SLOAN®
Water Connects Us®

VERIFIED by SCS GLOBAL SERVICES
ENVIRONMENTAL PRODUCT DECLARATION
BASED ON LCA

Declaration Owner:

Sloan Valve Company
10500 Seymour Avenue, Franklin Park, IL 60131
P: 847.671.4300 / 800.982.5839 · www.sloan.com

Product

Sloan Diaphragm Flushometers

Functional Unit

Diaphragm flushometers are intended for use with toilet or urinal fixtures as the dispensing unit for the water supplied. These fixtures are primarily installed in the commercial environment including commercial buildings, airports, stadiums, healthcare, hospitality sectors, etc. The functional unit is defined as "10 years of use of a flush valve (or flushometer) for toilets and urinals in an average US commercial environment". The reference service life (RSL) of the product is 10 years, an industry accepted average lifetime that is based on the economic lifespan of a product. However, the flushometer lifespan is expected to greatly exceed 10 years with proper maintenance.

The scope of this EPD is Cradle-to-Grave.

EPD Number and Period of Validity

SCS-EPD-04397
Beginning Date: March 1, 2017 – End Date: February 28, 2022
Version: April 10, 2017

Product Category Rule

Part A: LCA Calculation Rules and Report Requirements v2016; Sustainable Minds (March 2016).

Part B: Commercial Flush Valves Product Group v4.0; Sustainable Minds (December 2016).

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

SCSglobal SERVICES

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Disclaimers: *This Environmental Product Declaration (EPD) conforms to ISO 14025, 14040, ISO 14044, and ISO 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

PCR review, was conducted by	Part B PCR review conducted by the SM TAB, tab@sustainableminds.com
Approved Date: March 1, 2017 - End Date: February 28, 2022	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930:2007.	☐ internal ☑ external
Third party verifier	Thomas Gloria Tom Gloria, PhD, Industrial Ecology Consultants

PRODUCT

The following diaphragm flushometers are represented by this EPD:

SLOAN Diaphragm Flushometers			
Water Closets		Urinals	
Model #	Flush Volume	Model #	Flush Volume
ROYAL 111-1.28	(1.28 gpf/ 4.8 Lpf)	ROYAL 186-0.125	(0.125 gpf/ 0.5 Lpf)
ROYAL 113-1.28	(1.28 gpf/ 4.8 Lpf)	ROYAL 186-0.25	(0.25 gpf/ 1.0 Lpf)
ROYAL 115-1.28	(1.28 gpf/ 4.8 Lpf)	ROYAL 186-0.5	(0.5 gpf/ 1.9 Lpf)
ROYAL 116-1.28	(1.28 gpf/ 4.8 Lpf)	SLOAN 186-0.125	(0.125 gpf/ 0.5 Lpf)
SLOAN 111-1.28	(1.28 gpf/ 4.8 Lpf)	REGAL 186-0.5 XL	(0.5 gpf/ 1.9 Lpf)
SLOAN 113-1.28	(1.28 gpf/ 4.8Lpf)		
SLOAN 115-1.28	(1.28 gpf/ 4.8Lpf)		
SLOAN 116-1.28	(1.28 gpf/ 4.8Lpf)		
WES 111*	(1.28 gpf/ 4.8 Lpf)		
REGAL 111-1.28 XL	(1.28 gpf/ 4.8 Lpf)		
REGAL 115-1.28 XL	(1.28 gpf/ 4.8 Lpf)		

*WES 111 is a dual flush flushometer, with 1.6 gpf/ 6.1 Lpf (regular flush) and 1.1 gpf/ 4.2 Lpf (reduced flush) options.

PRODUCT DESCRIPTION

Diaphragm flushometers are precision metering valves designed to deliver a preset volume of water to a sanitary fixture (i.e., toilets and urinals). These are manual flushometers with the following features:

ROYAL

- Permex® Synthetic Rubber Diaphragm with Dual Filtered By-Pass
- ADA Compliant Handle with Triple Seal Packing
- Bak-Chek® Control Stop with Free Spinning Vandal
- Resistant Cap
- High Back Pressure Vacuum Breaker with One Piece
- Bottom Hex Coupling
- Sweat Kit with Cast Set Screw Wall Flange
- High Copper-Low Zinc Semi-red Brass Castings
- Non-Hold Open & No External Volume Adjustment to Ensure Water Conservation
- Fixed Volume Accuracy with CID technology

SLOAN

- Permex® Synthetic Rubber Diaphragm with
- Linear Filtered By-Pass Orifice
- ADA Compliant Handle
- Bak-Chek® Control Stop with Vandal
- Resistant Stop Cap
- High Copper-Low Zinc Semi-red Brass Castings
- Non-Hold Open & No External Volume
- Adjustment to Ensure Water Conservation
- Fixed Volume Accuracy with CID Technology

REGAL

- Natural Rubber Segment Diaphragm
- With Fixed Metering By-Pass Orifice
- ADA Compliant Handle
- Bak-Chek® Control Stop with Threaded Vandal
- Resistant Cap
- High Copper-Low Zinc Semi-red Brass Castings
- Non-Hold Open & No External Volume
- Adjustment to Ensure Water Conservation
- Fixed Volume Accuracy
- With Para-Flo® Technology

MATERIAL RESOURCES

The material composition and availability of raw material resources of the diaphragm flushometers are shown in Table 1. Information on product packaging is shown in Table 2.

Table 1. *Material composition (in % of mass) of Diaphragm flushometers.*

Material	% Mass	Availability			
		Renewable	Non-Renewable	Pre-Consumer Recycled Content	Post-consumer Recycled Content
Brass	89%		Yes	99%	0%
HDPE	3.1%		Yes	0%	0%
LDPE	2.5%		Yes	0%	0%
Stainless Steel	1.4%		Yes	0%	0%
Zamak	0.9%		Yes	0%	0%
Celcon	0.9%		Yes	0%	0%
Delrin	0.6%		Yes	0%	0%
EPDM	0.6%		Yes	0%	0%
Rubber	0.6%	Yes	Yes	0%	0%
Other	<1%		Yes	0%	0%
TOTAL	**100%**				

Table 2. *Material composition (in % of mass) of of packaging for Diaphragm flushometers.*

Material	% Mass	Availability			
		Renewable	Non-Renewable	Recycled Pre-Consumer Content	Post-consumer Recycled Content
Wood crate	41%	Yes		0%	0%
Cardboard	28%	Yes		0%	30%
Metal banding	19%		Yes	0%	0%
Paper pulp	12%	Yes		0%	0%
Styrofoam	1%		Yes	0%	0%
Plastic adhesive and water based ink	0.36%		Yes	0%	0%
Plastic film	0.07%		Yes	0%	0%
TOTAL	**100%**				

ADDITIONAL ENVIRONMENTAL INFORMATION

Since innovating the Royal® flushometer over 100 years ago, Sloan has led the industry in water efficiency. Sloan's flushometers offer water conservation without sacrifice. Our global team of engineers have developed technologies that improve water-efficiency without compromising design, quality, affordability or performance.

All Sloan flushometers are made in Chicagoland by our skilled union – a workforce with an average employment of over 17 years. All of our flushometers are made from highly recycled materials, and have become the benchmark for quality and performance in the commercial plumbing industry. In fact 89% of a Sloan flushometer is made from brass casting alloy, 99% of which is from recycled sources such as a car part or boat propeller. Sloan sees reclaimed brass as a way to preserve the environment by reducing or eliminating the need to mine virgin material from the earth. The flushometer itself is also recyclable. This means that after the effective life of the product, often the life of the building itself, Sloan Flushometers can be 100% recycled and turned into new product.

All the flushometers within this EPD are also Watersense labeled. The EPA WaterSense program was developed in 2006 and is a partnership program by the EPA. Similar to the Energy Star program for appliances and other energy consuming devises, WaterSense promotes the importance of water efficiency. Products and services that have the WaterSense label have been certified to be at least 20% more efficient than the baseline.

Sloan is a proud member of the United States Green Building Council (USGBC) and through the use of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, Sloan recognizes and validates the importance of best-in-class building strategies and practices of high performing green buildings. Sloan's flushometers within this EPD can be used to help achieve water efficiency goals as well as gaining USGBC LEED v4 points and/or complying with CAL Green and other building codes.

LIFE CYCLE ASSESSMENT OVERVIEW

The following life cycle stages are included in the EPD:

Production			Construction Process		Use							End-of-life				Benefits & loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
x	x	x	x	x	NR	x	x	NR	NR	NR	x	x	x	x	x	MND

X = included, MND = module not declared, NR = not relevant

The following provides a brief overview of the Modules included in the product system for Sloan® Diaphragm flushometers.

Module A1 Raw material extraction and processing, processing of secondary material inputs for Diaphragm flushometers

This module includes the potential environmental impacts associated with the production of raw materials for various component parts in the Diaphragm flushometers. The brass components are one of the primary materials comprising at least 90% of the flushometer product composition. The impacts from the following processes were considered for brass component processing:

Brass Ingot Production from Scrap Metal

The raw material for brass components are primarily sourced in the form of brass ingots from a U.S. based secondary smelter and scrap metal refiner. Scrap metal is sorted into grades depending on the purity and the scrap is subsequently melted down into molten brass in gas-fired rotary furnace and poured into molds to produce brass ingots. The brass ingots are then transported to the U.S. based sand casting facility for further processing.

Sand Casting of Brass Components

The brass ingots are sand cast depending on the design specification of the component parts in the flushometers.

Module A2: Transportation

This module includes transportation of the sand cast brass components to the Chicago based Sloan manufacturing facility. This also includes the transportation of all other components (such as plastics, stainless steel, synthetic rubber, etc.) from suppliers to the facility.

Module A3: Manufacture of Diaphragm flushometer

The brass component parts are polished and plated at the manufacturing facility. Diaphragm flushometer products are manufactured and packaged.

Module A4: Transportation & Delivery to the site

This module includes the impacts associated with transportation of finished diaphragm flushometers to the U.S. based distribution center and the subsequent delivery to the installation site.

Module A5: Construction & Installation

The installation of diaphragm flushometers is performed with hand tools and does not require any ancillary material input. This module considers the impacts associated with waste processing and disposal of product packaging waste generated during the installation process.

Module B1: Normal use of the product

This module includes environmental impacts arising through normal anticipated use of the product. This module is not applicable because the anticipated use of the flushometer is accounted for in Module B7: Operational water use.

Module B2: Maintenance

This module considers the impacts associated with cleaning and maintenance of the product over a 10-year period. Typical cleaning involves wiping the flushometer with a damp cloth. For a more thorough cleaning, the manufacturer recommends using a mild soap diluted in water. For the EPD, cleaning of the flushometer is assumed to occur each week for a period of 10 years. Additionally, waste processing and disposal related to these maintenance activities are included in this module.

Module B3: Repair

This module includes any anticipated repair events during the reference service of the flushometers. Some parts of the diaphragm flushometer require replacement up to two times over a 10 year period. This module considers the impacts associated with the production and transportation of components required for product maintenance.

Module B4-B5: Replacement and refurbishment

These modules include anticipated replacement or refurbishment events during the reference service life associated with replacing a whole product (Module B4) and restoration of parts to a condition in which the products can perform its required function (Module B5). These modules are not applicable to flushometers as these products are not required to be replaced as a whole product over a 10 year period. The replacement of certain worn out flushometer parts are considered as repair in Module B3.

Module B6: Operational Energy Use

This module is not applicable because manual diaphragm flushometers do not require energy during the operation of the product.

Module B7: Operational Water Use

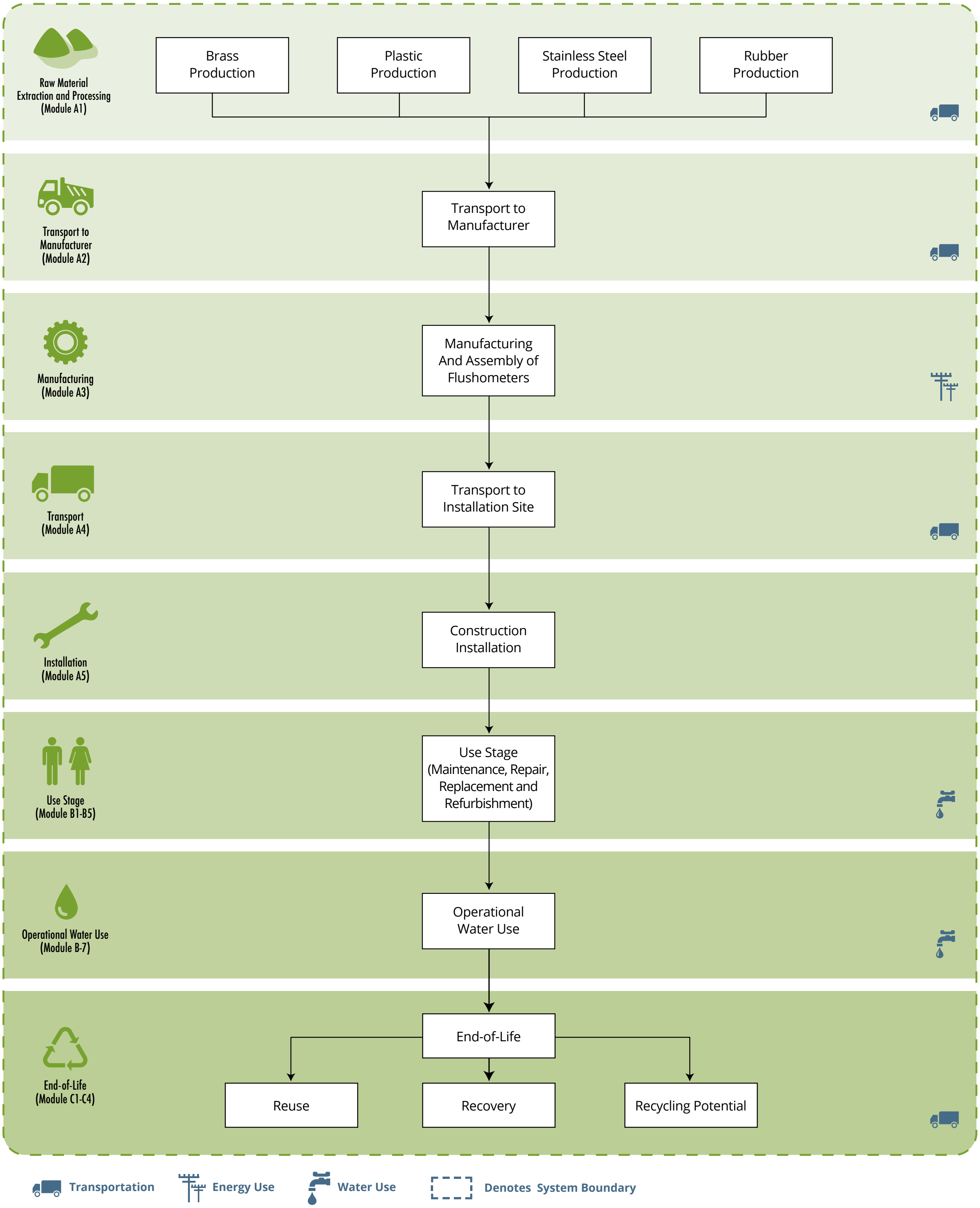
This module includes water use during the operation of the product, together with its associated environmental aspects and impacts considering the life cycle of water which includes production, delivery, and wastewater treatment. Impacts were calculated depending on the water use (gallons per flush) specifications of diaphragm flushometers.

Module C1-C4: End-of-Life

The end-of-life stage of the product starts when it is replaced, dismantled or deconstructed from the building. Impacts for deconstruction and dismantling processes were not modeled in the LCA as it is a manual process with hand tools, and does not require any energy for removal of the product. The impacts associated with transportation of waste materials to processing facilities, waste processing of material components and waste disposal of the product are included in these modules.

PROCESS FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the production for Diaphragm flushometers. The following life cycle stages are included: production (Modules A1-A3); construction & installation (Module A4-A5); product use (Modules B1-B7); and end-of-life (Modules C1-C4).



LIFE CYCLE IMPACT ASSESSMENT

Life cycle impact assessment is the process of converting the life cycle inventory results into a representation of environmental and human health impacts. For example, emissions of carbon dioxide, methane, and nitrous oxide (inventory data) together contribute to climate change (impact assessment). The impact assessment for the EPD is conducted in accordance with the requirements of the Product Category Rule (PCR). Impact category indicators were estimated using TRACI v2.1 characterization method, including Global Warming Potential (100 year time horizon), Acidification Potential, Eutrophication Potential, Photochemical oxidation creation potential, and ozone depleting potential.

Table 3. *Results for 10 years of use of a Diaphragm flushometer.*

Impact Category	Production			Construction & Installation		Use			End-of-Life			
	Raw Material Extraction/ Processing	Transport to the Manufacturer	Manufacturing	Transportation	Construction/ Installation	Maintenance	Repair	Operational Water Use	Demolition	Transportation	Waste Processing	Disposal
	A1	A2	A3	A4	A5	B2	B3	B7	C1	C2	C3	C4
Ecological Indicators												
Acidification (kg SO_2 eq)	0.11	9.6×10^{-3}	1.3×10^{-2}	7.8×10^{-2}	3.9×10^{-4}	3.9×10^{-5}	4.4×10^{-2}	See Table 4	0.0	1.1×10^{-4}	2.6×10^{-3}	2.8×10^{-4}
Eutrophication (kg N eq)	4.8×10^{-2}	2.4×10^{-3}	1.3×10^{-2}	1.6×10^{-2}	1.7×10^{-2}	7.1×10^{-5}	2.4×10^{-2}		0.0	3.8×10^{-5}	1.5×10^{-3}	9.1×10^{-3}
Global warming (kg CO_2 eq)	19	2.1	2.1	12	0.3	1.7×10^{-2}	8.1		0.0	1.9×10^{-2}	1.0	0.79
Ozone depletion (kg CFC-11 eq)	2.3×10^{-6}	5.3×10^{-7}	1.7×10^{-7}	2.9×10^{-6}	1.0×10^{-8}	6.3×10^{-10}	8.5×10^{-7}		0.0	5.9×10^{-10}	8.7×10^{-8}	5.9×10^{-9}
Human Health Indicators												
Smog (kg O_3 eq)	1.1	0.2	0.14	1.8	1.1×10^{-2}	4.7×10^{-4}	0.43	See Table 4	0.0	2.5×10^{-3}	2.9×10^{-2}	7.6×10^{-3}
Resource Depletion												
Fossil fuel depletion (MJ Surplus)	33	4.7	2.4	26	0.11	4.6×10^{-3}	14	See Table 4	0.0	4.2×10^{-5}	4.2×10^{-5}	0.8

The operational use phase (Module B7) considers the volume of water required per flush, the embedded energy required for water supply, distribution and wastewater treatment, and the number of flushes over a 10-year period. The volume required per flush (expressed in terms of gallons per flush) varies depending on the design specification of the flushometers for toilet and urinal fixtures.

Table 4. *Results for Module B7: Operational Water Use scenarios for toilet fixtures (51 flushes per day over 10 year period) and urinal fixtures (18 flushes per day over 10 year period).*

Impact Category	USE SCENARIOS FOR B7: Operational Water Use				
	TOILET FIXTURES (51 flushes per day over 10 year period)		URINAL FIXTURES (18 flushes per day over 10 year period)		
	1.1 gpf	1.28 gpf	0.125 gpf	0.25 gpf	0.5 gpf
Ecological Indicators					
Acidification (kg SO_2 eq)	2.7	3.1	0.11	0.21	0.43
Eutrophication (kg N eq)	1.4	1.6	$5.6x10^{-2}$	0.11	0.22
Global warming (kg CO_2 eq)	390	450	16	31	62
Ozone depletion (kg CFC-11 eq)	$1.6x10^{-5}$	$1.8x10^{-5}$	$6.3x10^{-7}$	$1.3x10^{-6}$	$2.5x10^{-6}$
Human Health Indicators					
Smog (kg O_3 eq)	17	20	0.69	1.4	2.8
Resource Depletion					
Fossil fuel depletion (MJ Surplus)	280	330	11	23	45

ADDITIONAL ENVIRONMENTAL PARAMETERS

ISO 21930 requires that several parameters be reported in the EPD, including resource use, waste categories and output flows, and other environmental information. The results for these parameters are shown in Table 5 and Table 6

Table 5. *Results for 10 years of use of a Diaphragm flushometer by module. Results representing energy flows are calculated using lower heating (i.e., net calorific) values.*

Impact Category	Production			Construction & Installation		Use			End-of-Life			
	Raw Material Extraction / Processing	Transport to the Manufacturer	Manufacturing	Transportation	Construction / Installation	Maintenance	Repair	Operational Water Use	Demolition	Transportation	Waste Processing	Disposal
	A1	A2	A3	A4	A5	B2	B3	B7	C1	C2	C3	C4
Non-hazardous waste disposed (kg)	8.6	2.8	0.3	13	2.3	$1.2x10^{-3}$	3.4	See Table 6	0.0	$4.1x10^{-4}$	1.1	1.2
Hazardous waste disposed (kg)	0.0	0.0	0.19	0.0	0.0	0.0	2.0		0.0	0.0	0.0	0.0
Radioactive waste disposed (kg)	$1.8x10^{-4}$	$3.8x10^{-5}$	$1.1x10^{-5}$	$2.1x10^{-4}$	$1.3x10^{-7}$	$2.6x10^{-8}$	$6.6x10^{-5}$		0.0	$6.6x10^{-8}$	$6.5x10^{-6}$	$4.2x10^{-7}$

Table 5 (Continued). *Results for 10 years of use of a Diaphragm flushometer by module. Results representing energy flows are calculated using lower heating (i.e., net calorific) values.*

Impact Category	Production			Construction & Installation		Use			End-of-Life			
	Raw Material Extraction / Processing	Transport to the Manufacturer	Manufacturing	Transportation	Construction / Installation	Maintenance	Repair	Operational Water Use	Demolition	Transportation	Waste Processing	Disposal
	A1	A2	A3	A4	A5	B2	B3	B7	C1	C2	C3	C4
Primary Energy Demand, Non-Renewable (MJ)	290	33	32	190	0.74	5.4×10^{-2}	130	See Table 6	0.25	7.2	0.49	0.72
Primary Energy Demand, Renewable (MJ)	2.5	0.2	1.3	1.7	0.0	2.0×10^{-3}	2.0		8.8×10^{-3}	0.39	1.6×10^{-2}	0.37
Water Use (m^3)	0.20	0.0	0.0	0.0	0.0	5.4×10^{-4}	6.5×10^{-2}		0.0	2.8×10^{-4}	3.9×10^{-6}	4.3×10^{-6}

Table 6. *Results for scenarios for Module B7: Operational Water Use (51 flushes per day over 10 year period). Results representing energy flows are calculated using lower heating (i.e., net calorific) values.*

Impact Category	TOILET FIXTURES (51 flushes per day over 10 year period)		URINAL FIXTURES (18 flushes per day over 10 year period)		
	1.1 gpf	1.28 gpf	0.125 gpf	0.25 gpf	0.5 gpf
Ecological Indicators					
Non-hazardous waste disposed (kg)	11	13	0.44	0.88	1.8
Hazardous waste disposed (kg)	0.0	0.0	0.0	0.0	0.0
Radioactive waste disposed (kg)	2.2×10^{-3}	2.6×10^{-3}	8.9×10^{-5}	1.8×10^{-4}	3.6×10^{-4}
Primary Energy Demand, Non-Renewable (MJ)	6,300	7,400	240	490	970
Primary Energy Demand, Renewable (MJ)	180	210	7.1	14	28
Water Use (m^3)	12	14	0.48	0.97	1.9

Interpretation of Results

The operational water use phase (Module B7) is the most significant contributor across all the life cycle stages for diaphragm flushometers, followed by the raw material extraction and processing stage (Module A1). This is primarily due to the impact associated with the life cycle of water which includes production, transportation and wastewater treatment. The assumptions used to model the operational water use phase (Module B7) all have a significant effect on final results. Module B7 is sensitive to two parameters: (1) water use depending on the number of flushes and flush volume (gpf), and (2) the embedded electricity usage in water supply, distribution and wastewater treatment. Overall, the flushometer manufacturing operations occurring at the Sloan manufacturing facility (Module A3) contribute less than 6% of impacts across all the impact category indicators.

SUPPORTING TECHNICAL INFORMATION

Data Sources. *Data sources used for the LCA.*

Material	Dataset	Publication Date
Product		
Brass components	Brass Ingot production: Gate-to-Gate LCI data from U.S. based supplier Sand Casting process: Gate-to-Gate LCI data from Sloan's U.S. based foundry Brass {GLO}| market for | Alloc Rec, U[1] (represents brass from other suppliers)	2015; 2015
Delrin, Celcon	Polypropylene, granulate {GLO}| market for | Alloc Rec, U[1] Injection moulding {GLO}| market for | Alloc Rec, U[1]	2015
EPDM	Synthetic rubber {GLO}| market for | Alloc Rec, U[1]	2015
Stainless steel	Steel, chromium steel 18/8, hot rolled {GLO}| market for | Alloc Rec, U[1] Steel, stainless 304, flat rolled coil/kg/RNA[2]	2015
Rubber	Literature[3]	2010
Packaging		
Wood crate	Waste wood, post-consumer {GLO}| waste wood, post-consumer, Recycled Content cut-off | Alloc Rec, U[1]	2015
Plastic shrink wrap	Packaging film, low density polyethylene {GLO} | market for |Alloc Rec[1]	2015
Print labels	Printing ink, offset, without solvent, in 47.5% solution state {RER}| printing ink production, offset, product in 47.5% solution state | Alloc Rec, U[1]	2015
Corrugated boxes	Corrugated board box {GLO}| market for corrugated board box | Alloc Rec, U[1]	2015
Styrofoam	Polyurethane, flexible foam {GLO}| market for | Alloc Rec, U[1]	2015
Metal band	steel, low-alloyed, hot rolled {GLO}[1]	2015
Energy Use		
Electricity use	The dataset represents the supply mix of electricity for eGRID power subregions, representing the locations of manufacturing facilities operated by SLOAN. These datasets use the energy generation mix and 7% transmission losses recorded by the U.S. EIA in Electric Power Monthly for April 2013.	2015
Natural gas	Heat, district or industrial, natural gas {GLO}| market group for | Alloc Rec, U[1]	2015
Resource Use		
Truck	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | Alloc Rec[1]	2014
Transoceanic ship	Transport, freight, sea, transoceanic ship {GLO}| market for | Alloc Rec, U[1]	2014
Rail	Transport, freight train {US}| market for | Alloc Rec, U[1]	2014

[1] Ecoinvent v3.2 Life Cycle Database
[2] USLCI
[3] Jawjit,W., et al., Greenhouse gas emissions from rubber industry in Thailand, J Clean Prod (2010), doi:10.1016/j.jclepro.2009.12.003

Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected.	Manufacturer provided primary data on product manufacturing for the U.S. based Sloan facility based on annual production for 2015. Primary data for intermediate processing of brass components, including brass ingot production, and sand casting operations, were provided by a supplier and the Sloan's U.S. based foundry respectively, based on annual production for 2015. Representative datasets (secondary data) used for upstream and background processes are generally less than 6 years old (typically 2010 or more recent).
Geographical Coverage: Geographical area from which data for unit processes is collected.	The data used in the analysis is considered to be of high quality and provide the best possible representation available with current data. Primary data for upstream operations of brass component production were provided by the supplier. Representative data from Europe was adapted to US regional electricity grid mixes and are considered sufficiently similar to actual processes.
Technology Coverage: Specific technology or technology mix.	Data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Data was collected for all key processes including manufacture of flushometer, polishing and plating, packaging and brass ingot production.
Precision: Measure of the variability of the data values for each data expressed. (e.g. variance)	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated.	The LCA model included all known mass and energy flows for production of diaphragm flushometer products. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest (i.e. geographical coverage, time period and technology coverage.	Overall, data used in the assessment represent actual processes for production of diaphragm flushometer products. Primary data is used to model upstream manufacture of brass components, which is one of the primary material in the flushometers. Data is considered to be representative of the actual technologies used for flushometer production.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis.	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent data where available.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study.	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the data: Description of primary and secondary data sources.	Data representing energy use at the manufacturer's facilities represent an annual average. Primary data were available for all key processes across the supply chain including manufacture of flushometer, packaging, transportation and brass component production for diaphragm flushometers. LCI datasets from Ecoinvent were used to model inputs such as plastics, stainless steel and other materials.
Uncertainty of the information: Uncertainty related to data, models, and assumptions.	Uncertainty related to the product materials and packaging is low. Data for upstream operations relied upon use of actual processes and technologies used for production of primary raw material components (brass components). These datasets are considered to be geographically representative as primary data was collected from the Sloan production facility. Uncertainty related to the impact assessment methods used in the study is relatively high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

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For more information contact:

Sloan Valve Company
10500 Seymour Avenue, Franklin Park, IL 60131
P: 847.671.4300 / 800.982.5839 · www.sloan.com

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608 USA
main +1.510.452.8000 | fax +1.510.452.8001