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SULZER

Sulzer Pumps

Karhula Foundry



The Heart of Your Process

Sulzer Pumps

Sulzer Pumps is a leading supplier of pumps, mixers and agitators together with associated maintenance services in its key business areas. Our customers comprise the oil and gas industry, hydrocarbon processing, pulp and paper industry, water and wastewater treatment, and the food, metals and fertilizer markets.

Our active R&D, in-depth process and application expertise together with knowledge of the needs of the market keep us constantly at the leading edge of technical developments.

Our company has production and assembly units in 15 countries. Our network of sales offices, service centers and agents covers the globe, guaranteeing swift and flexible service for our customers.

The Karhula Foundry is part of Sulzer Pumps Finland Oy, which supplies pumps, mixers and agitators as well as their maintenance services to the pulp and paper industry as well as the food, metals and fertilizer industries.



Karhula Foundry

The Karhula Foundry is one of the largest manufacturers of stainless castings for pumps, mixers and agitators in the world. It supplies demanding steel and special cast iron castings primarily to the company's own factories and to external special customers. We are specialized in delivering single castings within standard delivery times.

Of the total annual production of some 50,000 castings, almost 90 per cent are made of stainless duplex or superduplex steel grades. Our Foundry draws on more than 50 years of experience in the manufacture of duplex steel grades. We also have a license to cast the fully austenitic Avesta 654SMO steel.

The net weights of our castings range from 0.5 kg to 15,000 kg. Molds at the Karhula Foundry are made by using a method based on a no-bake sand or the Replicast® CS Ceramic Shell molding method.

Our Foundry operates a validated ISO 9001 quality management system, ISO 14001 environmental management system, and OHSAS 18001 safety management system, all accepted by Det Norske Veritas. Moreover, the Foundry has a certified manufacturing permit in accordance with the PED/97/23/EC directive to make certain cast materials.



Production phases of steel castings

Order handling	
Core manufacturing	Manufacturing of polystyrene pattern
Molding	Shelling and burning
Assembly of cores and closing of the mould	Packing
Melting	
Pouring of the moulds	
Shake-out	
Shot-blasting	
Abrasive wheel cutting, arc-air cutting	
Heat treatment	
Shot-blasting	
Grinding	
Inspection	
Shipping	



Quality has its origin

The Karhula Foundry has manufactured castings for more than 100 years. The accumulated knowledge and experience is passed on to a new generation of experts through induction, instruction and training.

The Foundry has full-time work instructors, and vocational qualifications and special vocational qualifications are taken within apprenticeship training making our personnel highly multi-skilled. The Foundry's own experts serve as the instructors. There is also close training co-operation with the Helsinki University of Technology, the Finnish Foundry Institute, British Castings Technology International, and local educational establishments. The critical phases of work processes are provided with written instructions in order to ensure that the work is performed correctly.



Pumps withdrawn from operation live on as raw material for new pumps

Sulzer Pumps Finland Oy controls the manufacturing chain from the scrap yard of the Foundry all the way to the complete pump, mixer or agitator. We know the environmental impacts involved in the manufacture and operation of our products.

Recycled material accounts for almost two thirds of the casting charge, and each year we use, among other things, hundreds of tonnes of chips created in the machining of our pumps. Sand removed from the casting process is used in applications such as harbor construction and as a raw material in the cement industry.

During the past 10 years, we have invested more than 2.5 million euros in environmental protection projects. These investments have reduced our dust and heavy metals load to a fraction of their original levels. Any residual products are sorted at source, and new uses are continuously being investigated for them. Dust containing heavy metals is treated in Sweden in a plasma furnace so most of the metallic raw materials contained in the dust are recovered for re-use.

Our environmental management system conforming to the ISO 14001 standard was certified in 1998. In 2002, we received an award from the Southeast Finland Regional Environment Centre for long-term and successful environmental protection efforts.



Rapid transformation of ideas into complete products

The Pattern Shop has an integral role in shortening the time spent on R&D. The Pattern Shop and the pattern team design and manufacture patterns for new products and hydraulic prototypes for R&D projects. Pattern design utilizes modern CAD/CAM software. Increasingly high-quality patterns can be made swiftly by utilizing the features of this engineering tool. The 3D geometry of the solid model is used in pattern making, casting simulation and 3D measurements.

The patterns are manufactured using a high-speed five-axis machining center. This ensures that the design integrity of the patterns and core boxes is maintained constantly and that they can be quickly manufactured.

Data files supplied by the customer can also be used in the manufacture of plastic prototype items and patterns.

The maximum dimensions of an item manufactured using the high-speed machining center are 3,000 x 1,800 x 800 mm. If necessary, the pattern can also be constructed from a number of component parts.



From individual castings to small series

All mold and core materials have been selected taking into account the rigorous demands of producing stainless steel castings.

Good surface quality on the pump castings is accomplished by factors such as:

- plastic core boxes and patterns made by means of CAD-CAM technology
- Cold-Box core manufacture
- good mold compaction
- high-quality molding sand
- use of sand mixers for no-bake molding sand, provided with online measurement and control systems
- flow coating

The net weights of castings manufactured through sand molding range from 0.5 kg to 15 tons. The dimensions of the largest molding flasks used are 3,600 x 3,600 x 3,600 mm.



Utmost precision

Replicast® Ceramic Shell molding is a Near Net Shape precision casting method which allows the manufacture of Rapid Prototyping prototypes, tailor-made solutions for a particular customer, and the casting of complete entities. The shell molding method gives Ra 9 to 12 µm surface quality and a tolerance range of CT 6-8 in accordance with the SFS/ISO 8062 standard.

The inert shell also makes it possible to cast super alloys. Robotized shell manufacture yields uniform product quality.

The maximum diameter of castings manufactured through ceramic shell molding can be up to 650 mm and net weight almost 200 kg.

Replicast® is a Registered Trade Mark of a patented process. Sulzer Pumps Finland Oy has been granted the right to use the Replicast® method developed by the British Castings Technology International.



Meeting the customer's requirements

The Karhula Foundry uses 0.5, 1.5 and 8 ton induction furnaces for the melting of steel plus an electric arc furnace with a nominal capacity of 8 tons.

Steel melted in the arc furnace is processed in the AOD converter (Argon-Oxygen-Decarburization). The AOD converter enables the manufacture of ELC grades (Extra Low Carbon) and nitrogen-alloyed high-quality steel grades. The induction furnaces are used for casting AOD-treated blanks.

The Analysis Laboratory has been integrated with the Melting Shop. The Laboratory features an ARL 4460 optical spectrometer for 22 elements (including super alloys). Separate analyzers are used for nitrogen and oxygen as well as sulfur and carbon. The analysis lists cover more than 60 cast materials.



Most common cast materials for pumps, mixers and agitators

Internal code	Corresponding material standards			Nominal chemical composition							Guaranteed mechanical properties				General properties and examples of applications
	EN10283		USA ASTM ⁽¹⁾	C	Cr	Ni	Mo	Cu	N	Others	Tensile strength N/mm ²	Yield strength N/mm ²	Elongation %	Hardness ⁽²⁾	
	Item	Number code													
Corrosion resistant cast steels															
Martensitic cast steels															
E2	G-X 4 CrNi 13 4	1.4317	A 743-03 Grade CA-6NM	max. 0.06	11.5-14.0	3.5-4.5	0.40-1.0				755	550	15	250	Air-hardening steel with good strength properties. Used e.g. in power industry applications.
4E	G-X 5 CrNiCu 16 4	1.4525	A 747-04 Grade CB7Cu-2	max. 0.07	14.0-15.5	4.5-5.5		2.5-3.2		Nb 0.15-0.35	1205	1035	5	400	A precipitation hardening grade with good strength properties and corrosion and wear resistance. Used for pump components.
Austenitic cast steels (solution heat treated)															
4G	C-X 5 CrNiMo 19 11 3	(1.4412)	A743-03 Grade CG-3M	max. 0.03	18.0-21.0	9.0-13.0	3.0-4.0				520	240	25	160	Improved resistance to hot sulphuric and organic acids due to a high molybdenum content. Molybdenum increases the pitting resistance of steel.
43	C-X 4 NiCrCuMo 30 20 4	1.4527	A 743-03 Grade CN-7M	max. 0.07	19.0-22.0	27.5-30.5	2.0-3.0	3.0-4.0			425	170	35	140	A grade for castings where resistance to sulphuric acid is essential.
4U	AVESTA 654SMO (3)		(UNS S32654)	max. 0.025	23.0-25.0	21.0-23.0	7.1-7.5	0.3-0.7	0.40-0.55		600	350	35	220	Excellent corrosion resistance. Nitrogen also gives very good resistance to pitting and crevice corrosion. Resistant to hot acids with high chloride content. Used in pulp bleaching plants, sea water applications, and in the handling of liquids containing halides.
Duplex steels (austenitic-ferritic, solution heat treated)															
41	(G-X 2 CrNiMoN 25 6 3)	(1.4468)	A-890-99 Grade 3A	max. 0.06	24.0-27.0	4.0-6.0	1.75-2.50		0.15-0.25		655	450	25	230	Steels with better tensile and yield strength and better machinability than austenitic steels. Used for various equipment in the chemical and pulp industries.
4L	(G-X 2 CrNiMoN 25 6 3 3)	(1.4517)	A-890-99 Grade 1B	max. 0.04	24.5-26.5	4.75-6.00	1.75-2.25	2.75-3.25	0.10-0.25		690	485	16	250	Similar grade to the previous one. The copper content improves corrosion resistance in e.g. weak sulphuric acid solutions. Molybdenum improves general corrosion resistance.
4T	G-X 2 CrNiMo 26 7 4	1.4469	A-890-99a Grade 5A	max. 0.03	24.0-26.0	6.0-8.0	4.0-5.0		0.1-0.3		690	515	18	250	Used for equipment in the chemical and pulp industries. Good resistance to sea water. ⁽⁴⁾
Nickel alloys (solution heat treated)															
4J			A-494-05 Grade CW-6M	max. 0.07	17.0-20.0	balance	17.0-20.0			Fe max. 3.0%	495	275	25	180	High Mo and Cr contents make the alloy suitable for reducing and oxidizing and otherwise severely corroding conditions. Good resistance to sulphuric acid, and also to hydrochloric acid up to concentrations of approx. 10%.
Carbon and low alloy cast steels															
Carbon steels (normalized)															
46	GP 240 GH	EN 10213-2	A 216-04 Grade WCB	max. 0.30						Mn. 1.0 %	520	260	18	160	Ductile and strong weldable steel, used e.g. in pump support structures. Also used in hot water pumps.
Cast irons															
Grey cast irons EN1561															
52	EN-GJL-200	EN-JL-1030	A 48-03 Class No 30 B								207			190	Used e.g. in pump bearing units.
53	EN-GJL-250	EN-JL-1040	A 48-03 Class No 35 B								241			210	Used in pump casings, casing covers and parts of bearings.
Spheroidal graphite cast irons EN1563															
56	EN-GJS-400-18	EN-JS-1020	A 536-84 Grade 60-40-18								414	276	18	150	Various casings and covers in uses such as district heat pumps.
5H	EN-GJS-400-18	EN-JS-1020	A 395-99 Grade 60-40-18								414	276	18	150	Used in casings and covers in various industries.
Wear resistant cast irons EN12513															
5B	EN-GJN-HV600 (XCr23)	EN-JN-3049	A532-93a Class III Type A	2.0-3.0	23.0-30.0	max. 2.5	max. 3.0	max. 1.2						600	High-chromium white cast iron for wear resistant pumps. The high chromium content guarantees reasonable corrosion resistance. Well suited for wearing applications alkaline conditions.

1) Standard corresponding to the internal code is ASTM.

2) The hardness is informative value.

3) AVESTA 654SMO is a trade mark owned by Outokumpu Stainless which has granted Sulzer Pumps licence to produce this material.

4) PRE ≥ 40

Adding the finishing touches to fulfill the customer's expectations

The facilities and equipment at the Fetting Shop include programmable heat treatment furnaces, a protective gas furnace for martensitic steel, versatile inspection and testing methods (such as magnetic particle, ultrasound, liquid penetrant and X-ray inspection), a laboratory for mechanical material testing, and a robotized polishing cell for special pumps. The castings can be polished up to a surface smoothness of Ra 0.8 μm .

We use the Faro 3D CMM for measuring the dimensions of castings. In our own mechanical material testing laboratory we can perform conventional strength, hardness and impact tests. Hot tensile tests and intergranular corrosion tests are performed by subcontractors.

Our inspectors are qualified in visual, magnetic particle and liquid penetrant inspections. We source ultrasound and radiographic inspections from subcontractors.

Our welders are qualified in SMAW welding, MAG welding and TIG welding methods in accordance with the SFS-EN 287 standard. Our welding work supervisor has the IWT qualification.

The largest cast items which can be heat treated at the Karhula Foundry can have dimensions of 4,500 x 4,500 x 3,000 mm.

By using our reliable network of subcontractors, we can deliver castings with rough or final machining or with primer.

