SUPER 7 MOLD QUALITY® PLATE

PRECISION MARSHALL
The Deluxe Company

SUPER 7 MQ®

Technical Bulletin

Dear Industry Colleagues,

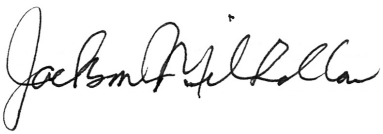
Precision Marshall Steel Company's primary mission is to provide higher value in the products and services we provide than can be found from our competitors. When it comes to meeting and exceeding your service and product quality needs, our goal is not to be the best in our industry, but rather to be the best there ever has been in our industry. This is what it means to be *The Deluxe Company*.

For over 70 years, we have been making substantial investments in operating systems, plant facilities, equipment and personnel. The end result is to keep improving our performance so that you can keep pace with your competition. We know that we must earn your business every day, and with continuous improvement, we all succeed. Despite our longevity, our eye is on the future and not the past.

We also know that without strong relationships our business will falter. We believe that "Companies Don't Succeed, People Do." Part of our continuing effort is to build relationships inside and outside of our organization that are productive and will stand the stresses of a dynamic global business environment.

Finally, we know you have many choices of suppliers and we appreciate your business. Remember, when you deal with *The Deluxe Company*, you should always expect the best.

Respectfully,



Jackson Milhollan
President and Chief Executive Officer

Precision Marshall's **Super 7 MQ®** is a premium shock resistant tool steel and is suitable for use in applications requiring high impact strength, like blanking and forming tools. Super 7 MQ® provides a unique combination of machinability, exceptional toughness, ease of heat treatment and minimum distortion. We are so confident in the quality of our materials that we guarantee them 100%.

Applications & General Features

Super 7 MQ® Deluxe Plate

- High Quality Cold Work Tool Steel
- Member of Shock-Resisting Steels Family
- Ideal for High Hardness Plastic Molding, Zinc Casting Dies, Hot Punching/Shearing Dies & Coining Dies
- Combines Optimized Chemistry with a Unique Manufacturing Process

Optimized Chemical Analysis + **Unique Manufacturing Process** = **SUPER 7 MQ®**

Resulting Key Characteristics

- Excellent Toughness
- High Polishability
- Superior Machinability
- Outstanding Wear Resistance
- High Compressive/Tensile Strength
- Low Distortion
- Superior Hardness After Heat Treat
- Shock Resistant

SUPER 7 MOLD QUALITY® PLATE

Optimized Chemical Analysis (Mass %)

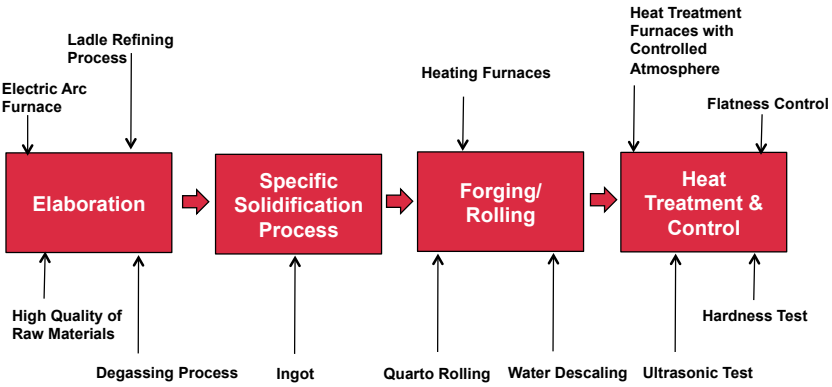
Improved Polishability – Low S (Sulfur) & Si (Silicon)
Good Wear Resistance – High Mn (Manganese) & Cr (Chromium)

	C	S	P	Si	Mn	Ni	Cr	Mo	V	Cu	Co
Super 7 MQ	**0,48/0.55**	**<0,20/0.50**	**<0,010**	**0,20/0.50**	**0,60/0.80**	**<0,40**	**3,10/3.50**	**1,30/1.55**	**0,20/0.30**	**0,23**	**X**
ASTM S7	0,45-0,55	<0.030	<0.030	0,2-1	0,2-0,8	X	3-3,5	1,3-1,8	<0,35	X	X
H11	0,33-0,43	<0.015	<0.015	0,8-1,2	0,2-0,5	<0,3	4,75-5,5	1,1-1,6	0,3-0,6	X	X
H13	0,32-0,45	<.030	<.030	0,8-1,2	0,2-0,5	<0,3	4,75-5,5	1,1-1,75	0,8-1,2	X	X
A2	0,95-1,05	<.030	<.030	0,2-0,4	0,45-0,75	X	4,75-5,5	0,9-1,4	(0,4)	X	X
D2	1,4-1,6	X	X	0,3-0,5	0,3-0,5	X	11 -- 13	0,7-1,2	(0,8)	X	(0,6)

High Toughness – Low C (Carbon), S (Sulfur), P (Phosphorus) & Si (Silicon)

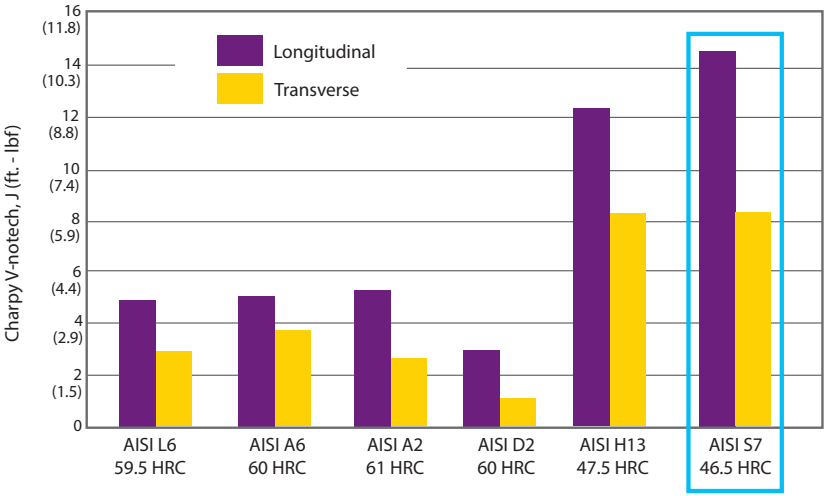
Good Heat Checking Resistance – High Cr (Chromium), Mo (Molybdenum) & V (Vanadium)

Unique Manufacturing Process



S7 Mold Quality® Characteristics:

Excellent Toughness



Source : ASTM Specialty Handbook®/Tool Materials

SUPER 7 MQ® shows better results in toughness tests than H13 because of a hardness Level 9 Points on the Rockwell C Scale above H13.

SUPER 7 MQ® also offers a very good hardness/toughness ratio, which is ideal for high hardness plastic molding applications.

Benefits of Excellent Toughness

- Decreased maintenance costs for tools due to improved longevity

S7 Mold Quality® Characteristics:

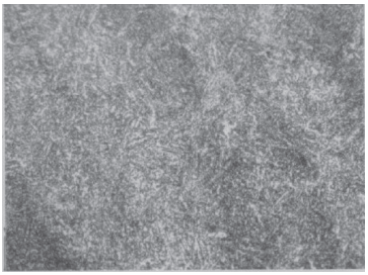
High Polishability

Microcleanliness

	Worst-Field Inclusion Ratings (ASTM E-45 - Method A)							
	Type A (sulfide)		Type B (alumina)		Type C (silicate)		Type D (globular oxide)	
	Thin	Heavy	Thin	Heavy	Thin	Heavy	Thin	Heavy
Specification	0,5	0,5	1.0	1.0	0,5	0,5	1.5	1.5

Microcleanliness is in accordance to international standards (North American Die Casting Association (NADCA) requirement for premium grades)

Structural Homogeneity



Microstructure in accordance with international standards (NADCA/SEP)

SUPER 7 MQ®'s high level of microcleanliness and structural homogeneity give it very good polishability for molding applications.

Benefits of High Polishability

- Reduces or eliminates surface defects on the mold and therefore produces a cleaner, smoother mold (reduces orange peeling and pitting)
- Reduces or eliminates re-polishing

S7 Mold Quality® Characteristics:

Superior Machinability

Grade	Hardness HB (after annealing)
SUPER 7 MQ®	187-223
A2	201-229
D2	217-255
H11	207-235
H13	192-229

Source : ASTM Specialty Handbook®/Tool Materials

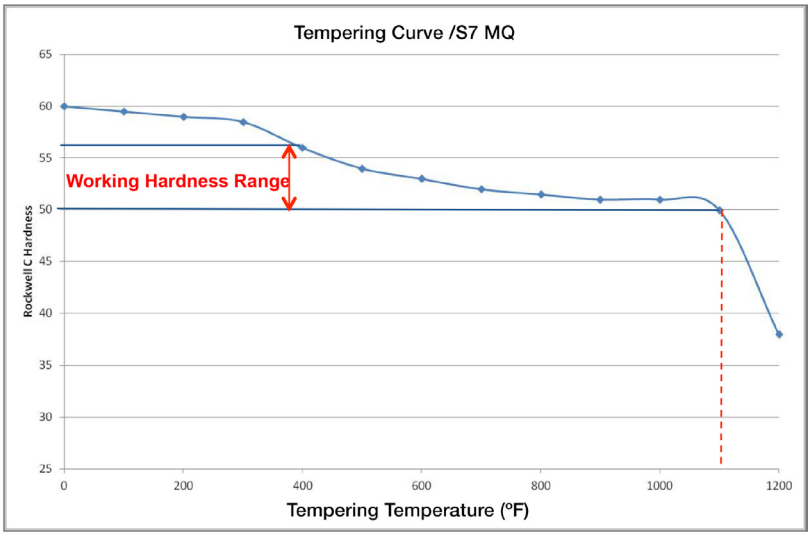
Compared to annealed standard steels for plastic molding applications, SUPER 7 MQ® has the lowest hardness among the grades listed. That feature makes S7 MQ® better than other steels for machinability.

Benefits of Superior Machinability

- Increases tool life
- Reduces machine and personnel time invested in the mold

S7 Mold Quality® Characteristics:

Outstanding Wear Resistance



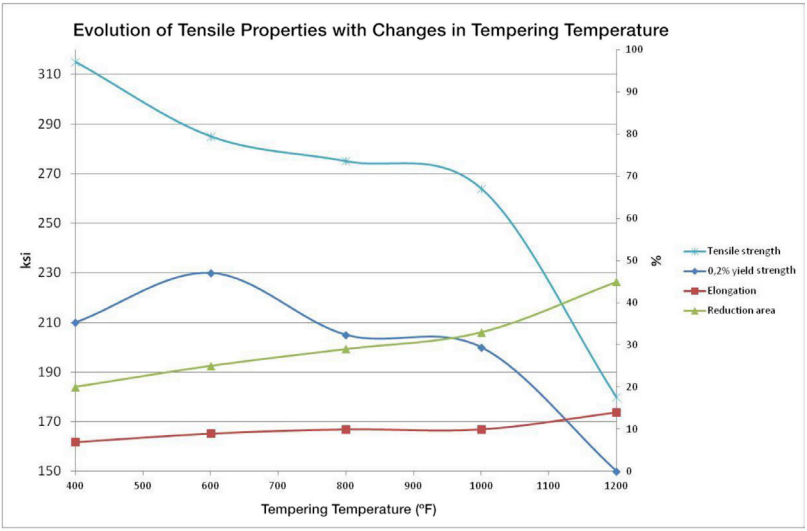
With its high hardness, S7 MQ® has excellent resistance and increases lifespan of tools.

Benefits of Wear Resistance

- Outstanding Wear Resistance makes Super 7 MQ® a superior option for glass filled or abrasive plastic molds
- The cleanliness is similar to ESR material

S7 Mold Quality® Characteristics:

High Tensile & Compressive Strength



As tempering temperature increases, tensile properties decrease.

SUPER 7 MOLD QUALITY® PLATE

SUPER 7 MQ®: Ideal for High Hardness Plastic Molding Applications

High:

- Polishability
- Toughness
- Tensile & Compressive Strengths

Good:

- Machinability
- Wear Resistance
- Heat Checking Resistance

Super 7 MQ® is available in the following thicknesses:

Thickness	S-7 MQ® Availability
¼″	X
⅜″	X
½″	X
⅝″	X
¾″	X
⅞″	X
1″	X
1-⅛″	X
1-¼″	X
1-⅜″	X
1-½″	X
1-¾″	X
2″	X
2-¼″	X
2-½″	X
2-¾″	X
3″	X
3-½″	X
4″	X
4-½″	X
5″	X
6″	X
8″	X

ADDITIONAL DELUXE PLATE PRODUCTS*

PRESCO O-1: Basic cold work tool steel for general purpose applications. Meets ASTM A-681 and W 2510.

AIRTRUE A-2: Most versatile cold work tool steel combining an excellent combination of wear resistance, toughness, ease of heat treatment and minimal distortion. Meets ASTM A-681.

ARISTOCRAT D-2: High Carbon/High Chrome tool steel for applications requiring superior wear resistance and medium toughness. Meets ASTM A-681 and W2379.

FIRECHROME H-13: General purpose hot work tool steel designed for use as die casting dies, die holder blocks, hot forging and extrusion dies, and hot work punches. Meets ASTM A-681 and W2344.

MARSHALLOY MQ®: Mold quality steel supplied in the prehardened condition. Special melting and refining practices are utilized to produce a uniform product with exceptional cleanliness. These characteristics allow the product to be polished to an extremely high finish required for plastic molding.

MARSHALLOY STANDARD: Premium 4140/42 PH alloy steel pre-hardened to 262-321 Brinell. Exceptionally versatile for use in short run tools and dies, non-critical molds, guide rails, back up and support tooling, and holder blocks.

MARSHALLOY ANNEALED: High quality 4140 alloy steel intended for a wide range of mechanical applications. Hardness is typically 200 Brinell and can be heat treated after machining where required.

**Most Deluxe Products available in thicknesses from ¼" through 8"*

SUPER 7 MOLD QUALITY® PLATE

We Stand Behind Our Products

Guarantee of Quality

Our conformance to specifications sets the industry standard.

At Precision Marshall, we assume complete liability for any costs directly relating to a deviation from our published specifications.

Any such costs, properly documented, will be reimbursed.

PRECISION MARSHALL
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