

**SULZER**

Flow Equipment

# Cast materials



# Rely on our material competence for your demanding industrial processes

Our customer-focused R&D and continuous research on new material options enable us to develop equipment with a strong resistance to corrosion and wear.

## Proven expertise

- Specialist competence in corrosive and erosive applications, built on leading material technology
- Pump designs consider both materials of construction and hydraulic requirements to optimize performance in the field
- Continuous research into new material options
- One of the largest suppliers of stainless castings for pumps, mixers and agitators in the world

## Experience

- Over 100 years of experience in manufacturing process pumps with casted parts
- Over 60 years of experience in duplex steel castings
- 15'000 pumps and agitators manufactured annually with casted parts
- Roughly 75% of deliveries in corrosion resistant duplex and super duplex cast steel grades



	Internal code		Specification Standard grade or other description	Comparable grades		Nominal chemical composition							Guaranteed mechanical properties				Main products	General properties and examples of applications
	MCN	Alterna- tive codes		Wrought	Cast EN	C	Cr	Ni	Mo	Cu	N	Others	Tensile strength N/mm <sup>2</sup>	Yield strength N/mm <sup>2</sup>	Elonga- tion %	Hardness HBW <sup>(1)</sup>		
<b>Corrosion-resistant cast steels</b>																		
Martensitic cast steels	J0263	E2 / S5M	ASTM A743 CA-6NM		1.4317	max. 0.06	11.5-14.0	3.5-4.5	0.40-1.0				755	550	15	(250)	CAHR	Air-hardening steel with good strength properties. Used e.g. in power industry applications.
	J0264	4E	ASTM A747 CB7Cu-2 (H900)	15-5 PH	1.4525	max. 0.07	14.0-15.5	4.5-5.5		2.5-3.2		Nb 0.15- 0.35	1170	1000	5	min. 375	AHLSTAR, CPE	A precipitation hardening corrosion resistant grade with good strength properties and wear resistance. Used for pump components.
Austenitic cast steels	J0299	4C	ASTM A743 Grade CF-8	AISI 304	1.4308	max. 0.08	18.0-21.0	8.0-11.0					485	205	35	(150)	A, APP	Standard stainless steel grade with good toughness and resistance to nitric acid solutions.
	J0268	42	ASTM A743 Grade CF-8M	AISI 316	1.4408	max. 0.08	18.0-21.0	9.0-12.0	2.0-3.0				485	205	30	(150)	SNS	Molybdenum alloyed grade with better resistance to acids and pitting compared to CF-8.
	J0553	I6M	ASTM A351 CF-3M	AISI 316L	1.4409	max. 0.03	17.0-21.0	9.0-13.0	2.0-3.0				485	205	30	(150)	CAHR, VRN	Similar to the previous one (CF-8M). Low carbon improves corrosion resistance (limit intragranular corrosion) and weldability.
	J0853	UBM	EN 10283 1.4584	904L	1.4584	max. 0.025	19.00-21.00	24.00-26.00	4.00-5.00	1.00-3.00			450	185	30	(150)	CAHR	Austenitic stainless steel. Higher Nickel and Molybdenum compared to CF-3M improves global corrosion resistance. Good corrosion resistance to sulphuric acid or strong phosphoric acid even with chloride content. Copper content improves corrosion resistance in e.g. weak sulphuric acid solutions.
	J0270	43	ASTM A743 Grade CN-7M	Alloy 20	1.4527	max. 0.07	19.0-22.0	27.5-30.5	2.0-3.0	3.0-4.0			425	170	35	(140)	CPE	A grade for castings where resistance to sulphuric acid is essential.
	J0859	A31	Alloy 31	Alloy 31	(1.4562)	max. 0.025	26.0-28.0	30.0-32.0	6.0-7.0	1.0-1.4	0.15-0.25		600	240			CAHR	Super austenitic stainless steel with excellent resistance to corrosion (high Molybdenum) and erosion (high Chromium). Used in sulphuric acid and phosphoric acid media even with solid and/or chloride content.
	J0271	4U <sup>(2)</sup>	654SMO	654SMO (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)	AHLSTAR, CPT, KCE, SALOMIX	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)	J0265	41	ASTM A890 Grade 3A		(1.4468)	max. 0.06	24.0-27.0	4.0-6.0	1.75-2.5		0.15-0.25		655	450	25	(230)	AHLSTAR, SNS, CPE, ZPP, KCE, MCE, SX, SALOMIX	Steel with better tensile and yield strength compared to austenitic steels. Used for various process industry and seawater applications.
	J0266	4L / U55	ASTM A890 Grade 1B		(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		690	485	16	(250)	AHLSTAR, CPT, CAHR, EMTECH, VRN	Similar grade to the previous one. The copper content improves corrosion resistance in e.g. weak sulphuric acid solutions. Molybdenum improves general corrosion resistance.
Super du- plex steels	J0267	4T / P5M <sup>(3)</sup>	ASTM A890 Grade 5A	EN 1.4410	1.4469	max. 0.03	24.0-26.0	6.0-8.0	4.0-5.0		0.10-0.30		690	515	18	(250)	AHLSTAR, CPE, ZPP, KCE, MCE, CAHR	Used for equipment in the chemical and pulp industries. Good resistance to sea water.
Ferritic stainless steel	J0840	ER <sup>(4)</sup>	ASTM A743 CC50 (Mod)			0.25-0.35	29.0-30.0	1.50-3.00	1.50-3.00	1.00-1.50	0.10-0.20		380			(275)	AHLSTAR WPP	Corrosive WPA with solids in phosphate fertilizer industry. Also metal processing like Lx-Sx-Ew plants and other applications especially when good corrosion and wear resistant material is needed.
<b>Carbon and low alloy cast steels</b>																		
Carbon steels	J0297	46	ASTM A216 Grade WCB		(1.0619)	max. 0.30	max. 0.50	max. 0.50	max. 0.20	max. 0.30		Mn 1.0 max. Si 0.6 max.	485-655	250	22	(160)		Ductile and strong weldable steel, used e.g. in pump support structures. Also used in hot water pumps.
<b>Cast irons</b>																		
Grey cast irons	F0067	53 / F25	ASTM A48 Class No 35 B	EN-GJL- 250									241			(210)	AHLSTAR APP, ZPP, EMTECH, CAHR, EMW-R	Used in pump casings, casing covers and parts of bearings.
Ductile cast irons	F0047	5H	ASTM A395 Grade 60-40-18	EN-GJS- 400-18		min. 3.00						Si 2.50 max. P 0.08 max.	414	275	18	(150)	A, CPE	Used in casings and covers in various industries.
Wear and corrosion resistant cast irons	F0068	5B	ASTM A532 III A level 1		(5.5610)	2.0-3.3	23.0-30.0	max. 2.5	max. 3.0	max. 1.2		Si 1.5 max. Mn 2.0 max.				min. 600	AHLSTAR WPP, PLR	High-chromium white cast iron for wear resistant pumps. Corrosion resistant grade: well suited for wearing applications in alkaline and slightly acidic condition.
	F0207	EXR	ASTM A532 III A level 2		(5.5610)	2.0-3.3	23.0-30.0	max. 2.5	max. 3.0	max. 1.2		Si 1.5 max. Mn 2.0 max.				min. 650	EMW-M, PLR	High-chromium white cast iron for wear resistant pumps. Corrosion resistant grade: well suited for wearing applications in alkaline and slightly acidic condition. Erosion resistance increase with level 2.
	F0206	CB3	CB3			2.9-3.1	max. 0.10	max. 0.10			min. 0.6	Si 2.8-3.2 Mn 0.6-0.8	300			200-250	VAS	Acid-resistant cast iron used in high concentration sulfuric acid in production process (drying and absorption tower).
	F0204	CRM	30Cr/Mo		(1.4138)	0.9-1.1	29.0-31.0	max. 0.4	1.9-2.2			Si 2.0 max. Mn 1.0 max.				260-330	VAS, EMW-M, PLR	Corrosive WPA with solids in phosphate fertilizer industry and in high concentration sulfuric acid. Also metal processing like Lx-Sx-Ew plants and other applications especially when good corrosion and wear resistant material is needed.
F0205	FC1	38Cr/5Ni/2Mo/1Cu			1.5-1.8	36-39	4.5-5.5	2.0-2.5	1.0-1.5		Si 1.5 max. Mn 1.0 max.				min. 450	PLR, EMW-M	Corrosive WPA with solids in phosphate fertilizer industry. Also metal processing like Lx-Sx-Ew plants and other applications especially when good corrosion and wear resistant material is needed.	
<b>Cast titanium and nickel alloy</b>																		
Titanium	R0017	75	ASTM B367 C-3		3.7055								450	380	12	max. 235	AHLSTAR A, SX	Excellent corrosion resistance in many severe conditions, particularly ones containing chlorine, and in oxidizing conditions. Used in e.g. chlorine dioxide and hypochlorite containing solutions in the pulp and paper and chemical process industry.
Nickel alloys	N0103	4J	ASTM A494 Grade CW-6M	Hastelloy C		max. 0.07	17.0-20.0	balance	17.0-20.0			Fe max. 3.0%	495	275	25	min. 180	SX	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%.

<sup>(1)</sup> Hardness values in brackets are informative

<sup>(2)</sup> Trademark by Outokumpu Oyj

<sup>(3)</sup> PRE ≥ 40

<sup>(4)</sup> Chemical composition modified

# Pitting and crevice corrosion

Pitting and crevice corrosion that occur in metals are of particular interest in stainless steel.

Pitting in pumps refers to small, deep cavities that can form randomly on wetted surfaces. Crevice corrosion, as the name suggests, occurs in narrow crevices into which a solution can penetrate, but where it is not flushed away during the normal course of operation as happens in more open areas of the pump.

By calculating the sum of the most important alloys in a weighed form, it is possible to identify the susceptibility of specific alloys to pitting and crevice corrosion.

This calculated parameter is called the Pitting Resistance Equivalent (PRE), commonly expressed as  $PRE = Cr \% + 3.3 \times Mo \% + 16 \times N \%$ . The values in the graph above have been calculated using this formula, with the higher PRE number representing greater resistance to pitting and crevice corrosion.

Alloy	PRE
ASTM A743 CF-8	19
ASTM A743 CF-8M, A351 CF-3M	27
ASTM A890 3A	34
ASTM A890 1B	35
EN 10283 1.4584	35
ASTM A890 5A	41
Alloy 31	52
654SMO	56

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



**The Sulzer Flow Equipment division keeps your processes flowing. Wherever fluids are treated, pumped, or mixed, we deliver highly innovative and reliable solutions for the most demanding applications.**

The Flow Equipment division specializes in pumping solutions specifically engineered for the processes of our customers. We provide pumps, agitators, compressors, grinders, screens and filters developed through intensive research and development in fluid dynamics and advanced materials. We are a market leader in pumping solutions for water, oil and gas, power, chemicals and most industrial segments.

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