Alleima

Sanmac® 4305

Hollow bar

Datasheet

Sanmac® 4305 is an austenitic chromium-nickel steel with extremely high machinability. For example, cutting speeds of up to twice those for Sanmac 304/304L can be used.

Standards

- ASTM: MT 303
- UNS: S30300
- EN Number: 1.4305

Product standards

- EN 10297-2, EN 10294-2
- ASTM A511

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr	Ni
≤0.035	0.4	1.8	≤0.040	0.2	17.5	9

Applications

Sanmac® 4305 is a good choice for components where high machinability is needed, but where corrosion resistance and high stresses are not a concern.

Corrosion resistance

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General corrosion

Sanmac® 4305 has good resistance to:

- Organic acids at moderate temperatures, with the exception of formic acid
- Sulphates, sulphides and sulphites
- Caustic solutions at moderate temperatures
- Oxidizing acids like nitric acid

Intergranular corrosion

Sanmac® 4305 has a low carbon content and therefore good resistance to intergranular corrosion.

Stress corrosion cracking

Austenitic steels are susceptible to stress corrosion cracking. This may occur at temperatures above about 60°C (140°F) if the steel is subjected to tensile stresses and at the same time comes into contact with certain solutions, particularly those containing chlorides. In applications demanding high resistance to stress corrosion cracking the austenitic-ferritic steels SAF 2304®, Alleima® 10RE51 or Sanmac® 2205 have higher resistance to stress corrosion cracking than 4305.

Pitting and crevice corrosion

The steel may be sensitive to pitting and crevice corrosion even in solutions of relatively low chloride content. Molybdenum-alloyed steels have better resistance and the resistance improves with increasing molybdenum content.

Forms of supply

Hollow bar- Finishes, dimensions and tolerances

Hollow bar in Sanmac® 4305 can be produced in various sizes in the solution annealed and white-pickled condition.

Dimensions are given as outside and inside diameters with guaranteed component sizes after machining, see catalogues.

Outside diameter tolerance is +2/-0%, but minimum +1/-0mm
Inside diameter tolerance is +0/-2%, but minimum +0/-1mm
Straightness +/-1.5mm/m
Better tolerances can be supplied on special order.

Other forms of supply
Bar
Steel with improved machinability, Sanmac, is also available in bar.

Heat treatment

Hollow bar is delivered in heat treated condition. If further heat treatment is needed after further processing the following is recommended:

Stress relieving
850–950°C (1560–1740°F), cooling in air.

Solution annealing
1000–1100°C (1830–2010°F), rapid cooling in air or water.

Mechanical properties

At 20°C (68°F)

Metric units

Proof strength		Tensile strength	Elong.		Hardness
$R_{p0.2}$[a]	$R_{p1.0}$[a]	R_m	A[b]	$A_{2"}$	HRB
MPa	MPa	MPa	%	%	
≥210	≥230	≥515	≥35	≥35	≤90

Imperial units

Proof strength		Tensile strength	Elong.		Hardness
$R_{p0.2}$[a]	$R_{p1.0}$[a]	R_m	A[b]	$A_{2"}$	HRB
ksi	ksi	ksi	%	%	
≥30	≥33	≥75	≥35	≥35	≤90

1 MPa = 1N/mm^2
a)$R_{p0.2}$ and $R_{p1.0}$ correspond to 0.2% offset and 1.0% offset yield strength, respectively.
b) Based on L_0 = 5.65 ÖS_0 where L_0 is the original gauge length and S_0 the original cross-section area.

Impact strength

Sanmac® 4305 possesses good impact strength both at room temperature and at low temperatures.

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Physical properties

Density: 7.9 g/cm^3, 0.29 lb/in^3

Thermal conductivity

Temperature, °C	W/m °C	Temperature, °F	Btu/ft h °F
20	15	68	8.5
100	16	200	9.5
200	18	400	19.5
300	20	600	12
400	22	800	13
500	23	1000	14
600	25	1200	15
700	26	1300	15

Specific heat capacity

Temperature, °C	J/kg °C	Temperature, °F	Btu/lb °F
20	475	68	0.11
100	500	200	0.12
200	530	400	0.13
300	560	600	0.13
400	580	800	0.14
500	600	1000	0.14
600	615	1200	0.15
700	625	1300	0.15

Thermal expansion, mean values in temperature ranges (x10^{-6})

Temperature, °C	Per °C	Temperature, °F	Per °F
30-100	16.5	86-200	9.5
30-200	17	86-400	9.5
30-300	17.5	86-600	10
30-400	18	86-800	10
30-500	18.5	86-1000	10

Datasheet last updated 2023-11-09 14:39:11 (supersedes all previous editions)

30-600	18.5	86-1200	10.5
30-700	19	86-1400	10.5

Modulus of elasticity

Temperature, °C	MPa	Temperature, °F	ksi
20	200	68	29.0
100	194	200	28.2
200	186	400	26.9
300	179	600	25.8
400	172	800	24.7
500	165	1000	23.5

Welding

Welding of Sanmac® 4305 should be carried out with filler material under carefully control due to Sulphur addition in the material. Suitable methods of fusion welding are manual metal-arc welding (MMA/SMAW) and gas-shielded arc welding, with the TIG/GTAW method as first choice.

For Sanmac® 4305, heat input of <1.0 kJ/mm and interpass temperature of <100°C (210°F) are recommended.

Recommended filler metals

TIG/GTAW or MIG/GMAW welding

ISO 14343 S 19 9 L / AWS A5.9 ER308L (e.g. Exaton 19.9.L)

ISO 14343 S 23 12 L / AWS A5.9 ER309L (e.g. Exaton 24.13.L)

ISO 14343 S 18 8 Mn / AWS A5.9 ER307 (e.g. Exaton 18.8.Mn)

MMA/SMAW welding

ISO 3581 E 19 9 L R / AWS A5.4 E308L-17(e.g. Exaton 19.9.LR)

ISO 3581 E 23 12 L R / AWS A5.4 E309L-17(e.g. Exaton 24.13.LR)

Machining

Sanmac is our trademark for the Alleima machinability concept. In SANMAC materials, machinability has been improved without jeopardising properties such as corrosion resistance and mechanical strength.

The improved machinability is owing to:

- optimised non-metallic inclusions

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- optimal chemical composition
- optimised process and production parameters

Detailed recommendations for the choice of tools and cutting data regarding turning, thread cutting, parting/grooving, drilling, milling and sawing are provided in the brochure S-02909-ENG.

The diagram shows the ranges within which data should be chosen in order to obtain a tool life of minimum 10 minutes when machining austenitic SANMAC materials (304/304L, 316/316L).

[bild]

The ranges are limited in the event of low feeds because of unacceptable chip breaking. In the case of high cutting speeds, plastic deformation is the most dominant cause of failure. When feed increases and the cutting speed falls, edge frittering (chipping) increases significantly. The diagram is applicable for short cutting times. For long, continuous cuts, the cutting speeds should be reduced somewhat.

The lowest recommended cutting speed is determined by the tendency of the material to stick to the insert (built-up-edge), although the integrity of insert clamping and the stability of the machine are also of great significance.

It is important to conclude which wear mechanism is active, in order to optimise cutting data with the aid of the diagram.

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