SULZER

Environmental Product Declaration - EPD

Environmental and economic life cycle performance including climate-related data

XRW Mixer

The mixer characterised in this EPD is inherently configurable. Configuration and efficiency depends on customer specification. The data given below are illustrative and only valid for the defined parameters (see chapter “Life cycle - coverage, assumptions, and exclusions”).

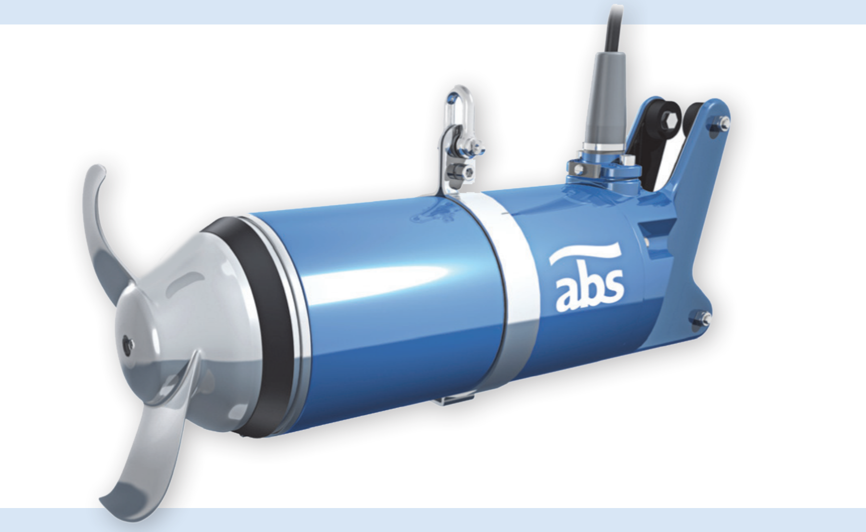
Main applications:
Submersible mixers in the ABS EffeX XRW range are for mixing and stirring applications in sewage treatment plants and industrial areas. Homogenization of highly-concentrated sewage sludge.

Type:
The ABS submersible mixer XRW is a compact, versatile submersible mixer with a wide range of applications in wastewater treatment plants.

Rated power:
3.5 kW

Manufacturer:
Sulzer Pumps Wexford, Ireland

CPC classification:
4322



Components included:

- ☑ Mixer including motor casting, hydraulics/guide rail castings, stator core, stator rotor block, stator shaft and stator windings/ cable conductor, cable insulation and other metallic components (e.g. stator windings, fasteners, bearings, washers & clips, lifting hoop, nameplates, transition piece).

Electricity mix considered for usage: **Europe**

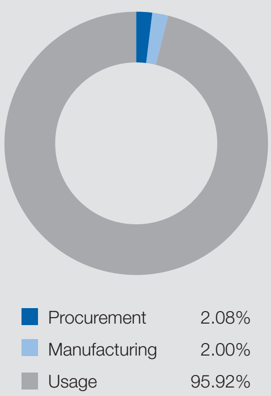
Key economic and environmental advantages

- High availability of more than 98% (customers typically buy one standby mixer in each service)
- Design life of the mixer is 10 years
- High efficiency by means of improved motor and mechanical performance lower energy consumption and hence lower emissions
- Variable frequency drives allow flexible performance and improved energy-efficiency
- Comprehensive training and professional service enable customers to operate the mixer more reliably
- Retrofit service to re-establish the best efficiency point if operating conditions change
- Used materials are well suited for recycling.

Key economic and environmental indicators over life-cycle of 10 years

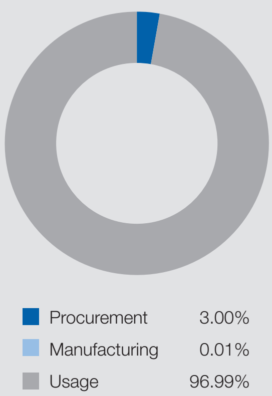
Energy consumption

3 598 MJ-Eq
1 028 GJ-Eq / kW



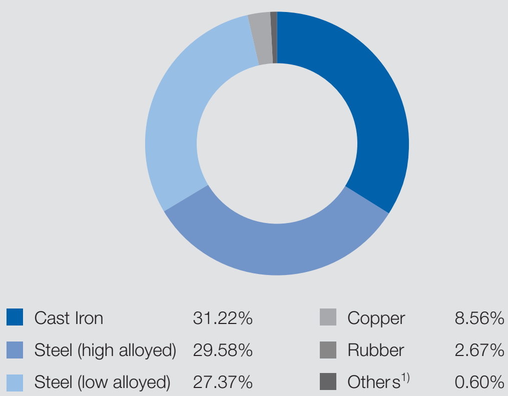
CO_2 emissions

169 tonnes CO_2-Eq
48.17 tonnes CO_2-Eq / kW



Weight & composition

75 kg
21.42 kg / kW



1) e.g. varnishes, seals, oils

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Functional unit

The functional unit is defined as 1 kW hydraulic power of the pump at best efficiency point.

Composition of the product

Material	kg	% 1)	kg / kW 2)
Cast iron	23	31.2%	6.69
Steel (high alloyed)	22	29.6%	6.33
Steel (low alloyed)	21	27.4%	5.86
Copper	6	8.6%	1.83
Rubber	2	2.7%	0.57
Oil	0	0.5%	0.13
Total	**75**	**100%**	**21.41**

Rounding has been used to simplify the results tables in the EPD.
1) By weight. 2) Rated power.

The mixer consists of 57% low alloyed and high alloyed steels, 31.2% of cast iron and 8.6% copper.

The indicated quantity of oil refers to the oil replaced when the mixer is serviced, which is twice during the lifetime.

Remaining components such as paints and seals amount to less than 0.01% of the total weight and have as such been omitted.

Material consumption during life cycle per mixer1) (material balance sheet)

Non-renewable resources	Procurement 2)		Manufacturing at Sulzer		Usage / end of life	
	kg	kg / kW	kg	kg / kW	kg	kg / kW
Steel (alloyed), casting and other materials			3)	3)		
for pump	77	22.00	74	21.14	74	21.14
for spare parts	3	0.86	0	0	0	0
Oil	1	0.29	0	0.29	1	0.29
Waste production (total)	n.a.	n.a.	10	2.86	75	21.43
Hazardous waste	n.a.	n.a.	0	0	1	0.29
Municipal waste	n.a.	n.a.	0	0	n.a.	n.a.
Recycling (total)	n.a.	n.a.	10	2.86	74	21.14
metals (pump)	n.a.	n.a.	0	0.86	74	21.14
metals (spare parts)	n.a.	n.a.	0	0.857	0	0
others	n.a.	n.a.	10	1.14	n.a.	n.a.
Renewable resources	**kg**	**kg / kW**	**kg**	**kg / kW**	**kg**	**kg / kW**
Wood (packaging)	10	2.86	10	2.86	10	10
Water consumption 4)	n.a.	n.a.	0.06	17.1	n.a.	n.a.

n.a.: not available, values per kW related to 3.5 kW rated power. 1) Material resources related to supply of energy to site are not considered. 2) Covers all resources procured during the life cycle by Sulzer, including the oil used to operate the pump. 3) Machining during the manufacturing produces recyclable waste of around 8% by mass of the metals bought in. 4) In manufacturing: used for testing purposes.

Primary energy consumption during life cycle (primarily from usage / end of life)

	Procurement 2)		Manufacturing at Sulzer		Usage / end of life 3)		Total	
	GJ-Eq	GJ-Eq/kW	GJ-Eq	GJ-Eq/kW	GJ-Eq	GJ-Eq/kW	GJ-Eq/	GJ-Eq/kW
Electricity	71.6	20.469	0 6)	0 6)	3 458	988	3 530	1 008
Gases 1)	0	0	0 6)	0 6)	0	0	0	0
Fuel oils	0	0	0 6)	0 6)	0	0	0	0
Fuels	n.a.	n.a.	0	0	0	0	0	n.a.
District heating 8)	n.a.	n.a.	0	0	0	0	0	n.a.
Materials	28	8.12	0	0	0	0	28	8.12
Transports	0.3	0.085	0.3	0.0771	41	11.65	41.6	11.812
Disposal, waste water	n.a.	n.a.	0	<0.001	-3 7)	-0.844	-3 9)	-0.843
Non-renewable energy sources 5)	**99**	**28.348**	**0.3**	**0.0752**	**3 283**	**938**	**3 382**	**966**
Total renewable energies 4) 5)	**3**	**0.765**	**0**	**<0.001**	**213**	**61**	**216**	**62**
Total energy sources 5)	**102**	**29.110**	**0.3**	**0.0781**	**3 496**	**999**	**3 598**	**1 028**

Rounding has been used to simplify the results tables in the EPD. 1) Natural gas, butane, propane. 2) Including transportation to Sulzer. 3) Including transportation to customer. 4) Hydro power, solar power, wind power, biomass. 5) Including waste and waste water treatment. 6) Fully allocated to procurement. 7) Including credit from recycling of pump at end of life-time. 8) Imported as heat. 9) See p.3 of this EPD for more information.

Eq: equivalents, kW related to 3.5 kW rated power.

The pump is used in various locations; for the purposes of this EPD the European electricity factor has been applied.

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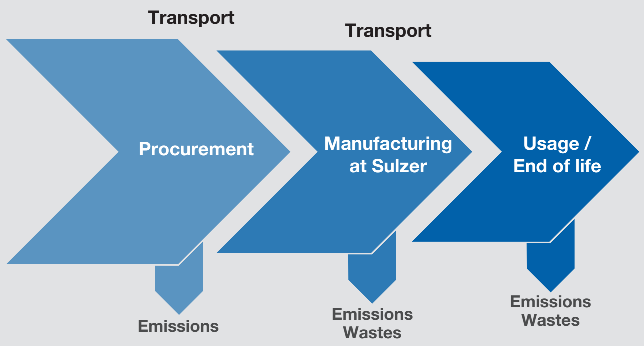
Emissions during life cycle (primarily from usage / end of life)

	Procurement		Manufacturing at Sulzer		Usage / end of life 1)		Total	
	t	kg / kW	t	kg / kW	t	kg / kW	t	kg / kW
Greenhouse Gas Potential (CO_2-equivalents)	5.0	1441.3	0.02	5.940	164	46726	169	48 174
Acidification potential (SOx-equivalents - AP)	0.2	47.745	0	0.002	3	776	3	823
Photosmog potential (ethylene equivalents)	0	0.076	0	<0.001	0	1.96	0	2.04
Ozone depleting potential (CFC11-equivalents)	0	<0.001	n.a 2)	n.a 2)	0	0	0	0
Biological Oxygen Demand (O_2-equivalents)	0	1.051	n.a 3)	n.a 3)	0.1	19.1	0.1	20.1

Rounding has been used to simplify the results tables in the EPD. n.a.: not available/applicable, kW related to 3.5 kW rated power. 1) Emissions are dominated by emissions in usage from electricity consumption. 2) Ozone depleting substances are not in use at the manufacturing site. 3) No related substances used in production.

Life-cycle – coverage, assumptions, and exclusions

System boundary: The EPD covers all relevant environmental aspects in relation to the life cycle phase diagram below.



The construction of buildings, production machinery and transport infrastructure are all excluded.

As the motor is encased within the mixer itself, this has been included in the EPD however the piping used to operate the mixer is excluded from the functional unit.

Procurement includes the extraction of raw materials and production of semi-finished products, consumables, and energy by suppliers. Production data were converted into environmental effects via factors from the EcoInvent Database; based on the component parts for this product as assembled by Sulzer.

The sourcing of both raw materials and external parts has been considered and together these account for over 99% of the product weight.

Due to low masses or rates of usage, small components such as solvents, varnishes and plastics (for e.g. seals) have not been included.

Manufacturing at Sulzer covers all product manufacturing activities undertaken at the manufacturing site including engineering, welding, grinding, machining, painting and assembly. Data used are drawn from the yearly Sulzer SEED data collection which includes energy (e.g. electricity, natural gas, butane, propane, fuel oils, district heating, coal and coke etc.) water consumptions and waste water, emissions to air and waste production. The energy used includes both manufacturing and on-site office activities. The emissions to air from the use of paints and solvents are included, however related consumption of the varnishes and paints are excluded. The environmental burden from waste and wastewater treatment has been calculated using factors from the EcoInvent Database.

The mixer is assembled in Ireland; therefore Ireland's emissions factor for the electricity generating mix has been applied for electricity used during manufacturing.

The packaging of the mixer for transport to the customer is a wooden crate, which has been included.

Usage/End of Life includes the usage and servicing of the product. It also includes the production and disposal of spare parts and of oil.

The electricity consumption of the mixer has been calculated assuming an efficiency of 95% for the motor.

Mixer is used in Europe; therefore the European electricity mix was used.

17% of the total weight of the mixer is typically replaced during the lifetime and includes bearings, seals, impeller, and wearing rings.

For recycling purposes, a credit of 50% of the initial materials burden to produce the mixer has been assumed. This conservative assumption was based on the fact that the use of recycled steel saves between 47% and 65% of energy compared to virgin steel (Volkshausen 2003; Wuppertal Institut 2008).

Spent oil is disposed as hazardous waste and incinerated accordingly; its environmental effects have been calculated based on factors from the EcoInvent Database.

Transportation to Sulzer (depending on the location of the supplier, variously by truck, train, ship or airplane) is included in the procurement phase. Transportation to the customer following the manufacturing phase is by truck, train and ship, and transportation for service activities in usage is by van for service at the customer site, or by truck if the mixer is serviced at Sulzer's site. Transportation of the dismantled mixer at the end of its working life is not considered.

Allocation: For manufacturing, data collected on the annual consumption of energy and water, emissions to air, waste water and waste production (from SEED) have been divided by the total number of mixers produced by the site to estimate the resource consumption per mixer. For procurement and usage all resources, emissions, and wastes have been fully allocated to the mixer.

Referenced period for underlying data: Data taken from the Sulzer SEED database and EcoInvent v.2 database, 2010.

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Applied load levels of pump during life cycle

The applied load levels are summarized in the table below. Based on expected usage characteristics advised by customers, the pump is expected to be operated at full load throughout its life.

Phases of load level	Duration of phase	Operating hours per year	Efficiency η	Effective Rating
	years	hours / year	%	kW
Phase 1: full load	10	8 760	83%	4
Phase 2: middle load	0	0	0%	0
Phase 3: low load	0	0	0%	0

Rounding has been used to simplify the results tables in the EPD.

Glossary

Life cycle assessment, LCA is a management tool for appraising and quantifying the total environment impact of products or activities during the entire life cycle.

Life cycle costs are based on LCAs and cover the total costs of a product during the entire life cycle from the extraction of resources to the disposal of the product.

A **Functional Unit** is a concept that is used to compare the life cycle costs of different products on a like-for-like basis.

CPC (Central Product Classification) is a UN-based scheme for statistical division of product categories and service types.

EcoInvent Database contains international industrial life cycle inventory data.

Acidification occurs through deposition of soluble sulphur and nitrogen compounds from agricultural and combustion processes. Acidification can be harmful to sensitive ecosystems.

Eutrophication is the often anthropogenic enrichment of bodies of water by nitrates and phosphates. This increases the growth of aquatic plants that deoxygenate water and outcompete other aquatic life.

Global warming potential, GWP is the potency of 1 kg of a gas as a radiative forcing agent relative to an emission of 1 kg of carbon dioxide over 100 years.

Ozone depletion potential, ODPs are calculated as the change that would result from the emission of 1 kg of a substance compared to that from the emission of 1 kg of CFC-11 (trichlorofluoromethane).

Photochemical ozone creation potential, POCP refers to the change in of ground level ozone concentration potentially caused by the emission of 1 kg of a gas compared to that from the emission of 1 kg of ethene.

SEED is the database that Sulzer uses to collect, validate, and report on social, economic, and ecological data.

Sulzer Pumps

Sulzer Pumps is a world leader in reliable products and innovative pumping solutions. The global network of modern manufacturing and packaging facilities together with sales offices, service centres and representatives located close to major markets provide fast responses to customer needs.

Sulzer Pumps has a long history of providing innovative pumping solutions to business partners in the following industries: Oil and Gas, Hydrocarbon Processing, Pulp and Paper, Power Generation, General Industry, Chemical Process Industry, Water and Wastewater

All manufacturing sites operate business man-agements systems certified to ISO 9001, ISO 14001, and OHSAS 18001.

Sustainability program of Sulzer

Sustainability is a key factor for the success of Sulzer.
The company is committed to creating long term economic value, while proactively assuming its social and environmental responsibility.
Sulzer continuously assesses its sustainability activities.
Extensive programs have been initiated to meet the expectations of Sulzer's stakeholders.

Applied standards and limitations

The document was prepared based on the EPD General Program Instructions, the PCR for pumps for liquids, liquid elevators and mixers (4322), and the ISO 14025:2010 standard. Environmental product declarations from different programs with different product category rules may not be comparable.

Verification

The EPD has been externally verified by Atkins Ltd, United Kingdom. The verification was undertaken in two sections; a review of the relevant documentation followed by a review of underlying data using a combination of a desk based review, a site visit and information exchange with Sulzer. This EPD has been verified against the updated PCR for Pumps for Liquids; Liquid Elevators and Mixers (CPC Class 4322), valid until 2016-02-22.

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Further information about products of Sulzer Pumps can be found at: www.sulzerpumps.com/products

This and other EPDs are available online at: www.sulzer.com/sustainability.

Further information about Sulzer: www.sulzer.com

Further information about the Sulzer sustainability program: www.sulzer.com/sustainability

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