LEED v4.1 EPD Optimization Report for Diaphragm Flushometers

Prepared for:

Sloan Valve Company

Claim Valid from:	Claim Expires:
August 26, 2022	August 9, 2027

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Optimization Report Owner:		Sloan Valve Company
Address:		10500 Seymore Avenue, Franklin Park, IL 60131
Products:		Diaphragm Flushometers
Declaration Number:		SCS-OPT-08147
Validity Period:		August 26, 2022 through August 9, 2027
Product Type:		Manual Flushometer
Product Name:		Sloan Diaphragm Flushometers
Optimized EPD Information	Document Link:	https://cdn.scscertified.com/products/cert_pdfs/SCS-EPD-08147_SloanValveCo_DiaphramFlushometers_081022.pdf
	Declaration Number:	SCS-EPD-08147
	Validation Period:	August 10, 2022 through August 9, 2027
	Program Operator:	SCS Global Services
	LCA Software:	OpenLCA v10.1
	LCA Practitioner:	Beth Cassese, LCACP
Baseline EPD Information	Document Link:	expired, no longer available
	Declaration Number:	SCS-EPD-04397
	Validation Period:	March 1, 2017 through February 28, 2022
	Program Operator:	SCS Global Services
	LCA Software:	SimaPro v8.2 (updated for optimization to OpenLCA v10.1)
	LCA Practitioner:	Aditi Suresh
Reference PCR:		UL PCR Guidance for Building-Related Products and Services Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements. Version 1.0. October 2020.
Independent critical review of the Optimization Report:		☐ internal ☒ external
Verifier of Optimization Report:		Thomas Gloria, Ph.D., Industrial Ecology Consultants
Optimization Report Contents:		1 Introduction 2 Summary of Results 3 Impact Reduction Narrative 4 Supporting Technical Information 5 References

Disclaimers: *This Optimization Report conforms to the LEED v4.1 Guidance for MR Credit: Environmental Product Declarations, Option 2.*

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, the EPDs this report is based on provide estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR the referenced EPDs were 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.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1 Introduction

This Optimization Report was prepared by the EPD Program Operator, SCS Global Services, following the requirements in the LEED v4.1 Building Design and Construction Guide[1]. This Optimization Report serves as documentation to demonstrate that the 2022 Sloan EPD for manual diaphragm flushometers[2] meets the LEED v4.1 *MR Credit: Environmental Product Declarations, Option 2: Embodied Carbon/LCA Optimization.*

The LEED v4.1 Standard includes a credit for EPDs of permanently installed products in a LEED project, allowing for up to two points.

- One point for a project which includes 20 products from 5 different manufacturers LCA and/or EPDs.
- A second point is available for a project which includes 5 products from 3 different manufactures with compliant embodied carbon/LCA optimization repots or action plans.

The LEED v4.1 credit for Environmental Product Declarations, Option 2: Embodied Carbon/LCA Optimization, recognizes products which have achieved "optimization". To qualify for optimization, a manufacturer specific EPD must show reductions in environmental impact potentials. The amount of credit achieved depends on the amount of reductions in impact.

Table 1. LEED v4.1 credit for Environmental Product Declarations, Option 2 Optimization Credit Requirements.

Reduction Type	Reference Document(s) for the Optimization Report	Report Verification	Valuation
Embodied Carbon/LCA Action Plan	Product-specific LCA or product-specific Type III EPD	Prepared by the manufacturer and signed by company executive	½ product
Reductions in Embodied Carbon: < 10% reduction in GWP relative to baseline	Baseline: Product-specific LCA, product-specific Type III EPD, or Industry-wide Type III EPD Optimized: Product-specific LCA or product-specific Type III EPD	Comparative analysis verified by an independent party	1 product
Reductions in Embodied Carbon: > 10% reduction in GWP relative to baseline	Baseline: Product-specific LCA, product-specific Type III EPD, or Industry-wide Type III EPD Optimized: Product-specific LCA or product-specific Type III EPD	Comparative analysis verified by an independent party	1.5 product
Reductions in Embodied Carbon: > 20% reduction in GWP and > 5% reduction in two additional impact categories, relative to baseline	Baseline: Product-specific LCA or product-specific Type III EPD Optimized: Product-specific LCA or product-specific Type III EPD	Comparative analysis verified by an independent party	2 products

Note: Reference documents for the optimization reports must be compliant with EPD Credit Option 1.

[1] LEED v4.1 Building Design and Construction, Getting started guide for beta participants. USGBC. July 2022.
[2] Sloan Diaphragm Flushometers EPD. Valid August 10, 2022. SCS-EPD-08147. https://www.scsglobalservices.com/certified-green-products-guide

LCA/EPD based comparisons require the greatest degree of care in ensuring that the systems under comparison are treated equally and without bias. For example, parameters in LCA which need to be held constant for comparability to be achieved included:

- Equivalent functional unit
- Same background database
- Same LCA software
- Same Life Cycle Impact Assessment (LCIA) methods
- Parity of assumptions
- Same version of the Product Category Rule (PCR)
- Equivalent data quality requirements

The importance of achieving parity when comparing EPDs has been explored and documented in research by others[3]. This research has shown that differences in software, databases, and assumptions can have significant effects (e.g., >10%) on the LCA results. The methods used to calculate results are also updated over time, and the same methodology must be used when attempting to compare LCAs or EPDs. The uncertainty which can be introduced by different LCA practitioners using different assumptions or tools must be minimized when attempting to demonstrate optimization of a manufacturing process.

In 2017, Sloan registered a verified EPD for the diaphragm flushometers with the SCS Global Services EPD Program Operator and the EPD was updated in 2022. The original EPD was based on an LCA using the Simapro software and prepared following the Sustainable Minds Part B PCR for Commercial flushometer valves.[4] The LCA for the 2022 EPD was developed using the OpenLCA software and the UL Product Category Rule (PCR) Guidance for Building-Related Products and Services Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements[5]. To address the differences in LCA software, Product Category Rules (PCR), and the incompatibility of comparisons made using these different tools, the 2017 EPD was recalculated using OpenLCA, following the same PCR and modeling approach as the 2022 EPD.

2 Summary of Results

As the LEED v4.1 EPD Optimization credit only applies to embodied carbon, the results presented in this section are for the A1-A3 Modules (raw material extraction and processing; raw material transportation; and manufacturing) only. Information for additional modules of the life cycle can be found in the updated 2022 EPD for Sloan Diaphragm Flushometers.

It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All LCA results are stated to three significant figures in agreement with the PCR for this product and therefore the sum of the total values may not exactly equal 100%. The following environmental impact category indicators are reported using characterization factors using the CML-IA impact assessment method and the TRACI 2.1 impact assessment method.

[3] An Evaluation of the Variability Possible within a Single Environmental Product Declaration and Product Category Rules. Commissioned by BIFMA. April 28, 2014.
[4] SM Transparency Report/EPD Framework. Part B: Product group definition: Commercial flushometer valves. Sustainable Minds. December 2016.
[5] UL Product Category Rule (PCR) Guidance for Building-Related Products and Services, Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements. Underwriters Laboratories Inc. (UL). October 2020.

Table 2. *Mandatory Environmental Impact Assessment Categories.*

CMLI-A Impact Category	Unit	TRACI 2.1 Impact Category	Unit
GWP: Global Warming Potential	kg CO_2 eq.	**GWP:** Global Warming Potential	kg CO_2 eq.
ODP: Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	**ODP:** Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.
AP: Acidification Potential of soil and water	kg SO_2 eq.	**AP:** Acidification Potential of soil and water	kg SO_2 eq.
EP: Eutrophication Potential	kg PO_4^{3-} eq.	**EP:** Eutrophication Potential	kg N eq.
POCP: Photochemical Oxidant Creation Potential	kg C_2H_4 eq.	**SFP:** Smog Formation Potential	kg O_3 eq.
ADPE: Abiotic Depletion Potential, elements	kg Sb eq	**FFD:** Fossil Fuel Depletion	MJ Surplus
ADPF: biotic Depletion Potential, fossil fuels	MJ		

2.1 Recalculation of 2017 EPD results

Table 3 below details the recalculated LCA results for the 2017 Sloan diaphragm flushometer EPD. The results are shown for the PCR specified functional unit of 1 packaged, installed unit with a Reference Service Life (RSL) of 10 years in a building with an Estimated Service Life (ESL) of 75 years. The analysis was completed using the same software, data sources, methods, modeling assumptions, and PCR requirements of the updated 2022 EPD.

Table 3. *2017 EPD Impact Indicator Results for Sloan Diaphragm Flushometers. All values are rounded to three significant digits.*

CML Impact Method	GWP	ODP	AP	EP	POCP	ADPE	ADPF
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg PO_4^{3-} eq	kg C_2H_4 eq	kg Sb eq	MJ
A1	13.3	$9.67x10^{-7}$	0.307	0.113	0.012	0.010	145
A2	0.982	$1.70x10^{-7}$	0.004	0.001	$1.40x10^{-4}$	$3.35x10^{-6}$	14.5
A3	4.03	$4.17x10^{-7}$	0.009	0.004	0.001	$1.19x10^{-5}$	45.6
Total A1-A3:	**18.3**	**$1.55x10^{-6}$**	**0.321**	**0.118**	**0.013**	**0.010**	**205**

TRACI 2.1 Impact Method	GWP	ODP	AP	EP	SFP	FFD
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg N eq	kg O_3 eq	MJ Surplus
A1	13.0	$1.20x10^{-6}$	0.279	0.247	1.40	17.5
A2	0.981	$2.27x10^{-7}$	0.005	0.001	0.118	2.07
A3	3.89	$4.99x10^{-7}$	0.010	0.007	0.094	7.02
Total A1-A3:	**17.9**	**$1.92x10^{-6}$**	**0.293**	**0.255**	**1.61**	**26.6**

2.2 Summary of 2022 EPD Results

Table 4 below details the LCA results for the 2022 Sloan diaphragm flushometer EPD. The results are shown for the PCR specified functional unit of 1 packaged, installed unit with a Reference Service Life (RSL) of 10 years in a building with an Estimated Service Life (ESL) of 75 years.

Table 4. *2022 EPD Impact Indicator Results for Sloan Diaphragm Flushometers. All values are rounded to three significant digits.*

CML Impact Method	GWP	ODP	AP	EP	POCP	ADPE	ADPF
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg PO_4^{3-} eq	kg C_2H_4 eq	kg Sb eq	MJ
A1	14.2	$1.05x10^{-6}$	0.330	0.121	0.013	0.011	155
A2	0.857	$1.49x10^{-7}$	0.004	0.001	$1.30x10^{-4}$	$2.92x10^{-6}$	12.6
A3	2.37	$2.33x10^{-7}$	0.005	0.003	$3.90x10^{-4}$	$7.22x10^{-6}$	26.1
Total A1-A3:	**17.4**	**$1.43x10^{-6}$**	**0.340**	**0.125**	**0.013**	**0.011**	**194**

TRACI 2.1 Impact Method	GWP	ODP	AP	EP	SFP	FFD
	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg N eq	kg O_3 eq	MJ Surplus
A1	13.9	$1.29x10^{-6}$	0.299	0.266	1.50	18.7
A2	0.856	$1.98x10^{-7}$	0.005	0.001	0.105	1.81
A3	2.29	$2.81x10^{-7}$	0.006	0.005	0.061	3.96
Total A1-A3:	**17.1**	**$1.77x10^{-6}$**	**0.309**	**0.272**	**1.66**	**24.5**

2.3 Optimization Results

Table 5 below summarizes the differences in the cradle-to-gate (A1-A3) results between the 2017 and 2022 Sloan diaphragm flushometer EPDs. The results show a 4% optimization in the global warming potential impact indicator. This level of optimization conforms to the LEED v4.1 MR Credit for Environmental Product Declarations Option 2 and qualifies as 1 product in the LEED v4.1 credit calculation.

Table 5. *Impact Indicator Results comparison analysis. All values are rounded to three significant digits.*

CML Impact Method		A1-A3 Results			
		2017 EPD	2022 EPD	Difference	
GWP	kg CO_2 eq	18.3	17.4	-0.831	-4.5%
ODP	kg CFC-11 eq	$1.55x10^{-6}$	$1.43x10^{-6}$	$-1.25x10^{-7}$	-8.0%
AP	kg SO_2 eq	0.321	0.340	+0.019	+6.0%
EP	kg PO_4^{3-} eq	0.118	0.125	+0.007	+6.4%
POCP	kg C_2H_4 eq	0.013	0.013	$+6.10x10^{-4}$	+4.7%
ADPE	kg Sb eq	0.010	0.011	$+7.85x10^{-4}$	+7.8%
ADPF	MJ	205	194	-11.5	-5.6%
TRACI 2.1 Impact Method		**A1-A3 Results**			
		2017 EPD	**2022 EPD**	**Difference**	
GWP	kg CO_2 eq	17.9	17.1	-0.780	-4.4%
ODP	kg CFC-11 eq	$1.92x10^{-6}$	$1.77x10^{-6}$	$-1.70x10^{-7}$	-7.8%
AP	kg SO_2 eq	0.293	0.309	+0.016	+5.6%
EP	kg N eq	0.255	0.272	+0.018	+6.9%
SFP	kg O_3 eq	1.61	1.66	+0.055	+3.4%
FFD	MJ Surplus	26.6	24.5	-2.14	-8.0%

3 Impact Reduction Narrative

The manufacturing processes in the Franklin Park facility have been improved since data collection began for the initial Life Cycle Assessment in 2016. These improvements include, but are not limited to:

- Implementation of LEAN manufacturing initiatives
- Improvements to the wastewater treatment system
- Implementation of the Alliance for Water Stewardship Standard

Aggressive Kaizen Events and 6S initiatives have been conducted in every manufacturing department and have greatly improved efficiencies throughout the manufacturing process. This initiative has led to the replacement of inefficient machinery with modern equipment, relocated multiple machines to improve material handling flow between machining processes, and automation of several labor intensive processes. These improvements have increased capacity and quality while reducing the energy intensity to produce the final product.

Modernization improvements to the wastewater treatment plant reduced energy consumption requirements and dramatically reduced waste generation. The mechanical filtering process has been eliminated and replaced with a modern and efficient method to effectively treat our wastewater stream before discharge to the local publicly owned treatment works facility.

In 2020 Sloan implemented the Alliance for Water Stewardship Standard into the Franklin Park facility to reduce potable water consumption. This standard requires the facility to understand and address water risks within the facility and throughout the affected watershed. By implementing this standard the Franklin Park facility understands

water dependencies and impacts, works to mitigate operational and supply chain water risks, ensures responsible water procedures are in place, and address water challenges shared with others in the watershed.

4 Supporting Technical Information

The following is a summary of the data sources, software tools, and LCIA methods used for calculation of the Sloan LCA. In all cases, equivalent assumptions were used in the study for modeling of both the 2017 and 2022 EPD data.

- Background LCA Report: Life Cycle Assessment of Manual and Sensor Flushometers. Final Report. June 2022.
- Data Sources: Ecoinvent v3.8
- Software: OpenLCA v10.1
- LCIA Methodology: CML-IA Baseline, TRACI 2.1
- Product Category Rule: UL Product Category Rule (PCR) Guidance for Building-Related Products and Services Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements.

5 References

- CML-IA Characterization Factors. Leiden University, Institute of Environmental Sciences. April 2013. https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors
- Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). U.S. EPA.
- Ecoinvent v3.8 2021. Swiss Center for Life Cycle Inventories, 2021. http://www.ecoinvent.org
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- UL. PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 3.2. December 2018.
- UL PCR Guidance for Building-Related Products and Services Part B: Kitchen and Bath Fixture Fittings and Accessory Products EPD Requirements. Version 1.0. October 2020.
- LEED v4.1 Building Design and Construction, Getting started guide for beta participants. United States Green Building Council (USGBC). July 2022.