SULZER

Sulzer Pumps

Karhula Foundry

Sulzer Pumps

Sulzer Pumps is a world leader in reliable products and innovative pumping solutions. Our advanced research and development, detailed process and application knowledge together with a comprehensive understanding of market demands keep us consistently at the leading edge of technical development. Our global network of modern manufacturing and packaging facilities together with sales offices, service centers 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 Industry

Karhula Foundry

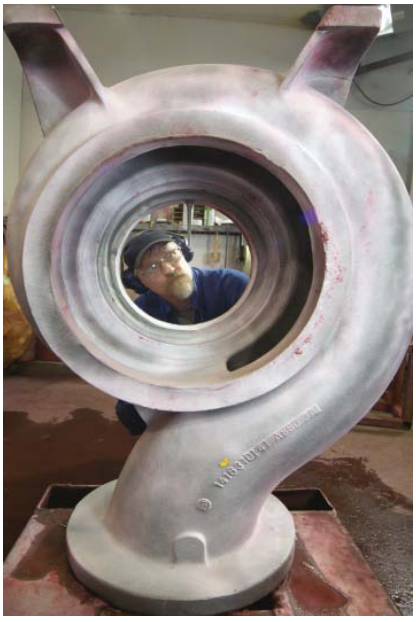
Karhula Foundry

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.

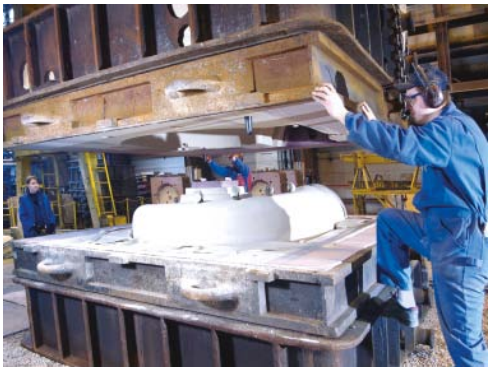
The net weights of our castings range from 0.5 kg to 8,000 kg. Molds at the Karhula Foundry are made by using a method based on a no-bake sand or the Replicast® CS Ceramic Shell molding method.

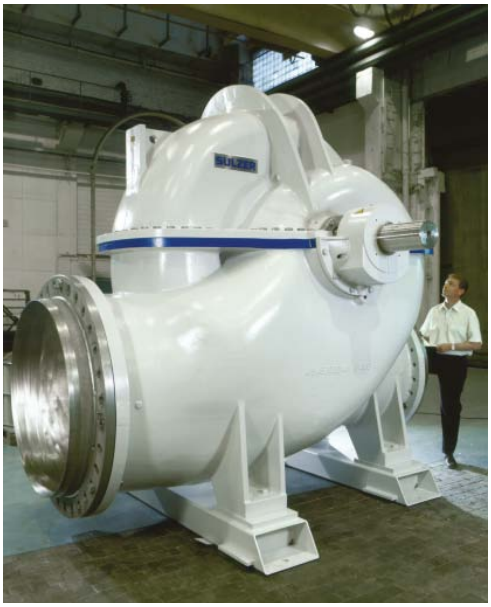
Our Foundry operates a validated ISO 9001 quality management system, ISO 14001 environmental management system, and OHSAS 18001 safety management system, all accepted by Det Norske Veritas. Moreover, the Foundry has a certified manufacturing permit in accordance with the PED/97/23/EC directive to make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

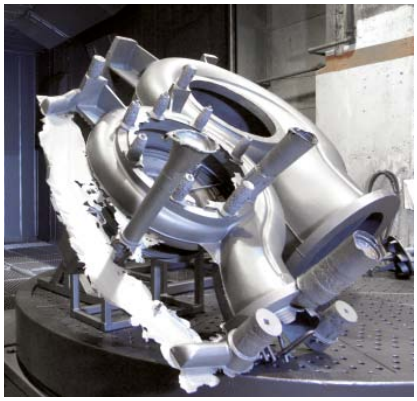
Pumps Withdrawn from Operation Live on as Raw Material for New Pumps

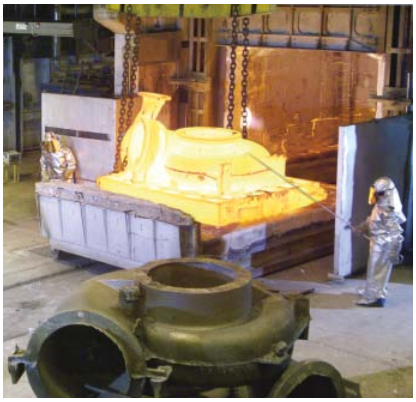
Sulzer Pumps Finland Oy controls the manufacturing chain from the scrap yard of the Foundry all the way to the complete pump, mixer or agitator. We know the environmental impacts involved in the manufacture and operation of our products.

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.

We have invested significantly in environmental protection projects and as a result our dust and heavy metals load has reduced 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.



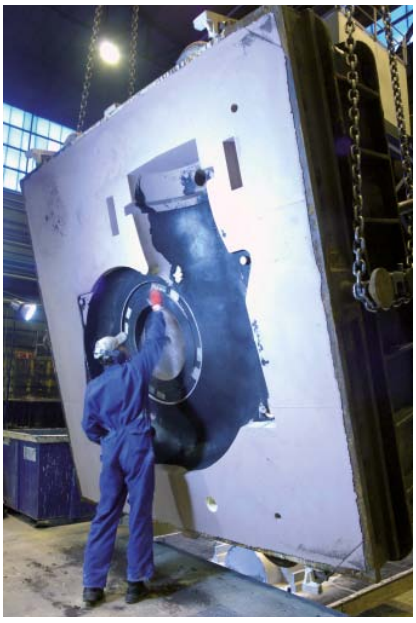


Rapid Transformation of Ideas into Complete Products

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.



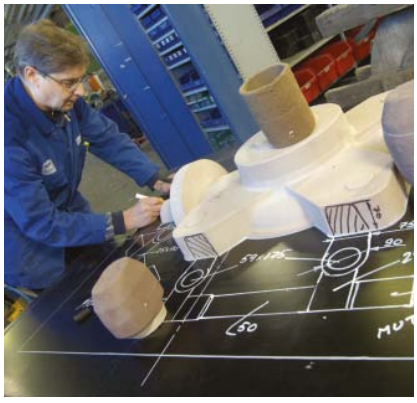
From Individual Castings to Small Series

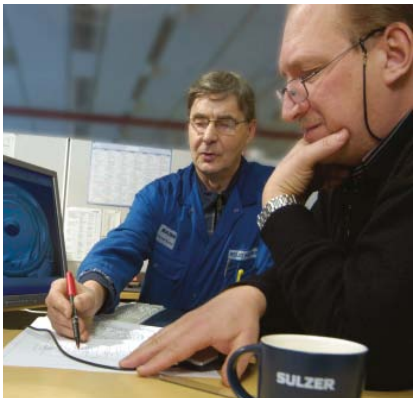
All mold and core materials have been selected taking into account the rigorous demands of producing stainless steel castings.

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 8 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.

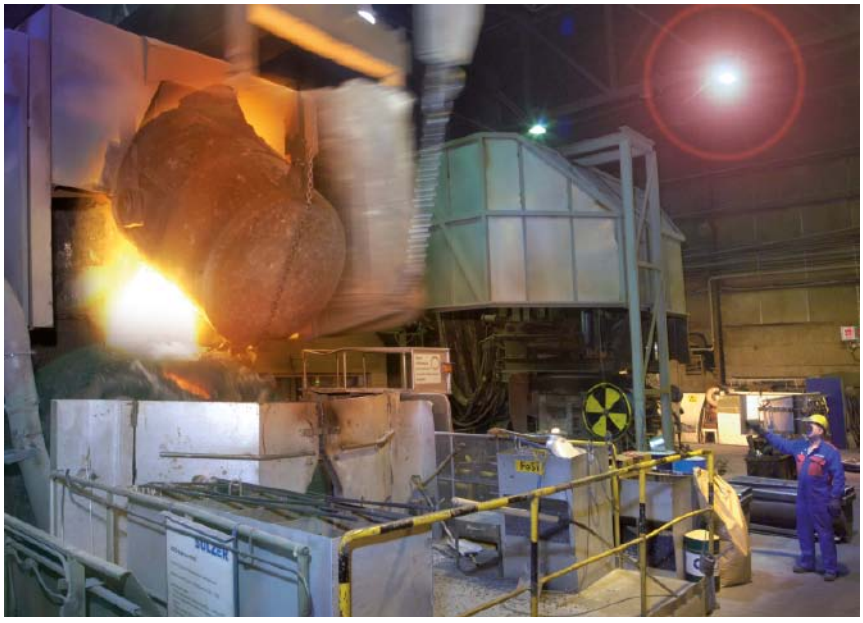
Replicast® is a Registered Trade Mark of a patented process. Sulzer Pumps Finland Oy has been granted the right to use the Replicast® method developed by the British Castings Technology International.

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	Standard specification ASTM [1]	Comparable grades EN10283		Nominal chemical composition					
		Item	Number code	C	Cr	Ni	Mo	Cu	N
Corrosion Resistant Cast Steels									
Martensitic Cast Steels									
E2	A 743 Grade CA-6NM	G-X 4 CrNi 13 4	1.4317	max. 0,06	11,5-14,0	3,5-4,5	0,40-1,0		
4E	A 747 Grade CB7Cu-2	G-X 5 CrNiCu 16 4	1.4525	max. 0,07	14,0-15,5	4,5-5,5		2,5-3,2	
Austenitic Cast Steels (solution heat treated)									
4C	A743 Grade CF-8	G-X 6 CrNi 19 10	1.4308	max. 0,08	18,0-21,0	8,0-11,0			
42 [3]	A743 Grade CF-8M	G-X 6 CrNiMo 19 11 2	1.4408	max. 0,08	18,0-21,0	9,0-11,0	2,0-3,0		
4G	A743 Grade CG-3M	C-X 5 CrNiMo 19 11 3	(1.4412)	max. 0,03	18,0-21,0	9,0-13,0	3,0-4,0		
43	A 743 Grade CN-7M	C-X 4 NiCrCuMo 30 20 4	1.4527	max.0,07	19,0-22,0	27,5-30,5	2,0-3,0	3,0-4,0	
4U	AVESTA 654SMO [4] (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
Duplex Steels (austenitic-ferritic, solution heat treated)									
EJ	Sulzer 2304 (UNS 32304)			max. 0,06	22,0-24,0	3,5-5,5	0,1-0,6	0,1-0,6	0,05-0,20
41	A-890 Grade 3A	(G-X 2 CrNiMoN 25 6 3)	(1.4468)	max. 0,06	24,0-27,0	4,0-6,0	1,75-2,50		0,15-0,25
4L	A-890 Grade 1B	(G-X 2 CrNiMoN 25 6 3 3)	(1.4517)	max. 0,04	24,5-26,5	4,7-6,0	1,7-2,3	2,7-3,3	0,10-0,25
4T	A-890 Grade 5A	G-X 2 CrNiMo 26 7 4	1.4469	max. 0,03	24,0-26,0	6,0-8,0	4,0-5,0		0,1-0,3
Nickel Alloys (solution heat treated)									
4J	A-494 Grade CW-6M			max. 0,07	17,0-20,0	balance	17,0-20,0		
Cast Irons									
Wear Resistant Cast Irons EN12513									
5B	A532 Class III Type A	EN-GJN-HV600 (XCr23)	EN-JN-3049	2,0-3,0	23,0-30,0	max.2,5	max.3,0	max.1,2	

1) Standard corresponding to the internal code is ASTM.
2) The hardness is informative value.
3) Not a standard material of SPP products.
4) AVESTA 654SMO is a trade mark owned by Outokumpu Stainless which has granted Sulzer Pumps licence to produce this material.
5) PRE ≥ 40

	Guaranteed mechanical properties				
Others	Tensile strength N/mm²	Yield strength N/mm²	Elonga-tion %	Hard-ness [2]	General properties and examples of applications
	755	550	15	250	Air-hardening steel with good strength properties. Used e.g. in power industry applications.
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.
	485	205	35	150	Standard stainless steel grade with good toughness and resistance to nitric acid solutions.
	485	205	30	150	Standard stainless steel grade with good toughness and resistance to acid solutions.
	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.
	425	170	35	140	A grade for castings where resistance to sulphuric acid is essential.
	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.
	550	360	25	200	Steel with better tensile and yield strength compared to austenitic steels. Good machinability. Used for various process industry applications.
	655	450	25	230	Steel with better tensile and yield strength compared to austenitic steels. Used for various process industry and seawater applications.
	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.
	690	515	18	250	Used for equipment in the chemical and pulp industries. Good resistance to sea water. [5]
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%.
				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.

Adding the Finishing Touches to Fulfill the Customer's Expectations

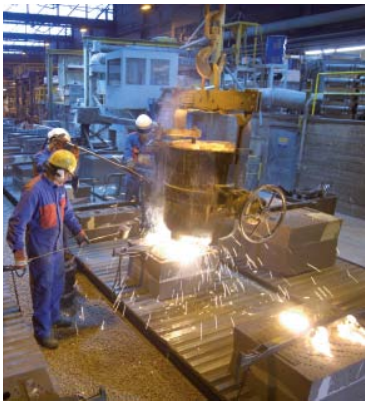
The facilities and equipment at the Fettling Shop include programmable heat treatment furnaces, a protective gas furnace for martensitic steel, versatile inspection and testing methods (such as magnetic particle, ultrasound, liquid penetrant and X-ray inspection), a laboratory for mechanical material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

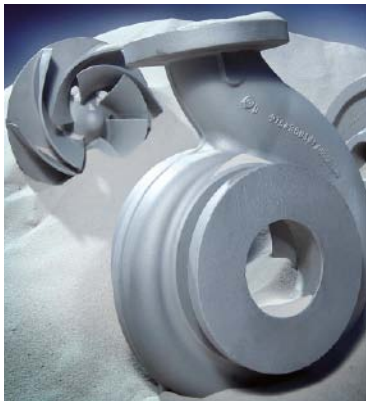
We use the Faro 3D CMM for measuring the dimensions of castings. In our own mechanical material testing laboratory we can perform conventional strength, hardness and impact tests. Hot tensile tests and intergranular corrosion tests are performed by subcontractors.

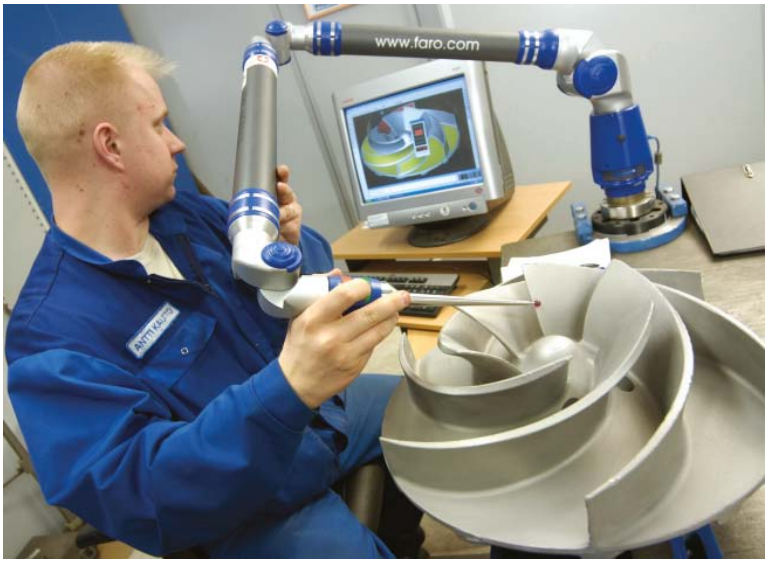
Our inspectors are qualified in visual, magnetic particle and liquid penetrant inspections. We source ultrasound and radiographic inspections from subcontractors.

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.







www.sulzerpumps.com