TG Steels

2379

PRIME

One of the most common cold work tool steel, with a very good high abrasive and adhesive wear resistance.

2379 PRIME;

- 2379 PRIME is a 12% Cr steel produced by a process that ensures a good level of cleanliness
- 2379 PRIME has a high abrasive wear resistant and also good adhesive wear resistance
- 2379 PRIME has a good dimensional stability, good compressive strength
- 2379 PRIME has a very good suitability for surface treatments such as gas, ionic or salt bath nitriding, as well as PVD or CVD coatings.

Applications

2379 PRIME is used for forming, blanking dies, deep drawing dies, shearing dies and tools and also in roll forming operations: rolls and tools.

2379 PRIME is also used for cold die and punches manufacturing. Stone crushing balls. Industrial knives. Hand knives.

Main properties

- Good abrasive and adhesive wear resistance
- Good compressive strength
- Good dimensional stability
- Suitable for surface treatments

Chemical composition *(typical)*

C	Mn	Si	P	S	Cr	Mo	V
1.45 1.60	0.40 0.60	0.10 0.60	≤0.030	≤0.025	11.0 13.0	0.70 1.0	0.70 1.0

Designation

Werkstoff Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1,2379	X153CrMoV12 -1	Cr12Mo1V1A	SKD11	BD2	D2	-	Z160CDV12	-

Structure

The structure of the 2379 PRIME is fine and homogeneous without precipitation or alignments of carbides.

The 2379 PRIME is ingot casted to guarantee fine primary carbides with a homogeneous distribution in the product.

Hardness at the time of delivery

Annealed for 255 HB max.

Physical properties

Temperature	20°C	100°C	200°C	300°C
Volumic mass kg/m³	7700	7680	7650	7630
Young Modulus N/mm²	215 000	205 000	199 000	193 000
Thermal conductivity W/m.K	20	20	21	21.5
Coefficient of linear expansion 10^{-6}/K	12	12.3	12.4	12.5

Heat treatment

SOFT ANNEALING

Temperature: 820 - 850°C, duration 1h + 1h for 25mm 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: 550°C time: 30s / mm of thickness
- 2nd preheating step: temperature: 850°C time: 30s / 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 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 -190°C for 1 hour for 25mm 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 and the temperature range from -135°C down to -190°C (named cryotreatment of steel) leads also to the complete transformation of austenite and also the precipitation of ultra fine carbides improving a lot the wear resistance without modification of the toughness. This treatment is optional for common applications.

TEMPERING

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

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

Hardness as a function of tempering temperature:

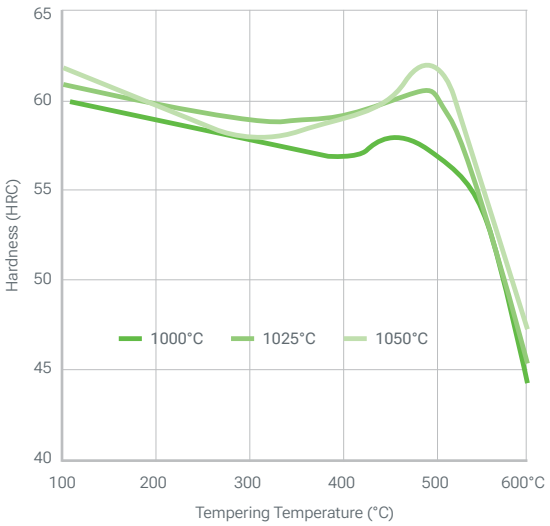
The usual hardness for cold working uses is in the range of 58 to 61 HrC and is obtained by tempering between 450 and 500°C. Higher tempering temperature can be performed for hot work applications.

In order to avoid the formation of large carbides that are detrimental to toughness, it is preferable to carry out austenitization at the lowest possible temperature, i.e. 1000 or 1020°C.

The table below shows the HrC hardness obtained as a function of the tempering temperature and the austenitization temperature.

	Austenitisation temperature°C			
Tempering temperature °C	1000	1025	1050	1080
100	60	61	62	--
200	59	60	60	--
300	58	58	58	58
400	57	58	59	57.5
450	57	58	60	59.5
500	57	60	61	61
550	54	55	55	56
600	44	45	47	50

TEMPERING CURVE



Surface treatment

Nitriding

2379 PRIME can be nitrided at temperatures less than or equal to 20°C below tempering temperatures without risk of deterioration of the mechanical characteristics.

The hardness of the nitride layer is around 1100HV1 and the thickness is dependent on the nitriding process.

PVD, CVD

2379 PRIME is suitable for all kinds of PVD and CVD treatment as soon as the treatment temperature is 30°C lower than the last tempering temperature.

Machining

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

TURNING

	Carbide insert		HSS tool
	Rough turning	Finishing	Turning
Cutting speed m/ min	100 - 150	140 - 200	10 - 15
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

	Carbide tools		Solid tool
	Rough machining	½ finishing	Finishing
Cutting speed m/ min	100 - 120	160 - 180	80 -100
Feed mm/r	0.2 – 0.4	0.1 – 0.2	0.02 – 0.2
Depth of cut mm	2 - 4	0.5 – 2	

DRILLING: CARBIDE DRILL

	Carbide type		
	Indexable insert	Solid carbid	Carbide tip
Cutting speed m/min	120	80 - 90	35 - 45
Feed mm / r	0.10	0.10 – 0.25	0.15 – 0.25

HSS TWIST DRILL

Drill diameter mm	Cutting speed m/min	Feed mm/r
< 5	10 - 12	0.05 – 0.15
5 - 10	10 - 12	0.15 – 0.20
10 - 15	10 - 12	0.20 – 0.25

FINE GRINDING

General indications for grinding wheels to be used on 2379 PRIME 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.

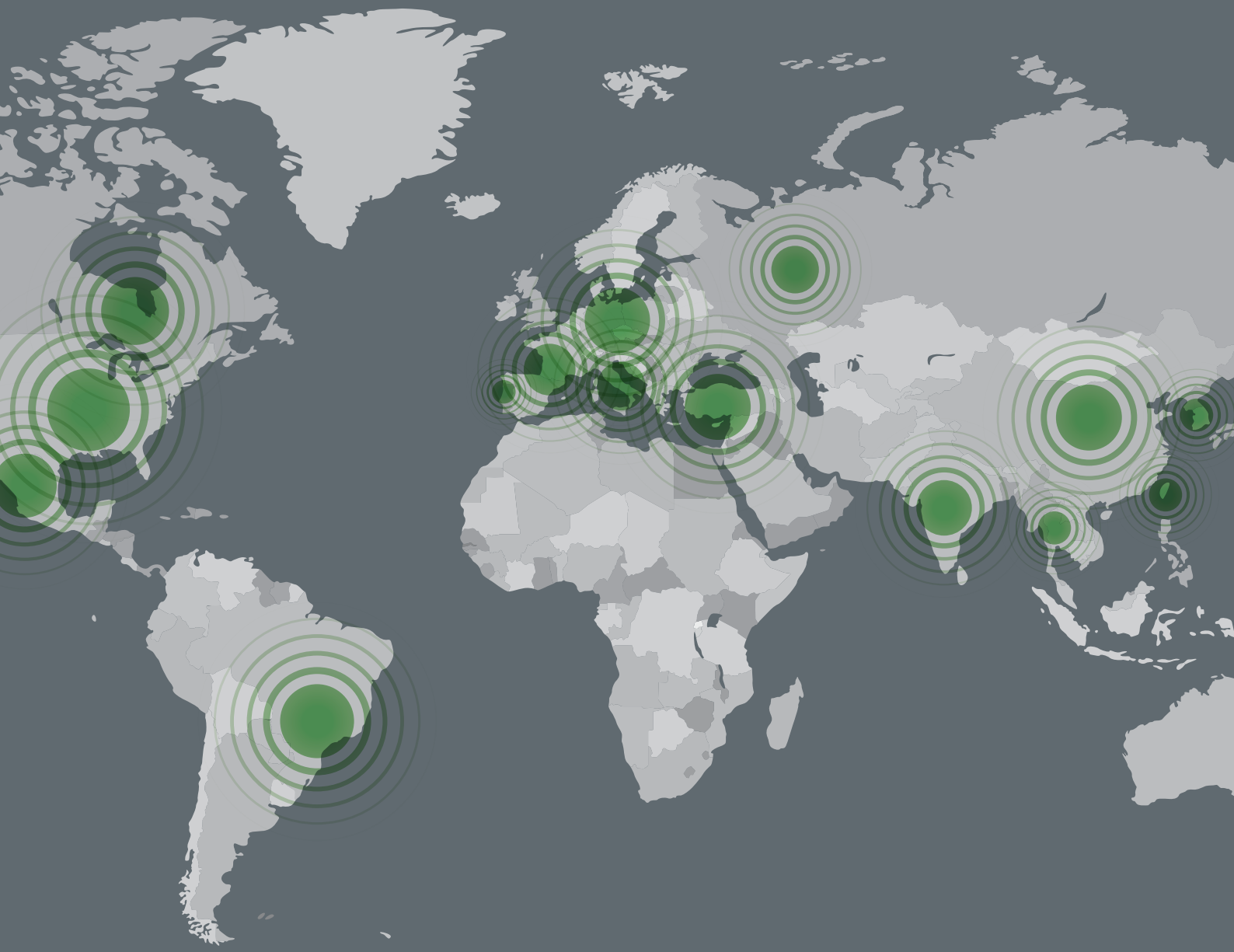
ELECTRO-DISCHARGE MACHINING

2379 PRIME 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.

Welding

2379 PRIME cannot be welded.



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