TG Steels

TGP 34

WAHOO ESR

Electroaslag Remelted cold work tool steel with 18% Chromium with very high wear resistance associated with an excellent corrosion resistance.

TGP34 WAHOO ESR;

- is an Electroslag Remelted *(ESR)* 18% Cr steel that ensures a very high level of cleanliness and homogeneity.
- has a very high wear resistance associated with a high hardness.
- exhibits a very good corrosion resistance.
- is suitable for the food and medical industries.
- is suitable for surface treatments.

Applications

TGP34 WAHOO ESR is a versatile material widely used in the manufacture of cutting and punching tools, including blades and knives designed for food contact. Its excellent corrosion resistance makes it suitable for applications such as ball bearings, valve parts, and other components exposed to harsh environments.

Additionally, TGP34 WAHOO ESR is ideal for parts that encounter highly abrasive or corrosive materials. It is frequently used in the production of plastics moulding tools where high polishability is required, as well as guiding components that demand durability and precision.

The material's properties also make it suitable for medical tools and precision measuring equipment.

Main properties

- Excellent wear resistance
- Excellent corrosion resistance
- High polishability
- High hardenability

Chemical composition *(typical)*

C	Mn	Si	P	S	Cr	Mo	V
0.90	≤ 1.0	≤ 1.0	≤ 0.030	≤ 0.005	18.0	1.10	0.10

Designation

Werkstoff Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1.4112	X90CrMoV18	-	-	-	-	-	-	-

Structure

The structure of the TGP34 WAHOO ESR is fine and homogeneous without precipitation or alignments of big carbides.

Hardness at the time of delivery

Annealed for 260 HB max.

Physical properties

Temperature	20°C	300°C	500°C
Volumic mass kg/m^3	7700	7660	-
Young Modulus N/mm^2	220000	202000	183000
Thermal conductivity W/m.K	19.0	21.9	23.5
Coefficient of linear expansion 10^{-6}/K	10.8	11.3	12.0

Heat treatment

SOFT ANNEALING

Temperature: 810 - 860°C, duration 1h + 1h for 25 mm thickness. slow cooling in the oven *(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 oven 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: 30 s/mm of thickness
- 2nd preheating step:
  temperature: 750°C time: 30 s/mm of thickness

Recommended austenitizing temperature:

980 - 1000°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.
After quenching the hardness is 56 HRC.

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 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 better stability associated with improved hardness and 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 ultrafine carbides improving a lot the wear resistance without modification of the toughness. This treatment is optional for common applications.

TEMPERING

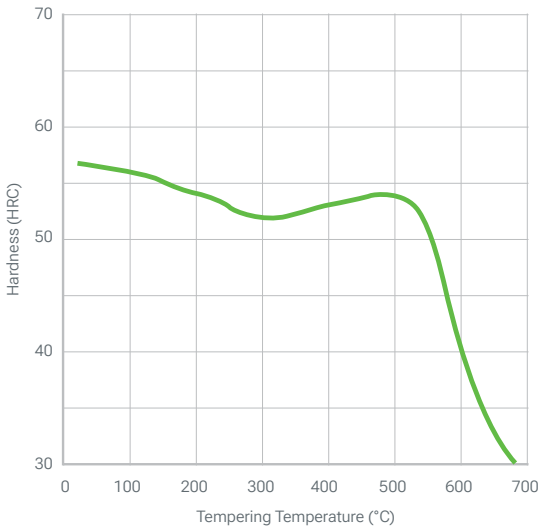
To ensure a minimum residual austenite rate as well as greater tool stability, it is essential to perform a double tempering. Each tempering is followed by a cooling under 100°C.

Each tempering time must be at least equal to 1h + 1h for 25 mm of thickness of the treated part *(equivalent thermal thickness).* For the best corrosion resistance the tempering is preferably done at a temperature in the range 250 to 350°C. For the best wear resistance a tempering temperature slightly over 500°C is recommended associated with a sub zero treatment after quenching.

Tempering and corrosion resistance:

In order to improve the corrosion resistance of the 4112 PRIME, the tempering must be performed at a temperature outside of the area between 350 and 500°C, since in this temperature range there is a precipitation of chromium carbides, which weaken the steel and greatly reduce its resistance to corrosion.

TEMPERING CURVE



Surface treatment

NITRIDING

Because of the low tempering temperature and the high Cr content the TGP34 WAHOO ESR is not suitable for nitriding.

PVD, CVD

TGP34 WAHOO ESR 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.

Polishing

TGP34 WAHOO ESR a remelted steel grade and so it 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 of fairly close roughness and stopping each step as soon as the last scratch of 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	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	1 - 4	0.5 - 2	0.5 - 2

MILLING: SURFACING

	Milling with carbide tools		Solid tool
	Rough machining	½ Finishing	Finishing
Cutting speed m/min	100 - 120	140 - 160	70 -90
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
Cutting speed m/min	80 - 100	50 - 70
Feed mm/t	0.05 - 0.10	0.10 - 0.25

HSS TWIST DRILL

Drill diameter mm	Cutting speed m/min	Feed mm/t
< 5	10 - 12	0.05 - 0.15
5 - 10	10 - 12	0.15 - 0.20
10 - 15	10 - 12	0.20 - 0.25
15 - 20	10 - 12	0.25 - 0.30

FINE GRINDING

General indications for grinding wheels to be used on TGP34 WAHOO ESR 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

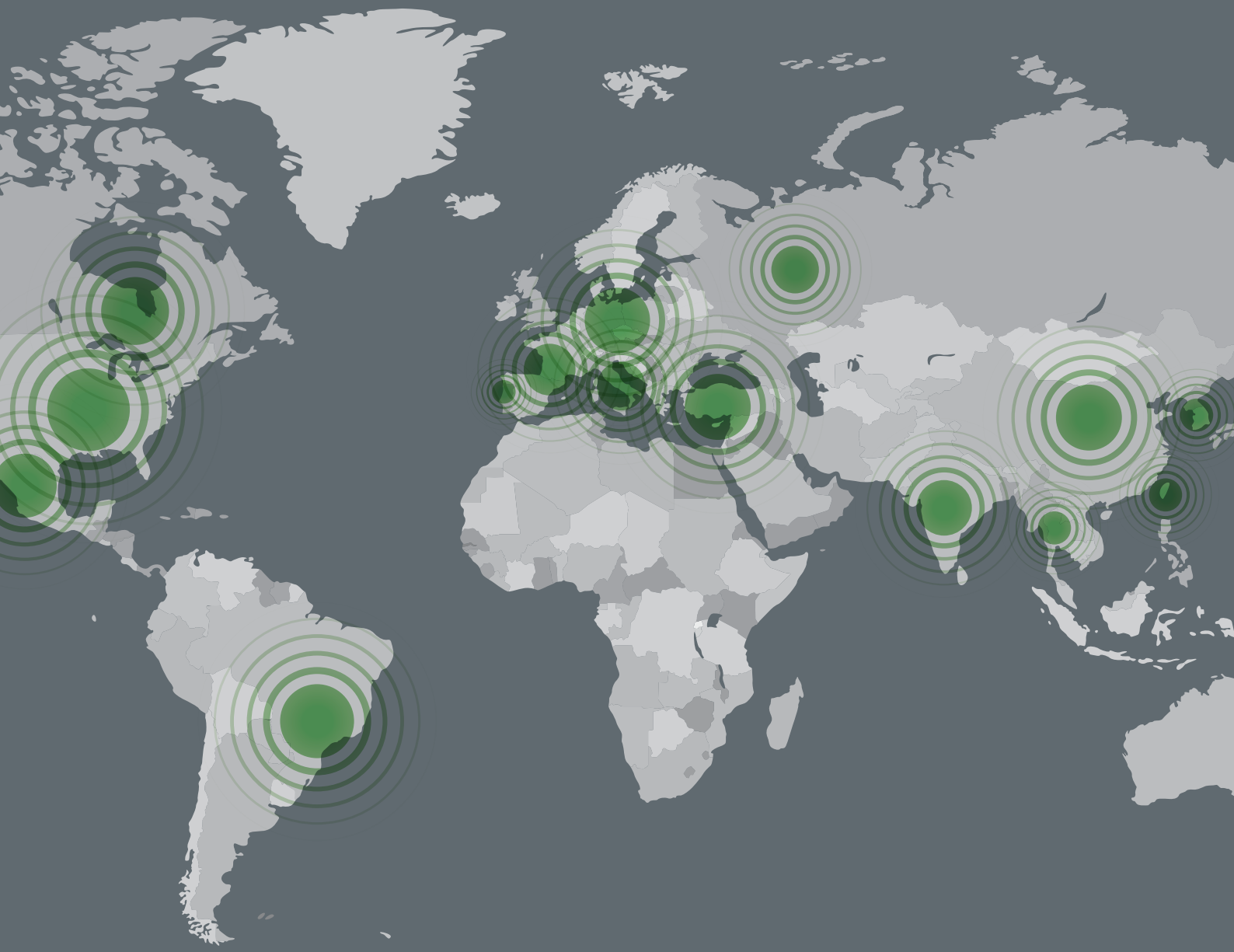
TGP34 WAHOO ESR is also suitable for EDM machining *(wire or electrode)*. Preferably, the machining will be carried out with a low current density and a high frequency in order to limit the thickness of the white layer as much as possible.

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

It is not recommended to weld TGP34 WAHOO ESR since there is a high risk of cracking.

If this is mandatory to weld it, in the annealed conditions, then preheat to 260°C, maintain the tool at 300°C during the welding operation without exceeding 400°C and post treat at 725 - 760°C for at least 5 hours followed by a slow cooling in the furnace *(10 to 20°C/h)*.



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