

# DATA SHEET



## Finkl Steel

### MD®Xtra

~AISI P20mod - 1.2738mod (HH)

### QUALITY PREHARDENED MOLD STEEL

#### TYPICAL APPLICATIONS

- Molds for Painted Parts of any size
- Grained or Textured molds
- Molds for Chrome-Plated parts
- Compression molds
- Long run molds
- Abrasive or filled plastic injection molds
- Dies for non corrosive plastic extrusion

#### GENERAL

##### Delivery Condition:

Hardened and Tempered

Surface Hardness Range:

	BHN	HRC	N/mm <sup>2</sup>
Regular	285-321	30-34	963-1082
High Hard	321-352	34-38	1082-1202
Super Hard	363-401	39-43	1255-1393

**MD®Xtra** is a new, patented, pre-hardened mold steel grade specially designed for through-hardening, ease of machining and simple post-production mold maintenance. It has high impact strength to prevent cracking and very high thermal conductivity that improves heat extraction and reduces molding cycle times. The well-balanced chemistry assures homogeneous hardness and microstructure in very large cross sections with nearly no section hardness loss due to mass.

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

**MD®Xtra** is forged using a special densifying process that assures optimum consolidation of centers.

#### Typical Chemical Analysis\* - % weight

C	Mn	Si	Ni	Cr	Mo	Other
0.26	1.00	0.35	0.60	1.45	0.55	Micro alloying

\*Covered under one or more of the following U.S. Patents: 10,260,122; 10,294,538

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

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

**MD®Xtra** is characterized by:

- Highest thermal conductivity
- Improved through hardenability
- Good polishability
- Excellent weldability
- Uniform hardness
- Superior texturing
- Improved wear resistance

**MD®Xtra** is 100 % ultrasonic tested to very stringent acceptance levels. It is defect free.

**MD®Xtra** has high hardenability that achieves hardness loss from surface to core of less than 3 HRC points, even on molds up to 45" (1150 mm) thick with deep impressions.

**MD®Xtra** is an excellent material for Photo-Etching & Acid Texturing. The patented low alloy composition minimizes segregation.

®Finkl Steel Trademark

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## QUALITY PREHARDENED MOLD STEEL

### MD<sup>®</sup>Xtra

#### MATERIAL CHARACTERISTICS

Uniform, high through-hardness assures:

- Stable and continued machining with automatic (CNC) machines
- Defect-free machined surfaces
- Dimensional stability of parting lines

#### Structure

After hardening and tempering, the structure of MD<sup>®</sup>Xtra consists of tempered martensite and fine bainite.

The benefits of through hardness combined with a uniform and stable microstructure 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

#### Microcleanliness

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

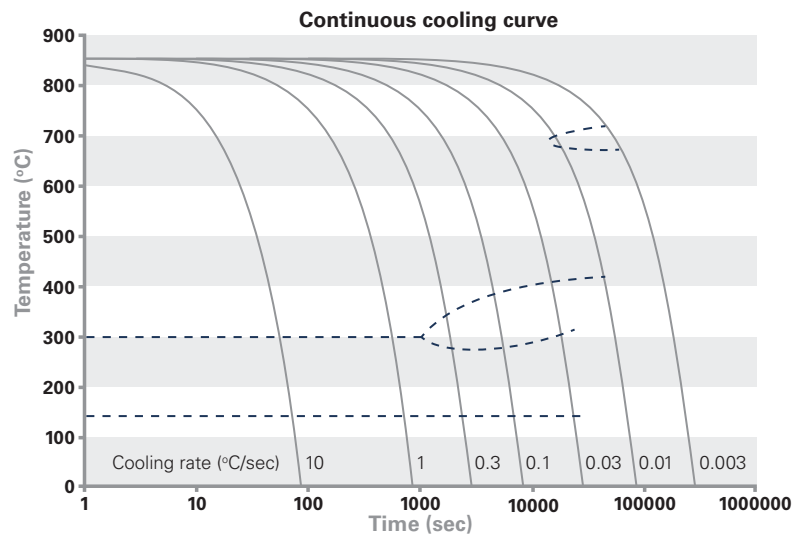
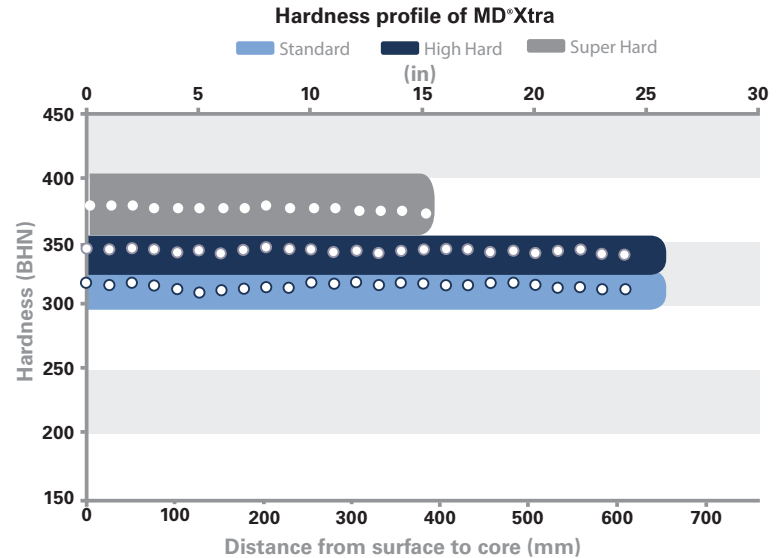
#### Physical Properties

Thermal conductivity	Thermal expansion coefficient (10 <sup>-6</sup> K <sup>-1</sup> )			Thermal capacity	Density
W/m <sup>2</sup> K (BTU/hr <sup>2</sup> ft <sup>2</sup> °F)	25-100 °C	25-300 °C	25-400°C	(J/Kg*K)	-
>45 (26)	12.3	13.7	14.8	620	7.68

#### Mechanical Properties

Typical values for a 102mm (4") thick plate

Hardness range	Hardness BHN (HRC)	Y.S. 0.2 MPa (KSI)	UTS MPa (KSI)	EI (%)	Impact@RT J (Ft-lb)	
					Long.	Trans.
285-321 BHN	311 (33)	827 (120)	979 (142)	> 15	111 (82)	108 (80)
321-352 BHN	331 (36)	924 (134)	1062 (154)	> 15	88 (65)	81 (60)
363-401 BHN	363 (39)	1007 (146)	1124 (163)	> 15	34 (25)	30 (22)



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## QUALITY PREHARDENED MOLD STEEL

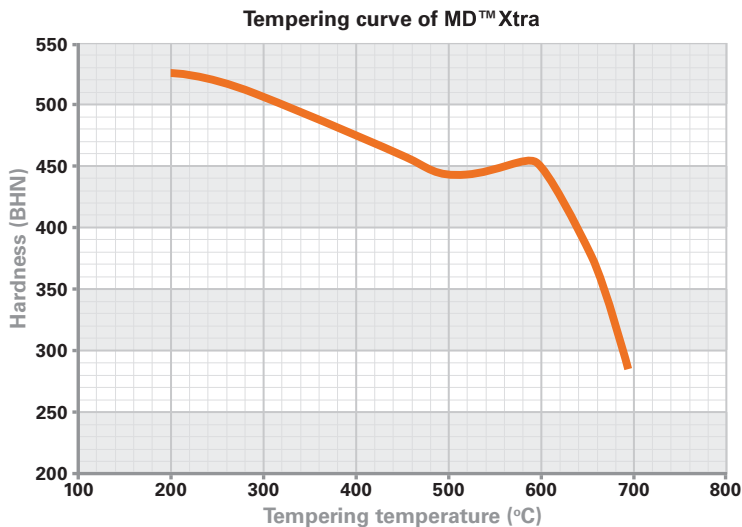
### MD<sup>®</sup>Xtra

#### HEAT TREATMENT

##### Attainable Hardness of MD<sup>®</sup>Xtra

Quenched from 900 °C (1650 °F) and Tempered 4 hours

Size of section – 102mm X 102mm (4" X 4")



#### TEMPERING

Tempering treatments vary for different sizes and applications. To ensure through-tempering, heat uniformly at the selected tempering temperature and hold at temperature for one hour per inch (25.4 mm) of total thickness.

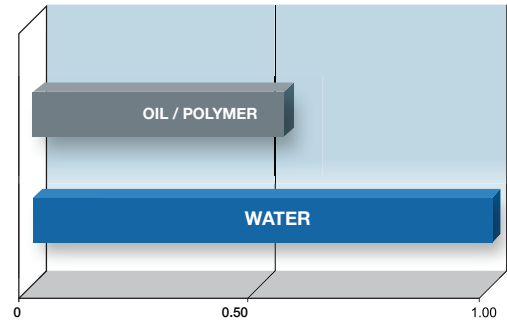
#### STRESS RELIEVING

Heat uniformly to 850 to 900 °F (454-482 °C). Hold at temperature for one hour per inch (25.4 mm) of total thickness and air cool.

#### INDUCTION AND LASER HARDENING

MD<sup>®</sup>Xtra lends itself well 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).

#### Relative Quenching Power:



#### EDM (ELECTRIC DISCHARGE MACHINING)

This method of machining is widely used on prehardened MD<sup>®</sup>Xtra. 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 hours at 350 °F (180 °C) to avoid hydrogen embrittlement. When re-plating, the tool should be tempered after it has been acid stripped.

#### BALITHERM PRIMEFORM

The BALITHERM PRIMEFORM treatment has a significant influence on the surface hardness of MD<sup>®</sup>Xtra. An increase in surface hardness of more than 100% for all MD<sup>®</sup>Xtra delivery conditions is possible with no loss of base hardness, and for MD<sup>®</sup>Xtra Super Hard, values up to 66 HRC have been demonstrated. This hardness increase provides superior resistance to abrasive wear during the injection of long glass fiber thermoplastics and makes mirror polishing easier. As an added benefit, repair and retreatment of the mold is possible without stripping the surface treatment.

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### MD<sup>®</sup>Xtra

#### TEXTURING

MD<sup>®</sup>Xtra offers excellent response to texturing because of the superior homogeneity of its structure and patented low alloy composition.

#### POLISHING

Successful polishing requires talent, patience and experience. Some basic best practices include:

- 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

When the requirements for finish are particularly high (800 up to 1200 grit), it is recommended to use MD<sup>®</sup>Xtra SuperHard.

For high-gloss finish or SPI A1 and greater, it is recommended to use grade MLQ<sup>®</sup>Xtra.

#### SIZE MD<sup>®</sup>Xtra REGULAR and HIGH HARD

(Approximate)

Max weight	64 000 kg	140 000 lbs
Max section	2.2 m <sup>2</sup>	3400 sq in
Max width	2600 mm	102"
Max thickness	1320 mm	52"

#### SIZE MD<sup>®</sup>Xtra SUPER HARD

(Approximate)

Max weight	64 000 kg	140 000 lbs
Max section	2.2 m <sup>2</sup>	3400 sq in
Max width	2600 mm	102"
Max thickness	815 mm	32"

#### METALLURGICAL SERVICE

Finkl Metallurgical Laboratories provide standard mechanical properties testing for Tensile Testing (ASTM A370), Impact Testing (ASTM E23), Hardness Testing (ASTM E10, E18, A956), Macroetch Testing (ASTM E381), and other metallurgical testing with certification of results when 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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