

CHEMICAL ANALYSIS

Typical:	C	S max	P max	Si	Mn	Cr	Mo
In Weight %	0.4	0.005	.012	.3	1.5	1.9	.2

W 1.2311: A prehardened mold steel (300 HB/32 HRC)

MATERIAL PROPERTIES

Standard prehardened steel designed for plastic mold industry.

FOR WHICH TOOLS

Plastic injection mold cores and cavities, extension dies for thermoplastics.

FOR WHICH PLASTICS

Thermoplastics (PE, PP, PS), thermosetting plastics, transparent melts.

PROPERTIES

> EN	40 CrMnMo7
> WERKSTOFF Number	1.2311
> AISI	P20

METALLURGICAL PROPERTIES

Internal soundness

All plates are ultrasonically tested. The acceptance standards of ASTM A578.96.S9 is guaranteed.

Grain size

Uniform 7/8 grain according to ASTM E112.

Cleanliness

W 1.2311 is melted in an electric arc furnace and refined through a VOD or DH process – consequently, the content of non-metallic inclusions is reduced to an extremely low level. This ensures a good polishability and chemical etching ability. Non-metallic inclusions content is assessed in accordance with ASTM E45 Method A (“worst field”).

MECHANICAL PROPERTIES

1.2311 is delivered **quenched and tempered to 280 – 325 HB (29 – 33 HRC)**

Hardness	Rp 0.2 Yield Strength		Rm Tensile Strength		Elongation	Reduction of Area	K C V 20°C	Elastic Modulus	
	MPa	Ksi	MPa	Ksi				GPa	Ksi
300	854	124	1014	147	11	50	25	205	29733

PHYSICAL PROPERTIES

Thermal Conductivity W.m-1.K-1	Thermal expansion Coefficient (10-6.K-1)				
20°C	20 - 100°C	20 - 200°C	20 - 300°C	20 - 400°C	Specific Heat J/Kg °C
34	11.5	11.6	12.5	12.8	470

Typical Values

W 1.2311

TECHNICAL DATASHEET

Homogeneity

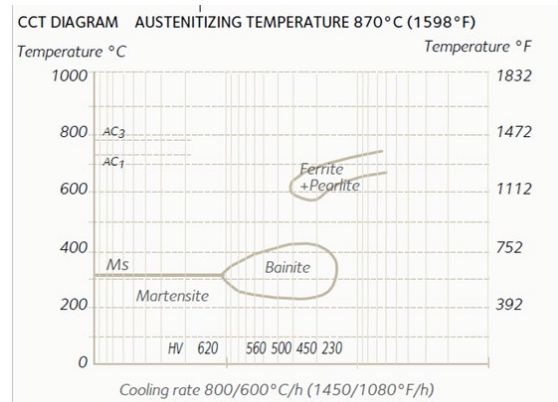
W 1.2311 has an excellent hardenability resulting in good uniformity of hardness and microstructure.

Heating Conditions

150°C/h up to 875°C, holding time 10 minutes,
270°F/h up to 1607°F, holding time 10 minutes

Metallurgical transformation points

AC ₁	AC ₃	M _s	V ₁	V ₂
733°C 1351°F	780°C 1436°F	320°C 608°F	1000°C/h 1830°F/h	300°C/h 540°F/h



DELIVERY CONDITIONS / DIMENSIONAL PROGRAM

Thickness	Width
7 – 150 mm (.27" – 5.9")	1000 - 2000 mm (39" – 98.4")
150 – 610 mm (5.9" – 24")	1000 – 2000 mm (39" – 78.7")

Length: up to 6000mm (20 ft). For specific dimensions, please contact your Swiss Steel USA representative.

HEAT TREATMENT

For specific applications where mechanical properties higher than 300HB are required, hardening can be performed in the following way:

- > heating about 850°C (1560°F) with a sufficient holding time of 1 hour/25mm (1 hour/inch).
- > water, oil or air quenching depending on thickness (see C.C.T. diagram)

The tempering temperature controls the mechanical characteristics. Generally, instructions given here after must be followed to obtain an efficient tempering:

- Uniform heating at the selected tempering temperature (see tempering curve).
- Holding time of one hour per inch of total thickness.
- Double tempering with complete cooling to room temperature for each treatment.

SURFACE TREATMENT

The quality of surface treatments depends on the surface roughness and polishing quality. Homogeneity of hardness, microstructure and good cleanliness ensure a good behavior for chromium plating, nickel plating or nitriding. Nevertheless, after hard-chromium plating, the steel should be tempered for about 4 hours at 180°C (356°F) to avoid any hydrogen embrittlement.

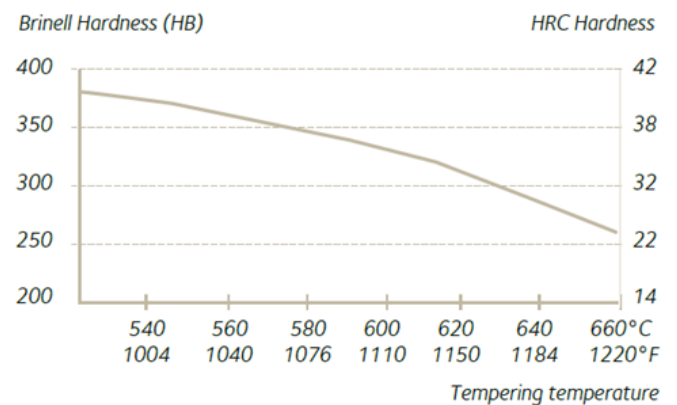
MACHINING

W 1.2311 grade performs very well in drilling and in milling using high speed steel or carbide tools. Cutting conditions (cutting speed, feed rate, etc.) depend on the tool, but W 1.2311 is a well-known grade for which any tool maker can provide cutting conditions adapted to its tools.

Tempering Curve

Test conditions:

- > austenitization 870°C (1600°F)
- > tempering / holding time 1h
- > air cooling



Note that complicated shapes require accurate control of steel temperature uniformity and sufficient holding times to limit stresses and prevent cracking.

ELECTRICAL DISCHARGE MACHINING (EDM)

This method of machining can be used on W 1.2311 grade. Precaution should be taken to avoid the presence, after machining, of a rehardened surface layer ("white layer"). This layer should be completely removed by grinding and polishing.

POLISHING

W 1.2311 has a good polishability in quenched and tempered condition. After grinding, polishing shall be made with aluminum oxide or diamond paste.

A typical polishing sequence could be:

Grinding	- >	Emery polishing paper or stones FEPA 120 - > 240 - > 320 - > 600 - > 1000 GRIT 120 - > 220 - > 280 - > 360 > 500	- >	Diamond paste 10 µm - > 6 µm
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TEXTURING

W 1.2311 is particularly adapted to texturing. The steelmaking process leads to uniform structure and homogeneous hardness, which ensures accurate and consistent pattern reproduction.

WELDING

GTAW is the recommended process to ensure a clean weld without sulphides, porosities or oxides which effect properties of the weld such as chemical etching ability, polishability. Pre and postheating treatment must be achieved to ensure crack free welds. A specific procedure was developed to limit the risks of cracking and improve the response of the welded area to polishing and etching. For more information, please contact your Swiss Steel USA representative.

GENERAL NOTE

All statements regarding the properties or utilization of the materials or products mentioned are for the purpose of description only. Guarantees regarding the existence of certain properties or a certain utilization are only valid if agreed upon in writing.

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