

SULZER

Sulzer Pumps

Cast Materials



The Heart of Your Process

Sulzer Pumps – Striving to Serve You Better

Sulzer Pumps is a leading global supplier of reliable products and innovative pumping solutions for end users. Our active research and development, detailed process and application knowledge together with a comprehensive understanding of market demands keeps 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 is active serving business partners in the following industries:

- Oil & Gas
- Hydrocarbon Processing
- Pulp & Paper
- Power Generation
- Food, Metals & Fertilizers
- Water & Wastewater

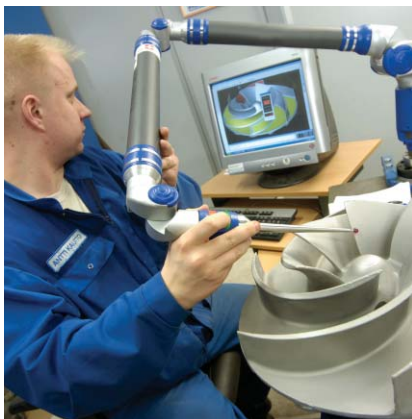
Karhula Foundry

The Karhula Foundry is part of Sulzer Pumps Finland Oy, supplying demanding corrosion resistant steel and special cast iron castings primarily to the company's own factories. Of the total annual production of some 50,000 castings, almost 90 per cent are made of corrosion resistant duplex and super duplex cast steel grades.

The net weights of the castings range from 0.5 kg to 15,000 kg. The patterns are manufactured using a 5-axis machining centre, and dimension control is carried out

by means of a 6-axis coordinate measuring machine (CCM). Molds at the Karhula Foundry are made by using a method based on resin bonded sand or the Replicast® CS Ceramic Shell molding method. Steel melted in an electric arc furnace or induction furnace is treated using an AOD converter, which gives steel of very high quality. The heat treatment furnaces are programmable, and they are calibrated at regular intervals. The foundry has modern analysis and materials testing laboratories.

The Karhula Foundry applies a valid ISO 9001 quality system, ISO 14001 environmental management system and OHSAS 18001 safety system, all approved by Det Norske Veritas, and it has a PED approval.



Pitting and Crevice Corrosion

Pitting and crevice corrosion are localized forms of corrosion that can occur in stainless steels. Wherever there are acidic chloride solutions, such as sea water, bleach or oxidizing salts e.g. ferric chloride and cupric chloride, this form of corrosion can occur.

Pitting occurs randomly on wetted surfaces in the form of small deep cavities. Crevice corrosion occurs in narrow crevices into which the solution can penetrate but is not flushed away during normal operation as in other, more open areas.

Attempts have been made to establish a measure of the pitting and crevice corrosion resistance by calculating the sum of the most important alloying elements in a weighed form. This sum is called PRE (Pitting Resistance Equivalent) and one common expression is $PRE = Cr \% + 3.3 \times Mo \% + 16 \times N \%$. The figures in the table have been calculated using this formula.



PRE-figures of various stainless steels (informative values)

Alloy	PRE
2304	26
3A	34
1B	35
5A	41
654 SMO	56

The higher the PRE-figure the greater pitting and crevice corrosion resistance of the alloy.



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Internal code	Corresponding material standards			Nominal chemical composition					
	EN10283		USA ASTM ⁽¹⁾	C	Cr	Ni	Mo	Cu	N
	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		
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	
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		
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	
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	0.40-0.5
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	0.05-0.2
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		0.15-0.2
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	0.10-0.2
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
Nickel alloys (solution heat treated)									
4J			A-494-05 Grade CW-6M	max. 0.07	17.0-20.0	balance	17.0-20.0		
Carbon and low alloy cast steels									
Carbon steels (normalized)									
46	GP 240 GH	EN 10213-2	A 216-04 Grade WCB	max. 0.30					
Cast irons									
Grey cast irons EN1561									
52	EN-GJL-200	EN-JL-1030	A 48-03 Class No 30 B						
53	EN-GJL-250	EN-JL-1040	A 48-03 Class No 35 B						
Spheroidal graphite cast irons EN1563									
5H	EN-GJS-400-18	EN-JS-1020	A 395-99 Grade 60-40-18						
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	

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

		Guaranteed mechanical properties				General properties and examples of applications
Others	Tensile strength N/mm ²	Yield strength N/mm ²	Elongation %	Hardness (2)		
	755	550	15	250	Air-hardening steel with good strength properties. Used e.g. in power industry applications.	
Nb 0.15-0.35	1170	1000	5	400	A precipitation hardening grade with good strength properties and corrosion and wear resistance. Used for pump components.	
	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.	
5	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.	
0	550	360	25	200	Steel with better tensile and yield strength compared to austenitic steels. Good machinability. Used for various process industry applications.	
5	655	450	25	230	Steel with better tensile and yield strength compared to austenitic steels. Used for various process industry and seawater applications.	
5	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. (4)	
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%.	
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.	
	207			190	Used e.g. in pump bearing units.	
	241			210	Used in pump casings, casing covers and parts of bearings.	
	414	276	18	150	Used in casings and covers in various industries.	
				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.	

Check our worldwide offices at
www.sulzerpumps.com



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