The aluminum mold alloy that 
out-machines, out-cools, 
out-cycles, out-produces 
and outsmarts steel.
It’s time to think differently about mold materials for production-ready plastic injection molding. It’s time to think aluminum instead of steel.

As Alcoa’s next generation mold alloy, QC-10® expands mold design options and brings new performance capabilities to high volume manufacturing. It machines 8-10 times faster than steel, reducing finishing costs and lead times by 20-30%. Plus it conducts heat nearly 5 times faster than P-20 tool steel, shortening production cycle times by 20-40%.

No wonder it’s the new mold material of choice.
For mold makers, aluminum offers significant benefits over tool steels — benefits that allow them to expand their design options and take advantage of its unrivaled thermal and machining properties.

A lighter metal, aluminum is easier to cut and faster to machine into molds, translating into faster machining rates, shorter mold production time, and extended tooling life. Fewer water lines are required for gun drilling, reducing machining time. And because heat developed during machining stays largely in the chips, cutting tools stay sharp and last longer. Not only that: with one-third the density of steel, aluminum’s lighter weight makes it easier and less expensive to handle and transport.

<table>
<thead>
<tr>
<th>QC-10 COMPARISON</th>
<th>Mold Material</th>
<th>Thermal Conductivity (Btu/ft/hr/°F)</th>
<th>Density lb/in³</th>
<th>Hardness</th>
<th>Yield Strength (ksi)</th>
<th>Coefficient of Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>QC-10</td>
<td>7xxx Aluminum</td>
<td>92.2</td>
<td>0.103</td>
<td>150-170 HB</td>
<td>66 - 76</td>
<td>13.7</td>
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<tr>
<td>7075 - T651</td>
<td>7xxx Aluminum</td>
<td>75</td>
<td>0.101</td>
<td>150 HB</td>
<td>48-73</td>
<td>13.1</td>
</tr>
<tr>
<td>6061 - T651</td>
<td>6xxx Aluminum</td>
<td>96</td>
<td>0.098</td>
<td>95 HB</td>
<td>40-42</td>
<td>13.1</td>
</tr>
<tr>
<td>2618 T6</td>
<td>2xxx Aluminum</td>
<td>102</td>
<td>0.101</td>
<td>95 HB</td>
<td>28-30</td>
<td>12.9</td>
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<tr>
<td>P20 Grade Steel</td>
<td>Carbon Steel</td>
<td>20</td>
<td>0.285</td>
<td>28-36 Rc</td>
<td>130-135</td>
<td>7.1</td>
</tr>
<tr>
<td>MoldMax HH®</td>
<td>Beryllium Copper</td>
<td>75</td>
<td>0.302</td>
<td>40 Rc</td>
<td>140-145</td>
<td>9.7</td>
</tr>
</tbody>
</table>

*www.moldmakingtechnology.com/articles/120801.html

15-25% savings in tooling, depending on mold simplicity*

*fewer machine hours per mold
Aluminum’s shorter lead times mean mold users can be up and running parts while steel tools are still being built. In addition, mold startup time is shortened since tools come up to temperature so quickly. And because aluminum heats up and cools down faster than steel, molders can increase parts-per-hour on existing presses with fewer rejections. Parts are ejected more quickly, with less distortion, warpage, and post-mold shrinkage than parts from a steel mold on a comparable cycle. Better thermal conductivity creates 20-40% faster cycle times and uses less energy, which lowers production costs. Plus aluminum’s ability to manage temperature evenly across the surface of a mold eliminates hot spots, resulting in better-formed plastic parts with less residual stress.

FOR MOLD USERS:

Faster cycle times, lower production costs

Aluminum molds are more efficient than steel molds

Below: This series of six photos illustrates a machining time of 11 minutes from start to rough-cut core features. QC-10 mold alloy is ideal for lights-out machining and boosting process efficiency.

“Aluminum tooling for mainstream injection molded auto parts is continuing to gather interest, with Ford Motor Company executives urging mold makers and molders alike to learn more about using it.”

Posted 10-26-09 by plasticsnews.com
FOR OEMs:

Lower piece cost, high piece quality

Aluminum delivers critical advantages for OEMs as well. Spurred by increased globalization, increased demand for worldwide product availability is shortening already short product life cycles. Aluminum molds help mold users meet the demanding delivery needs of OEMs. Faster cycle times for mold users mean faster delivery times for end users, leading in turn to faster manufacturer throughput.

To keep costs down, OEMs are turning to their suppliers for greater process efficiencies. Lower production costs for aluminum mold users are reflected in lower piece costs for end users – as well as lower overall manufacturing costs. In addition, the improved quality and consistency of aluminum-molded parts is a definite plus for OEMs.
Specifically designed for high production injection and blow mold applications, QC-10 offers greater strength, stability, and durability than any other high-grade aluminum mold alloy on the market today. Its improved alloy composition provides outstanding, 1"-24" thick section strength and hardness equal to that of rolled plate. While its quench insensitive microstructure allows minimal strength drop-off and unequalled machinability.
FOR MOLD MAKERS:

The fastest machining

A high hard type of aluminum mold material, QC-10 machines 8-10 times faster than P20 steel for rough milling. In fact with high-speed spindles, rough machining of QC-10 can occur at cutting speeds of 20,000 rpm\(^1\) and feed rates of 0.325 mm\(\times\)pt – significantly faster than the 2,000 rpm and 0.127 feed rates of P20 steel.

These kinds of speeds mean QC-10 production molds can be made in hours or days rather than weeks or months, resulting in 20% faster mold delivery times. In addition, a cutting force one-third of that required by P20 steel means cutting tools last longer machining QC-10.

Specifically designed for production molds, QC-10 balances strength, toughness, and corrosion resistance to provide optimal hardness and extended mold life. In fact, QC-10 molds in use today have achieved hundreds of thousands of shots. The superior strength of QC-10 allows mold makers to design molds with deeper parts. And its consistent through-thickness hardness is critical for holding a sharp edge along the parting line.

Alcoa’s Signature Stress Relief SSR cold-worked technology gives QC-10 consistent strength in the middle of the block, differentiating it from other aluminum mold alloys. Fully wrought and heat-treated, it offers greater process efficiency as it requires no post-machining heat treatment.

1 “General Guidelines for QC-10 Injection Molds”, July 2009

Faster cycle times use less energy

Can be textured and polished

Availability of the widest range of material sizes for enhanced mold design
QC-10®: GREATER PRODUCTIVITY

FOR MOLD USERS:

The fastest cycle times

QC-10’s outstanding thermal conductivity is key to faster cycle times. The aluminum mold block conducts heat nearly 5 times faster than P-20 tool steel, reducing molding cycle times by 20-40%. Reduced cycle time increases productivity. Plus because QC-10 molds heat and cools faster than steel molds, plastic flows better and resin is processed more efficiently.

With as much as 75% of the heat dissipating in the mold, parts cool more quickly, without the “hot spots” and molded-in stresses common to parts from steel molds. That means QC-10 tools offer the kind of improved finished part stability that translates into better all-around quality.

QC-10 automotive applications include:

- Rear deck trays
- Trunk liners
- Wheel well liners
- Center consoles
- Glove box interiors
- Climate control/HVAC components
- Rocker panels
- Bumpers/bumper components
- Instrument panel end caps
- Cup holders and bins
- Spare tire and underbody covers
- Engine protection covers

FOR OEMs:

Lower piece-part pricing

By offering reduced molding cycle times of 20-40%, QC-10 aluminum tooling has clear cost advantages for original equipment manufacturers. Currently, as much as 50% of the cost of an injection-molded part is cycle time². Cutting cycle time increases production and decreases piece-part costs, creating significant savings that can be passed onto OEMs.

What’s more, the advent of shorter product life cycles, combined with increasing consumer
Decked Out Like Never Before.

Traditionally, injection molds for plastic automotive components have been made of P-20 steel. But with the creation of Alcoa’s QC-10, there’s now a better way. Working jointly with an automotive interior parts supplier, a rear deck mold was made from forged QC-10 aluminum and put into full production. The results were impressive:

- Mold machining costs were cut and development time was significantly shortened.
- Cycle times were reduced by as much as 25% for faster part production.

As of September of 2010, over 700,000 shots on rear deck tray have been produced, proving aluminum molds capable of high-volume production runs.

3 “Honda sets the stage for Broader use of Aluminum Molds,” www.plasticstoday.com/imm/articles/moldmaking-aluminum-honda-0210
Working jointly with mold makers and mold users/OEMs, we use a collaborative design approach to challenge conventional practices and provide innovative solutions that deliver greater value.

By working with our scientists and engineers, as well as the experts at the Alcoa Technical Center – the world’s largest and most advanced light metals research and development center with more than 120 Ph.D.s – you can benefit from our in-depth knowledge. In fact, no other company in the world can offer you Alcoa’s combination of aluminum engineering expertise and world-class fabrication facilities – facilities that span two continents and include the world’s largest forging presses and widest rolling mills.
Looking to the long term.

We are continually investing to make sure our QC-10 manufacturing capabilities can meet the promise of our proprietary advanced alloys, our technical and engineering expertise, and our collaborative design capabilities. Not only that; with plants located in Cleveland, Ohio, and Samara, Russia, Alcoa is uniquely positioned to provide high quality QC-10 in thicknesses up to 24” virtually on demand.

Interested in the opportunities presented by QC-10?

About Alcoa Forgings
and Extrusions
Alcoa Forgings and Extrusions (AFE) produces QC-10 mold block in thicknesses above 7". The business unit is a part of Alcoa’s Engineered Products and Solutions Group, and is the leading global supplier of hard-alloy forged and extruded aluminum products. The world’s number one producer of aerospace and defense forgings and extrusions, AFE also provides innovative solutions for the industrial, transportation, and oil & gas markets.

North American
Rolled Products
Manufacturing QC-10 in thicknesses up to 6", Alcoa North American Rolled Products produces the widest variety of aluminum plate and sheet in the world. They are a leading value-added supplier to the aerospace, automotive, commercial transportation, building and construction, industrial, and packaging markets.

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