Kiki USA		CST703 (w/C703 bowl & ST703 tank)
13) Universal-Rundle	Atlas	4290 bowl & 4471 tank
14) Universal-Rundle	Atlas 1.6	4090 (w/4290 bowl & 4490 tank)
15) Vitromex/St. Thos.	Eclipse Marathon	6201.010 (w/6201.013.01 bowl and 6201.024 tank)
16) Vitromex/St. Thos.	Eclipse Marathon ²	6201.110 (w/6201.013.01 bowl and 6201.024 tank-including bucket)
17) Western Pottery	Aris	822 bowl & ULF-8 tank

1-Models being tested are all designated for 12" rough-in

2-Toilet tank equipped with internal "bucket"

3-Both the Abingdon II (Model 4275) and the Altima (Model 4220) use the same tank.

Table 3. Water Consumption - 1995 Model Toilets

No.	Toilet Brand Name	Toilet Model Name or No.	Water Consumption (Gallons per flush) With After-Market Flappers Installed										
			Adjustable Flappers (see note 1 below)								Non-Adjustable Flappers		
			Lee Meyers #7		Frugal #45		Hunter #47		Frugal #48		Total No.	(see note 2)	
			Low	High	Low	High	Low	High	Low	High	(note 3)	Low	High
1	American Standard	Colony	0.70	3.75	1.82	3.17	0.45	3.75	1.86	3.49	24	3.90	4.76
2	Briggs	Abingdon	0.77	2.95	1.92	3.05	0.77	3.44	1.77	3.37	24	3.26	4.51
3	Crane	3-662	1.67	4.16	1.64	2.51	0.46	2.81	1.57	2.81	24	2.94	4.38
4	Kohler	Wellworth Lite	0.89	1.70	1.77	3.03	0.87	5.61	1.73	3.90	7	5.67	6.42
5	Mansfield	130-160	Not applicable								2	1.77	1.78
6	St. Thomas Eclipse	Marathon	1.59	2.84	2.25	2.91	1.08	2.97	2.23	3.00	24	3.33	4.06
7	Toto	CST703	0.76	2.18	1.76	2.36	0.85	2.21	1.67	2.43	24	2.37	3.09

Note: (1) Adjustable flappers are identified by the tracking numbers listed in Table 1. The Fluidmaster adjustable flapper (tracking no. 50) was not available for the tests of 1994-95 model toilets

(2) Figures shown represent the spread or range of measured consumption across all non-adjustable flappers that were physically compatible with the specific ULF toilet.

(3) total number of flappers (from the list of 44 non-adjustable) that were physically compatible with the existing flush valve and did not leak.

October 15, 1998

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Table 4. Individual Flapper Performance on 1994-95 Toilet Models

Test results for each of the seven 1994-95 model toilets are included on the following seven pages. Those toilets are listed in Table 2.

The reader should note that the information shown in the column titled “1/2 Hour Leak Check” is to be interpreted as follows (refer also to Appendix A, paragraph IV.D):

“Pass” - Water remains at the fill line for 1/2-hour after the tank is filled

“Fail” - Tank is empty (to its lowest possible level as when flushed) after
1/2-hour after the tank is filled

Numeric data in the column represents the amount of water that leaked past
the flapper in a 1/2-hour period after filling the tank

American Standard Colony 2188.012 (1994-95)
Table 4 - page 2 of 8

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
1	FILLPRO #RFP001	PASS	*** COULD NOT TEST. PULL TAB TOO STRETCHY. IN ORDER TO OPEN ALL THE WAY IT WOULD NOT RESEAL					
2	LEE MEYERS #BTB1	PASS	3.84	3.83	3.79	3.84	4.18	3.90
3	LEE MEYERS #BTB41	PASS	4.21	4.28	4.30	4.36	4.32	4.29
6	LEE MEYERS #BTB54	PASS	4.43	4.10	4.17	4.16	4.20	4.21
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	3.73	3.77	3.74	3.67	3.84	3.75
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	0.68	0.82	0.67	0.72	0.61	0.70
10	DANCO #80812	FAIL	4.26	4.21	4.22	4.32	4.31	4.26
11	DANCO #88442	PASS	4.55	4.31	4.29	4.21	4.25	4.32
12	HOME PLUMBER #25017	PASS	4.28	4.91	4.92	4.95	4.97	4.81
15	HOME PLUMBER #825017	PASS	4.66	4.89	4.77	4.75	4.75	4.76
17	FLUIDMASTER #501X	PASS	4.24	4.06	4.24	4.32	4.25	4.22
20	LAVELLE #54BP	PASS	4.37	4.30	4.19	4.16	4.20	4.24
22	LAVELLE #58BP	PASS			SEE NOTE 6			
23	LAVELLE #92BP	PASS	4.42	4.43	4.40	4.42	4.41	4.42
24	LAVELLE #2001BP	PASS	4.20	4.24	4.27	4.35	4.16	4.24
25	TRUE VALUE #838J	PASS	4.04	4.12	4.09	4.06	4.00	4.06
26	LINCOLN PROD #1044	PASS			SEE NOTE 6			
27	MELARD #16198	PASS	4.45	4.47	4.44	4.50	4.70	4.51
29	KIRK HILL #13631	PASS	4.49	4.49	4.54	4.51	4.93	4.59
31	HARVEY'S #91425	FAIL	3.90	3.91	3.94	3.97	3.97	3.93
33	ACE #43749	PASS	4.65	4.26	4.29	4.25	4.30	4.35
35	ACE #46677	PASS	4.28	4.32	4.34	4.31	4.41	4.33
36	WARD #4-290	PASS	4.37	4.36	4.32	4.32	4.40	4.35
37	WARD #4-291	PASS	4.28	4.50	4.36	4.31	4.25	4.34
42	WARD #4-287	PASS			SEE NOTE 6			
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.20	3.09	3.17	3.06	3.32	3.17
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.83	1.83	1.80	1.86	1.78	1.82
46	HUNTER #525C	PASS	4.27	4.29	4.26	4.35	4.34	4.30
47 Adjust high (note 3)	HUNTER #414C	PASS	3.75	3.73	3.75	3.76	3.74	3.75
47 Adjust low (note 4)	HUNTER #414C	PASS	0.59	0.42	0.38	0.42	0.43	0.45
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.54	3.61	3.41	3.43	3.46	3.49
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.12	1.83	1.74	1.85	1.76	1.86

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL): 4, 5, 8, 9, 13, 14, 16, 18, 19, 21, 28, 30, 32, 34, 38, 39, 40, 41, 43, 44.

2) SET @ SMALLEST HOLE FOR MAX WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) WOULD NOT RESEAL AFTER FLUSH INFLUENT KEPT LIFTING FLAPPER.

Briggs Abingdon 4775 (1994-95)

Table 4 - Page 3 of 8

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
1	FILLPRO #RPFP001	PASS	3.62	3.56	3.61	3.56	3.51	3.57
2	LEE MEYERS #BTB1	PASS	3.33	3.25	3.18	3.27	3.26	3.26
3	LEE MEYERS #BTB41	PASS	3.70	3.65	3.65	3.65	3.67	3.66
6	LEE MEYERS #BTB54	PASS	3.64	3.49	3.55	3.56	3.57	3.56
7 Adjust high (note 3)	LEE MEYERS #BKL95	PASS	2.92	2.96	2.98	2.95	2.93	2.95
7 Adjust low (note 4)	LEE MEYERS #BKL95	PASS	0.89	0.74	0.73	0.74	0.76	0.77
10	DANCO #80812	PASS	4.06	4.05	4.12	4.03	4.12	4.08
11	DANCO #88442	PASS	3.87	3.88	3.94	3.93	3.92	3.91
12	HOME PLUMBER #25017	PASS	4.24	4.99	4.30	4.55	4.36	4.49
15	HOME PLUMBER #825017	PASS	3.88	4.01	3.97	3.99	3.99	3.99
17	FLUIDMASTER #501X	PASS	3.71	3.68	3.66	3.66	3.73	3.69
20	LAVELLE #54BP	PASS	4.00	4.02	4.07	3.99	3.97	4.01
22	LAVELLE #58BP	PASS	4.37	4.34	4.29	4.23	4.34	4.31
23	LAVELLE #92BP	PASS	4.06	4.06	4.06	4.04	4.06	4.06
24	LAVELLE #2001BP	PASS	3.99	4.01	4.01	4.02	4.03	4.01
25	TRUE VALUE #838J	PASS	3.90	3.85	3.90	3.86	3.90	3.88
26	LINCOLN PROD.#1044	PASS	4.53	4.36	4.41	4.38	4.53	4.44
27	MELARD #16198	PASS	3.97	4.00	3.99	3.92	4.01	3.98
29	KIRKHILL #13631	PASS	3.88	4.01	4.03	4.02	4.00	3.99
31	HARVEY'S #91425	PASS	3.78	3.80	3.78	3.76	3.82	3.79
33	ACE #43749	PASS	4.04	4.10	4.04	4.02	4.00	4.04
35	ACE #46677	PASS	4.06	3.97	4.05	4.09	4.07	4.05
36	WARD #4-290	PASS	4.09	4.14	4.14	4.13	4.14	4.13
37	WARD #4-291	PASS	4.11	4.10	4.13	4.09	4.10	4.11
42	WARD #4-287	PASS	4.51	4.48	4.53	4.49	4.52	4.51
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.08	3.06	2.96	3.09	3.08	3.05
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.92	1.95	1.90	1.89	1.92	1.92
46	HUNTER #525C	PASS	4.00	3.98	3.95	3.96	3.97	3.97
47 Adjust high (note 3)	HUNTER #414C	PASS	3.46	3.45	3.44	3.45	3.42	3.44
47 Adjust low (note 4)	HUNTER #414C	FAIL	0.69	0.73	0.86	0.72	0.83	0.77
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.39	3.38	3.40	3.37	3.30	3.37
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.71	1.73	1.82	1.81	1.80	1.77

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
1	FILLPRO #RPFP001	PASS	3.27	3.29	3.33	3.29	3.30	3.30
2	LEE MEYERS #BTB1	PASS	2.97	2.83	2.90	2.97	3.01	2.94
3	LEE MEYERS #BTB41	PASS	3.35	3.37	3.38	3.39	3.39	3.38
6	LEE MEYERS #BTB54	PASS	3.50	3.47	3.42	3.53	3.46	3.48
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	4.10	4.22	4.07	4.19	4.23	4.16
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	1.82	1.58	1.41	1.86	1.66	1.67
10	DANCO #80812	PASS	2.96	3.26	3.27	3.26	3.24	3.20
11	DANCO #88442	PASS	3.34	3.33	3.31	3.30	3.33	3.32
12	HOME PLUMBER #25017	PASS	4.67	5.00	3.92	4.18	4.15	4.38
15	HOME PLUMBER #825017	PASS	4.04	3.90	3.87	3.80	3.84	3.89
17	FLUIDMASTER #501X	PASS	3.44	3.41	3.44	3.43	3.38	3.42
20	LAVELLE #54BP	PASS	3.33	3.27	3.30	3.31	3.30	3.30
22	LAVELLE #58BP	PASS	3.43	3.45	3.44	3.43	3.44	3.44
23	LAVELLE #92BP	PASS	3.47	3.45	3.43	3.42	3.45	3.44
24	LAVELLE #2001BP	PASS	3.36	3.37	3.33	3.39	3.31	3.35
25	TRUE VALUE #838J	PASS	3.26	3.26	3.28	3.40	3.32	3.30
26	LINCOLN PROD #1044	PASS	3.43	3.39	3.43	3.40	3.43	3.42
27	MELARD #16198	FAIL	3.43	3.40	3.40	3.42	3.45	3.42
29	KIRK HILL #13631	PASS	3.25	3.32	3.24	3.26	3.30	3.27
31	HARVEY'S #91425	PASS	3.02	2.98	3.03	2.97	3.00	3.00
33	ACE #43749	FAIL	3.16	3.21	3.18	3.18	3.18	3.18
35	ACE #46677	PASS	3.36	3.32	3.36	3.39	3.42	3.37
36	WARD #4-290	PASS	3.29	3.29	3.31	3.31	3.30	3.30
37	WARD #4-291	PASS	3.24	3.25	3.25	3.25	3.26	3.25
42	WARD #4-287	PASS	3.38	3.39	3.40	3.39	3.41	3.39
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.48	2.54	2.50	2.50	2.55	2.51
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.55	1.71	1.64	1.63	1.65	1.64
46	HUNTER #525C	PASS	3.41	3.19	3.24	3.22	3.25	3.26
47 Adjust high (note 3)	HUNTER #414C	PASS	2.75	2.83	2.69	2.97	2.83	2.81
47 Adjust low (note 4)	HUNTER #414C	PASS	0.39	0.51	0.49	0.46	0.47	0.46
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.88	2.73	2.80	2.81	2.84	2.81
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.55	1.54	1.58	1.63	1.54	1.57

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

Kohler Wellworth Lite K3421 (1994-95)
Table 4 - Page 5 of 8

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
1	FILLPRO #RPFP001	SEE NOTE 6						
2	LEE MEYERS #BTB1	SEE NOTE 6						
3	LEE MEYERS #BTB41	PASS	6.24	6.28	6.22	6.25	6.18	6.23
6	LEE MEYERS #BTB54	SEE NOTE 6						
7 Adjust high (note 3)	LEE MEYERS #BKL95	PASS	1.70	1.71	1.71	1.67	1.70	1.70
7 Adjust low (note 4)	LEE MEYERS #BKL95	PASS	0.92	0.87	0.83	0.87	0.97	0.89
10	DANCO #80812	FAIL	6.10	6.13	6.13	6.01	6.17	6.11
11	DANCO #88442	SEE NOTE 6						
12	HOME PLUMBER #25017	SEE NOTE 6						
15	HOME PLUMBER #825017	SEE NOTE 6						
17	FLUIDMASTER #501X	PASS	6.35	6.41	6.46	6.47	6.40	6.42
20	LAVELLE #54BP	SEE NOTE 6						
22	LAVELLE #58BP	SEE NOTE 6						
23	LAVELLE #92BP	SEE NOTE 6						
24	LAVELLE #2001BP	SEE NOTE 6						
25	TRUE VALUE #838J	SEE NOTE 6						
26	LINCOLN PROD.#1044	SEE NOTE 6						
27	MELARD #16198	SEE NOTE 6						
29	KIRKHILL #13631	SEE NOTE 6						
31	HARVEY'S #91425	FAIL	5.70	5.78	5.75	5.44	5.66	5.67
33	ACE #43749	SEE NOTE 6						
35	ACE #46677	SEE NOTE 6						
36	WARD #4-290	PASS	6.27	6.26	6.28	6.24	6.26	6.26
37	WARD #4-291	PASS	6.22	6.33	6.22	6.33	6.23	6.27
42	WARD #4-287	SEE NOTE 6						
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.98	2.92	3.22	3.06	2.96	3.03
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.82	1.67	1.83	1.88	1.64	1.77
46	HUNTER #525C	PASS	6.29	6.18	6.26	6.22	6.21	6.23
47 Adjust high (note 3)	HUNTER #414C	PASS	5.64	5.59	5.63	5.50	5.67	5.61
47 Adjust low (note 4)	HUNTER #414C	PASS	0.83	0.93	0.88	0.86	0.84	0.87
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.73	3.89	3.97	4.17	3.76	3.90
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.75	1.76	1.72	1.73	1.70	1.73

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) COULD NOT USE. CHAIN OR PULL TAB TOO SHORT.

Mansfield 130-160 (1994-95)

Table 4 - Page 6 of 8

[illegible]

Note: 1) DUE TO THE SPECIALIZED NATURE OF THE FLUSH VALVE SEAT THIS TOILET WOULD NOT ACCEPT ANY FLAPPERS OTHER THAN THE ONES TESTED.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
1	FILLPRO #RPF001	LEAKED .3 GAL.	2.59	2.66	2.71	2.65	2.65	2.65
2	LEE MEYERS #BTB1	PASS	2.37	2.37	2.34	2.38	2.38	2.37
3	LEE MEYERS #BTB41	PASS	2.83	2.76	2.83	2.78	2.76	2.79
6	LEE MEYERS #BTB54	PASS	2.68	2.66	2.67	2.62	2.69	2.66
7 Adjust high (note 3)	LEE MEYERS #BKL95	PASS	0.80	0.77	0.76	0.72	0.77	0.76
7 Adjust low (note 4)	LEE MEYERS #BKL95	PASS	2.10	2.20	2.14	2.23	2.22	2.18
10	DANCO #80812	LEAKED .7 GAL.	2.81	2.83	2.81	2.79	2.79	2.81
11	DANCO #88442	PASS	2.70	2.69	2.65	2.72	2.67	2.69
12	HOME PLUMBER #25017	PASS	3.04	3.11	3.09	3.14	3.09	3.09
15	HOME PLUMBER #825017	PASS	2.90	2.88	2.90	2.85	2.88	2.88
17	FLUIDMASTER #501X	PASS	2.83	2.82	2.82	2.83	2.82	2.82
20	LAVELLE #54BP	PASS	2.60	2.69	2.66	2.61	2.65	2.64
22	LAVELLE #58BP	PASS	3.00	3.00	3.01	3.03	3.06	3.02
23	LAVELLE #92BP	PASS	2.69	2.76	2.68	2.70	2.75	2.72
24	LAVELLE #2001BP	PASS	2.62	2.60	2.63	2.65	2.61	2.62
25	TRUE VALUE #838J	PASS	2.59	2.61	2.65	2.67	2.68	2.64
26	LINCOLN PROD #1044	PASS	3.01	3.05	3.04	3.04	2.99	3.03
27	MELARD #16198	PASS	2.75	2.79	2.81	2.85	2.81	2.80
29	KIRK HILL #13631	PASS	2.68	2.68	2.64	2.68	2.68	2.67
31	HARVEY'S #91425	LEAKED 1.1 GAL.	2.46	2.58	2.76	2.74	2.66	2.64
33	ACE #43749	PASS	2.73	2.71	2.73	2.70	2.70	2.71
35	ACE #46677	PASS	2.48	2.59	2.65	2.61	2.66	2.60
36	WARD #4-290	PASS	2.68	2.70	2.69	2.70	2.64	2.68
37	WARD #4-291	PASS	2.74	2.78	2.73	2.73	2.76	2.75
42	WARD #4-287	PASS	3.06	3.02	3.05	3.05	3.06	3.05
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.39	2.37	2.30	2.38	2.37	2.36
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.77	1.80	1.75	1.76	1.74	1.76
46	HUNTER #525C	PASS	2.70	2.71	2.75	2.74	2.65	2.71
47 Adjust high (note 3)	HUNTER #414C	LEAKED .2 GAL.	2.24	2.22	2.23	2.17	2.21	2.21
47 Adjust low (note 4)	HUNTER #414C	PASS	0.86	0.85	0.80	0.88	0.88	0.85
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.45	2.43	2.37	2.42	2.47	2.43
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.65	1.70	1.67	1.69	1.64	1.67

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

St. Thomas Eclipse Marathon (1994-95)
Table 4 - Page 8 of 8

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
1	FILLPRO #RPF001	PASS	3.67	3.66	3.77	3.55	3.58	3.65
2	LEE MEYERS #BTB1	PASS	3.69	3.21	3.73	3.21	3.35	3.44
3	LEE MEYERS #BTB41	PASS	3.72	3.70	3.68	3.70	3.78	3.72
6	LEE MEYERS #BTB54	PASS	3.51	3.53	3.47	3.37	3.37	3.45
7 Adjust high (note 3)	LEE MEYERS #BKL95	PASS	2.83	2.87	2.82	2.83	2.84	2.84
7 Adjust low (note 4)	LEE MEYERS #BKL95	PASS	1.48	1.77	1.70	1.55	1.45	1.59
10	DANCO #80812	FAIL	3.73	3.68	3.60	3.69	3.76	3.69
11	DANCO #88442	PASS	3.62	3.67	3.60	3.65	3.58	3.62
12	HOME PLUMBER #25017	PASS	4.04	4.03	4.08	4.09	4.05	4.06
15	HOME PLUMBER #825017	PASS	3.74	3.75	3.78	3.76	3.77	3.76
17	FLUIDMASTER #501X	PASS	3.74	3.70	3.73	3.65	3.72	3.71
20	LAVELLE #54BP	PASS	3.62	3.69	3.68	3.70	3.71	3.68
22	LAVELLE #58BP	PASS	3.97	3.92	3.94	3.95	4.01	3.96
23	LAVELLE #92BP	PASS	3.67	3.71	3.69	3.65	3.77	3.70
24	LAVELLE #2001BP	PASS	3.53	3.55	3.56	3.61	3.66	3.58
25	TRUE VALUE #838J	PASS	3.61	3.55	3.47	3.51	3.60	3.55
26	LINCOLN PROD.#1044	PASS	3.88	3.85	3.87	3.83	3.67	3.82
27	MELARD #16198	PASS	3.65	3.72	3.70	3.68	3.73	3.70
29	KIRKHILL #13631	PASS	3.64	3.63	3.65	3.62	3.60	3.63
31	HARVEY'S #91425	FAIL	3.25	3.43	3.30	3.32	3.35	3.33
33	ACE #43749	PASS	3.61	3.59	3.59	3.60	3.61	3.60
35	ACE #46677	PASS	3.51	3.50	3.48	3.55	3.63	3.53
36	WARD #4-290	PASS	3.55	3.59	3.62	3.65	3.63	3.61
37	WARD #4-291	PASS	3.62	3.62	3.66	3.64	3.59	3.63
42	WARD #4-287	PASS	4.02	3.98	4.00	4.01	4.02	4.01
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.92	2.91	2.91	2.84	2.96	2.91
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.39	2.02	2.24	2.37	2.25	2.25
46	HUNTER #525C	PASS	3.62	3.66	3.67	3.68	3.68	3.66
47 Adjust high (note 3)	HUNTER #414C	FAIL	2.97	2.98	3.04	2.91	2.94	2.97
47 Adjust low (note 4)	HUNTER #414C	PASS	1.07	0.90	1.18	1.08	1.15	1.08
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.01	2.99	3.00	3.04	2.94	3.00
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.10	2.26	2.31	2.12	2.36	2.23

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

Table 5. Water Consumption - 1997-98 Model Toilets

No.	Toilet Brand Name	Toilet Model Nos.	Water Consumption (Gallons per flush)															
			Original Installed (OEM) Flapper	With After-Market Flappers Installed														
				Adjustable Flappers (see note 1)												Non-Adjustable Flappers		
				Lee Meyers #7		Frugal #45		Hunter #47		Frugal #48		Fluidmstr #50		Total # (note 2)	Lowest gpf	Highest gpf		
			Low	High	Low	High	Low	High	Low	High	Low	High						
1	American Standard	2188.012	1.67	0.82	3.28	1.57	2.57	1.68	3.28	1.53	3.42	1.14	3.13	21	3.61	4.40		
2	Briggs	4275	1.58	leaked		1.02	1.41	leaked		1.05	1.43	0.91	1.29	12	1.43	1.89		
3	Crane	3-782	1.63	leaked		1.72	2.15	0.90	2.05	1.70	2.21	1.48	2.18	24	2.11	2.98		
4	Crane	3-668	1.67	leaked		1.59	2.64	0.82	2.73	1.56	2.84	1.15	2.96	24	3.10	3.32		
5	Eljer	141-0120	1.46	(note 3)	1.60	(note 3)		0.54	1.36	0.84	1.43			18	0.66	1.85		
6	Kohler	3423	1.67	leaked		2.06	2.54	1.03	leaked	2.19	2.67	1.71	2.51	21	2.69	4.41		
7	Mansfield	130-160	1.61	Not applicable (see note 4)												2	1.63	1.64
8	Niagara	N2202	1.57	leaked		1.96	2.50	1.19	2.41	1.98	2.65			22	2.52	3.70		
9	Niagara	N2202TP	1.60	leaked		(note 3)		(note 3)		(note 3)				18	0.43	1.74		
10	Peerless	7160	2.22	leaked		2.00	2.82	1.39	2.77	2.06	2.92			23	2.98	3.68		
11	St. Thomas Eclipse	6201.010	1.74	leaked		2.28	3.01	0.77	3.12	2.19	3.39	1.73	3.37	23	3.32	3.93		
12	St. Thomas Eclipse	6201.110	1.46	did not fit		(note 3)		(note 3)		(note 3)		(note 3)		12	0.50	1.61		
13	Sterling	402015	1.58	leaked		1.22	1.42	leaked		1.26	1.48	1.12	1.37	21	1.40	1.99		
14	Toto	CST703	1.58	leaked		1.65	1.92	0.82	1.86	1.68	2.03	1.40	1.91	23	1.93	2.78		
15	Universal Rundle	4290/4471	1.70	leaked		1.26	1.59	0.90	1.43	1.29	1.73	1.11	1.62	20	1.76	2.31		
16	Universal Rundle	4290/4490	1.87	leaked		1.23	1.55	0.53	1.39	1.31	1.67	1.10	1.55	17	1.71	2.69		
17	Western	822/ULF-8	1.73	leaked		1.95	2.47	0.98	2.58	2.15	2.79	1.66	2.69	22	2.52	3.33		

Notes: Toilets Nos. 5, 9, and 12 contain a "bucket" that creates an effective tank capacity of 1.6 gallons; the "bucket" performs the function of a semi-permanent toilet dam. Toilet No. 12 is not commercially available at this time; the model tested was a prototype unit.

The selection of only one of each ULF toilet and one each of the after-market flappers available on retail shelves does not provide a statistically valid representation of all ULF toilets of a given toilet model or all after-market flappers. Therefore, the results should be viewed only as a rough indication of the "real world" performance of toilets and flappers. To obtain statistically reliable results, a larger sample of each of these products would be required for the tests conducted.

1-adjustable flappers were tested at their minimum and maximum settings.

2-total number of flappers (from the list of 45 non-adjustable) that were physically compatible with the existing flush valve and did not leak.

3-insufficient water to complete the flush.

4-Mansfield toilets use a unique flush valve that does not employ a traditional flapper device.

October 15, 1998

Table 6. Individual Flapper Performance on 1997-98 Toilet Models

Test results for each of the seventeen 1997-98 model toilets are included on the following seventeen pages. Those toilets are listed in Table 2.

The reader should note that the information shown in the column titled “1/2 Hour Leak Check” is to be interpreted as follows (refer also to Appendix A, paragraph IV.D):

“Pass” - Water remains at the fill line for 1/2-hour after the tank is filled

“Fail” - Tank is empty (to its lowest possible level as when flushed) after
1/2-hour after the tank is filled

Numeric data in the column represents the amount of water that leaked past
the flapper in a 1/2-hour period after filling the tank

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.66	1.68	1.70	1.70	1.69	1.69
1	FILLPRO #RPPF001	PASS	3.75	3.75	3.71	3.71	3.73	3.73
2	LEE MEYERS #BTB1	PASS	3.64	3.62	3.60	3.47	3.70	3.61
3	LEE MEYERS #BTB41	PASS	3.97	3.98	4.01	4.01	4.05	4.00
6	LEE MEYERS #BTB54	PASS	3.63	3.69	3.69	3.87	3.79	3.73
7 Adjust high (note 3)	LEE MEYERS #BKL95	PASS	3.29	3.34	3.18	3.31	3.30	3.28
7 Adjust low (note 4)	LEE MEYERS #BKL95	PASS	0.81	0.84	0.79	0.85	0.82	0.82
10	DANCO #80812	FAIL	4.16	4.12	4.10	4.14	4.14	4.13
11	DANCO #88442	PASS	3.84	3.83	3.81	3.82	3.86	3.83
12 note 6	HOME PLUMBER #25017	PASS	4.44	4.55	4.39	4.06	4.56	4.40
15 note 6	HOME PLUMBER #825017	PASS	4.33	4.21	4.38	4.33	4.35	4.32
17	FLUIDMASTER #501X	PASS	3.98	3.97	3.99	3.98	4.02	3.99
20	LAVELLE #54BP	PASS	3.74	3.66	3.68	3.59	3.62	3.66
22	LAVELLE #58BP	PASS	4.18	4.21	4.15	4.15	4.23	4.18
23	LAVELLE #92BP	PASS	3.91	3.97	3.99	3.97	3.92	3.95
24	LAVELLE #2001BP	PASS	3.80	3.87	3.77	3.77	3.78	3.80
25	TRUE VALUE #838J	PASS	3.76	3.76	3.85	3.79	3.80	3.79
26	LINCOLN PROD #1044	PASS	4.11	4.10	4.11	4.03	4.09	4.09
27	MELARD #16198	PASS	4.01	4.20	4.16	4.16	4.18	4.14
29	KIRKHILL #13631	PASS	4.19	3.71	3.63	3.51	3.81	3.77
31	HARVEY'S #91425	PASS	3.61	3.61	3.73	3.67	3.72	3.67
33	ACE #43749	PASS	3.87	3.86	3.85	3.87	3.93	3.88
35	ACE #46677	PASS	3.74	3.81	3.84	3.85	3.80	3.81
36	WARD #4-290	PASS	3.92	3.93	3.94	3.92	3.85	3.91
37	WARD #4-291	PASS	3.81	3.83	3.81	3.84	3.86	3.83
42	WARD #4-287	PASS	4.29	4.16	4.26	4.21	4.15	4.21
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.50	2.49	2.54	2.66	2.64	2.57
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.43	1.67	1.56	1.64	1.57	1.57
46	HUNTER #525C	PASS	3.91	3.85	3.92	3.88	3.90	3.89
47 Adjust high (note 3)	HUNTER #414C	PASS	3.25	3.27	3.23	3.26	3.29	3.26
47 Adjust low (note 4)	HUNTER #414C	PASS	1.69	1.67	1.65	1.90	1.51	1.68
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.27	3.43	3.40	3.48	3.52	3.42
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.54	1.58	1.44	1.51	1.56	1.53
49	LEE MEYERS #B-262V	LEAKED 1.2 GAL.	4.52	4.01	4.00	4.01	4.02	4.11
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.17	1.17	1.14	1.10	1.11	1.14
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	3.31	3.15	3.10	2.82	3.25	3.13

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.57	1.58	1.57	1.58	1.59	1.58
1	FILLPRO #RPFP001	LEAKED .25 GAL.	1.49	1.44	1.46	1.54	1.47	1.48
2	LEE MEYERS #BTB1	PASS	1.40	1.39	1.42	1.45	1.48	1.43
3	LEE MEYERS #BTB41	PASS	1.59	1.61	1.63	1.62	1.64	1.62
6	LEE MEYERS #BTB54	PASS	1.59	1.60	1.58	1.63	1.61	1.60
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	1.35	1.35	1.37	1.33	1.35	1.35
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	0.69	0.65	0.69	0.71	0.67	0.68
10	DANCO #80812	FAIL	1.57	1.57	1.58	1.66	1.62	1.60
11	DANCO #88442	PASS	1.59	1.61	1.60	1.56	1.55	1.58
12	HOME PLUMBER #25017	PASS	1.91	1.88	1.91	1.87	1.87	1.89
15 note 6	HOME PLUMBER #825017	PASS	1.91	1.77	1.83	1.73	1.81	1.81
17	FLUIDMASTER #501X	PASS	1.61	1.61	1.59	1.60	1.61	1.60
20	LAVELLE #54BP	PASS	1.55	1.58	1.57	1.55	1.57	1.56
22	LAVELLE #58BP	LEAKED .17 GAL.	1.90	2.06	1.98	2.08	2.04	2.01
23	LAVELLE #92BP	PASS	1.64	1.67	1.68	1.67	1.70	1.67
24	LAVELLE #2001BP	LEAKED .28 GAL.	1.59	1.61	1.61	1.60	1.64	1.61
25	TRUE VALUE #838J	FAIL	1.54	1.59	1.56	1.59	1.58	1.57
26	LINCOLN PROD.#1044	LEAKED .21 GAL.	2.08	2.00	1.98	1.97	1.91	1.99
27	MELARD #16198	LEAKED .46 GAL.	1.61	1.67	1.70	1.63	1.67	1.66
29	KIRKHILL #13631	FAIL	1.79	1.77	1.75	1.73	1.82	1.77
31	HARVEY'S #91425	FAIL	1.55	1.49	1.49	1.49	1.48	1.50
33	ACE #43749	PASS	1.59	1.59	1.61	1.60	1.60	1.60
35	ACE #46677	PASS	1.59	1.52	1.54	1.53	1.53	1.54
36	WARD #4-290	PASS	1.57	1.58	1.58	1.58	1.57	1.58
37	WARD #4-291	LEAKED .25 GAL.	1.47	1.50	1.52	1.50	1.53	1.50
42	WARD #4-287	LEAKED .15 GAL.	2.19	2.20	2.15	2.06	2.09	2.14
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.42	1.39	1.42	1.43	1.40	1.41
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.05	1.02	1.03	0.99	1.03	1.02
46	HUNTER #525C	PASS	1.49	1.52	1.52	1.54	1.55	1.52
47 Adjust high (note 3)	HUNTER #414C	FAIL	1.20	1.32	1.24	1.23	1.24	1.25
47 Adjust low (note 4)	HUNTER #414C	PASS	0.63	0.57	0.61	0.54	0.58	0.59
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.42	1.42	1.43	1.43	1.43	1.43
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.06	1.05	1.04	1.06	1.03	1.05
49	LEE MEYERS #B-262V	LEAKED .10 GAL.	1.54	1.59	1.57	1.57	1.55	1.56
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	0.90	0.91	0.91	0.92	0.90	0.91
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	1.28	1.28	1.28	1.31	1.28	1.29

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE

Crane New Galaxy Elite 3-782 (1997-98)
Table 6 - Page 4 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.63	1.61	1.63	1.64	1.62	1.63
1	FILLPRO #RPFP001	PASS	2.31	2.31	2.33	2.29	2.30	2.31
2	LEE MEYERS #BTB1	PASS	2.12	2.10	2.11	2.11	2.10	2.11
3	LEE MEYERS #BTB41	LEAKED 1.01 GAL.	2.64	2.58	2.62	2.63	2.58	2.61
6	LEE MEYERS #BTB54	PASS	2.52	2.51	2.51	2.51	2.51	2.51
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	LEAKING TOO FAST TO FILL TANK					NA
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	LEAKING TOO FAST TO FILL TANK					NA
10	DANCO #80812	PASS	2.40	2.41	2.42	2.41	2.41	2.41
11	DANCO #88442	PASS	2.42	2.42	2.43	2.42	2.44	2.43
12 note 6	HOME PLUMBER #25017	PASS	3.02	2.96	2.85	3.04	3.05	2.98
15 note 6	HOME PLUMBER #825017	PASS	3.25	2.87	2.98	2.81	3.00	2.98
17	FLUIDMASTER #501X	PASS	2.45	2.45	2.45	2.44	2.44	2.45
20	LAVELLE #54BP	PASS	2.40	2.42	2.46	2.46	2.44	2.44
22	LAVELLE #58BP	PASS	2.49	2.54	2.51	2.52	2.51	2.51
23	LAVELLE #92BP	PASS	2.52	2.54	2.56	2.55	2.56	2.55
24	LAVELLE #2001BP	PASS	2.45	2.45	2.46	2.45	2.44	2.45
25	TRUE VALUE #838J	PASS	2.39	2.40	2.42	2.39	2.40	2.40
26	LINCOLN PROD #1044	PASS	2.52	2.52	2.50	2.50	2.51	2.51
27	MELARD #16198	PASS	2.47	2.45	2.46	2.45	2.44	2.45
29	KIRK HILL #13631	PASS	2.37	2.42	2.32	2.41	2.40	2.38
31	HARVEY'S #91425	PASS	2.24	2.22	2.20	2.22	2.23	2.22
33	ACE #43749	PASS	2.40	2.44	2.42	2.43	2.41	2.42
35	ACE #46677	PASS	2.46	2.45	2.44	2.49	2.45	2.46
36	WARD #4-290	PASS	2.43	2.44	2.45	2.43	2.46	2.44
37	WARD #4-291	PASS	2.38	2.41	2.39	2.41	2.42	2.40
42	WARD #4-287	PASS	2.51	2.53	2.54	2.54	2.55	2.53
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.14	2.17	2.16	2.16	2.14	2.15
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.71	1.75	1.74	1.70	1.72	1.72
46	HUNTER #525C	PASS	2.44	2.45	2.44	2.44	2.43	2.44
47 Adjust high (note 3)	HUNTER #414C	PASS	2.04	2.05	2.06	2.06	2.05	2.05
47 Adjust low (note 4)	HUNTER #414C	PASS	0.86	0.98	0.91	0.92	0.83	0.90
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.17	2.23	2.20	2.22	2.21	2.21
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.66	1.73	1.69	1.71	1.72	1.70
49	LEE MEYERS #B-262V	PASS	2.48	2.50	2.50	2.50	2.50	2.50
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.48	1.48	1.50	1.48	1.44	1.48
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	2.16	2.19	2.18	2.19	2.19	2.18

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) :

4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.66	1.68	1.71	1.62	1.68	1.67
1	FILLPRO #RPF001	PASS	3.10	3.12	3.12	3.11	3.13	3.12
2	LEE MEYERS #BTB1	PASS	2.95	2.96	2.95	2.94	2.98	2.96
3	LEE MEYERS #BTB41	LEAKED .45 GAL	3.50	3.49	3.49	3.55	3.50	3.51
6	LEE MEYERS #BTB54	PASS	3.32	3.32	3.34	3.30	3.32	3.32
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	LEAKING TOO FAST TO FILL TANK					NA
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	LEAKING TOO FAST TO FILL TANK					NA
10	DANCO #80812	PASS	3.09	3.14	3.08	3.14	3.07	3.10
11	DANCO #88442	PASS	3.16	3.14	3.15	3.17	3.14	3.15
12 note 6	HOME PLUMBER #25017	PASS	3.38	3.25	3.23	3.00	3.12	3.20
15 note 6	HOME PLUMBER #825017	PASS	3.33	2.99	3.21	3.39	3.21	3.23
17	FLUIDMASTER #501X	PASS	3.24	3.25	3.21	3.22	3.25	3.23
20	LAVELLE #54BP	PASS	3.27	3.27	3.27	3.25	3.25	3.26
22	LAVELLE #58BP	PASS	3.21	3.22	3.22	3.20	3.22	3.21
23	LAVELLE #92BP	PASS	3.29	3.29	3.28	3.28	3.30	3.29
24	LAVELLE #2001BP	PASS	3.30	3.25	3.23	3.25	3.25	3.26
25	TRUE VALUE #838J	PASS	3.09	3.19	3.10	3.10	3.10	3.12
26	LINCOLN PROD.#1044	PASS	3.21	3.19	3.19	3.19	3.20	3.20
27	MELARD #16198	PASS	3.28	3.32	3.26	3.25	3.30	3.28
29	KIRKHILL #13631	PASS	3.15	3.18	3.16	3.15	3.17	3.16
31	HARVEY'S #91425	PASS	3.02	3.32	3.26	3.25	3.30	3.23
33	ACE #43749	PASS	3.19	3.18	3.17	3.16	3.17	3.17
35	ACE #46677	PASS	3.21	3.18	3.17	3.16	3.17	3.18
36	WARD #4-290	PASS	3.26	3.24	3.23	3.24	3.24	3.24
37	WARD #4-291	PASS	3.12	3.12	3.12	3.11	3.13	3.12
42	WARD #4-287	PASS	3.22	3.25	3.24	3.25	3.25	3.24
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.62	2.65	2.63	2.63	2.67	2.64
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.59	1.59	1.59	1.58	1.60	1.59
46	HUNTER #525C	PASS	3.17	3.17	3.18	3.16	3.15	3.17
47 Adjust high (note 3)	HUNTER #414C	PASS	2.71	2.73	2.72	2.74	2.75	2.73
47 Adjust low (note 4)	HUNTER #414C	PASS	0.80	0.88	0.83	0.79	0.78	0.82
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.84	2.80	2.83	2.89	2.85	2.84
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.57	1.54	1.57	1.55	1.57	1.56
49	LEE MEYERS #B-262V	PASS	3.17	3.16	3.16	3.18	3.18	3.17
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.20	1.06	1.20	1.09	1.21	1.15
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	2.94	2.96	2.96	2.96	2.97	2.96

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL).

4 5 8 9 13 14 16 18 19 21 28 30 32 34 38 39 40 41 43 44

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE

6) HAD TO BE PHYSICALLY PUSHED CLOSE DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.46	1.47	1.47	1.46	1.44	1.46
1	FILLPRO #RFP001	LEAKED .25 GAL	1.60	1.58	1.60	1.60	1.59	1.59
2	LEE MEYERS #BTB1	PASS	0.95	0.77	0.81	0.79	0.94	0.85
3	LEE MEYERS #BTB41	PASS	1.66	1.67	1.67	1.65	1.65	1.66
6	LEE MEYERS #BTB54	PASS	1.60	1.68	1.68	1.69	1.68	1.67
7 Adjust high (note 3)	LEE MEYERS #BKL95	PASS	1.66	1.54	1.59	1.57	1.62	1.60
7 Adjust low (note 4 & 7)	LEE MEYERS #BKL95	PASS	0.35	0.45	0.49	0.35	0.30	0.39
10	DANCO #80812	PASS	1.65	1.63	1.65	1.61	1.63	1.63
11	DANCO #88442	PASS	1.66	1.60	1.60	1.60	1.60	1.61
12 note 6	HOME PLUMBER #25017	PASS	1.84	1.94	1.86	1.80	1.82	1.85
15 note 6	HOME PLUMBER #825017	PASS	1.83	1.84	1.75	1.78	1.79	1.80
17	FLUIDMASTER #501X	PASS	1.65	1.63	1.65	1.63	1.63	1.64
20 note 7	LAVELLE #54BP	PASS	0.69	0.65	0.63	0.64	0.67	0.66
22	LAVELLE #58BP	PASS	1.61	1.62	1.61	1.59	1.61	1.61
23 note 7	LAVELLE #92BP	PASS	0.69	0.61	0.62	0.65	0.81	0.68
24 note 7	LAVELLE #2001BP	PASS	0.69	0.63	0.69	0.70	0.67	0.68
25	TRUE VALUE #838J	PASS	1.59	1.59	1.58	1.58	1.57	1.58
26	LINCOLN PROD #1044	PASS	1.66	1.65	1.62	1.63	1.64	1.64
27	MELARD #16198	PASS	1.62	1.61	1.62	1.62	1.61	1.62
29	KIRK HILL #13631	PASS	1.39	0.93	1.08	1.40	1.10	1.18
31	HARVEY'S #91425	PASS	1.52	1.54	1.54	1.55	1.59	1.55
33	ACE #43749	PASS	1.58	1.59	1.59	1.60	1.58	1.59
35 note 7	ACE #46677	PASS	0.69	0.65	0.68	0.66	0.66	0.67
36	WARD #4-290	PASS	1.60	1.62	1.60	1.60	1.60	1.60
37	WARD #4-291	PASS	1.61	1.61	1.60	1.60	1.61	1.61
42	WARD #4-287	PASS	1.67	1.67	1.66	1.65	1.68	1.67
45 Adjust high (note 2 & 7)	FRUGAL FLUSH	PASS	1.59	0.85	0.78	0.80	0.88	0.98
45 Adjust low (note 5 & 7)	FRUGAL FLUSH	PASS	0.93	0.99	0.78	0.71	0.87	0.86
46	HUNTER #525C	PASS	1.60	1.63	1.60	1.60	1.59	1.60
47 note 3	HUNTER #414C	PASS	1.55	1.33	1.28	1.11	1.51	1.36
47 note 4	HUNTER #414C	PASS	0.63	0.52	0.49	0.57	0.50	0.54
48 note 2	FRUGAL FLUSH	PASS	1.61	1.33	1.35	1.60	1.28	1.43
48 note 5	FRUGAL FLUSH	PASS	0.85	0.83	0.86	0.86	0.80	0.84
49	LEE MEYERS #B-262V	PASS	1.54	1.55	1.56	1.54	1.56	1.55

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) WOULD NOT OPEN COMPLETELY. INCOMPLETE FLUSH.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL.
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	PER FLUSH
ORIGINAL EQUIPMENT		FAIL	1.67	1.67	1.67	1.67	1.68	1.67
1	FILLPRO #RFPF001	PASS	2.72	2.78	2.74	2.76	2.75	2.75
2	LEE MEYERS #BTB1	PASS	2.71	2.71	2.76	2.67	2.64	2.70
3	LEE MEYERS #BTB41	PASS	2.94	2.97	2.96	2.92	2.94	2.95
6	LEE MEYERS #BTB54	PASS	2.83	2.82	2.82	2.76	2.83	2.81
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	2.47	2.47	2.49	2.48	2.50	2.48
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	0.91	0.92	0.93	0.87	0.90	0.91
10	DANCO #80812	FAIL	2.91	2.93	2.90	2.94	2.92	2.92
11	DANCO #88442	PASS	2.75	2.76	2.75	2.78	2.78	2.76
12 note 6	HOME PLUMBER #25017	PASS	3.01	3.25	3.13	3.16	3.09	3.13
15	HOME PLUMBER #825017	PASS	3.03	3.07	3.03	2.90	2.96	3.00
17	FLUIDMASTER #501X	PASS	2.89	2.87	2.89	2.89	2.87	2.88
20	LAVELLE #54BP	PASS	2.82	2.83	2.86	2.81	2.82	2.83
22	LAVELLE #58BP	PASS	4.24	4.16	4.00	4.16	4.17	4.15
23	LAVELLE #92BP	PASS	3.03	3.06	3.06	3.06	3.05	3.05
24	LAVELLE #2001BP	PASS	2.89	2.88	2.90	2.89	2.82	2.88
25	TRUE VALUE #838J	PASS	2.82	2.81	2.83	2.82	2.83	2.82
26	LINCOLN PROD #1044	PASS	4.11	4.41	4.63	4.48	4.44	4.41
27	MELARD #16198	LEAKED .2 GAL	2.89	2.90	2.88	2.90	2.90	2.89
29	KIRK HILL #13631	PASS	2.84	2.85	2.81	2.82	2.81	2.83
31	HARVEY'S #91425	LEAKED .87 GAL	2.73	2.74	2.72	2.72	2.72	2.73
33	ACE #43749	PASS	2.84	2.83	2.85	2.83	2.83	2.84
35	ACE #46677	PASS	2.80	2.82	2.84	2.81	2.82	2.82
36	WARD #4-290	PASS	2.83	2.84	2.83	2.81	2.85	2.83
37	WARD #4-291	PASS	2.79	2.81	2.80	2.80	2.80	2.80
42	WARD #4-287	PASS	3.69	3.73	3.75	3.80	3.80	3.75
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.54	2.54	2.54	2.55	2.55	2.54
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.07	2.04	2.06	2.08	2.06	2.06
46	HUNTER #525C	PASS	2.80	2.81	2.81	2.81	2.81	2.81
47 Adjust high (note 3)	HUNTER #414C	LEAKED .85 GAL	2.42	2.43	2.54	2.42	2.57	2.48
47 Adjust low (note 4)	HUNTER #414C	PASS	0.97	0.97	1.13	1.06	1.04	1.03
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.66	2.67	2.68	2.68	2.66	2.67
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.08	2.09	2.37	2.33	2.07	2.19
49	LEE MEYERS #B-262V	PASS	2.91	2.93	2.94	2.95	2.94	2.93
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.71	1.70	1.70	1.72	1.70	1.71
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	2.52	2.48	2.54	2.52	2.48	2.51

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) :

4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE

Mansfield 130/160 (1997-98)

Table 6 - Page 8 of 18

[illegible]

Note: 1) THIS TOILET WOULD ONLY ACCEPT THE FLUSH VALVE CLOSURE SEALS SHOWN ABOVE.

Niagara 2202 (1997-98)

Table 6 - Page 9 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT			1.56	1.60	1.56	1.55	1.56	1.57
1	FILLPRO #RPFP001	PASS	2.81	2.82	2.85	2.81	2.81	2.82
2	LEE MEYERS #BTB1	PASS	2.50	2.53	2.50	2.51	2.55	2.52
3	LEE MEYERS #BTB41	FAIL	3.08	3.09	3.08	3.06	3.05	3.07
6	LEE MEYERS #BTB54	PASS	2.90	2.89	2.92	2.92	2.92	2.91
7 Adjust high (note 3 & 7)	LEE MEYERS #BKL95	FAIL	4.73	4.59	4.76	4.44	4.44	4.59
7 Adjust low (note 4 & 7)	LEE MEYERS #BKL95	FAIL	2.25	2.07	2.03	2.08	2.04	2.09
10	DANCO #80812	PASS	2.82	2.79	2.80	2.80	2.79	2.80
11	DANCO #88442	PASS	2.85	2.78	2.86	2.81	2.80	2.82
12	HOME PLUMBER #25017	PASS	3.70	3.59	3.55	3.86	3.80	3.70
15 note 6	HOME PLUMBER #825017	PASS	3.28	3.27	3.33	3.31	3.16	3.27
17	FLUIDMASTER #501X	PASS	2.90	2.91	2.89	2.90	2.91	2.90
20	LAVELLE #54BP	PASS	2.88	2.81	2.88	2.87	2.81	2.85
22	LAVELLE #58BP	PASS	2.94	2.95	2.94	2.96	2.95	2.95
23	LAVELLE #92BP	PASS	3.01	3.01	3.04	3.00	3.02	3.02
24	LAVELLE #2001BP	PASS	2.93	2.94	2.94	2.93	2.94	2.94
25	TRUE VALUE #838J	PASS	2.83	2.82	2.83	2.77	2.83	2.82
26	LINCOLN PROD #1044	PASS	2.96	2.96	2.96	2.97	2.98	2.97
27	MELARD #16198	PASS	2.97	2.87	2.93	3.01	2.97	2.95
29	KIRKHILL #13631	PASS	2.78	2.83	2.84	2.77	2.85	2.81
31	HARVEY'S #91425	PASS	2.66	2.66	2.66	2.66	2.67	2.66
33	ACE #43749	LEAKED .5 GAL	2.88	2.83	2.86	2.88	2.86	2.86
35	ACE #46677	PASS	2.84	2.91	2.89	2.88	2.88	2.88
36	WARD #4-290	PASS	2.79	2.81	2.80	2.80	2.83	2.81
37	WARD #4-291	PASS	2.85	2.82	2.82	2.83	2.84	2.83
42	WARD #4-287	PASS	2.93	2.95	2.94	2.94	2.96	2.94
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.56	2.49	2.51	2.48	2.48	2.50
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.99	1.99	1.94	1.98	1.90	1.96
46	HUNTER #525C	PASS	3.05	2.81	2.83	2.76	2.83	2.86
47 Adjust high (note 3)	HUNTER #414C	PASS	2.41	2.38	2.41	2.39	2.44	2.41
47 Adjust low (note 4)	HUNTER #414C	PASS	1.18	1.21	1.29	1.19	1.08	1.19
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.65	2.66	2.64	2.66	2.64	2.65
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.02	1.96	2.00	1.98	1.93	1.98
49	LEE MEYERS #B-262V	PASS	3.00	3.01	2.99	3.00	2.98	3.00

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) : 4, 5, 8, 9, 13, 14, 16, 18, 19, 21, 28, 30, 32, 34, 38, 39, 40, 41, 43, 44

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) NUMBERS ARE ESTIMATES. FLAPPER WAS LEAKING TOO FAST TO BE ACCURATE.

Niagara 2202TP (1997-98)
Table 6 - Page 10 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.57	1.60	1.61	1.57	1.63	1.60
1	FILLPRO #RPFP001	PASS	1.61	1.61	1.60	1.61	1.60	1.61
2	LEE MEYERS #BTB1	PASS	1.61	1.59	1.64	1.59	1.59	1.60
3	LEE MEYERS #BTB41	PASS	1.73	1.73	1.67	1.70	1.68	1.70
6	LEE MEYERS #BTB54	PASS	1.61	1.62	1.61	1.58	1.60	1.60
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	0.73	0.75	0.74	0.75	0.75	0.74
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	0.78	0.77	0.84	0.82	0.79	0.80
10	DANCO #80812	PASS	1.63	1.64	1.64	1.63	1.64	1.64
11	DANCO #88442	PASS	1.69	1.71	1.68	1.67	1.66	1.68
12	HOME PLUMBER #25017	PASS	1.77	1.74	1.79	1.76	1.77	1.77
15	HOME PLUMBER #825017	PASS	1.78	1.78	1.77	1.78	1.80	1.78
17 note 6	FLUIDMASTER #501X	PASS	1.71	1.73	1.74	1.71	1.71	1.72
20 note 7	LAVELLE #54BP	PASS	0.93	0.60	0.40	0.42	0.38	0.55
22	LAVELLE #58BP	PASS	1.67	1.67	1.68	1.68	1.67	1.67
23 note 7	LAVELLE #92BP	PASS	0.40	0.43	0.41	0.45	0.44	0.43
24 note 7	LAVELLE #2001BP	PASS	0.70	0.68	1.50	0.72	0.60	0.84
25 note 6	TRUE VALUE #838J	PASS	1.65	1.68	1.65	1.68	1.68	1.67
26	LINCOLN PROD #1044	PASS	1.65	1.67	1.68	1.67	1.68	1.67
27	MELARD #16198	PASS	1.85	1.70	1.73	1.68	1.74	1.74
29 note 6	KIRKHILL #13631	PASS	1.66	1.66	1.66	1.76	1.68	1.68
31 note 7	HARVEY'S #91425	PASS	0.57	0.58	0.60	0.58	0.57	0.58
33	ACE #43749	PASS	1.66	1.68	1.64	1.66	1.67	1.66
35	ACE #46677	PASS	0.64	0.76	0.78	0.72	0.75	0.73
36	WARD #4-290	PASS	1.66	1.68	1.65	1.65	1.68	1.66
37	WARD #4-291	PASS	1.64	1.64	1.66	1.64	1.66	1.65
42	WARD #4-287	PASS	1.58	1.59	1.59	1.59	1.60	1.59
45 Adjust high (note 2 & 7)	FRUGAL FLUSH	PASS	0.48	0.45	0.48	0.45	0.42	0.46
45 Adjust low (note 5 & 7)	FRUGAL FLUSH	PASS	0.44	0.47	0.47	0.49	0.42	0.46
46	HUNTER #525C	PASS	1.65	1.65	1.65	1.63	1.64	1.64
47 Adjust high (note 3 & 7)	HUNTER #414C	PASS	0.58	0.50	0.53	0.50	0.56	0.53
47 Adjust low (note 4 & 7)	HUNTER #414C	PASS	0.28	0.25	0.33	0.31	0.33	0.30
48 Adjust high (note 2 & 7)	FRUGAL FLUSH	PASS	0.48	0.42	0.40	0.46	0.51	0.45
48 Adjust low (note 5 & 7)	FRUGAL FLUSH	PASS	0.39	0.44	0.43	0.46	0.42	0.43
49	LEE MEYERS #B-262V	PASS	1.65	1.65	1.65	1.64	1.64	1.65

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) TRIP LEVER HAD TO BE DEPRESSED TWICE IN QUICK SUCCESSION TO COMPLETE FLUSH.

7) WOULD NOT OPEN COMPLETELY. INCOMPLETE FLUSH.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	2.16	2.25	2.18	2.27	2.24	2.22
1	FILLPRO #RPPF001	PASS	3.11	3.16	3.19	3.20	3.13	3.16
2	LEE MEYERS #BTB1	PASS	3.17	2.85	2.89	3.09	2.98	3.00
3	LEE MEYERS #BTB41	FAIL	3.41	3.43	3.45	3.44	3.41	3.43
6	LEE MEYERS #BTB54	PASS	3.13	3.15	3.17	3.16	3.21	3.16
7 Adjust high (note 3 & 7)	LEE MEYERS #BKL95	FAIL	4.00	4.02	3.50	4.05	4.20	3.95
7 Adjust low (note 4 & 7)	LEE MEYERS #BKL95	FAIL	1.59	2.01	2.04	2.10	2.16	1.98
10	DANCO #80812	PASS	3.17	3.18	3.19	3.20	3.20	3.19
11	DANCO #88442	PASS	3.13	3.16	3.19	3.18	3.17	3.17
12 note 6	HOME PLUMBER #25017	PASS	3.39	3.39	3.51	3.27	3.29	3.37
15	HOME PLUMBER #825017	PASS	3.65	3.62	3.72	3.73	3.66	3.68
17	FLUIDMASTER #501X	PASS	3.21	3.20	3.21	3.21	3.23	3.21
20	LAVELLE #54BP	PASS	3.22	3.22	3.24	3.22	3.22	3.22
22	LAVELLE #58BP	PASS	3.31	3.31	3.31	3.30	3.31	3.31
23	LAVELLE #92BP	PASS	3.36	3.34	3.33	3.37	3.35	3.35
24	LAVELLE #2001BP	PASS	3.30	3.27	3.26	3.27	3.29	3.28
25	TRUE VALUE #838J	PASS	3.17	3.19	3.21	3.17	3.21	3.19
26	LINCOLN PROD #1044	PASS	3.28	3.29	3.30	3.32	3.33	3.30
27	MELARD #16198	PASS	3.39	3.29	3.34	3.33	3.34	3.34
29	KIRKHILL #13631	PASS	3.11	3.09	3.09	3.08	3.09	3.09
31	HARVEY'S #91425	PASS	2.97	2.98	2.99	2.99	2.98	2.98
33	ACE #43749	PASS	3.12	3.11	3.12	3.12	3.10	3.11
35	ACE #46677	PASS	3.25	3.25	3.26	3.23	3.23	3.24
36	WARD #4-290	PASS	3.20	3.19	3.18	3.20	3.17	3.19
37	WARD #4-291	PASS	3.20	3.23	3.20	3.21	3.22	3.21
42	WARD #4-287	PASS	3.32	3.30	3.31	3.31	3.30	3.31
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.82	2.83	2.78	2.84	2.83	2.82
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.85	2.06	2.02	2.01	2.05	2.00
46	HUNTER #525C	PASS	3.16	3.14	3.17	3.12	3.13	3.14
47 Adjust high (note 3)	HUNTER #414C	PASS	2.77	2.78	2.77	2.79	2.76	2.77
47 Adjust low (note 4)	HUNTER #414C	PASS	1.41	1.39	1.18	1.33	1.64	1.39
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.92	2.91	2.94	2.92	2.90	2.92
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.95	2.07	2.08	2.08	2.10	2.06
49	LEE MEYERS #B-262V	PASS	3.34	3.33	3.31	3.32	3.33	3.33

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL): 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) NUMBERS ARE ESTIMATES. FLAPPER WAS LEAKING TOO FAST TO BE ACCURATE.

Sterling 404015/404515 (1997-98)

Table 6 - Page 12 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.59	1.61	1.57	1.57	1.58	1.58
1	FILLPRO #RPFP001	PASS	1.51	1.51	1.52	1.52	1.51	1.51
2	LEE MEYERS #BTB1	PASS	1.41	1.39	1.44	1.40	1.38	1.40
3	LEE MEYERS #BTB41	LEAKED .15 GAL	1.65	1.65	1.65	1.65	1.61	1.64
6	LEE MEYERS #BTB54	PASS	1.62	1.58	1.61	1.60	1.58	1.60
7 Adjust high (note 3)	LEE MEYERS #BKL95	LEAKED .60 GAL	1.27	1.29	1.31	1.29	1.29	1.29
7 Adjust low (note 4)	LEE MEYERS #BKL95	LEAKED 1.05 GAL	0.66	0.66	0.71	0.68	0.66	0.67
10	DANCO #80812	LEAKED .89 GAL	1.60	1.58	1.58	1.61	1.58	1.59
11	DANCO #88442	PASS	1.56	1.57	1.57	1.54	1.57	1.56
12	HOME PLUMBER #25017	PASS	1.94	2.04	1.92	2.00	2.04	1.99
15 note 6	HOME PLUMBER #825017	PASS	1.97	1.90	1.92	1.90	1.93	1.92
17	FLUIDMASTER #501X	PASS	1.66	1.64	1.63	1.64	1.62	1.64
20	LAVELLE #54BP	PASS	1.59	1.58	1.57	1.59	1.58	1.58
22	LAVELLE #58BP	PASS	1.92	1.84	1.85	1.88	1.86	1.87
23	LAVELLE #92BP	PASS	1.64	1.63	1.64	1.64	1.62	1.63
24	LAVELLE #2001BP	PASS	1.57	1.57	1.57	1.56	1.55	1.56
25	TRUE VALUE #838J	PASS	1.54	1.55	1.53	1.55	1.54	1.54
26	LINCOLN PROD #1044	PASS	1.94	1.91	1.93	1.85	1.90	1.91
27	MELARD #16198	PASS	1.68	1.64	1.66	1.66	1.65	1.66
29	KIRK HILL #13631	PASS	1.55	1.55	1.57	1.55	1.55	1.55
31	HARVEY'S #91425	FAIL	1.46	1.42	1.44	1.44	1.46	1.44
33	ACE #43749	PASS	1.53	1.53	1.55	1.52	1.55	1.54
35	ACE #46677	PASS	1.59	1.56	1.56	1.53	1.54	1.56
36	WARD #4-290	PASS	1.56	1.56	1.57	1.56	1.55	1.56
37	WARD #4-291	PASS	1.57	1.56	1.57	1.55	1.57	1.56
42	WARD #4-287	PASS	1.93	1.90	1.92	1.88	1.90	1.91
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.43	1.41	1.41	1.40	1.43	1.42
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.21	1.22	1.22	1.22	1.21	1.22
46	HUNTER #525C	PASS	1.55	1.57	1.56	1.57	1.55	1.56
47 Adjust high (note 3)	HUNTER #414C	LEAKED .9 GAL	1.30	1.33	1.30	1.30	1.32	1.31
47 Adjust low (note 4 & 6)	HUNTER #414C	LEAKED .2 GAL	0.76	0.75	0.79	0.70	0.70	0.74
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.47	1.48	1.50	1.47	1.48	1.48
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.25	1.24	1.28	1.25	1.27	1.26
49	LEE MEYERS #B-262V	PASS	1.65	1.69	1.66	1.67	1.66	1.67
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.10	1.14	1.12	1.12	1.11	1.12
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	1.38	1.35	1.41	1.34	1.36	1.37

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL):

4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE.

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.58	1.61	1.59	1.56	1.57	1.58
1	FILLPRO #RPFP001	PASS	2.22	2.20	2.19	2.22	2.18	2.20
2	LEE MEYERS #BTB1	PASS	1.92	1.93	1.92	1.96	1.94	1.93
3	LEE MEYERS #BTB41	PASS	2.33	2.34	2.33	2.33	2.30	2.33
6	LEE MEYERS #BTB54	PASS	2.23	2.24	2.23	2.20	2.16	2.21
7 Adjust high (note 3)	LEE MEYERS #BKL95	LEAKED .85 GAL	1.85	1.84	1.79	1.84	1.85	1.83
7 Adjust low (note 4)	LEE MEYERS #BKL95	LEAKED .30 GAL	0.70	0.67	0.70	0.69	0.67	0.69
10	DANCO #80812	LEAKED .21 GAL	2.24	2.33	2.30	2.32	2.29	2.30
11	DANCO #88442	PASS	2.16	2.14	2.13	2.12	2.16	2.14
12	HOME PLUMBER #25017	PASS	2.57	2.63	2.51	2.55	2.65	2.58
15	HOME PLUMBER #825017	PASS	2.71	2.67	2.89	2.78	2.85	2.78
17	FLUIDMASTER #501X	PASS	2.29	2.28	2.31	2.31	2.31	2.30
20	LAVELLE #54BP	PASS	2.11	2.08	2.03	2.08	2.09	2.08
22	LAVELLE #58BP	PASS	2.53	2.58	2.51	2.56	2.61	2.56
23	LAVELLE #92BP	PASS	2.16	2.20	2.13	2.09	2.16	2.15
24	LAVELLE #2001BP	PASS	2.17	2.04	2.20	2.09	2.12	2.12
25	TRUE VALUE #838J	PASS	2.10	2.08	2.15	2.13	2.18	2.13
26	LINCOLN PROD.#1044	PASS	2.66	2.75	2.73	2.69	2.62	2.69
27	MELARD #16198	PASS	2.27	2.27	2.25	2.25	2.26	2.26
29	KIRK HILL #13631	PASS	2.13	2.12	2.11	2.15	2.12	2.13
31	HARVEY'S #91425	LEAKED .80 GAL	2.01	2.00	2.00	2.00	2.00	2.00
33	ACE #43749	PASS	2.21	2.21	2.19	2.20	2.22	2.21
35	ACE #46677	PASS	2.07	2.06	2.02	2.11	2.11	2.07
36	WARD #4-290	PASS	2.20	2.20	2.21	2.19	2.18	2.20
37	WARD #4-291	PASS	2.20	2.21	2.19	2.19	2.18	2.19
42	WARD #4-287	PASS	2.69	2.65	2.65	2.63	2.64	2.65
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.89	1.91	1.91	1.95	1.92	1.92
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.66	1.64	1.65	1.65	1.65	1.65
46	HUNTER #525C	PASS	2.24	2.24	2.21	2.23	2.23	2.23
47 Adjust high (note 3)	HUNTER #414C	PASS	1.86	1.85	1.86	1.88	1.85	1.86
47 Adjust low (note 4)	HUNTER #414C	PASS	0.80	0.88	0.78	0.80	0.84	0.82
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.04	2.02	2.00	2.07	2.04	2.03
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.65	1.67	1.68	1.71	1.67	1.68
49	LEE MEYERS #B-262V	PASS	2.38	2.39	2.39	2.38	2.40	2.39
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.36	1.43	1.38	1.40	1.42	1.40
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	1.93	1.91	1.96	1.87	1.86	1.91

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS(SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE.

Universal Rundle 4290/4471 (1997-98)
Table 6 - Page 14 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL.
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	PER FLUSH
ORIGINAL EQUIPMENT		PASS	1.66	1.69	1.69	1.74	1.72	1.70
1	FILLPRO #RPPF001	PASS	1.74	1.75	1.76	1.77	1.76	1.76
2	LEE MEYERS #BT81	PASS	1.54	1.55	1.56	1.56	1.53	1.55
3	LEE MEYERS #BT841	FAIL	2.20	2.30	2.38	2.32	2.27	2.29
6	LEE MEYERS #BT854	PASS	1.98	1.99	1.94	1.95	1.99	1.97
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	2.32	2.36	2.38	2.36	2.35	2.35
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	1.32	1.33	1.36	1.36	1.41	1.36
10	DANCO #80812	PASS	1.75	1.79	1.79	1.79	1.79	1.78
11	DANCO #88442	PASS	1.76	1.76	1.77	1.76	1.79	1.77
12	HOME PLUMBER #25017	PASS	2.35	2.33	2.33	2.19	2.33	2.31
15 note 6	HOME PLUMBER #825017	PASS	2.15	2.36	2.22	2.23	2.21	2.23
17	FLUIDMASTER #501X	PASS	1.91	1.87	1.89	1.87	1.91	1.89
20	LAVELLE #54BP	PASS	1.84	1.85	1.85	1.83	1.83	1.84
22	LAVELLE #58BP	PASS	1.91	1.92	1.91	1.93	1.92	1.92
23	LAVELLE #92BP	PASS	1.97	1.96	1.96	1.95	1.98	1.96
24	LAVELLE #2001BP	PASS	1.92	1.91	1.90	1.92	1.90	1.91
25	TRUE VALUE #838J	PASS	1.77	1.74	1.79	1.76	1.77	1.77
26	LINCOLN PROD #1044	PASS	1.88	1.88	1.88	1.89	1.89	1.88
27	MELARD #16198	LEAKED .10 GAL	1.1.93	1.92	1.93	1.91	1.94	1.93
29	KIRKILL #13631	PASS	1.77	1.76	1.77	1.78	1.80	1.78
31	HARVEY'S #91425	LEAKED .24 GAL	1.64	1.64	1.66	1.66	1.64	1.65
33	ACE #43749	LEAKED .10 GAL	1.84	1.84	1.87	1.85	1.86	1.85
35	ACE #46677	PASS	1.85	1.84	1.84	1.81	1.82	1.83
36	WARD #4-290	PASS	1.85	1.85	1.86	1.85	1.83	1.85
37	WARD #4-291	PASS	1.83	1.83	1.83	1.84	1.85	1.84
42	WARD #4-287	PASS	1.91	1.91	1.91	1.90	1.90	1.91
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.59	1.58	1.59	1.60	1.61	1.59
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.25	1.27	1.26	1.26	1.26	1.26
46	HUNTER #525C	PASS	1.79	1.80	1.79	1.80	1.80	1.80
47 Adjust high (note 3)	HUNTER #414C	PASS	1.42	1.43	1.42	1.42	1.44	1.43
47 Adjust low (note 4)	HUNTER #414C	PASS	0.85	0.90	0.94	0.90	0.89	0.90
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.71	1.72	1.73	1.74	1.74	1.73
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.25	1.31	1.31	1.26	1.30	1.29
49	LEE MEYERS #B-262V	PASS	1.91	1.91	1.90	1.90	1.90	1.90
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.10	1.12	1.11	1.12	1.12	1.11
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	1.59	1.68	1.6	1.62	1.61	1.62

1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) :

4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE.

Universal Rundle 4290/4490 (1997-98)
Table 6 - Page 15 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.86	1.87	1.86	1.88	1.87	1.87
1	FILLPRO #RPP001	FAIL	1.90	1.89	1.90	1.89	1.83	1.88
2	LEE MEYERS #BTB1	PASS	1.72	1.71	1.71	1.71	1.70	1.71
3	LEE MEYERS #BTB41	PASS	2.06	2.05	2.10	2.12	2.10	2.09
6	LEE MEYERS #BTB54	PASS	2.01	2.05	1.94	2.06	1.91	1.99
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	1.42	1.32	1.45	1.44	1.43	1.41
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	0.89	0.90	0.95	1.05	1.07	0.97
10	DANCO #80812	PASS	2.38	2.42	2.60	2.37	2.45	2.44
11	DANCO #88442	PASS	2.11	1.90	1.92	1.92	2.10	1.99
12	HOME PLUMBER #25017	PASS	2.30	2.68	2.60	2.68	2.42	2.54
15 (note 6)	HOME PLUMBER #825017	PASS	2.41	2.45	2.50	2.42	2.45	2.45
17	FLUIDMASTER #501X	PASS	2.02	2.01	2.02	2.00	1.99	2.01
20	LAVELLE #54BP	PASS	1.88	1.84	1.80	1.79	1.75	1.81
22	LAVELLE #58BP	PASS	2.68	2.66	2.64	2.57	2.62	2.63
23	LAVELLE #92BP	FAIL	2.10	2.11	2.09	2.13	2.09	2.10
24	LAVELLE #2001BP	PASS	1.94	1.95	1.93	1.96	1.93	1.94
25	TRUE VALUE #B3BJ	PASS	1.94	2.00	1.96	1.94	1.97	1.96
26	LINCOLN PROD.#1044	FAIL	2.74	2.62	2.67	2.80	2.64	2.69
27	MELARD #16198	PASS	2.05	2.07	2.02	2.02	2.01	2.03
29	KIRK HILL #13631	PASS	1.90	1.90	1.87	1.85	1.87	1.88
31	HARVEY'S #91425	FAIL	1.70	1.73	1.70	1.80	2.10	1.81
33	ACE #43749	FAIL	1.88	1.91	1.90	1.95	1.95	1.92
35	ACE #46677	PASS	1.95	2.04	2.19	1.97	1.91	2.01
36	WARD #4-290	PASS	1.92	1.91	1.91	1.91	1.92	1.91
37	WARD #4-291	LEAKED .33 GAL.	1.88	1.87	1.89	1.86	1.88	1.88
42	WARD #4-287	LEAKED .20 GAL.	2.54	2.71	2.59	2.60	2.62	2.61
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.56	1.51	1.54	1.55	1.58	1.55
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.18	1.24	1.26	1.25	1.23	1.23
46	HUNTER #525C	PASS	1.91	1.91	1.86	1.92	1.87	1.89
47 Adjust high (note 3)	HUNTER #414C	PASS	1.39	1.39	1.39	1.39	1.40	1.39
47 Adjust low (note 4)	HUNTER #414C	PASS	0.49	0.64	0.47	0.51	0.54	0.53
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	1.67	1.66	1.67	1.68	1.67	1.67
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.31	1.28	1.32	1.32	1.31	1.31
49	LEE MEYERS #B-262V	PASS	1.94	1.94	2.05	2.11	1.95	2.00
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.08	1.12	1.10	1.09	1.09	1.10
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	1.56	1.53	1.57	1.55	1.54	1.55

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) : 4, 5, 8, 9, 13, 14, 16, 18, 19, 21, 28, 30, 32, 34, 38, 39, 40, 41, 43, 44.

2) SET AT SMALLEST HOLE FOR MAXIMUM WATER USAGE.

3) FLOAT SET AT LOWEST SETTING FOR MAXIMUM WATER USAGE.

4) FLOAT SET AT HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET AT BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSED. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE, THE FLAPPER STUCK IN THE OPEN POSITION.

7) SETTING AT #1 FOR MINIMUM WATER USAGE.

8) SETTING AT #9 FOR MAXIMUM WATER USAGE

St. Thomas Eclipse 6201.010 (1997-98)
Table 6 (Revised) - Page 16 of 18

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.75	1.75	1.72	1.76	1.72	1.74
1	FILLPRO #RFP001	PASS	3.65	3.68	3.66	3.68	3.68	3.67
2	LEE MEYERS #BTB1	PASS	3.35	3.34	3.28	3.30	3.31	3.32
3	LEE MEYERS #BTB41	PASS	3.85	3.88	3.91	3.91	3.83	3.88
6	LEE MEYERS #BTB54	PASS	3.75	3.73	3.72	3.76	3.73	3.74
7 Adjust high (note 3)	LEE MEYERS #BKL95	FAIL	LEAKING TOO FAST TO TEST					
7 Adjust low (note 4)	LEE MEYERS #BKL95	FAIL	LEAKING TOO FAST TO TEST					
10	DANCO #80812	PASS	3.63	3.65	3.65	3.63	3.65	3.64
11	DANCO #88442	PASS	3.62	3.64	3.62	3.62	3.62	3.62
12 note 6	HOME PLUMBER #25017	PASS	0.50	0.52	0.55	0.60	0.52	0.54
15 note 6	HOME PLUMBER #825017	PASS	0.65	0.63	0.70	0.68	0.60	0.65
17	FLUIDMASTER #501X	PASS	3.76	3.74	3.74	3.73	3.80	3.75
20	LAVELLE #54BP	PASS	3.71	3.66	3.71	3.62	3.66	3.67
22	LAVELLE #58BP	PASS	3.87	3.88	3.88	3.88	3.86	3.87
23	LAVELLE #92BP	PASS	3.80	3.77	3.82	3.80	3.80	3.80
24	LAVELLE #2001BP	PASS	3.70	3.69	3.70	3.69	3.68	3.69
25	TRUE VALUE #838J	PASS	3.58	3.60	3.57	3.60	3.52	3.57
26	LINCOLN PROD.#1044	PASS	3.86	3.87	3.87	3.88	3.88	3.87
27	MELARD #16198	PASS	3.76	3.76	3.72	3.74	3.77	3.75
29	KIRKHILL #13631	PASS	3.59	3.78	3.62	3.61	3.59	3.64
31	HARVEY'S #91425	PASS	3.43	3.44	3.44	3.43	3.45	3.44
33	ACE #43749	PASS	3.64	3.64	3.64	3.65	3.66	3.65
35	ACE #46677	PASS	3.70	3.72	3.71	3.72	3.73	3.72
36	WARD #4-290	PASS	3.70	3.69	3.71	3.71	3.69	3.70
37	WARD #4-291	PASS	3.63	3.64	3.62	3.60	3.60	3.62
42	WARD #4-287	PASS	3.87	3.89	3.87	3.90	4.11	3.93
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.03	3.01	3.01	2.98	3.00	3.01
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.30	2.25	2.29	2.31	2.27	2.28
46	HUNTER #525C	PASS	3.61	3.59	3.60	3.59	3.58	3.59
47 Adjust high (note 3)	HUNTER #414C	PASS	3.09	3.13	3.14	3.12	3.13	3.12
47 Adjust low (note 4)	HUNTER #414C	PASS	0.72	0.79	0.83	0.73	0.77	0.77
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	3.41	3.40	3.42	3.37	3.37	3.39
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.18	2.19	2.14	2.19	2.23	2.19
49	LEE MEYERS #B-262V	PASS	3.83	3.85	3.83	3.81	3.83	3.83
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.73	1.71	1.75	1.74	1.72	1.73
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	3.37	3.36	3.39	3.37	3.36	3.37

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS: 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43, and 44.

2) SET AT SMALLEST HOLE FOR MAXIMUM WATER USAGE.

3) FLOAT SET AT LOWEST SETTING FOR MAXIMUM WATER USAGE.

4) FLOAT SET AT HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET AT LARGEST HOLE FOR MINIMUM WATER USE.

6) INCOMPLETE FLUSH. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER, WOULD NOT "POP" OPEN.

7) SETTING AT #1 SETTING FOR MINIMUM WATER USAGE.

8) SET AT #9 SETTING FOR MAXIMUM WATER USAGE

Table 6 - Page 17 of 18

St. Thomas Eclipse Marathon 6201.110 (1997-98)

(non-production/prototype model)

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.46	1.47	1.46	1.46	1.47	1.46
1 note 6	FILLPRO #RFPF001	PASS	0.71	0.80	0.75	0.82	0.99	0.81
2 note 6	LEE MEYERS #BTB1	PASS	0.80	0.90	0.80	0.85	0.86	0.84
3	LEE MEYERS #BTB41	LEAKED 1.2 GAL.	1.59	1.64	1.60	1.60	1.63	1.61
6 note 6	LEE MEYERS #BTB54	PASS	0.59	0.66	0.66	0.73	0.62	0.65
7 Adjust high (note 3)	LEE MEYERS #BKL95	N/A	FLOAT OBSTRUCTED FLAPPER CLOSING					N/A
7 Adjust low (note 4)	LEE MEYERS #BKL95	N/A	FLOAT OBSTRUCTED FLAPPER CLOSING					N/A
10	DANCO #80812	PASS	1.45	1.43	1.45	1.44	1.43	1.44
11 note 6	DANCO #88442	PASS	0.66	0.58	0.61	0.55	0.60	0.60
12	HOME PLUMBER #25017	PASS	FLAPPER WOULD NOT "POP-UP". UNABLE TO COMPLETE TEST.					N/A
15	HOME PLUMBER #825017	PASS	FLAPPER WOULD NOT "POP-UP". UNABLE TO COMPLETE TEST.					N/A
17	FLUIDMASTER #501X	PASS	1.48	1.49	1.48	1.47	1.48	1.48
20 note 6	LAVELLE #54BP	PASS	0.49	0.46	0.42	0.45	0.50	0.46
22	LAVELLE #58BP	PASS	1.47	1.47	1.46	1.46	1.46	1.46
23	LAVELLE #92BP	PASS	FLAPPER WOULD NOT "POP-UP". UNABLE TO COMPLETE TEST.					N/A
24 note 6	LAVELLE #2001BP	PASS	0.46	0.51	0.46	0.53	0.53	0.50
25 note 6	TRUE VALUE #838J	PASS	0.74	1.09	0.90	0.89	0.93	0.91
26	LINCOLN PROD #1044	PASS	1.53	1.54	1.53	1.55	1.53	1.54
27 note 6	MELARD #16198	PASS	0.51	0.71	0.61	0.60	0.57	0.60
29	KIRK HILL #13631	N/A	DID NOT FIT					N/A
31 note 6	HARVEY'S #91425	PASS	0.65	0.64	0.84	0.91	0.87	0.78
33	ACE #43749	PASS	1.47	1.48	1.48	1.48	1.47	1.48
35 note 6	ACE #46677	PASS	0.48	0.57	0.59	0.66	0.65	0.59
36	WARD #4-290	PASS	1.49	1.48	1.48	1.47	1.48	1.48
37	WARD #4-291	PASS	1.51	1.52	1.52	1.51	1.51	1.51
42	WARD #4-287	PASS	1.55	1.57	1.56	1.55	1.54	1.55
45 Adjust high (note 2 & 6)	FRUGAL FLUSH	PASS	0.70	0.84	0.70	0.75	0.74	0.75
45 Adjust low (note 5 & 6)	FRUGAL FLUSH	PASS	0.67	0.78	0.92	0.67	0.68	0.74
46 note 6	HUNTER #525C	PASS	0.65	0.68	0.60	0.62	0.63	0.64
47 Adjust high (note 3 & 6)	HUNTER #414C	PASS	0.45	0.52	0.48	0.49	0.52	0.49
47 Adjust low (note 4 & 6)	HUNTER #414C	PASS	ONE FLUSH NOT ENOUGH TO ACTIVATE FILL VALVE. UNABLE TO COMPLETE TEST.					N/A
48 Adjust high (note 2 & 6)	FRUGAL FLUSH	PASS	0.54	0.67	0.62	0.57	0.66	0.61
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	0.59	0.62	0.60	0.63	0.53	0.59
49	LEE MEYERS #B-262V	PASS	1.50	1.49	1.49	1.49	1.48	1.49
50 Adjust low (note 7 & 6)	FLUIDMASTER #502	PASS	0.50	0.55	0.52	0.57	0.54	0.54
50 Adjust high (note 6 & 8)	FLUIDMASTER #502	PASS	0.6	0.59	0.58	0.6	0.61	0.60

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) : 4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE

6) INCOMPLETE FLUSH

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE

FLAPPER TRACKING #	FLAPPER BRAND	1/2 HOUR LEAK CHECK	GALLONS PER FLUSH					AVG. GAL. PER FLUSH
			1ST FLUSH	2ND FLUSH	3RD FLUSH	4TH FLUSH	5TH FLUSH	
ORIGINAL EQUIPMENT		PASS	1.68	1.67	1.79	1.76	1.75	1.73
1	FILLPRO #RPFP001	PASS	2.97	2.97	2.96	2.91	2.97	2.96
2	LEE MEYERS #BTB1	PASS	2.59	2.50	2.52	2.50	2.50	2.52
3	LEE MEYERS #BTB41	PASS	2.93	2.84	2.92	2.86	2.86	2.88
6	LEE MEYERS #BTB54	PASS	3.02	2.83	2.90	2.94	2.95	2.93
7 Adjust high (note 3)	LEE MEYERS #BKL95	LEAKED .45 GAL.	2.58	2.57	3.02	2.58	2.89	2.73
7 Adjust low (note 3)	LEE MEYERS #BKL95	FAIL	1.03	1.00	0.89	0.92	0.91	0.95
10	DANCO #80812	PASS	2.74	2.73	2.74	2.75	2.74	2.74
11	DANCO #88442	PASS	2.85	2.81	2.82	2.86	2.86	2.84
12 note 6	HOME PLUMBER #25017	PASS	3.41	3.36	3.31	3.53	3.36	3.39
15 note 6	HOME PLUMBER #825017	PASS	3.06	3.20	3.00	3.01	3.19	3.09
17	FLUIDMASTER #501X	PASS	2.95	2.85	2.96	2.95	2.97	2.94
20	LAVELLE #54BP	PASS	2.99	2.92	2.95	2.98	2.96	2.96
22	LAVELLE #58BP	PASS	3.20	3.02	3.20	3.24	2.99	3.13
23	LAVELLE #92BP	PASS	3.06	3.09	3.07	3.01	3.06	3.06
24	LAVELLE #2001BP	PASS	2.95	2.93	2.96	2.93	2.92	2.94
25	TRUE VALUE #838J	PASS	2.91	2.88	2.78	2.86	2.90	2.87
26	LINCOLN PROD #1044	PASS	3.37	3.29	3.28	3.38	3.31	3.33
27	MELARD #16198	PASS	2.88	3.00	2.92	2.97	2.97	2.95
29	KIRK HILL #13631	PASS	3.04	3.09	3.04	3.09	3.06	3.06
31	HARVEY'S #91425	LEAKED .98 GAL.	2.81	2.79	2.93	2.84	2.72	2.82
33	ACE #43749	PASS	2.94	2.91	2.91	2.97	2.83	2.91
35	ACE #46677	PASS	2.94	2.96	2.90	2.92	2.92	2.93
36	WARD #4-290	PASS	2.91	2.89	2.85	2.88	2.89	2.88
37	WARD #4-291	PASS	3.14	3.14	3.12	3.09	3.02	3.10
42	WARD #4-287	PASS	3.08	3.09	3.07	3.05	3.07	3.07
45 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.57	2.41	2.45	2.46	2.45	2.47
45 Adjust low (note 5)	FRUGAL FLUSH	PASS	1.99	2.00	1.86	1.95	1.95	1.95
46	HUNTER #525C	PASS	3.12	3.13	3.13	3.13	3.11	3.12
47 Adjust high (note 3)	HUNTER #414C	PASS	2.52	2.59	2.58	2.59	2.60	2.58
47 Adjust low (note 4)	HUNTER #414C	PASS	1.09	0.96	0.95	0.91	0.98	0.98
48 Adjust high (note 2)	FRUGAL FLUSH	PASS	2.68	2.72	2.72	2.95	2.87	2.79
48 Adjust low (note 5)	FRUGAL FLUSH	PASS	2.24	2.07	2.09	2.20	2.17	2.15
49	LEE MEYERS #B-262V	PASS	3.03	2.92	3.02	3.03	2.93	2.99
50 Adjust low (note 7)	FLUIDMASTER #502	PASS	1.68	1.69	1.63	1.68	1.64	1.66
50 Adjust high (note 8)	FLUIDMASTER #502	PASS	2.7	2.66	2.67	2.71	2.69	2.69

Notes: 1) THIS TOILET WOULD NOT ACCEPT FLAPPERS WITH THE FOLLOWING TRACKING NUMBERS (SEE MASTER LIST FOR MAKE AND MODEL) :
4,5,8,9,13,14,16,18,19,21,28,30,32,34,38,39,40,41,43,44.

2) SET @ SMALLEST HOLE FOR MAX. WATER USAGE.

3) FLOAT SET @ LOWEST SETTING FOR MAX. WATER USAGE.

4) FLOAT SET @ HIGHEST SETTING FOR MINIMUM WATER USE.

5) SET @ BIGGEST HOLE FOR MINIMUM WATER USE.

6) HAD TO BE PHYSICALLY PUSHED CLOSE. DUE TO CLOSE TOLERANCE WITH "EARS" ON FILL VALVE FLAPPER STUCK OPEN.

7) SETTING @ #1 FOR MINIMUM WATER USAGE.

8) SETTING @ #9 FOR MAX. WATER USAGE.

APPENDIX A

TEST PROTOCOL FOR VOLUME TESTING OF ULTRA-LOW-FLUSH TOILETS

I. Purpose

To evaluate the flush volume characteristics of:

- A. OEM (original equipment manufacturer) flappers as installed in ULF toilets currently being funded as part of the Metropolitan Water District's ULF toilet retrofit programs; and
- B. After-market flappers intended as replacement for the OEM flappers described in A above and generally available to residential consumers through the normal stream of commerce.

II. Scope

This testing shall include flappers from various manufacturers available to the general public at retail outlets throughout Metropolitan's service area. The after-market replacement flappers will be tested in ULF toilet models that were manufactured in 1995-1995 and in 1997-1998.

III. Apparatus

The apparatus used to mount the test toilets shall be built to specifications set forth in the Uniform Plumbing Code and ASME A112.19.6-1995. This shall include the use of ABS drainline. The drainline shall be vented to atmosphere. The water supply line shall supply a static water pressure of 50 psi and shall be fitted with a flow totalizer. The flow totalizer shall be a digital, resettable meter that will give the operator an exact reading. The toilet bowl shall be secured to the decking using adequate means and sealed at the drainline interface with a commercially available wax gasket. The toilet bowl/tank assembly shall be constructed according to manufacturer's instructions.

After initial installation of the toilet (tank and bowl), the water level in the tank shall be adjusted to the appropriate fill line according to manufacturer's instructions. The fill rate shall be adjusted according to manufacturer's instructions, if so indicated. If no fill rate is specified by the manufacturer, the unit shall be tested as delivered.

IV. Test Procedure

- A. Verify that the OEM flapper is installed according to the toilet manufacturer's instructions .
- B. Turn on water supply and allow tank to fill.

- C. Flush toilet a few times to assure that flapper has seated and the fill level is up to the fill line. After the operator is satisfied that the flapper is seated and the fill levels are correct, the shutoff valve to the test toilet water supply shall be moved to the “off” position. The shutoff valve shall remain closed for 1/2 hour, at the end of which time a check shall be performed for leakage at the flush valve.
- D. If, at the conclusion of the leak test, the water level is still at the water line, the operator shall mark “pass” on the test data sheet in the appropriate space. If the tank is completely empty, the operator shall mark “fail” in the appropriate space on the test data sheet. If the water level is somewhere below the water line but not completely empty, the operator shall turn the shutoff valve to the “on” position allowing the tank to fill. The operator shall note how much water was required to fill the tank by using the flow totalizer located on the water supply line. The value observed on the flow totalizer shall be recorded on the test data sheet by the operator. (This value is recorded and utilized only to assist in the analysis of the flush volume data, i.e., a high volume may be attributed to a failure of the flapper to seat properly on a specific valve seat.)
- E. After the leak test is completed, the operator shall turn the shutoff valve to the “on” position. The operator shall flush the toilet at least one time and check the fill level again. Upon completion of a successful flush, the volumetric test shall begin.
- F. Following flow totalizer manufacturer’s instructions, set the flow totalizer to zero.
- G. Flush the toilet. This shall be accomplished by tripping and releasing the flush device in a normal manner (i.e. no excessive force, no holding the device down at the end of it’s stroke, etc.).
- H. Upon completion of the flush cycle, after the fill valve has closed, read the value shown on the flow totalizer, which shall be recorded as the amount of water used for the test flush. Record this value on the test data sheet in the appropriate space.
- I. Repeat steps F through H for a total of five test flushes.
- J. Perform a mathematical average calculation on the five test flush values. Record this value on the test data sheet in the appropriate space. This average shall be the value reported for the test flapper in the specified toilet.
- K. Repeat steps A through J for the after-market test flappers, making sure that they are installed according to the flapper and toilet manufacturer’s instructions.