

Environmental Product Declaration - EPD

Environmental and economic life cycle performance including climate-related data

AHLSTAR Process Pump

The pump characterized 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:

The large & tight hydraulic coverage of AHLSTAR pumps is designed to satisfy the most demanding requirements of industrial pumping applications. It is designed to work with all types of liquids including (but not limited to), clean/lightly contaminated liquids, viscous liquids, fibrous slurries, non-fibrous slurries and large solids containing liquids.

Type:

End suction single stage centrifugal process pump.
Pump configured according to customer requirements.

Rated power:

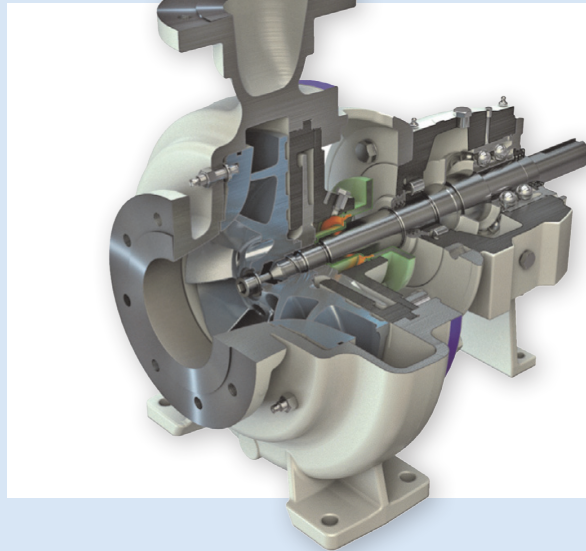
205 kW

Manufacturer:

Sulzer Pumps Finland Oy, Karhula Pump Factory, Finland

CPC classification:

4322



Components included:

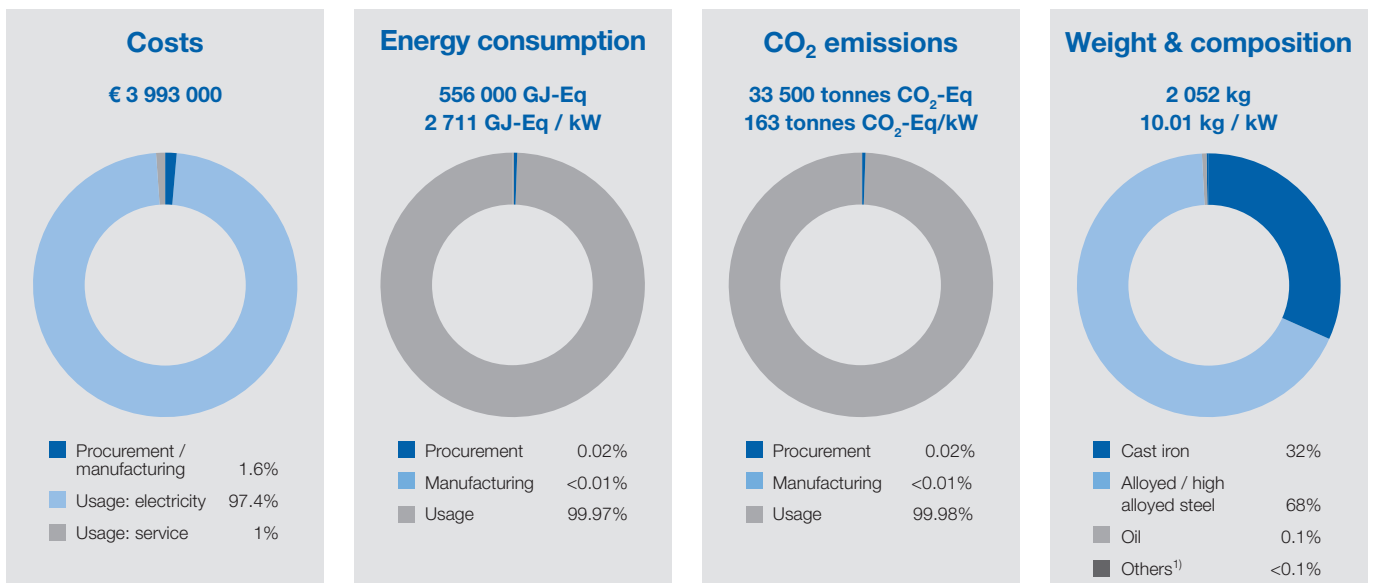
- Pump including casing, baseplate, shaft, impeller, bearings
- Gearbox
- Motor
- Frequency inverter
- Piping system

Electricity mix considered for usage: USA

Key economic and environmental advantages

- High availability of more than 98% (in normal applications (e.g. water, paper stock, liquors) & if correct material and duty point is selected and the pump operates close to the BEP as normal)
- Life-time of 50 years; for paper stock 30 years
- High efficiency of the pump means lower energy consumption and emissions
- Frequency inverter would allow flexible and energy-efficient adaptation to the effective power used
- Ample training & professional service enable customers to operate the pump cost & energy efficiently
- Retrofit service to re-establish the best efficiency point if operating conditions change
- Simply to dismantle, well suited for recycling due to high quantity of high alloyed steels (>95% by weight) that easily can be separated: metal parts are marked to identify composition.

Key economic and environmental indicators over life-cycle of 25 years



¹⁾ e.g. varnishes, seals

Functional unit

The functional unit 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	648	38%	3.16
Steel (high alloyed)	1 402	68%	6.84
Oil	2	0%	0.01
Total	2 052	100%	10.01

The pump consists of 68% alloyed and high al-loyed steels and 32% of cast iron.

The indicated quantity of oil refers to the initial fill of the pump, the oil is replaced every fourth year after installation.

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

1) By weight. 2) Rated power.

Material consumption during life-cycle per pump¹⁾ (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			³⁾	³⁾		
for pump	2 130	10.39	2 040	9.95	2 040	9.95
for spare parts	90	0.44	90	0.44	90	0.44
Oil	10	0.05	10	0.05	10	0.05
Waste production (total)	n.a.	n.a.	1 890	9.22	2 140	10.44
Hazardous waste	n.a.	n.a.	50	0.24	10	0.05
Municipal waste	n.a.	n.a.	290	1.41	n.a.	n.a.
Recycling (total)	n.a.	n.a.	1 540	7.51	2 130	10.39
metals (pump)	n.a.	n.a.	90	0.44	2 040	9.95
metals (spare parts)	n.a.	n.a.	0	0	90	0.44
others	n.a.	n.a.	1 450	7.07	n.a.	n.a.
Renewable resources	kg	kg / kW	kg	kg / kW	kg	kg / kW
Wood (packaging)	100	0.49	100	0.49	100	100
Water consumption ⁴⁾	n.a.	n.a.	1304 310	6362.5	n.a.	n.a.

n.a.: not available, values per kW related to 205 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 4% 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	11.7	0.057	0 ⁶⁾	0 ⁶⁾	555 487	2 710	555 499	2 710
Gases ¹⁾	0	0	0 ⁶⁾	0 ⁶⁾	0	0	95.2	0
Fuel oils	0	0	0 ⁶⁾	0 ⁶⁾	0	0	0	0
Fuels	0	0	0	0	0	0	0	n.a.
District heating ⁸⁾	4.0	0.021	0	0	0	0	0	n.a.
Materials	123	0.60	0	0	0	0	123	0.60
Transports	0.7	0.003	11.2	0.0547	153	0.75	165	0.804
Disposal, waste water ⁷⁾	n.a.	n.a.	0.1	0.00029	-73	-0.354	-73 ⁹⁾	-0.354
Non-renewable energy sources ⁵⁾	117	0.568	11.1	0.0542	536 033	2 615	536 161	2 615
Total renewable energies ^{4) 5)}	27	0.133	0.2	0.00079	19 534	95	19 562	95
Total energy sources ⁵⁾	139	0.680	11.3	0.0550	555 568	2 710	555 718	2 711

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 205 kW rated power.

The pump is used in the Kingdom of Saudi Arabia (KSA); as a value for KSA is not currently available in Ecolnvent the USA energy mix was applied.

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

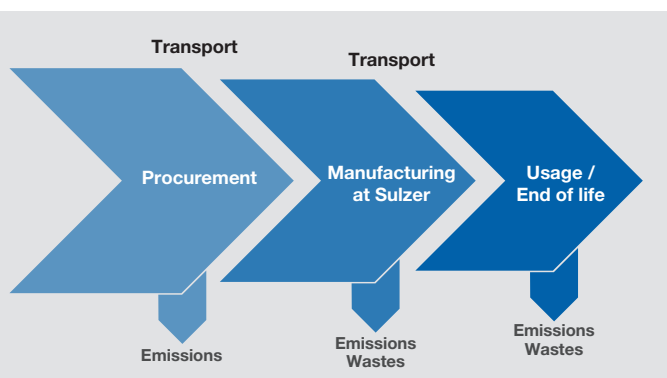
	Procurement		Manufacturing at Sulzer		Usage / end of life ¹⁾		Total	
	t	kg / kW	t	kg / kW	t	kg / kW	t	kg / kW
Greenhouse Gas Potential (CO ₂ -equivalents)	7.1	34.45	0.72	3.515	33 467	163 254	33 475	163 292
Acidification potential (SOx-equivalents - AP)	0.6	2.906	0.030	0.147	454	2 213	454	2 216
Photosmog potential (ethylene equivalents)	0.001	0.007	<0.001	<0.001	1.4	6.73	1.4	6.73
Ozone depleting potential (CFC11-equivalents)	<0.001	<0.001	n.a. ²⁾	n.a. ²⁾	<0.001	<0.001	<0.001	<0.001
Biological Oxygen Demand (O ₂ -equivalents)	0.01	0.050	n.a. ³⁾	n.a. ³⁾	9.7	47.1	9.7	47.2

n.a.: not available, kW related to 205 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.

Manufacturing and usage of the motor, frequency inverter, and the piping used to operate the pump are 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 Ecolnvent Database; based on the component parts for this product as assembled by Sulzer.

The consideration of externally sourced parts has been limited to the casing, baseplate, shaft, impeller and bearings; which together 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. In this particular case, the district heat comes from combined power plants, producing electricity and heat. The emissions to air from the use of paints and solvents are included; however related consumption of the varnishes and paints is excluded. The environmental burden from waste and wastewater treatment has been calculated using factors from the Ecolnvent Database.

The pump is assembled in Finland, and the mean Finland emissions factor for the electricity generating mix has been applied.

The packaging of the pump 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 motor and frequency inverter are not part of the system. The electricity consumption of the pump has therefore been calculated assuming an efficiency of 100% for both.

The pump is used in KSA, as this factor is not currently available; the USA electricity mix was assumed. The price for electricity applied is € 0.07 per kWh and is quoted in Euros for comparability with similar EPDs.

The yearly costs for maintenance are set at 2% of the purchase price of the pump, and the assumed average increase in prices is at 2% per year.

4% of the total weight of the pump 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 pump 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).

Costs and effects of dismantling are not considered and are assumed minor compared with the usage phase. Monetary benefits through selling the pump as scrap have not been considered, as the lifetime of the product is too long to make a robust estimate.

Spent oil is disposed as hazardous waste and incinerated accordingly; its environmental effects have been calculated based on factors from the Ecolnvent 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 and ship, and transportation for service activities in usage is by van for service at the customer site, or by truck if the pump is serviced at Sulzer's site. Transportation of the dismantled pump 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 pumps produced by the site to estimate the resource consumption per pump. For procurement and usage all resources, emissions, and wastes have been fully allocated to the pump.

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

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	25	8 760	91%	198
Phase 2: middle load	0	0	0%	0
Phase 3: low load	0	0	0%	0

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.

Ecolnvent 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 managements 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

This is an unverified draft for client information only

References

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Innovationspotenzial, Ergebnisse des ‚Zukunftsdialogs Rohstoffproduktivität und Ressourcenschonung‘, June 2008

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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