

MD®

Quality Prehardened Mold Steel

Data Sheet AISI P20+Ni - 2738 mod.

Typical Applications

- Injection molds up to 30" (760 mm)
- Molds for painted parts
- Compression molds
- Dies for non corrosive plastic extrusion

Delivery Condition

- Hardened and tempered

Surface Hardness Range

	BHN	HRC	N/mm ²
Standard	285-321	30-34	963-1082
High Hard	321-352	34-38	1082-1202

MD® is a prehardened mold steel grade specially designed for improved through hardenability, ease of machining and simple post-production mold maintenance versus standard P20. It has high impact strength and excellent temper resistance. The well-balanced chemistry assures homogeneous hardness and section hardness loss due to mass.

MD® is forged on our largest presses equipped with wide dies assuring maximum deformation during forging process.

MD® is forged using a special densifying process which assures optimum consolidation of centers.

Chemical composition in %

C	Mn	Si	Ni	Cr	Mo
0.33	0.85	0.35	0.55	1.85	0.50

MD® is melted to a low sulphur content to enhance polishability.

MD® is quenched in water. Best properties in steel are produced with the highest achievable quench severity.

MD® is characterized by :

- Excellent machinability
- Good polishability
- Excellent weldability
- Improved wear resistance

MD® is 100 % ultrasonic tested to very stringent acceptance levels.

MD® is hardenability versus standard grades ensures hardness loss from surface to core to be maintained at a maximum of 4 HRC points on molds up to 30" (760 mm) with deep impressions.

®Finkl Steel Trademark

MD[®]

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Material characteristics

The benefits of improved through hardenability are:

- Stable and continued machining can be performed with (C.N.C.) automatic machines.
- A defect free machined surface can be obtained.
- Dimensional stability of parting lines.

Structure

After hardening and tempering, the structure of MD[®] consists of tempered martensite to fine bainite.

The benefits of the through hardness combined with a uniform and stable micro-structure are:

- For mold design, consistent properties are assured.
- The machining distortion is minimized in the finished mold.
- A uniform luster can be obtained upon surface polishing.

Cleanliness

Method	A	B	C	D
ASTM E45	≤ 1.5	≤ 1.0	≤ 0.5	≤ 1.0
DIN 50602	K4 ≤ 20			

Physical Properties

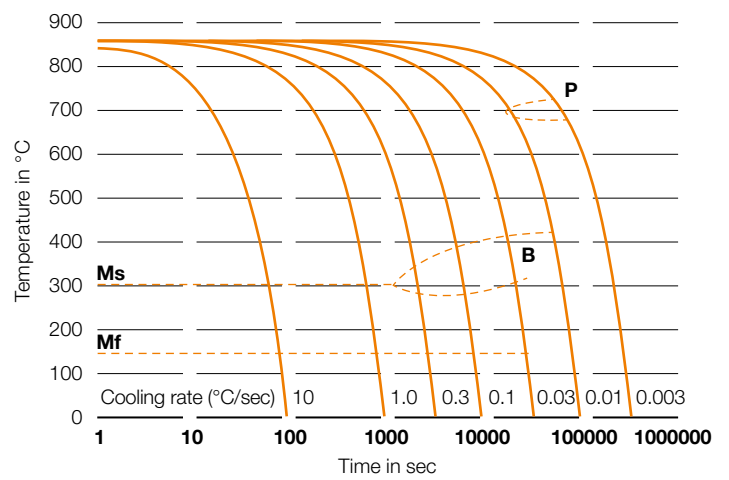
Thermal conductivity	Coefficient of thermal expansion (10 ⁻⁶ K ⁻¹)			Thermal capacity	Density
(W/m*K)	25–100 °C	25–300 °C	25–400 °C	(J/Kg*K)	-
30	12.3	13.7	14.8	384	7.85

Mechanical Properties

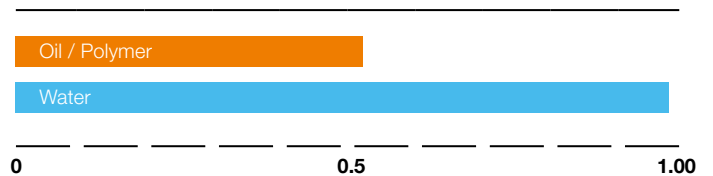
Typical values for a 4" (101.6 mm) thick plate.

Hardness range	Hardness BHN (HRC)	Y.S. 0.2 MPa (KSI)	UTS MPa (KSI)	EI (%)	Impact@RT J (Ft-lb)	
					Long.	Trans.
285–320 BHN	311 (33)	827 (120)	979 (142)	> 15	111 (82)	108 (80)
320–355 BHN	331 (36)	924 (134)	1062 (154)	> 15	88 (65)	81 (60)

Continuous cooling curve



Relative Quenching Power



MD®

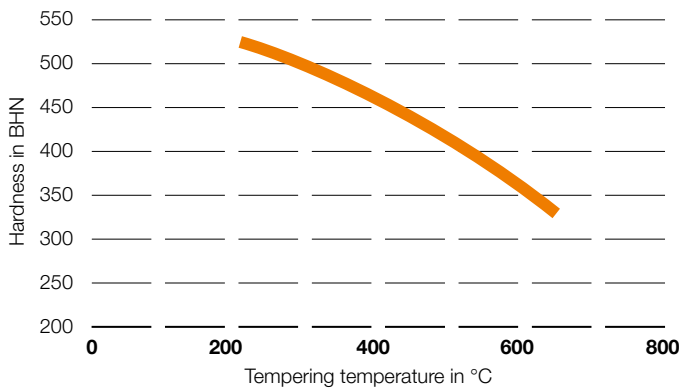
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Heat treatment

Attainable Hardness of MD®

Quenched from 1600 °F (870 °C) and Tempered 4 hours (Size of section – 4" X 4" (101.6 mm X 101.6 mm))

Tempering diagram



Stress Relieving

To minimize distortion in service or during maintenance (welding), it is recommended to stress relieve tooling after roughing stages. Heat uniformly to 850 to 900 °F (454-482 °C) Hold at temperature for one hour per inch (25.4 mm) and air cool.

Tempering

Tempering treatments vary for different sizes and applications. The following instructions will provide through tempering:

Heat uniformly at the selected tempering temperatures and hold at temperature for one hour per inch (25.4 mm) of total thickness.

Induction and laser hardening

MD® lends itself to induction or laser hardening of selective surfaces creating a surface hardness of up to 60–63 HRC varying in depth from skin hardness up to 0.125" (3 mm).

EDM (Electric Discharge Machining)

This method of machining is widely used on prehardened MD®. However, precaution should be taken since this method of machining leaves a rehardened surface layer (white layer) on the steel. It is advisable to remove this layer.

Hard-Chromium Plating

After hard-chromium plating, the tool should be tempered for a minimum of four (4) hours at 350 °F (180 °C) in order to avoid hydrogen embrittlement. In case of replating, the tool should be tempered after it has been acid stripped.



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Texturing

For best response to texturing, it is recommended to use grade **MD®Xtra** for its lower content in segregational elements.

Polishing

Successful polishing requires talent, patience and experience. But some known basics are:

- Practice extreme cleanliness between steps to avoid carryover of contaminant particles
- Use high quality consumables
- Over polishing is detrimental to the steel surface leading to so called orange-peeling and pitting

Grit	180	240	320	400	600
µm	80	60	35	20	8

When the requirements for finish are particularly high (> 600 grit), it is recommended to use grade **MD®Xtra** or **MLQ®Xtra**.

Size MD® Standard and High Hard (as forged/approx.)

Max weight	25 000 kg	55 000 lbs
Max section	1.55 m ²	2 400 sq in
Max width	2 130 mm	84"
Max thickness	1 245 mm	49"

Metallurgical Service

The Metallurgical Laboratory provides standard mechanical properties testing for Tensile Testing (ASTM A 370), Impact Testing (ASTM E 23), Hardness Testing (ASTM E 10, E 18, A 956), Macro-etch Testing (ASTM E 381), and other metallurgical testing with certification of results where requested.

Metallurgical facilities are made available to customers through your sales representative to assist in analysis of technical issues that may arise during processing or performance of Finkl forgings. Reports and consultation are offered as a service to customers with the aim of improving product performance.

Note

Provided technical data and information in this data sheet are typical values. Normal variations in chemistry, size and conditions of heat treatment may cause deviations from these values. We suggest that information be verified at time of enquiry or order. For additional data or metallurgical assistance, please contact us.



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