TG Steels

2083 PRIME

Stainless mold steel for either good corrosion resistance and high mechanical properties

2083 PRIME is stainless steel, which can be used for making small and medium sized plastic injection molds where good corrosion resistance is required.

Applications

2083 PRIME has both very high wear resistance, excellent corrosion resistance, excellent polishability *(suitable for transparent parts)* as well as correct machinability.

If higher polish ability is required *(e.g. for miror polish)* we recommend to use the CROMIS ESR *(remelted steel with the highest cleanliness).*

2083 PRIME can be used for injection molds for corrosive plastic *(PVC, recycled plastics...)*, molds for plastics reinforced with abrasive fillers, extrusion screws and barrels for extruders, molds for food, medical and optical equipment.

2083 PRIME is delivered in the annealed condition and in use it should be treated to a hardness of 52 HRC.

Main properties

- Good corrosion resistance
- Very Good polishability
- Good wear resistance
- High hardenabilty

Chemical composition *(typical)*

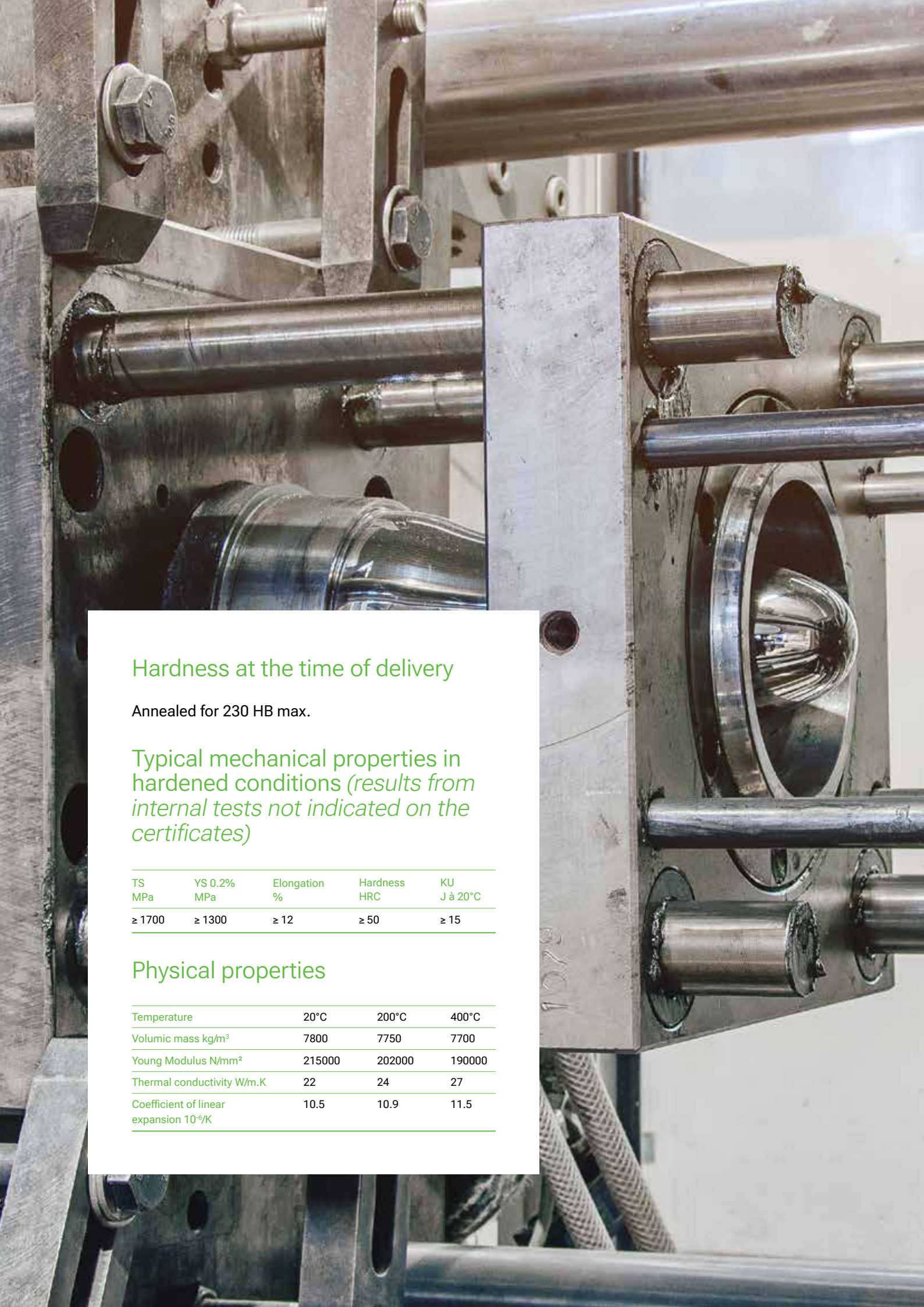
C	Mn	Si	P	S	Cr	Mo
0.40	0.30	Max 0.30	< 0.015	< 0.005	14.00	0.20

Structure

The structure of the 2083 PRIME is fine and homogeneous without precipitation or alignments of carbides.

Designation

Werkstoff Nr	ISO	China GB	JIS Japan	UK	AISI USA	Russia Gost	AFNOR	Other / Special
1.2083	X42Cr13	4Cr13	SUS420J2	420S45	420	40KH13	Z40C13	-



Hardness at the time of delivery

Annealed for 230 HB max.

Typical mechanical properties in hardened conditions *(results from internal tests not indicated on the certificates)*

TS MPa	YS 0.2% MPa	Elongation %	Hardness HRC	KU J à 20°C
≥ 1700	≥ 1300	≥ 12	≥ 50	≥ 15

Physical properties

Temperature	20°C	200°C	400°C
Volumic mass kg/m³	7800	7750	7700
Young Modulus N/mm²	215000	202000	190000
Thermal conductivity W/m.K	22	24	27
Coefficient of linear expansion 10^{-6}/K	10.5	10.9	11.5

Heat treatment

SOFT ANNEALING

Temperature: 760 - 790°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: 1000 - 1050°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.

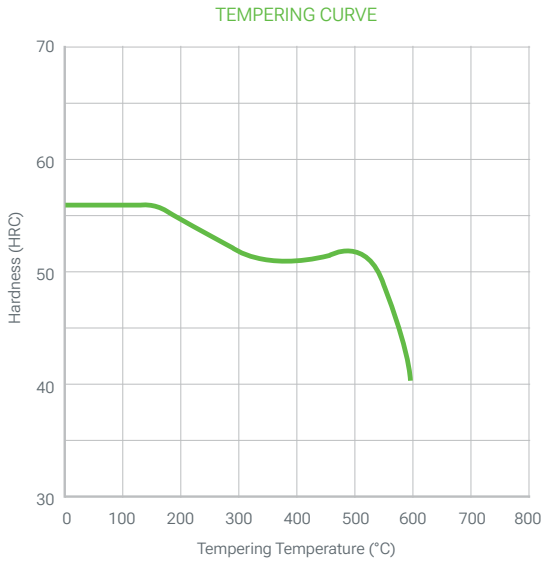
QUENCHING MEDIUM

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.

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)*.

Tempering temperature and corrosion resistance:
In order to avoid a better corrosion resistance it is highly recommended to avoid tempering temperatures in the range 400 to 550°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. For the higher hardness *(better wear resistance)* tempering temperatures lower than 400°C are recommended and for lower hardness *(better toughness)* tempering temperatures over 550°C are recommended.



Surface treatment

NITRIDING

2083 PRIME can be nitrided at temperatures less than or equal to 20°C below tempering temperatures without risk of deterioration of the mechanical characteristics. Nitriding at a temperature over 550°C is recommended to avoid any risk of carbide precipitation at the grain boundaries.

PVD, CVD

2083 PRIME 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

2083 PRIME is suitable for polishing in the heat treated condition and it can be used for applications requiring a high polished level *(Rt ≤ 0.2 µm, CNOMO level 1, Rugotest N4)* as used for transparent parts. 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.

Texturing

2083 PRIME is suitable for chemical or laser texturing.

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/teeth	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 carbide	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 2083 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

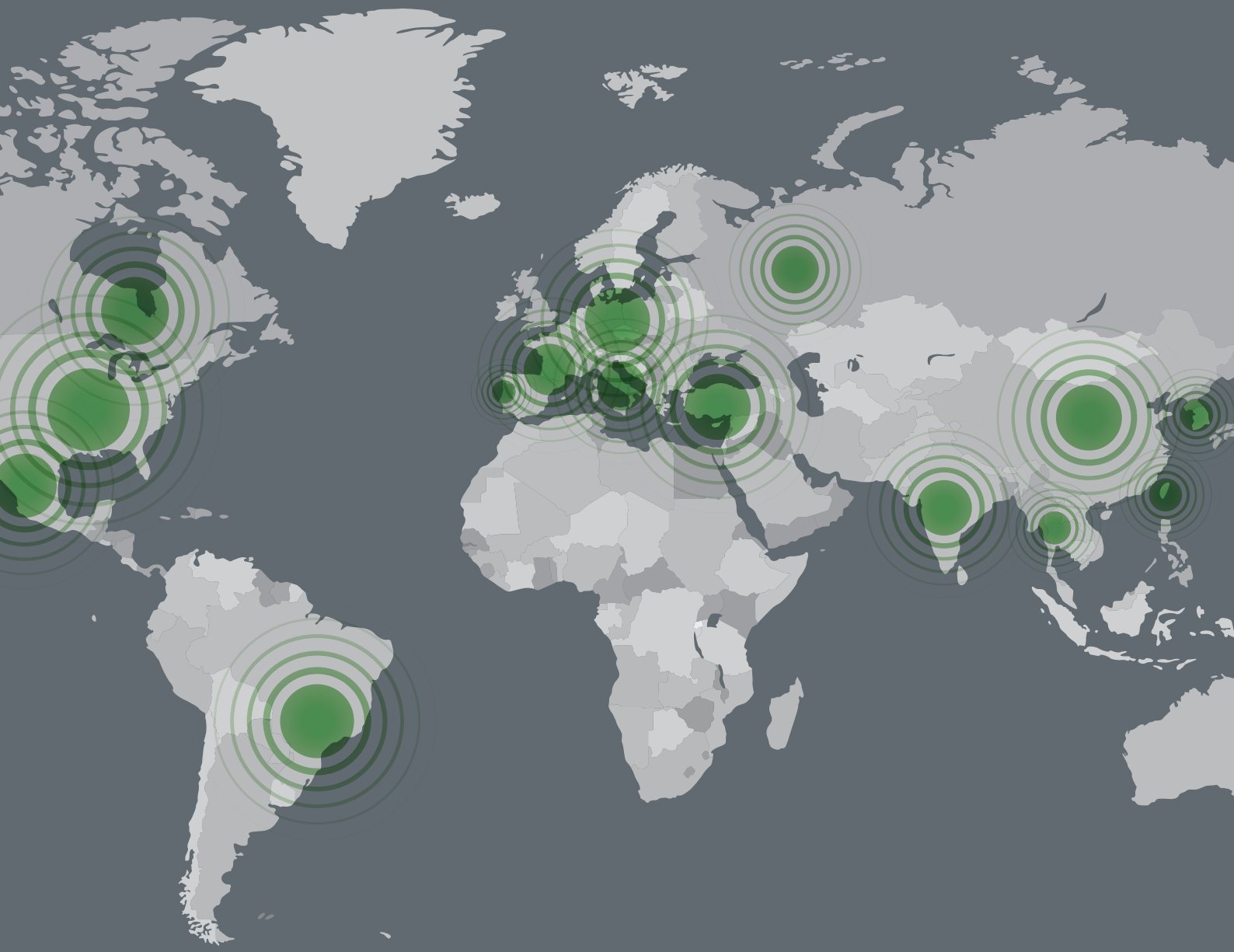
2083 PRIME is also suitable for EDM machining *(wire or electrode)*. Preferably, the machining will be carried out with a low current density and a high frequency in order to limit the thickness of the white layer as much as possible.

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

It is not recommended to weld 2083 PRIME but if this is mandatory it could be welded either in the annealed condition *(better)* or in the heat treated condition.

- Method: TIG
- Feeder wire: AISI 420
- Preheating: 250°C. hold at 200°C during the welding operation
- Post treatment:
  - » In the treated state: tempering for a minimum of 2 hours at 20°C below the initial tempering temperature.
  - » In the annealed state: carry out a soft annealing under the usual conditions: temperature: 840 - 870°C, duration 1h + 1h for 25 mm of thickness. Slow cooling in the furnace *(10 to 20°C/h)*.



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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