SANMAC 4571
BAR

DATASHEET

Sanmac 4571 is a titanium-stabilized, molybdenum-alloyed austenitic chromium-nickel steel with improved machinability.

STANDARDS

- ASTM: 316Ti
- UNS: S31635
- EN Number: 1.4571
- W.Nr.: 1.4571

Product standard

- EN 10088-3, EN 10088-5 (dimensions up to 250 mm)
- EN 10272, EN 10222-5, (dimensions ≥ 180 mm), AD-2000-W2
- ASTM A479, ASTM A276
- Chemical composition and mechanical properties acc. to ASTM A182

Approvals

- TÜV AD Merkblatt W0/TRD 100
- Pressure Equipment Directive (2014/68/EU)
- Pre-approval for PMA

Certificate

Status according to EN 10 204/3.1

CHEMICAL COMPOSITION (NOMINAL)

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr	Ni	Mo
0.03	0.4	1.8	≤0.045	≤0.030	17	11	2.1

Ti=>5xC

MECHANICAL PROPERTIES

Bar steel is tested in delivery condition.

At 20°C (68°F)

Metric units

Proof strength		Tensile strength	Elong.	Contr.	HB
$R_{p0.2}$[a)]	$R_{p1.0}$[a)]	R_m	A[b)]	Z	

MPa	MPa	MPa	%	%	
≥210	≥245	515-700	≥40	≥45	≤215

Imperial units

Proof strength		Tensile strength	Elong.	Contr.	HB
$R_{p0.2}$[a)]	$R_{p1.}$[a)]	R_m	A[b)]	Z	
ksi	ksi	ksi	%	%	
≥30.5	≥35.5	75-101.5	≥40	≥45	≤215

1 MPa = 1 N/mm2
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

Due to its austenitic microstructure, Sandvik SANMAC 4571 has very good impact strength both at room temperature and at cryogenic temperatures.
Tests have demonstrated that the steel fulfils the requirements (60 J (44 ft-lb) at -196 ◦C (-320◦F)) according to the European standards prEN13445-2(UFPV-2) and EN 10272.

At high temperatures

Metric units

Temperature	Proof strength		Tensile strength
°C	$R_{p.02}$	$R_{p1.0}$	R_m
	MPa	MPa	MPa
	min.	min.	min.
100	185	215	440
200	165	192	390
300	145	175	375
400	135	164	375
500	129	158	360

Imperial units

Temperature	Proof strength		Tensile strength
°F	$R_{p.02}$	$R_{p1.0}$	R_m
	ksi	ksi	ksi
	min.	min.	min.
200	26.8	31.2	63.8
400	23.9	27.8	56.6
600	21.0	25.4	54.4
800	19.6	23.8	54.4
1000	18.7	22.9	52.2

WELDING

The weldability of Sanmac 4571 is good. 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.

Since this material is alloyed in such a way to improve its machinability, the amount of surface oxides on the welded beads might be higher compared to that of the standard 316Ti steels.

This may lead to arc instability during TIG/GTAW welding, especially welding without filer material. However, the welding behavior of this material is the same as for standard 316Ti steels when welding with filler material.

For Sanmac 4571, heat input of <1.5 kJ/mm and interpass temperature of <100°C (210°F) are recommended. Preheating and post-weld heat treatment are normally not necessary.

Recommended filler metals

TIG/GTAW or MIG/GMAW welding

ISO 14343 S 19 12 3 Nb / AWS A5.9 ER318 (e.g. Exaton 19.12.3.Nb)

ISO 14343 S 19 12 3 L / AWS A5.9 ER316L (e.g. Exaton 19.12.3.L)

MMA/SMAW welding

ISO 3581 E 19 12 3 Nb R / AWS A5.4 E318-16

ISO 3581 E 19 12 3 L R / AWS A5.4 E316L-17(e.g. Exaton 19.12.3.LR)

MACHINING

SANMAC stands for Sandvik Machinability Concept. In SANMAC materials, machinability has been improved without jeopardizing properties such as corrosion resistance and mechanical strength.

The improved machinability is owing to:

- Optimized non-metallic inclusions
- Optimal chemical composition
- Optimized 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 SANMAC 4571.

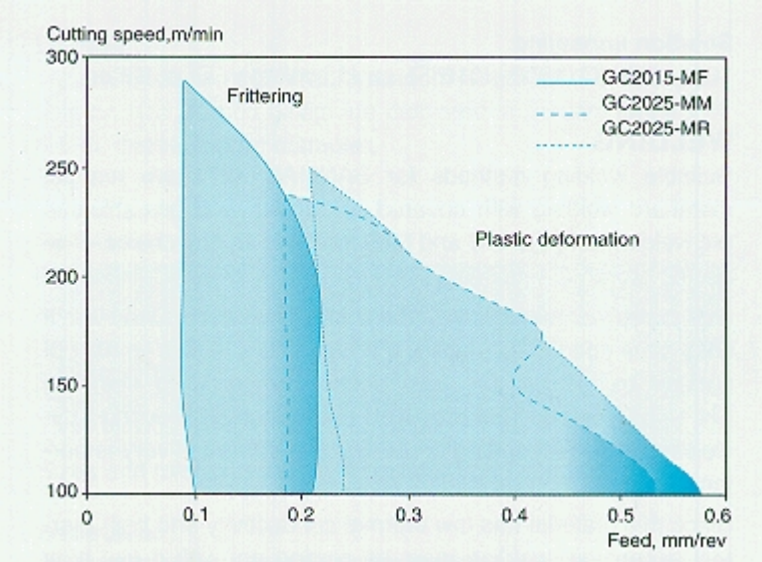

Figure 1. Machining chart Sandvik SANMAC 4571.

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 optimize cutting data with the aid of the diagram.

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Turning of Sandvik SANMAC 4571

Recommended insert and cutting data (starting values for a tool-life of 15 minutes)

Insert Geometry	Grade	Cutting data Feed	Cutting speed	Application
		mm/rev	m/min	
MF	GC2015	0.15	240	Finishing, copy turning
MM	GC2025	0.25	200	Medium machining
MR	GC2025	0.30	180	Medium-to-rough machining under less stable conditions

Drilling of Sandvik Sanmac

The recommended methods for drilling give the most cost effective results for the respective diameter ranges. When producing holes with diameters larger than 58 mm, short-hole drilling is used up to 58 mm, followed by

internal turning up to the desired diameter. Cutting data for internal turning should be chosen in accordance with the turning recommendations. The recommendations for drilling are applicable for a tool-life of 30 minutes.

Drilling with Sandvik Coromant Delta C drill, diameter 3 - 12.7 mm

Code R415.5. Grade GC1220
(diameter range 3 - 20 mm)

Cutting data, Feed*	Cutting speed	Application
mm/rev	m/min	
0.08-0.22	55	Finishing, copy turning

* The lower value should be selected for smaller diameters

Short hole drilling, diameter 12.7-58 mm

Coromant U-drill, R416.2

Insert Geometry	Grade*	Cutting data Feed	Cutting speed	Application
		mm/rev	m/min	
-53	Central insert GC1020	-	-	-
-53	Peripheral insert GC1020**	0.04-0.18	160	Less stable conditions
-53	Peripheral insert GC3040	0.04-0.18	200	Stable conditions

* Sandvik Coromant inserts
** GC1120 for diameters below 17.5 mm

Drilling with high speed steel (HSS) drills

(diameter 1-3 mm)

Cutting data,Feed*	Cutting speed**
mm/rev	m/min
0.03-0.09	10-15

* The lower feed value should be selected for smaller diameters
** The higher cutting speed should be selected for coated drills