Fai Ftc

The Special Steel Foundries

A Brief History and Description of the Company

Established in 1977, FAI-FTC is a foundry for heat-resistant and stainless steel.
In its two plants, the company produces static castings and centrifugally cast tubes in accordance with clients projects and specifications.

Pontevico Site

Its key markets are the steel industry, heat treatment, petrochemical, and incinerators.
The quality of its products and a reactive service are the founding values of the company. Driven by the conviction that the Quality Management System is essential to continuous improvement, the company achieved its first certification of compliance with UNI EN ISO 9001 Standards as early as 1994.
Right from the beginning, FAI-FTC has been a member of the Steel Founders' Society of America and as such has always been updated on innovations and advanced research in the sector, in terms of both materials and production technologies.

Manerbio Site

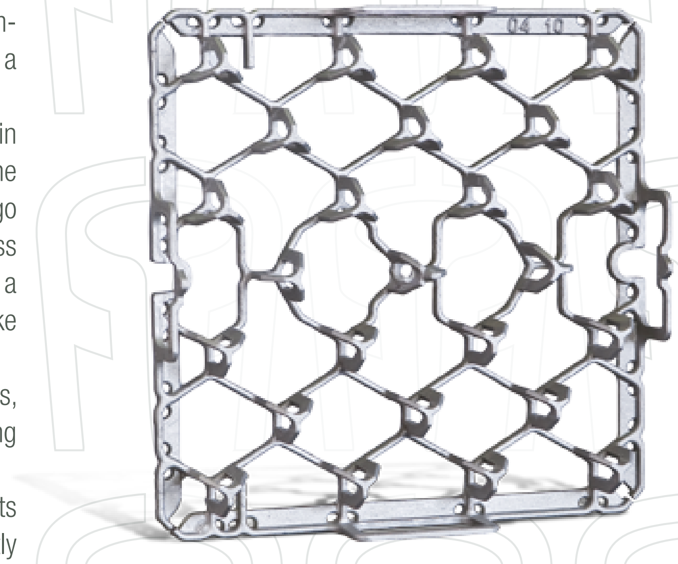
Why Choose a Casting

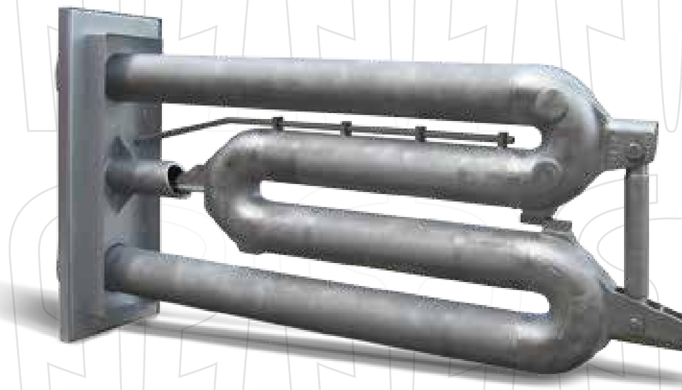
The most direct and effective way to produce steel items in complex shapes is by either static casting or centrifugal casting in a rotating mould.
Casting is the only possible option when items are to be made in special alloys with high physical and mechanical properties. The characteristics of these alloys do not allow the material to undergo processes such as rolling, forging, or drawing while the process of casting enables the production of items of complex design in a wide range of materials by simply varying the elements that make up the alloy.
Thanks to a greater flexibility in the foundry production process, users may even order only a few pieces at a time, thus reducing stock costs.
The quality of the castings is superior to that of welded products from rolled steel, as castings that have been designed correctly present fewer defects and last longer.
In particular, statistical data show that the difference between the cost of a rolled tube and that of a centrifugally cast tube increases in proportion to the tube diameter. So the bigger the dimensions of the tube, the cheaper it will be to purchase tubes using the centrifugal casting process.

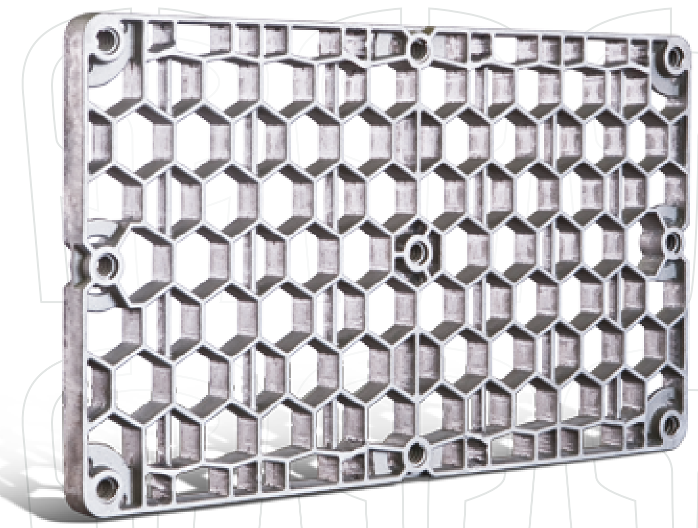
The advantages of casting over rolling or other processes

- Project flexibility: with this production technique, complex forms can be created
- Metallurgical versatility: the process allows the use of a large quantity of alloys with high mechanical properties
- Quality: greater uniformity of mechanical properties
- Lower Costs: increased product lifetime and smaller minimum production batches.

MEMBER
S.F.S.A.







How to Order Castings

The relation between customer and foundry is of the utmost importance, from the initial product engineering phase, throughout all the production steps and right up to the operation.
Close cooperation between technical departments in defining and designing the casting, as well as proper scheduling of lead times, guarantee satisfaction and excellent results to both the customer and the supplier.
To produce a casting with any moulding process, it is necessary to know in advance:

- the project (design, dimensional tolerances, machining parameters)
- the number of pieces
- the alloy
- required final testing
- supplementary requirements such as:
    - dye penetrant inspection or x-ray controls
    - acceptance criteria
- any other information that may contribute to the successful outcome of production and the use of the casting

All relevant details must be specified both on the request for quotation and on the purchase order.

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The Quality of the Castings

The quality of the casting defines its final cost: the higher the quality of the casting, the less its real cost.
The actual cost of the equipment does not coincide with its purchase price alone, but also depends on its lifetime and on set-up costs.

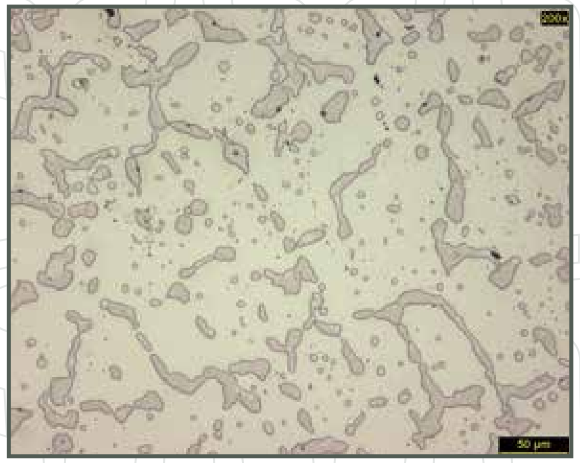
$$\text{Actual Cost}=\frac{\text{Cost of Purchase} + \text{Number of set-ups x Cost of set-ups}}{\text{duration}}$$

A good quality casting has a longer lifetime and therefore reduces the number of set-ups required to replace any worn-out part.
As a consequence, the quality control of the castings is an important phase of the production process. However, it is important not to require more controls than necessary, as these may also excessively affect the final price of the pieces.

In general, there are two quick, simple and inexpensive methods that enable us to verify the quality of the castings:

- visual and dimensional inspections: a fast and very economical method for timely detection of potential surface flaws such as porosity, cracks, inclusions, etc.
- Dye Penetrant Inspection: a simple and low-cost method for the detection of surface defects not visible to the naked eye.

X-ray control belongs to quite another category. It is very costly and should be used only for the production of prototypes.



The life of heat-resistant castings can be prolonged by following a few simple rules:

- handle the castings with care during unpacking, storage and assembly: heat-resistant alloys have low ductility at room temperature; any type of impact may damage the pieces;
- always clean the surface from contaminants (oils, grease, paints…) prior to introducing the equipments into the furnace: at high temperatures, such contaminants may make the atmosphere in the plant become corrosive;
- during operation, periodically check the surface of the casting, taking care to note any signs of initial defects and how long it takes before they appear. It is recommended to report immediately to the supplier, in order to understand the reason of anomalies and then take actions to delay or prevent further damage;
- inform your supplier immediately if you need to change the operating conditions of the furnace.

In general, the continuous exchange of information between the user and the foundry can contribute to product improvement, even under the most severe operating conditions.

Heat-resistant Steels

Heat-resistant cast steels are used in systems where the operating temperature exceeds 650°C (1200°F) and can endure temperatures of up to 1220°C (2228°F).

In order to identify the best alloy to meet production needs, these OPERATING CONDITIONS must be taken into consideration:

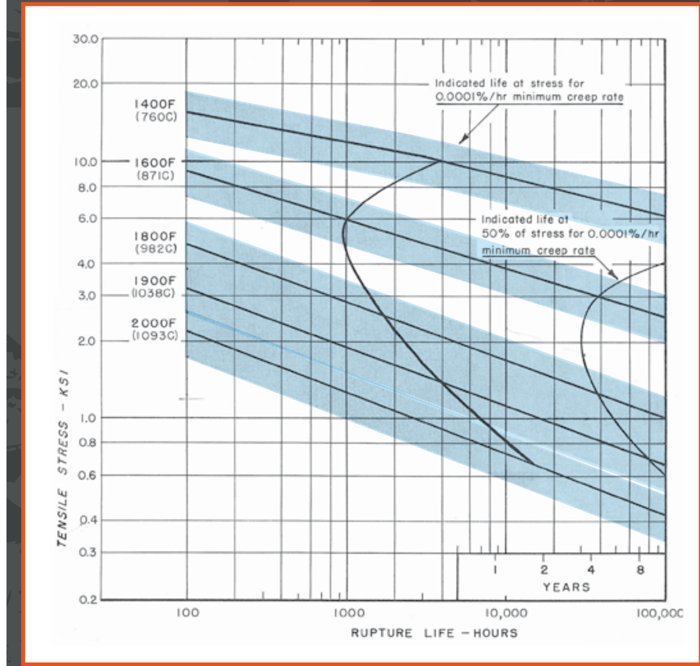
- normal operating temperature
- maximum and minimum furnace temperature
- maximum and minimum temperature close to the components
- periodicity of temperature cycles
- thermal expansion of the components
- applied load
- loading method, support and structural constraints
- minimum duration required (calculated through a trade-off analysis between cost and duration of the casting)
- acceptable degree of deformation
- operating atmosphere

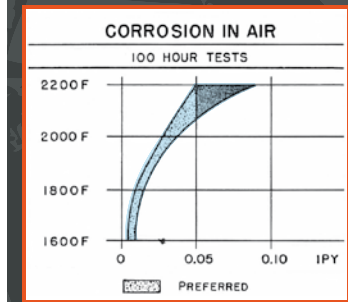
In keeping with these data, the engineer establishes the most suitable alloy capable of

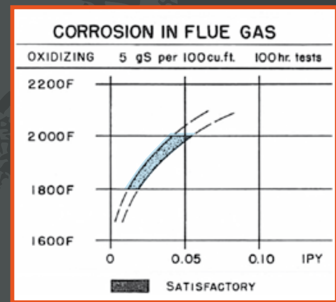
- resisting the temperatures and corrosive environment of the system
- having a deformation that is controlled and compatible with the structure limitations of system
- having a creep in conformity with the load on the piece
- having the necessary tensile strength

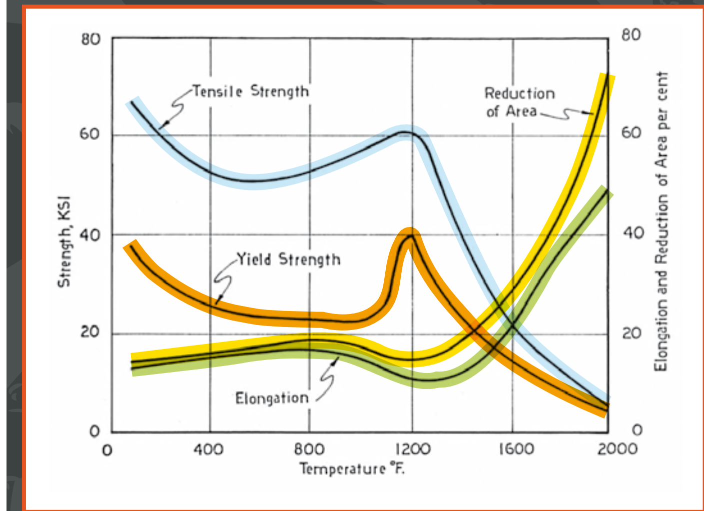
Several reports and researches offer plenty of technical data and case studies that engineers can use to decide which alloy is best for even the most complex operating conditions.
During this phase, it is essential that the client provide the supplier with as much information as possible.

Below are some tables to illustrate which are the key elements in choosing cast steels to be used in various sectors.









Ferritic Materials

Ferritic and Austenitic-Ferritic Types

Alloy		Composition											Heat Treatment		Tensile Test			Hardness	Specific Weight	Heat Capacity	Thermal Conductivity			
Designa-tion	Material-number	C [%]	Si [%]	Mn [%]	P max. [%]	S max. [%]	Cr [%]	Mo [%]	Ni [%]	Nb [%]	Co [%]	others	Symbol	Tempera-ture [°C]	$R_{p0,2}$ [MPa][a] min.	R_m [MPa][a] min.	A [%] min.	[HB] max.	[kg/ dm3]	[J/ (kg*K)] at	[W/(mK)] at			
															0,2% Yield Stress	Tensile Stress	Elonga-tion			20°C	20°C	100°C	800°C	1000°C
GX 30 CrSi 7[b]	1.4710	0,20 bis 0,35	1,00 - 2,50	0,50 - 1,00	0,035	0,030	6,00 - 8,00	max. 0,15	max. 0,50	-	-	-	+A[c]	800 - 850	-	-	-	300	7,7	460	24	-	-	-
GX 40 CrSi 13	1.4729	0,30 bis 0,50	1,00 - 2,50	max. 1,00	0,040	0,030	12,00 - 14,00	max. 0,50	max. 1,00	-	-	-	+A[c]	800 - 850	-	-	-	300	7,7	460	24	24,8	30	-
GX 40 CrSi 17	1.4740	0,30 bis 0,50	1,00 - 2,50	max. 1,00	0,040	0,030	16,00 - 19,00	max. 0,50	max. 1,00	-	-	-	+A[c]	800 - 850	-	-	-	300	7,7	460	-	20	-	-
GX 40 CrSi 24	1.4745	0,30 bis 0,50	1,00 - 2,50	max. 1,00	0,040	0,030	23,00 - 26,00	max. 0,50	max. 1,00	-	-	-	no heat treatment		-	-	-	d	7,6	500	18,8	-	-	-
GX 40 CrSi 28	1.4776	0,30 bis 0,50	1,00 - 2,50	max. 1,00	0,040	0,030	27,00 - 30,00	max. 0,50	max. 1,00	-	-	-			-	-	-	d	7,6	500	18,8	21	-	-
GX 130 CrSi 29	1.4777	1,20 bis 1,40	1,00 - 2,50	0,50 bis 1,00	0,035	0,030	27,00 - 30,00	max. 0,50	max. 1,00	-	-	-			-	-	-	d	7,6	500	18,8	-	-	-
GX 160 CrSi 18	1.4743	1,40 bis 1,80	1,00 - 2,50	max. 1,00	0,040	0,030	17,00 - 19,00	max. 0,50	max. 1,00	-	-	-			-	-	-	d	7,7	500	18,8	-	-	-
GX 40 CrNiSi 27-4	1.4823	0,30 bis 0,50	1,00 - 2,50	max. 1,50	0,040	0,030	25,00 - 28,00	max. 0,50	3,00 - 6,00	-	-	-			250	550	3	d	7,6	500	16,7	21	35	39,6

Alloy	Average Thermal Expansion			Long term Characteristics																			Max. Temperature in Air
				Tempe-rature	600°C			700°C			800°C			900°C			1000°C			1100°C			
Designa-tion	[10⁻⁶*K⁻¹] between 20°C and			Ten-sion	σ_r^e		$\sigma_{1\%}^f$	σ_r^e		$\sigma_{1\%}^f$	σ_r^e		$\sigma_{1\%}^f$	σ_r^e		$\sigma_{1\%}^f$	σ_r^e		$\sigma_{1\%}^f$	σ_r^e		$\sigma_{1\%}^f$	[°C]
	400°C	800°C	1000°C	Time [h]	100	1000	10000	100	1000	10000	100	1000	10000	100	1000	10000	100	1000	10000	100	1000	10000	
GX 30 CrSi 7[b]	12,5	13,5	-		-	-	19	-	-	8	-	-	2,5	-	-	-	-	-	-	-	-	-	750
GX 40 CrSi 13	12,5	13,5	-		120	75	22	28	21	9	10	7	3,5	-	-	1	-	-	-	-	-	-	850
GX 40 CrSi 17	12,5	13,5	-		-	-	22	-	-	9	-	-	3,5	-	-	1	-	-	-	-	-	-	900
GX 40 CrSi 24	12,5	14	16		-	-	22	-	-	9	-	-	3,5	-	-	1	-	-	-	-	-	-	1050
GX 40 CrSi 28	11,5	14	16		-	40	26	25	21	11	-	-	5	8	6,5	1,5	-	-	-	-	-	-	1150
GX 130 CrSi 29	11,5	14	16			-	26	-	-	11	12	11	5	7	5	1,5	-	-	-	-	-	-	1100
GX 160 CrSi 18	12,5	13,5	-			-	25	-	-	10	-	-	4	-	-	1,5	-	-	-	-	-	-	900
GX 40 CrNiSi 27-4	13	14,5	16,6		100	80	28	45	-	15	25	-	8	15	5	4	-	-	1	-	-	-	1100

(a) 1 MPa = 1 N/mm²

(b) This type can also be used for wear resistant castings; in this case it can be supplied without heat treatment

(c) +A indicates “annealing”

(d) The castings can also be supplied in annealed condition; in this case a max. value for the hardness can be agreed in advance

(e) σ_r - means tension in MPa for fracture after 100h and 1.000h

(f) $\sigma_{1\%}$ - means tension in MPa for 1% elongation after 10.000h

Austenitic Materials

Austenitic Types – Alloy, Composition, Heat Treatment, Tensile Test, Hardness, Specific Weight, Heat Capacity, Thermal Conductivity, Average Thermal Expansion, Max. Temperature in Air

Alloy: Designation	Alloy: Material number	C [%]	Si [%]	Mn [%]	P max. [%]	S max. [%]	Cr [%]	Mo [%]	Ni [%]	Nb [%]	Co [%]	others	Heat Treatment: Symbol / Temperatur [°C]	Tensile Test: $R_{p0,2}$ [MPa][a] min. (0,2% Yield Stress)	Tensile Test: R_m [MPa][a] min. (Tensile Stress)	Tensile Test: A [%] min. (Elongation)	Hardness [HB] max.	Specific Weight [kg/dm3]	Heat Capacity [J/(kg*K)] at 20°C	Thermal Conductivity [W/(m*K)] at 20°C	Thermal Conductivity 100°C	Thermal Conductivity 800°C	Thermal Conductivity 1000°C	Average Thermal Expansion [10^{-6}*K^{-1}] between 20°C and 400°C	800°C	1000°C	Max. Temperature in Air [°C]
GX 25 CrNiSi 18-9	1.4825	0,15 bis 0,35	0,50 - 2,50	max. 2,00	0,040	0,030	17,00 - 19,00	max. 0,50	8,00 - 10,00	-	-	-	no heat treatment	230	450	15	-	7,8	500	14,8	15,5	26	30	17,4	18,3	18,8	900
GX 40 CrNiSi 22-10	1.4826	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	21,00 - 23,00	max. 0,50	9,00 - 11,00	-	-	-		230	450	8	-	7,8	500	14	15	25,4	28,8	17,2	18,3	18,8	950
GX 25 CrNiSi 20-14	1.4832	0,15 bis 0,35	0,50 - 2,50	max. 2,00	0,040	0,030	19,00 - 21,00	max. 0,50	13,00 - 15,00	-	-	-		230	450	10	-	7,8	500	14	15	25,4	28,8	17,2	18,3	19,3	950
GX 40 CrNiSi 25-12	1.4837	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	24,00 - 27,00	max. 0,50	11,00 - 14,00	-	-	-		220	450	6	-	7,8	500	14	15	25,4	28,8	17,5	18,4	19,3	1050
GX 40 CrNiSi 25-20	1.4848	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	24,00 - 27,00	max. 0,50	19,00 - 22,00	-	-	-		220	450	8	-	7,8	500	14,6	16,7	25	28	17	18	19	1100
GX 40 CrNiSiNb 24-24	1.4855	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	23,00 - 25,00	max. 0,50	23,00 - 25,00	0,80 - 1,80	-	-		220	450	4	-	8,0	500	14	15,5	24,5	27,7	16,8	18	18,5	1050
GX 35 NiCrSi 25-21	1.4805	0,20 bis 0,50	1,00 - 2,00	max. 2,00	0,040	0,030	19,00 - 23,00	max. 0,50	23,00 - 27,00	-	-	-		220	430	8	-	8,0	500	-	14	23,8	27,7	16,4	17,5	18,2	1000
GX 40 NiCrSi 35-17	1.4806	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	16,00 - 18,00	max. 0,50	34,00 - 36,00	-	-	-		220	420	6	-	8,0	500	12	12,3	23	26,8	15,3	17	17,6	1000
GX 40 NiCrSiNb 35-18	1.4807	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	17,00 - 20,00	max. 0,50	34,00 - 36,00	1,00 - 1,80	-	-		220	420	4	-	8,0	500	12	12,3	23	26,8	15,3	17	17,6	1000
GX 40 NiCrSi 38-19	1.4865	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	18,00 - 21,00	max. 0,50	36,00 - 39,00	-	-	-		220	420	6	-	8,0	500	12	12,2	23,3	26,5	15,3	17	17,6	1020
GX 40 NiCrSiNb 38-19	1.4849	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	17,00 - 20,00	max. 0,50	36,00 - 39,00	1,00 - 1,80	-	-		220	420	4	-	8,0	500	12	12,3	23,3	26,5	15,3	17	17,6	1020
GX 10 NiCrSiNb 32-20	1.4859	0,05 bis 0,15	0,50 - 1,50	max. 2,00	0,040	0,030	19,00 - 21,00	max. 0,50	31,00 - 33,00	0,50 - 1,50	-	-		180	440	20	-	8,0	500	12,8	13	25,1	-	17,6	18,7	19,5	1050
GX 40 NiCrSi 35-26	1.4857	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	24,00 - 27,00	max. 0,50	33,00 - 36,00	-	-	-		220	440	6	-	8,0	500	12,8	13	23,8	27,7	15,7	17,4	18,3	1100
GX 40 NiCrSiNb 35-26	1.4852	0,30 bis 0,50	1,00 - 2,50	max. 2,00	0,040	0,030	24,00 - 27,00	max. 0,50	33,00 - 36,00	0,80 - 1,80	-	-		220	440	4	-	8,0	500	12,8	13	23,5	27,7	16	17,8	18,6	1100
GX 50 NiCrCo 20-20-20	1.4874	0,35 bis 0,65	max. 1,00	max. 2,00	0,040	0,030	19,00 - 22,00	2,50 - 3,00	18,00 - 22,00	0,75 - 1,25	18,50 - 22,00	W: 2,00 - 3,00		320	420	6	-	8,0	460	-	13,8	25	-	15,2	16,5	17	1150
GX 50 NiCrCoW 35-25-15-5	1.4869	0,45 bis 0,55	1,00 - 2,00	max. 1,00	0,040	0,030	24,00 - 26,00	-	33,00 - 37,00	-	14,00 - 16,00	W: 4,00 - 6,00		270	480	5	-	8,2	500	10	12,6	-	28	-	-	17,3	1200
GX 40 NiCrNb 45-35[b]	1.4889[b]	0,35 bis 0,45	1,50 - 2,00	1,00 - 1,50	0,040	0,030	32,50 - 37,50	-	42,00 - 46,00	1,50 - 2,00	-	-		240	440	3	-	8,0	500	-	11,3	30,6	36,1	14,3	15,3	15,7	1160

Long term Characteristics (Temperature / Tension / Time [h])

Designation	600°C σ_r[e] 100	600°C σ_r[e] 1000	600°C $\sigma_{1\%}$[f] 10000	700°C σ_r[e] 100	700°C σ_r[e] 1000	700°C $\sigma_{1\%}$[f] 10000	800°C σ_r[e] 100	800°C σ_r[e] 1000	800°C $\sigma_{1\%}$[f] 10000	900°C σ_r[e] 100	900°C σ_r[e] 1000	900°C $\sigma_{1\%}$[f] 10000	1000°C σ_r[e] 100	1000°C σ_r[e] 1000	1000°C $\sigma_{1\%}$[f] 10000	1100°C σ_r[e] 100	1100°C σ_r[e] 1000	1100°C $\sigma_{1\%}$[f] 10000
GX 25 CrNiSi 18-9	-	220	78	120	90	44	60	50	22	40	30	9	-	-	-	-	-	-
GX 40 CrNiSi 22-10	-	-	82	-	-	46	-	-	23	-	-	10	-	-	-	-	-	-
GX 25 CrNiSi 20-14	-	-	82	-	-	46	-	-	23	-	-	10	-	-	-	-	-	-
GX 40 CrNiSi 25-12	-	-	-	100	80	50	70	40	26	45	25	13	26	15	6	-	-	-
GX 40 CrNiSi 25-20	-	-	-	100	80	65	75	50	36	47	28	17	28	16	7	12	6	2,5
GX 40 CrNiSiNb 24-24	-	-	-	170	125	80	97	70	46	60	45	22	32	23	7,5	-	10	-
GX 35 NiCrSi 25-21	-	-	-	-	-	80	-	70	45	-	45	22	-	23	7,5	-	10	-
GX 40 NiCrSi 35-17	-	-	-	-	80	55	90	50	30	48	30	17	28	17	6	-	6	3
GX 40 NiCrSiNb 35-18	-	-	-	180	140	-	110	70	-	60	35	-	35	20	-	18	10	-
GX 40 NiCrSi 38-19	-	-	-	-	80	55	90	50	32	48	30	18	28	17	7	-	6	3
GX 40 NiCrSiNb 38-19	-	-	-	-	93	60	93	-	38	49	36	20	-	-	8	-	-	-
GX 10 NiCrSiNb 32-20	-	-	-	135	105	64	84	60	36	49	36	15,5	26	14	5	-	-	-
GX 40 NiCrSi 35-26	-	-	-	-	-	70	-	-	40	-	-	20	-	-	8	-	-	-
GX 40 NiCrSiNb 35-26	-	-	-	155	120	72	90	70	41	49	38	22	30	20	9	15	8,3	3
GX 50 NiCrCo 20-20-20	-	-	-	-	-	-	135	100	-	80	60	27	-	32	17	-	-	-
GX 50 NiCrCoW 35-25-15-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	6
GX 40 NiCrNb 45-35[b]	-	-	-	-	-	-	-	-	-	50	35	-	25	20	8	13	9	-

(a) 1 MPa = 1 N/mm²

(b) At working temperatures below 1000°C, it can be advisable to limit the percentage by mass ofCr to 29,00%-32,00% and of Si to 1,00%-1,50%, because unfavourable conditions can cause embrittlement

(e) σ_r - mean tension in MPa for fracture after 100h and 1.000h

(f) $\sigma_{1\%}$ - mean tension in MPa for 1% elongation after 10.000h

Fai Ftc

Corrosion-resistant Materials

Type	Alloy: Designation	Material-number	C max [%]	Si max [%]	Mn max [%]	P max [%]	S max [%]	Cr [%]	Mo [%]	Ni [%]	N [%]	Cu [%]	Nb[1] [%]	W [%] max.
Martensitic Types	GX 12 Cr 12	1.4011	0,15	1,0	1,0	0,035	0,025	11,5-13,5	max. 0,5	max. 1,0	-	-	-	-
Martensitic Types	GX 7 CrNiMo 12-1	1.4008	0,1	1,0	1,0	0,035	0,025	12,0-13,5	0,20-0,50	1,00-2,00	-	-	-	-
Martensitic Types	GX 4 CrNi 13-4	1.4317	0,06	1,0	1,0	0,035	0,025	12,0-13,5	max. 0,7	3,50-5,00	-	-	-	-
Martensitic Types	GX 4 CrNiMo 16-5-1	1.4405	0,06	0,8	1,0	0,035	0,025	15,0-17,0	0,70-1,50	4,00-6,00	-	-	-	-
Martensitic Types	GX 4 CrNiMo 16-5-2	1.4411	0,06	0,8	1,0	0,035	0,025	15,0-17,0	1,50-2,00	4,00-6,00	-	-	-	-
Martensitic Types	GX 5 CrNiCu 16-4	1.4525	0,07	0,8	1,0	0,035	0,025	15,0-17,0	max. 0,8	3,50-5,50	max. 0,05	2,50-4,00	max. 0,35	-
Austenitic Types	GX 2 CrNi 19-11	1.4309	0,03	1,5	2	0,035	0,025	18,0-20,0	-	9,00-12,00	max. 0,20	-	-	-
Austenitic Types	GX 5 CrNi 19-10	1.4308	0,07	1,5	1,5	0,040	0,030	18,0-20,0	-	8,00-11,00	-	-	-	-
Austenitic Types	GX 5 CrNiNb 19-11	1.4552	0,07	1,5	1,5	0,040	0,030	18,0-20,0	-	9,00-12,00	-	-	8*%C ≤1,0	-
Austenitic Types	GX 2 CrNiMo 19-11-2	1.4409	0,03	1,5	2	0,035	0,025	18,0-20,0	2,00-2,50	9,00-12,00	max. 0,20	-	-	-
Austenitic Types	GX 5 CrNiMo 19-11-2	1.4408	0,07	1,5	1,5	0,040	0,030	18,0-20,0	2,00-2,50	9,00-12,00	-	-	-	-
Austenitic Types	GX 5 CrNiMoNb 19-11-2	1.4581	0,07	1,5	1,5	0,040	0,030	18,0-20,0	2,00-2,50	9,00-12,00	-	-	8*%C ≤1,0	-
Austenitic Types	GX 5 CrNiMo 19-11-3	1.4412	0,07	1,5	1,5	0,040	0,030	18,0-20,0	3,00-3,50	10,00-13,00	-	-	-	-
Austenitic Types	GX 2 CrNiMoN 17-13-4	1.4446	0,03	1,0	1,5	0,040	0,030	16,5-18,5	4,00-4,50	12,50-14,50	0,12-0,22	-	-	-
Fully Austenitic Types	GX 2 NiCrMo 28-20-2	1.4458	0,03	1,0	2	0,035	0,025	19,0-22,0	2,00-2,50	26,00-30,00	max. 0,20	max. 2,00	-	-
Fully Austenitic Types	GX 4 NiCrCuMo 30-20-4	1.4527	0,06	1,5	1,5	0,040	0,030	19,0-22,0	2,00-3,00	27,50-30,50	-	3,00-4,00	-	-
Fully Austenitic Types	GX 2 NiCrMoCu 25-20-5	1.4584	0,025	1,0	2	0,035	0,020	19,0-21,0	4,00-5,00	24,00-26,00	max. 0,20	1,00-3,00	-	-
Fully Austenitic Types	GX 2 NiCrMoN 25-20-5	1.4416	0,03	1,0	1	0,035	0,020	19,0-21,0	4,50-5,50	24,00-26,00	0,12-0,20	-	-	-
Fully Austenitic Types	GX 2 NiCrMoCuN 29-25-5	1.4587	0,03	1,0	2	0,035	0,025	24,0-26,0	4,00-5,00	28,00-30,00	0,15-0,25	2,00-3,00	-	-
Fully Austenitic Types	GX 2 NiCrMoCuN 25-20-6	1.4588	0,025	1,0	2	0,035	0,020	19,0-21,0	6,00-7,00	24,00-26,00	0,10-0,25	0,50-1,50	-	-
Fully Austenitic Types	GX 2 CrNiMoCuN 20-18-6	1.4557	0,025	1,0	1,2	0,030	0,010	19,5-20,5	6,00-7,00	17,50-19,50	0,18-0,24	0,50-1,00	-	-
Austenitic-Ferritic Types	GX 6 CrNiN 26-7	1.4347	0,08	1,5	1,5	0,035	0,020	25,0-27,0	-	5,50-7,50	0,10-0,20	-	-	-
Austenitic-Ferritic Types	GX 2 CrNiMoN 22-5-3	1.4470	0,03	1,0	2	0,035	0,025	21,0-23,0	2,50-3,50	4,50-6,50	0,12-0,20	-	-	-
Austenitic-Ferritic Types	GX 2 CrNiMoN 25-6-3	1.4468	0,03	1,0	2	0,035	0,025	24,5-26,5	2,50-3,50	5,50-7,00	0,12-0,25	-	-	-
Austenitic-Ferritic Types	GX 2 CrNiMoCuN 25-6-3-3	1.4517	0,03	1,0	1,5	0,035	0,025	24,5-26,5	2,50-3,50	5,00-7,00	0,12-0,22	2,75-3,50	-	-
Austenitic-Ferritic Types	GX 2 CrNiMoN 25-7-3	1.4417	0,03	1,0	1,5	0,030	0,020	24,0-26,0	3,00-4,00	6,00-8,50	0,15-0,25	max.1,00	-	1,00
Austenitic-Ferritic Types	GX 2 CrNiMoN 26-7-4	1.4469	0,03	1,0	1	0,035	0,025	25,0-27,0	3,00-5,00	6,00-8,00	0,12-0,22	max.1,30	-	-

(1) The value of the Niob mass content is intended as the amount of Niob and Tantal

Mechanical Characteristics at Ambient Temperature

Designation	Thickness [mm] max.	Tensile Test: $R_{p0,2}$ [MPa][a] min. 0,2% Yield Stress	Tensile Test: $R_{p1,0}$ [MPa][a] min. 1% Yield Stress	Tensile Test: R_m [MPa][a] min. Tensile Stress	Tensile Test: A [%] min. Elongation	Impact Test: KV [J] min. Resilience	Heat Capacity [J/(kg*K)] at 20°C	Thermal Conductivity [W/(m*K)] at 50°C	Thermal Conductivity [W/(m*K)] at 100°C	Average Thermal Expansion [10^-6*K^-1] between 20°C and 100°C	Average Thermal Expansion 300°C	Average Thermal Expansion 500°C
GX 12 Cr 12	150	450		620	15	20	440	25	26	10,5	11,3	12
GX 7 CrNiMo 12-1	300	440		590	15	27	460	25	26	10,5	11,3	12
GX 4 CrNi 13-4	300	550[b]	-	760[b]	15[b]	50[b]	460	26	27	10,5	11	12
GX 4 CrNiMo 16-5-1	300	540		760	15	60	460	17	18	10,8	11,5	12
GX 4 CrNiMo 16-5-2	300	540		760	15	60	460	17	18	11	11,8	12,3
GX 5 CrNiCu 16-4	300	750[b]	-	900[b]	12[b]	20	460	17,5	18,5	11,8	12,8	13,4
GX 2 CrNi 19-11	150	185	210	440	30	80	530	15,2	16,5	16,8	17,9	18,6
GX 5 CrNi 19-10	150	175	200	440	30	60	530	15,2	16,5	16,8	17,9	18,6
GX 5 CrNiNb 19-11	150	175	200	440	25	40	530	15,2	16,5	16,8	17,9	18,6
GX 2 CrNiMo 19-11-2	150	195	220	440	30	80	530	14,5	15,8	15,8	17	17,7
GX 5 CrNiMo 19-11-2	150	185	210	440	30	60	530	14,5	15,8	15,8	17	17,7
GX 5 CrNiMoNb 19-11-2	150	185	210	440	25	40	530	14,5	15,8	15,8	17	17,7
GX 5 CrNiMo 19-11-3	150	205	230	440	30	60	530	14,5	15,8	15,8	17	17,7
GX 2 CrNiMoN 17-13-4	150	210	235	440	20	50	530	13,5	15	16	18	19
GX 2 NiCrMo 28-20-2	150	165	190	430	30	60	500	16	17	14,5	16,2	17
GX 4 NiCrCuMo 30-20-4	150	170	195	430	35	60	500	15	16	14,5	16,2	17
GX 2 NiCrMoCu 25-20-5	150	185	210	450	30	60	500	17	21	14,5	15,8	17
GX 2 NiCrMoN 25-20-5	150	185	210	450	30	60	450	12,2	13,2	15,1	15,8	16,6
GX 2 NiCrMoCuN 29-25-5	150	220	245	480	30	60	500	17	21	14,5	15,8	17
GX 2 NiCrMoCuN 25-20-6	50	210	235	480	30	60	500	15	16	16,5	17,5	18,5
GX 2 CrNiMoCuN 20-18-6	50	260	285	500	35	50	500	15	16	16,5	17,5	18,5
GX 6 CrNiN 26-7	150	420	-	590	20	30	500	15	-	12,5	13,5	14,5
GX 2 CrNiMoN 22-5-3	150	420	-	600	20	30	450	18	19	13	14	-
GX 2 CrNiMoN 25-6-3	150	480	-	650	22	50	450	17	18	13	14	-
GX 2 CrNiMoCuN 25-6-3-3	150	480	-	650	22	50	450	17	18	13	14	-
GX 2 CrNiMoN 25-7-3	150	480	-	650	22	50	450	17	18	13	14	-
GX 2 CrNiMoN 26-7-4	150	480	-	650	22	50	450	17	18	13	14	-

(a) 1 MPa = 1 N/mm²

(b) By variation of the heat treatment, different values can be obtained

Superalloys

Alloy			Composition										Heat Treatment		Tensile Test			Hardness	Specific Weight	Heat Capacity
	Designation	Material-number	C [%]	Si [%]	Mn [%]	P max. [%]	S max. [%]	Cr [%]	Mo [%]	Ni [%]	Nb [%]	Co [%]	others	Symbol	Temperatur [°C]	$R_{p0,2}$ [MPa] [a] min.	R_m [MPa] [a] min.	A [%] min.	[HB] max.	[kg/dm3]	[J/(kg*K)] at
																0,2% Yield Stress	Tensile Stress	Elonga-tion			20°C
Nickel and Cobalt Based Alloys	G-NiCr 28 W	2.4879	0,35 bis 0,55	1,00 - 2,00	max. 1,50	0,040	0,030	27,00 - 30,00	max. 0,50	47,00 - 50,00	-	-	Fe: balance W:4,00 - 6,00	No heat treatment		240	440	3	-	8,2	500
	G-CoCr28	2.4778	0,05 bis 0,25	0,50 - 1,50	max. 1,50	0,040	0,030	27,00 - 30,00	max. 0,50	max. 4,00	max. 0,50	48,00 - 52,00	Fe: balance			235	490	6	-	8,1	500
	G-NiCr 50 Nb	2.4680	max. 0,10	max. 1,00	max. 0,50	0,020	0,020	48,00 - 52,00	max. 0,50	Rest	1,00 - 1,80	-	Fe: max. 1,00 N: max. 0,16			230	540	8	-	8,0	450
	G-NiCr 15	2.4815	0,35 bis 0,65	1,00 - 2,50	max. 2,00	0,040	0,030	12,00 - 18,00	max. 1,00	58,00 - 66,00	-	-	Fe: balance			200	400	3	-	8,3	460

Designation	Thermal Conductivity				Average Thermal Expansion			Long term Characteristics																			Max. Temperature in Air
								temperatur	600°C			700°C			800°C			900°C			1000°C			1100°C			
	[W/(m*K)] at				[10^{-6}*K^{-1}] between 20°C at			Tension	σ_r [e]		$\sigma_{1\%}$ [f]	σ_r [e]		$\sigma_{1\%}$ [f]	σ_r [e]		$\sigma_{1\%}$ [f]	σ_r [e]		$\sigma_{1\%}$ [f]	σ_r [e]		$\sigma_{1\%}$ [f]	σ_r [e]		$\sigma_{1\%}$ [f]	[°C]
	20°C	100°C	800°C	1000°C	400°C	800°C	1000°C	Time [h]	100	1000	10000	100	1000	10000	100	1000	10000	100	1000	10000	100	1000	10000	100	1000	10000	
G-NiCr 28 W	11	11,3	30,6	36,1	14,4	15,7	16,3		-	-	-	-	-	70	-	80	41	-	45	22	-	23	10	-	10	4	1150
G-CoCr28	8,5	-	21	-	15	16	17		-	-	-	-	-	70	-	-	34	48	25	16	23	12	9,5	-	-	4	1200 [g]
G-NiCr 50 Nb	14,2	-	-	-	13	15	15		-	-	-	170	110	71	105	70	38	60	38	18	30	15	6,8	-	6	-	1050 [h]
G-NiCr 15	-	12,5	24	27,5	13,3	15,3	16,5		-	-	-	-	-	-	-	-	-	60	24	-	20	13	-	-	-	-	1100

(a) 1 MPa = 1 N/mm²

(e) σ_r - mean tension in MPa for fracture after 100h and 1.000h

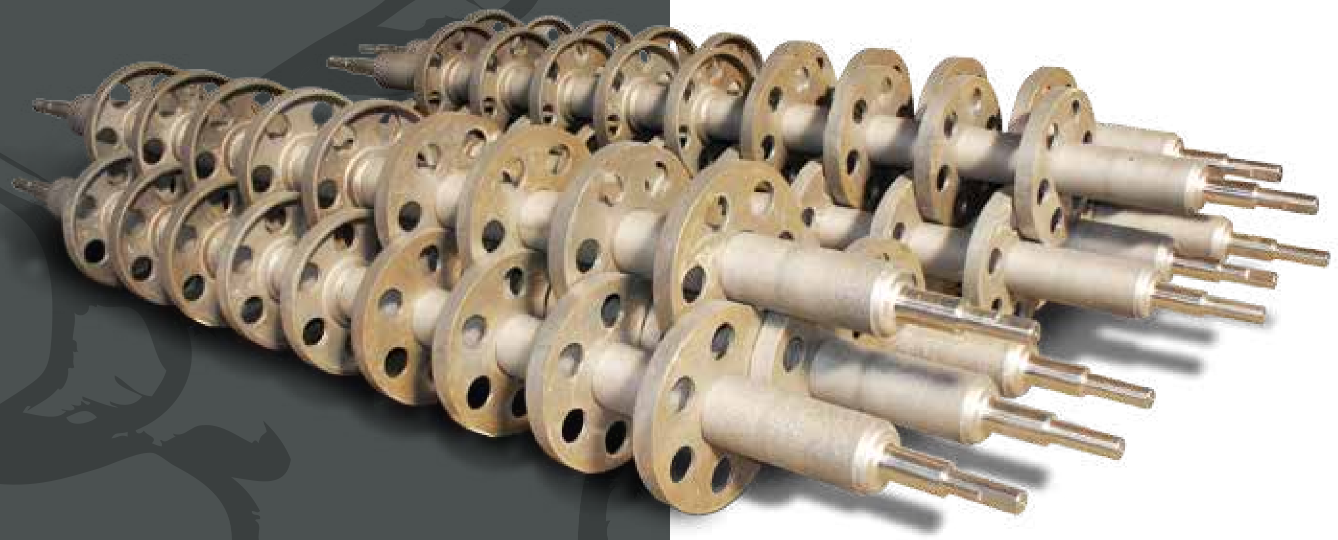
(f) $\sigma_{1\%}$ - mean tension in MPa for 1% elongation after 10.000h

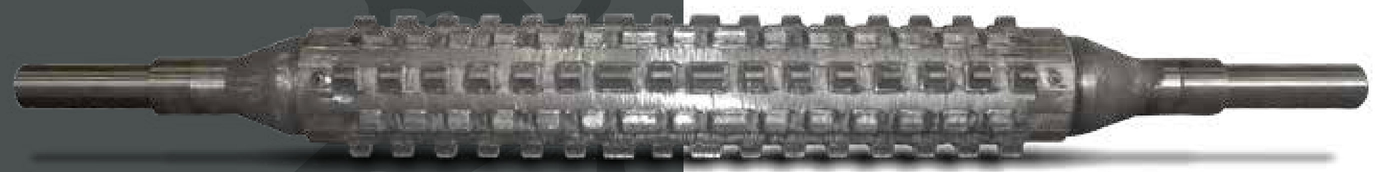
(g) max 1100°C in case of cyclic heating

(h) max 950°C in case of oil ash attack

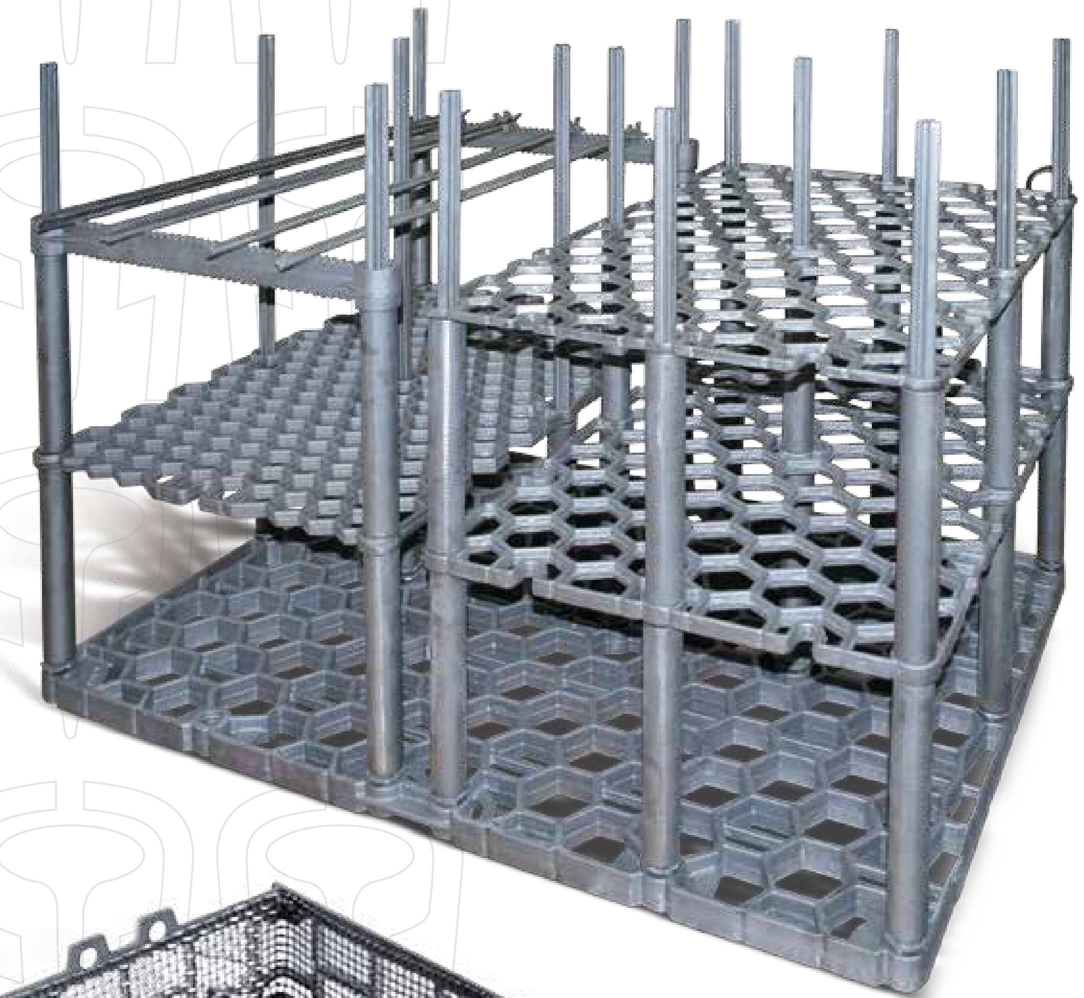
Fai Ftc

Some of our products





Fai Ftc



Our commitment

We believe in our work and accomplish it with fairness and enthusiasm, always following these principles:

- Maximum attention to safety in our facilities and to environmental protection.
- Constant training of personnel.
- Continuous improvement of product quality and service through:
    - investments in state-of-the-art equipment;
    - use of software for the calculation of complex parameters such as casting and feeding systems, stress on resilient sections, etc.;
    - collaboration with research laboratories.