TG Steels

TPM69

ULTRACLEAN

PM stainless steel for both good corrosion resistance and very high wear resistance

TPM69 UltraClean is a stainless steel obtained by powder metallurgy and it is used at a hardness of 59 - 61 HRC.

Applications

TPM69 UltraClean has both very high wear resistance, excellent corrosion resistance, excellent polishability *(suitable for transparent parts)* as well as correct machinability.

TPM69 UltraClean can be used for industrial knifes as used in food processing, and also all type of knifes and blades for demanding applications especially when a good corrosion resistance associated with extremely high wear resistance is required.

TPM69 UltraClean can be used for moulds for plastics reinforced with abrasive fillers, extrusion screws, moulds for food, medical and optical equipment.

TPM69 UltraClean is delivered in the annealed condition and in use it should be treated to a hardness of 59 - 61HRC.

TPM69 UltraClean is suitable for using in food contact and also in medical tools.

Main properties

- Very good corrosion resistance
- Excellent wear resistance
- Good dimensional stability
- Good polishability

Chemical composition *(typical)*

C	Mn	Si	P	S	Cr	Co	Mo	V
1.05	0.40	0.40	< 0.015	< 0.005	17.50	1.50	1.20	0.10

Designation

Werkstoff Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1.4528	X105CrCoMo18 2	-	-	-	-	-	-	-

Structure

The structure of the TPM69 UltraClean is fine and homogeneous without precipitation or alignments of carbides. Due to its elaboration by powder metallurgy with Hot Isostatic Compression the typical size of the carbides is about 2 μm and the level of cleanliness is far better than conventional cold work tool steels.

Hardness at the time of delivery

Annealed for 285 HB max.

Physical properties

Temperature	20°C	200°C	400°C
Volumic mass kg/m^3	7700	7650	7600
Young Modulus N/mm²	222000	209000	199000
Thermal conductivity W/m.K	15	17	20
Coefficient of linear expansion 10^{-6}/K	10.5	10.9	11.5

Heat treatment

SOFT ANNEALING

Temperature: 800 - 850°C, duration 1h + 1h for 25 mm thickness. slow cooling in the furnace *(10 to 20°C/h)*. The atmosphere in the furnace must be reducing to avoid decarburization of the steel.

STRESS RELIEVING

After machining, it is recommended to perform stress relieving at 650°C for a minimum of 2 hours, followed by slow cooling in the furnace to 450°C.

AUSTENITIZATION

In order to avoid any risk of cracking it is recommended to preheat in 2 steps.

- 1st preheating step:
  temperature: 600°C time: 30 s/mm of thickness
- 2nd preheating step:
  temperature: 850°C time: 30 s/mm of thickness

Recommended austenitizing temperature: 1030 - 1080°C. The holding time should not be too long to avoid a risk of grain coarsening and a loss of toughness. It is recommended to keep the room for 30 minutes at the austenitizing temperature, as soon as the core of the room has reached the austenitizing temperature.

QUENCHING MEDIUM

Oil at 80°C, vacuum *(pressure > 6 bars)*, salt bath 500 - 550°C.
To ensure good toughness, treatment with oil or salt bath is preferable.

TEMPERING

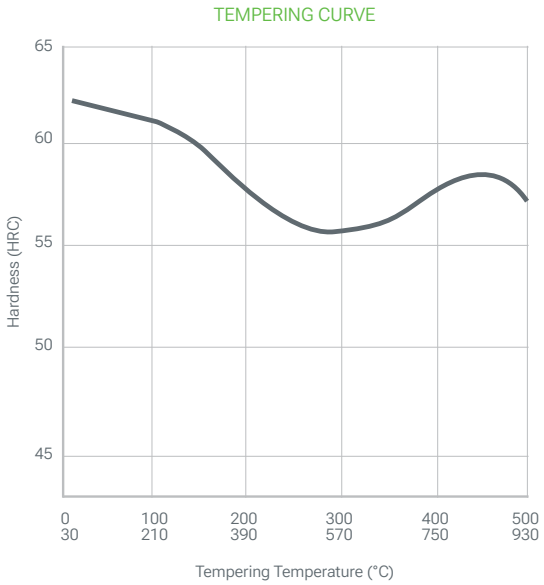
to ensure a minimum residual austenite rate as well as greater tool stability, it is essential to perform double tempering. Each tempering is followed by cooling under 80°C.

Each tempering time must be at least equal to 1h + 1h for 25 mm of thickness of the treated part *(equivalent thermal thickness).*

The recommended tempering temperature is in the range 100 to 250°C.

Tempering temperature and corrosion resistance:

In order to avoid a better corrosion resistance it is highly recommended to avoid tempering temperatures over 300°C since at these temperatures there is a precipitation of chromium carbides at the grain boundaries leading to an increase of the local corrosion at these locations.



Surface treatment

NITRIDING

TPM69 UltraClean is not suitable for nitriding since this is a stainless steel.

PVD, CVD

TPM69 UltraClean is suitable for all kind of PVD and CVD treatment as soon as the treatment temperature is 30°C lower than the last tempering temperature.

Polishing

TPM69 ULTRACLEAN is suitable for polishing in the heat treated condition and it can be used for applications requiring a mirror polished level *(Rt ≤ 0.25µm, CNOMO level 1, Rugotest N1)* as used for parts requiring a mirror polishing level.

Optimal polishing is achieved by performing consecutive steps with similar roughness and stopping each step as soon as the last scratch from the previous step disappears.

Machining

The machining parameters below are given for information only and must be adapted according to the equipment and usual machining conditions.

TURNING

	Carbide tool		HSS tool
	Rough machining	Finishing	Finishing
Cutting speed m/min	160 - 200	210 - 250	17 - 22
Feed mm/r	0.2 - 0.4	0.1 - 0.2	0.1 - 0.3
Depth of cut mm	2 - 4	0.5 - 2	0.5 - 2

MILLING: SURFACING

	Milling with carbide tools	
	Rough machining	Finishing
Cutting speed m/min	160 - 200	250 - 280
Feed mm/r	0.2 - 0.4	0.1 - 0.2
Depth of cut mm	2 - 4	0.5 - 2
Carbide designation ISO	P20 - P40 coated carbide	P10 - P20 coated carbide or cermet

END MILLING

	Milling with carbide tools		HSS milling tool
	Solid carbide	Carbide indexable insert	
Cutting speed m/ min	120 - 150	160 - 210	25 - 29
Feed mm/r	0.02 - 0.2	0.07 - 0.2	0.01 - 0.3
Carbide designation ISO	NA	P20 - P30	NA

DRILLING: HSS TWIST DRILL

Drill diameter mm	Cutting speed m/min	Feed mm/t
< 5	14 - 16	0.05 - 0.15
5 - 10	14 - 16	0.15 - 0.20
10 - 15	14 - 16	0.20 - 0.25
15 - 20	14 - 16	0.25 - 0.30

DRILLING: CARBIDE DRILL

	Carbide type		
	Indexable insert	Solid carbid	Carbide tip
Cutting speed m/ min	210 - 230	80 - 100	70 - 80
Feed mm/t	0.05 - 0.10	0.10 - 0.25	0.15 - 0.25

FINE GRINDING

General indications for grinding wheels to be used on TPM69 UltraClean in the heat treated condition. Usually, rather soft vitrified aluminum oxide grinding wheels *(grades G for plane grinding to K for cylindrical grinding)* are used. Particular attention will be paid to effective cooling of the surface during grinding to prevent degradation of the material surface.

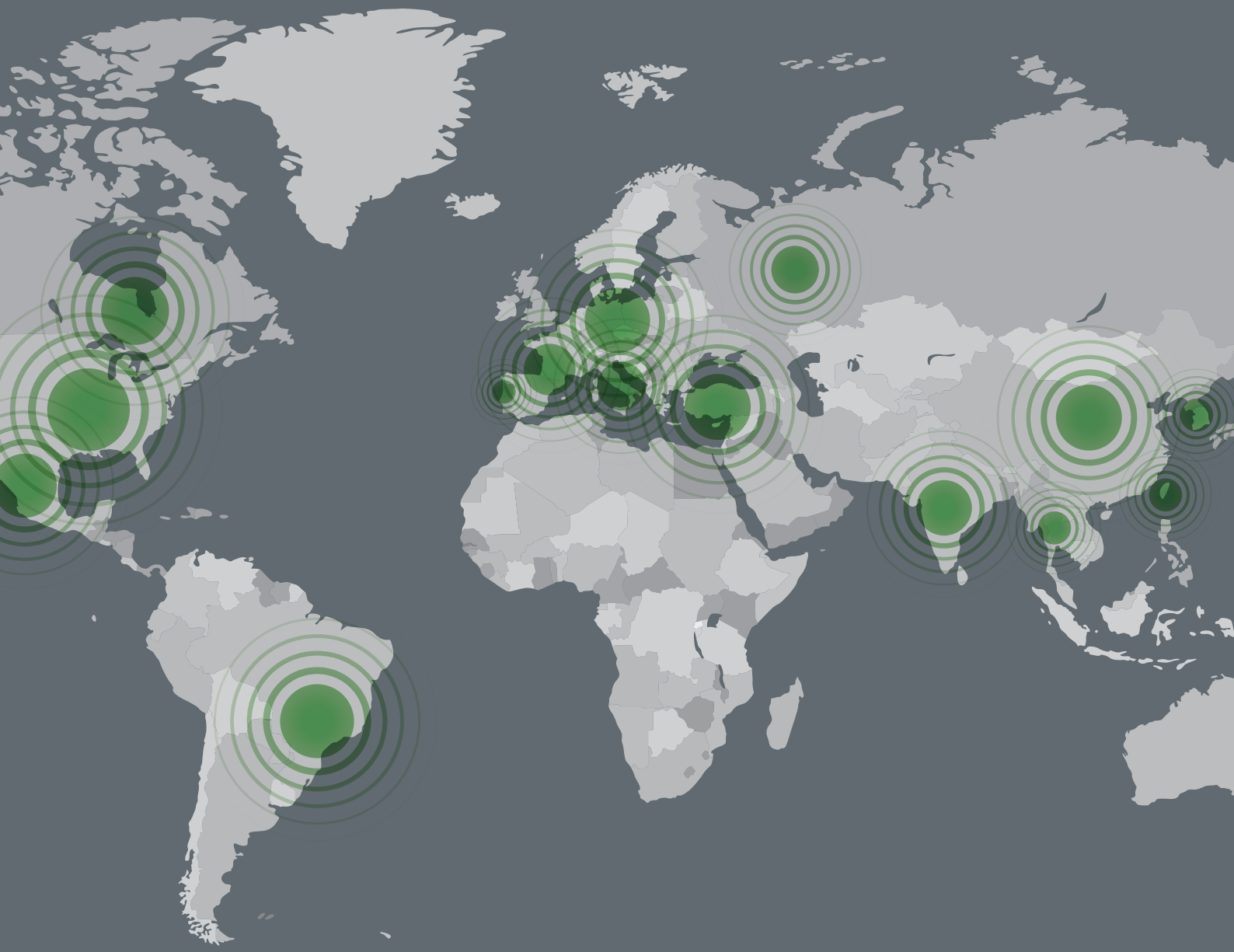
ELECTRO-DISCHARGE MACHINING

TPM69 UltraClean is also suitable for EDM machining *(wire or electrode).* Preferably, the machining will be carried out with a low current density and a high frequency in order to limit the thickness of the white layer as much as possible.

Then it is necessary to carry out a stress relieving at 25°C below the last tempering in order to reduce the level of residual stresses *(which could lead to a risk of cracking)* and to carry out polishing to completely remove the white layer formed during the discharge machining process.

Welding

TPM69 UltraClean is not weldable.
If this is mandatory to weld it, please consult us.



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