TG Steels

TPM39

ULTRACLEAN

Stainless PM steel for either good wear resistance AND excellent corrosion resistance associated with high fatigue resistance

TPM39 UltraClean is a 20%Cr alloyed tool steel is obtained by powder metallurgy. It is characterized by a very good wear resistance associated with an excellent corrosion resistance and a high hardness associated with a high fatigue resistance and an excellent polishability.

Applications

TPM39 UltraClean is used in high-performance bearings, medical devices, and high-end cutting tools. TPM39 UltraClean is particularly recommended for tools where a high hardness and wear resistance associated with an excellent corrosion resistance is required.

TPM39 UltraClean is particularly suitable for molds for high precision parts in aggressive *(corrosion and wear)* plastics as electronic chips. TPM39 UltraClean is also used for injection screws for highly aggressive polymers.

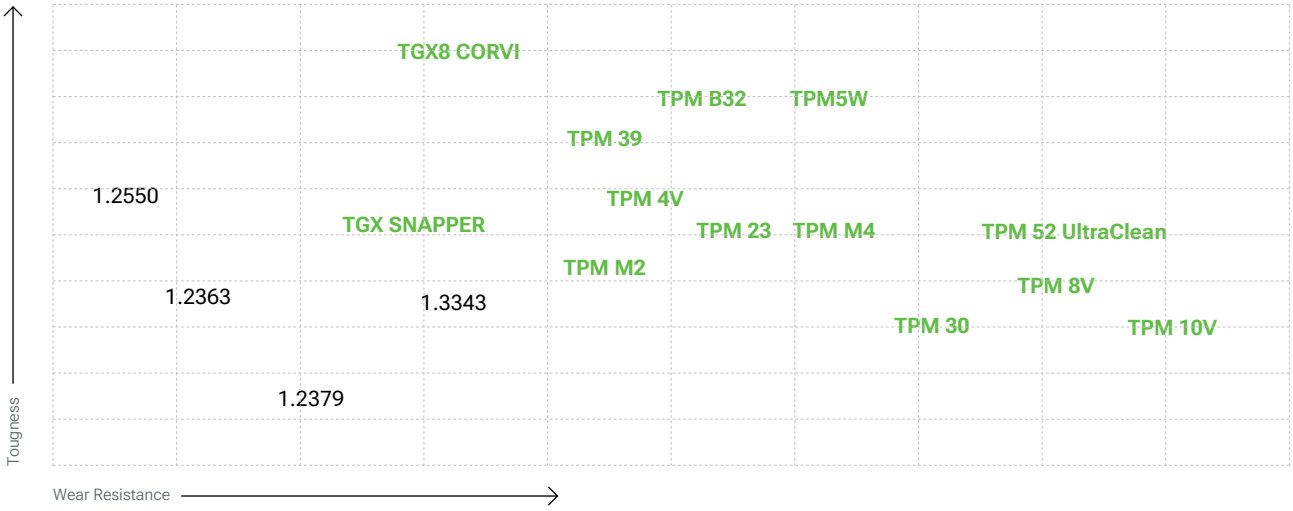
Main properties

- Excellent corrosion resistance
- Excellent polishability suitable for mirror polished parts
- Good wear resistance
- High hardness
- High fatigue resistance
- Very good toughness

Comparison with the other PM tool steels available at Atlas the position on the toughness vs wear resistance diagram is shown here under:

Designation

Werkstoff Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
-	X190CrVW20 4 1 1	-	-	-	-	-	-	-



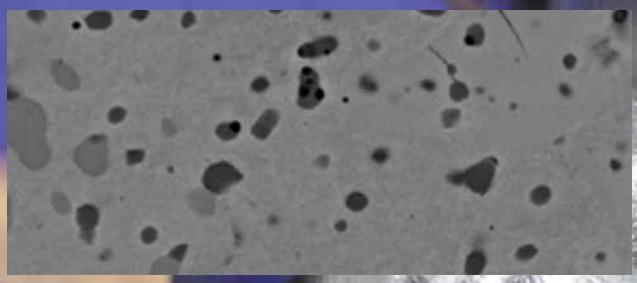
Chemical composition *(typical)*

C	Si	Mn	Cr	Mo	V	W
1.90	0.70	0.30	20.0	1.0	4.00	0.60

Structure

The structure of the TPM39 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 lower than 5 μm and the level of cleanliness is far better than conventional cold work tool steels.



SEM PICTURE OF THE STRUCTURE OF TPM39 UltraClean:
CR CARBIDES: LIGHT GREY AND V CARBIDES: DARK GREY

Hardness at the time of delivery

Annealed for 280 HB max.

Physical properties

Temperature	20°C	200	500
Volumic mass kg/m³	7610	7580	7460
Young Modulus N/mm²	213 700	205 000	198 000
Thermal conductivity W/m.K	13.9	15.2	17.6
Coefficient of linear expansion 10^{-6}/K	10.9	11.2	11.5

Heat treatment

SOFT ANNEALING

Soft annealing is not recommended.
Temperature: 750°C, duration 1h + 1h for 25 mm thickness. slow cooling in the oven (*10 to 20°C/h).*

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: 400°C time: 30 s/mm of thickness
- 2nd preheating step:
  temperature: 875°C time: 30 s/mm of thickness

Recommended austenitizing temperature:
1100 - 1160°C. For higher toughness the temperature range of 1100 to 1130°C is recommended and for higher wear resistance the temperature range of 1130 to 1160°C is recommended.

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 part at the austenitizing temperature 30 minutes per inch of thickness as soon as the temperature of the surface reach the austenitization 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.

SUB ZERO TREATMENT

For parts that need to have high dimensional stability and to increase wear resistance without reducing toughness, it is recommended to perform a subzero treatment at a temperature between -70°C and -120°C for 1 hour for 25 mm of thickness of the part.

The temperature range from -70°C up to -120°C *(named cold treatment of steel)* leads to the complete transformation of austenite into martensite and as a consequence to a better stability associated with an improved hardness and a better wear resistance.

This treatment is useful for improving the wear resistance and highly recommended for lowering the amount of residual austenite when austenitisation temperatures are higher than 1150°C *(it avoids the risk of cracking).*

TEMPERING

To ensure a minimum residual austenite rate as well as greater tool stability, it is essential to perform a double *(better triple)* tempering. Each tempering is followed by a cooling under 100°C.

For optimal corrosion resistance it is recommended to perform the tempering in the temperature range of 200 to 300°C.

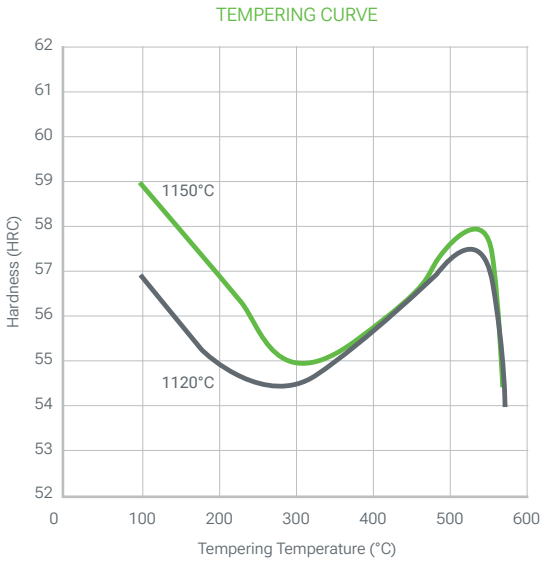
For optimal wear resistance it is recommended to perform the tempering in the temperature range of 510 to 550°C after a subzero treatment. After the sub zero treatment the hardness is 1 to 2 HRC higher than without it.

Depending on the use of the final part the following tempering temperatures are recommended:

Austenitizing temperature	Tempering temperature	Hardness	Properties
1120°C *	250°C	54.5 HRC	Optimized hardness and corrosion resistance
1150°C*	525°C	59.5 HRC	For tools working at high temperature with high hardness and moderate corrosion resisitance

**: subzero treatment is recommended to lower the retained austenite content.*

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



Surface treatment

NITRIDING

TPM39 UltraClean is a stainless steel and cannot be nitrided.

PVD, CVD

TPM39 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, but there is not much interest for it.

Polishing

TPM39 UltraClean is suitable for polishing in the heat treated condition and it can be used for applications requiring a mirror polished level *(Rt ≤ 0.25 µm, 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.

GRINDING IN ANNEALED CONDITIONS

	Carbide tool	
	Rough machining	Finishing
Cutting speed m/min	60 - 70	50 - 60
Feed mm/r	0.4 - 0.6	0.1 - 0.2
Depth of cut mm	2 - 4	0.3 - 0.5

TURNING IN ANNEALED CONDITIONS

	Carbide insert	Solid tool
	Rough machining	Finishing
Cutting speed m/min	60 - 70	50 - 90
Feed mm/r	0.15	0.10- 0.15
Depth of cut mm	2 - 3	0.1

DRILLING IN ANNEALED CONDITIONS CARBIDE DRILL

	Solid
Cutting speed m/min	40
Feed mm/r	0.15

HSS TWIST DRILL

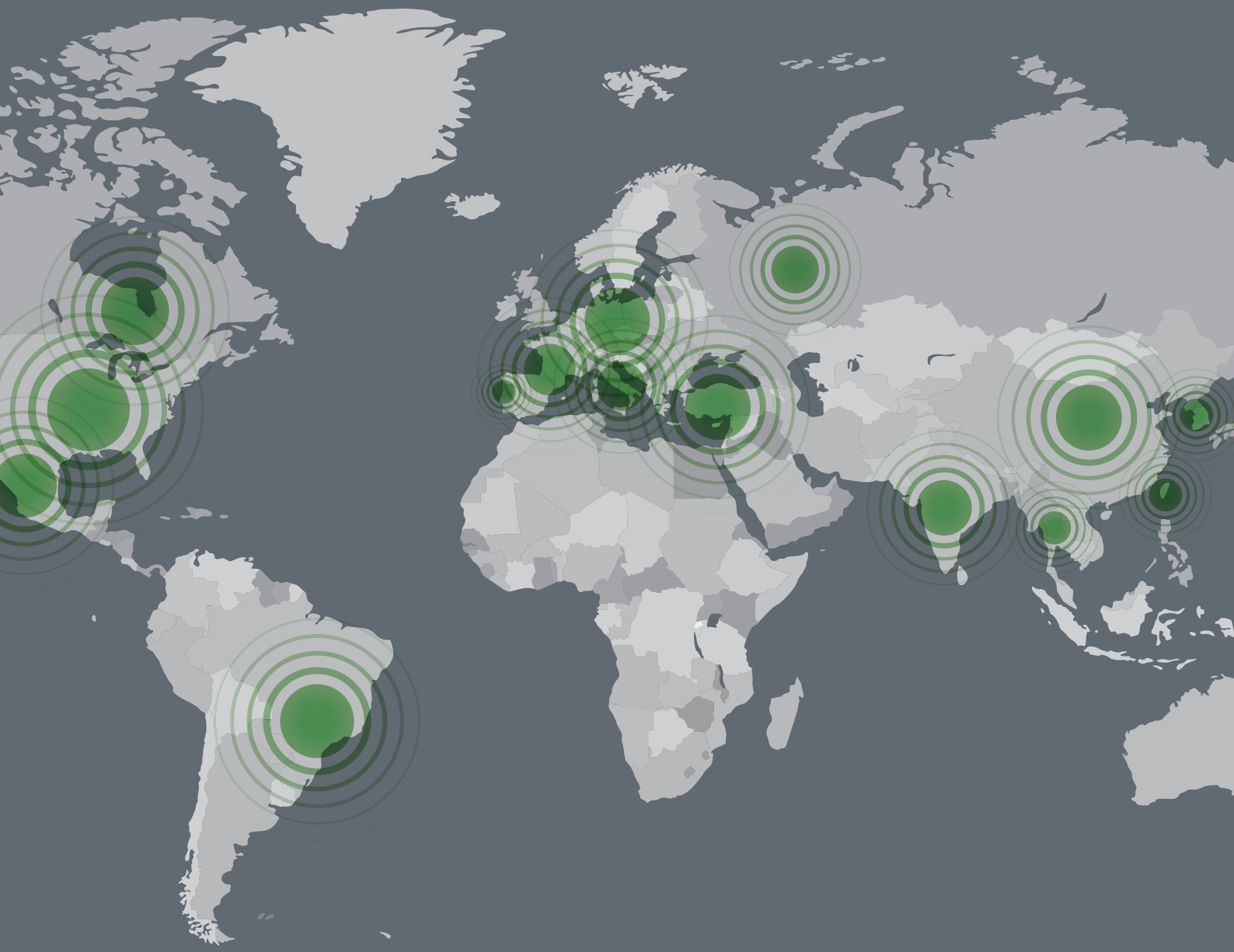
Drill diameter mm	Cutting speed m/min	Feed mm/r
< 5	7	0.10
5 - 10		0.20
10 - 15		0.30
15 - 20		0.35

FINE GRINDING

General indications for grinding wheels to be used on TPM39 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

TPM39 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 a polishing to completely remove the white layer formed during the discharge machining process. Avoid to perform the stress relieving in the range 400 - 550°C if a good corrosion resistance is required.



TG Steels

E info@tgsteels.com **W** www.tgsteels.com

Atlas Special Steels, s.l.
Avinguda de Can Sucarrats, 88-92,
08191 Rubí, Barcelona, Spain
+34 938 233 590
info@atlassteels.eu

Atlas Special Steels Unipessoal, Lda
Rua do Antuã, nr. 64 pavilhão A e B
3720-558 Travanca – OAZ, Portugal
+351 256 245 497
info@atlassteels.eu

Five Star Special Steel Europe srl
Via Glenn Curtiss, 9, 25018
Montichiari BS, Italy
+39 030 524 3724
info@fssseurope.com

GNG Consultoria
Rua Ituporanga, 210 – Bom Retiro
Joinville – SC – 89222-430
+55 47 99669-5557
marcus@gngconsultoria.com.br

OSS Canada Special Steel Inc
2384 Speers Rd, Oakville,
ON, Canada L6L 5M2
905-827-5888
sales@oss-material.ca

OSS Special Steel Inc.
2015 Mitchell Blvd Suite C
Schaumburg, IL 60193
(618) 426 – 6158
sales@oss-material.com

TG Steels s.r.o.
Libušina 850, Dubí 272 03
Kladno, Czech Republic
info@tgsteels.com

TG Middle East
Kocaeli KOBİ OSB, Köseler Mh.,
3. Cd., No: 15 Dilovası, Kocaeli, Türkiye
+90 262 728 11 67 (pbx)
info@tgme.com.tr