

DATA SHEET



Finkl Steel

MLQ®Xtra

~AISI P20mod - 1.2738mod (HH) Remelted

PREMIUM QUALITY PREHARDENED MOLD STEEL

TYPICAL APPLICATIONS

- Clear lens molds
- Mirror surface finish molds (SPI A-1 and sharper)
- Long run molds
- Abrasive plastic injection molds
- Reinforced plastic injection molds
- Dies for non corrosive plastic extrusion

GENERAL

Delivery Condition: Hardened and tempered Electroslag Remelted (ESR) or Vacuum Arc Remelted (VAR)

Surface Hardness Range:

	BHN	HRC	N/mm ²
MLQ®Xtra 40	363-401	39-43	1255-1393

Other hardness ranges are available on request

MLQ®Xtra is a new, patented, pre-hardened mold steel grade specially designed for through hardenability, ease of machining and simple post-production mold maintenance. It has high impact strength and temper resistance 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.

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

MLQ®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

MLQ®Xtra is an excellent material for Polishing, Photo-Etching & Acid Texturing. The high-quality mold steel undergoes premium refinement through either Vacuum Arc Remelting or Electroslag Remelting, thus eliminating nearly all segregation and inclusions.

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

MLQ®Xtra is characterized by:

- Highest thermal conductivity
- Improved through hardenability
- Best polishability
- Excellent weldability
- Uniform hardness
- Improved wear resistance

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

MLQ®Xtra has high hardenability that ensures hardness levels are maintained at the working surfaces, even on large molds with deep impressions.

®Finkl Steel Trademark

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PREMIUM QUALITY MOLD STEEL

MLQ®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

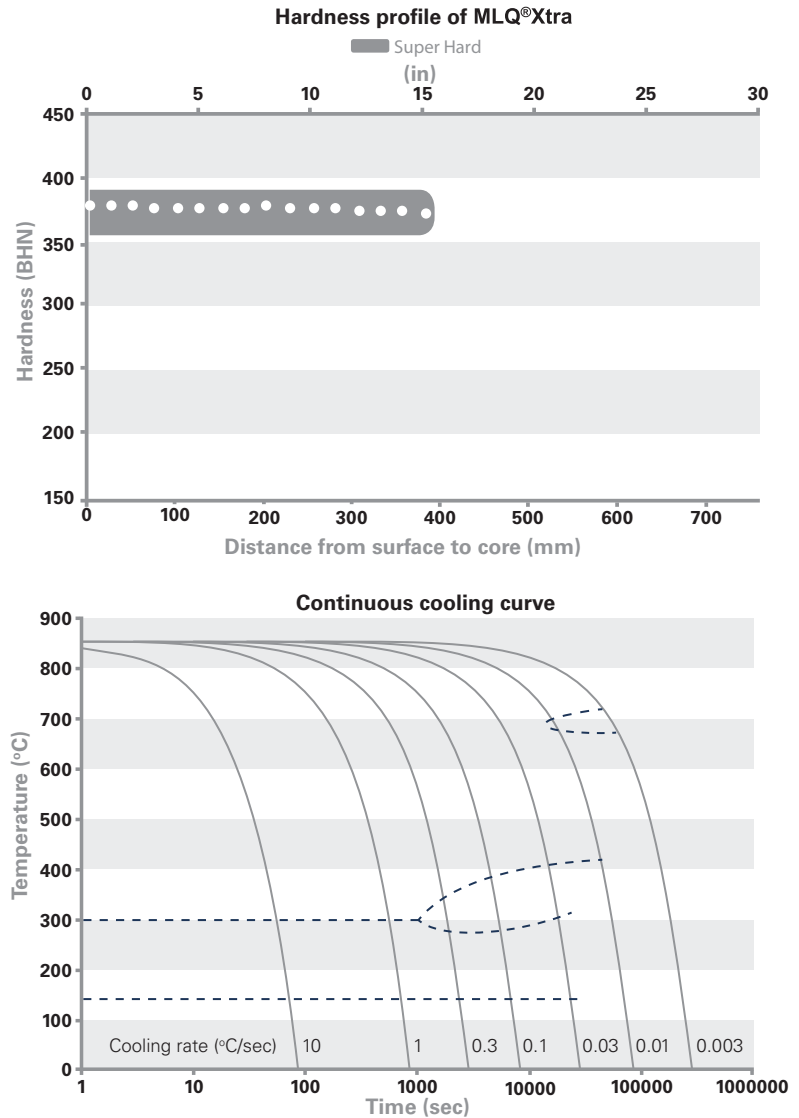
After hardening and tempering, the structure of **MLQ®Xtra** consists of tempered martensite and fine bainite.

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	≤ 0.5	≤ 0.5	0	≤ 0.5
DIN 50602	K1 ≤ 10			



Physical Properties

Thermal conductivity	Thermal expansion coefficient ($10^{-6} K^{-1}$)			Thermal capacity	Density
W/m*K (BTU/hr*ft*°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 102 mm (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.
363-401 BHN	363 (39)	1082 (157)	1179 (174)	> 15	60 (44)	56 (41)

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PREMIUM QUALITY MOLD STEEL

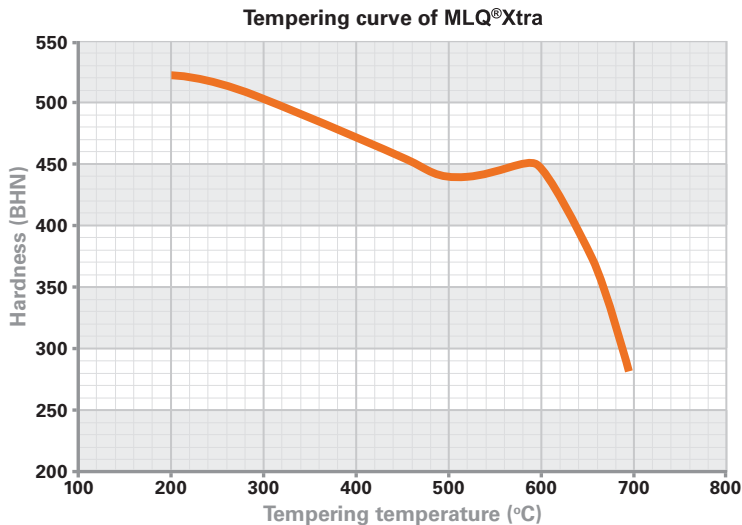
MLQ®Xtra

HEAT TREATMENT

Attainable Hardness of MLQ®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.

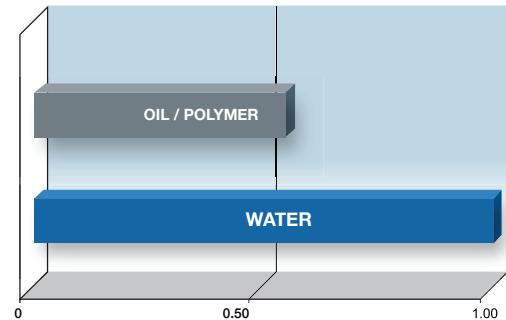
STRESS RELIEVING

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

MLQ®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 MLQ®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 MLQ®Xtra. An increase in surface hardness of more than 100% for all MLQ®Xtra delivery conditions is possible with no loss of base hardness, and for MLQ®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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PREMIUM QUALITY MOLD STEEL MLQ®Xtra

TEXTURING

MLQ®Xtra offers excellent response to texturing because of the great 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

The following is an example of good hard-polishing procedure:

Preparation for diamond polishing

- Step 1 • Polish with 220 – grit silicon stone
- Step 2 • Polish with 320 – grit silicon stone
- Step 3 • Polish with 520 – grit silicon stone
- Step 4 • Polish with 800 – grit silicon stone
- Step 5 • Polish with diamond paste grade 15
- Step 6 • Polish with diamond paste grade 6
- Step 7 • Polish with diamond paste grade 3

When the demands for finish are particularly high, use grade 1. Be aware that the best result is obtained after a certain optimum polishing time.

SIZE MLQ®Xtra (Approximate)

Max weight	16330 kg	36000 lbs
Max section	0.90 m ²	1400 sq in
Max width	1350 mm	53"
Max thickness	760 mm	30"

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.

Finkl Steel—Chicago
1355 E. 93rd Street
Chicago, IL 60619
773.975.2510
TOLL-FREE: 800.621.1460

Finkl Steel—Sorel
100 McCarthy Street St-
Joseph-de-Sorel
Quebec, Canada J3R 3M8
450.746.4122
TOLL-FREE: 800.363.9484

Finkl Steel—Composite
2300 W. Jefferson Avenue
Detroit, MI 48216
313.496.8599
TOLL-FREE: 800.521-0520

Finkl Steel—Houston
14710 Cypress North
Houston Rd.
Cypress, TX 77429
281-640-2050

www.finkl.com

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