By RON MOORE

Extrication Challenges of Advanced Steel In Vehicles: Part 3 – Cutting Tools

SUBJECT: Advanced Steel
TOPIC: Extrication Challenges of Advanced Steel in Vehicles: Part 3
OBJECTIVE: The rescuer will understand and explain the capabilities and limitations of various manual-, air-, and electric-powered rescue tools.
TASK: Given the information contained in Part 3 of this series and reference to a late-model passenger vehicle, the rescuer will be able to identify individual rescue tools within the department's tool inventory that can and cannot be expected to cut through advanced steel Boron structural areas.

THE SERIES...

- ❑ Part 1: More Steel
- ❑ Part 2: Advanced Steel
- ☑ Part 3: Cutting Tools
- ❑ Part 4: Power Cutters
- ❑ Part 5: New Rescue Techniques

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This cross-section of the B-pillar on the driver's side of a Dodge Caliber reveals the multiple layers that make up the pillar. The outer layer and the inner-most layer are mild steel. Only the thicker middle layer is advanced steel; in this case, hot-stamped Boron.

RON MOORE, a *Firehouse*® contributing editor, is a battalion chief and the training officer for the McKinney, TX, Fire Department. He also authors a monthly online article in the Firehouse.com "MembersZone" and serves as the Forum Moderator for the extrication section of the Firehouse.com website. Moore can be contacted directly at Rmoore@firehouse.com.

During this first-ever research into the challenges of advanced steels for vehicle rescue, it became very apparent that there were rescue tools out there that did not have the capability to cut through advanced steel. Essentially, our current generation of cutting tools were being out-gunned by the strength of the new alloy steels such as Boron and Martensite. In Part 3 of this series, we begin exploring exactly which tools will cut advanced steels and which won't. The time to find out is now, not at the scene of a crash with people trapped.

The research into tool capabilities began by first taking rescue tools that could potentially be used for cutting vehicles apart and organizing them into specific categories. The categories selected were air chisel tools, electric sawing-type tools, gas-powered cutting tools, hand tools and power rescue system cutters. The plan called for each family of rescue tool to be evaluated in a systematic manner on confirmed advanced steel.

Research Partners

Engineers from the American Iron & Steel Institute who participated in this field work confirmed that Daimler-Chrysler had exactly the same advanced steel structure present in its Dodge Caliber four-door sedan as well as its Jeep Patriot and Compass SUVs. The structural A-pillar, the B-pillar, and the roof rail back to the C-pillar were confirmed to be made of hot-stamped

After repeated unsuccessful attempts to cut into or through a Boron B-pillar with various air chisels, the tests were stopped. The chisel was only able to cut into the outer mild steel layer and would not cut through the inner Boron.

Boron alloy steel; that's one of the ultra-high-strength steels that are giving our rescue tools problems. Armed with that information, the Learning & Development group at the corporate offices of State Farm Insurance became involved in supporting the project. Through their network of agents, State Farm officials were able to locate eight 2007 or 2008 models of these specific vehicles, five Calibers and three Jeeps. All had suffered some sort of collision damage, were assigned as "total loss" vehicles and were scheduled for salvage auctions around the country.

Armed with knowledge of exactly what steel was present in these specific vehicles, exactly where it could be found, how thick it was and even how it was attached to the rest of the vehicle, the next step was to plan some rescue tool testing. The outcome of the research had to show what the capability of our current rescue tools are and what tools exist that have the capability of cutting through the advanced steels. The steel that was going to be consistently encountered in all these vehicles was Boron; ranging in thickness from 0.889 mm to 1.9 mm. To put things in perspective, the Boron ranged from slightly thinner than a penny to slightly thicker than a quarter. Also, in every vehicle the Boron layer was an inner layer of steel either inside the A- or B-pillars or comprising a layer of the roof rail. The B-pillar is constructed of three layers of metal – two mild steel layers and the Boron.

Air Chisel Tools

Air-powered tools, both high and low pressure, were tested first. In every case, the air chisels or airgun tools were unable to cut through the Boron B-pillars. The chisel bits cut into the outer mild steel layer but were unable to cut through the Boron layer, even the thinnest areas. In several cases, the chisel bit actually broke. Air chisels are not advanced steel cutting tools.

Sawing Tools: Recip, Circular and Rotary

Electric sawing tools were tried next including an electric-powered reciprocating saw and a special electric rotary saw. Reciprocating saw blade manufacturers from across the country were solicited to get their input into whether they had a blade that would cut Boron. A variety of demolition-quality recip saw blades were purchased for the testing. The blade that represented the best chance of being Boron-capable was the LENOX Gold blade, a product of the Lenox Co. in East Longmeadow, MA. This reinforced tooth design blade with its titanium coating is specially designed to dissipate heat and make the blade's teeth more wear resistant so they stay sharp for quicker cuts. The bi-metal LENOX Gold blade is a unique saw blade; easily identified by its white blade and gold titanium tooth edge.

Prior to the recip saw blade testing, a representative of the Walters Corp. contacted this author to offer a special product called CoolCut. Turns out it is a special gel packaged inside a caulking tube-type container. Instructions were to insert the saw blade into the CoolCut gel. With that coating on the saw blade, the manufacturer stated that it would chemically react during the cutting to keep the blade cool. A cool blade would cut through the Boron was the claim.

After basically sawing the teeth off

The electric-powered Evolution 230 Xtreme Res-Q-Saw did cut into and through the Boron B-pillar and roof rail. Sparks flew in all directions due to the hardened advanced steel, the noise level was very high and the saw blade was ruined in the testing.

Cutting through the hardened advanced steel of the B-pillar destroyed the abrasive blade of the rotary saw. As expected, significant showers of sparks were generated during use of the saw, making this an unrealistic tool for extrication operations.

every recip saw blade we had, CoolCut-coated or not, the end result was that we had only managed to scratch away the mild steel outer layer of the B-pillar but had not even scratched the Boron steel of the vehicle. In fact, the recip saw blades smoked and emitted showers of sparks as they tried to cut their way through the hard metal Boron layer. At the present time, there is essentially no reciprocating saw blade available that will cut through the advanced steels of a vehicle's structure at a crash scene.

Next, the Evolution 230 Xtreme Res-Q-Saw from the Res-Q-Jack Co. was offered for evaluation. This new tool for vehicle rescue is an electric-powered circular saw that utilizes a 1,750-watt, 15-amp motor to power a nine-inch-diameter carbide-tipped blade. The blade is specifically designed to cut mild steel, aluminum, stainless steel and wood. The saw did cut completely through the thickest 1.9-mm portion of a Boron B-pillar on a Dodge Caliber, but only after much effort on the part of the rescuers handling the saw.

Because the teeth on the saw blade were up against a hardened metal, there was a significant shower of sparks coming off the blade in all directions and damage occurred to the blade itself. Of the 48 carbide tips on the blade when we started, approximately 10 were gone by the time we completed our B-pillar cut. The noise level while the tool was working at maximum speed was almost deafening even while standing outside the vehicle. Yes, the saw cut through the 1.9-mm-thick layer of Boron steel in the B-pillar, but it isn't practical to consider this being realistically done at a real-world crash scene with a trapped patient and EMS personnel inside.

The final rescue tool in the saw category that was evaluated was a fire department gasoline-powered rotary saw. This versatile forcible entry tool was set up with an abrasive blade and tasked with cutting through the advanced steel structure of the vehicle. This saw, as one can already assume, did cut completely through the Boron B-pillar with only a typical amount of effort. That is the fact. The reality is that the blade was completely chewed up during the process, the shower of hot sparks from the Boron steel were scattered throughout the length of the vehicle, and the noise and exhaust smoke also made this tool Boron-capable, but not Boron-realistic tool for a real-world rescue scene.

Hand Tools

The next category of tools evaluated were our fire department hand tools. To balance out the reality of what we are up against with advanced steels, an entire B-pillar from a Jeep Patriot was placed on the ground. One firefighter was assigned to take sharp-pointed tools and attempt to puncture a hole in the B-pillar. He first took a pick-head axe and swung it over his head. As he came down, the pick end of his tool struck the B-pillar and simply glanced off. After repeated efforts to make a hole in the steel, the tired and frustrated researcher gave up. End result: a small ding in the pillar. Most strikes of the axe bounced off the hardened metal, leaving hardly a trace of any damage. The same results occurred when a halligan-type bar was used to attempt to puncture the pillar. We're definitely up against some tough stuff here.

Power Rescue Cutters

The performance of hydraulic-powered rescue cutters were evaluated as well as part of this overall project. Manufacturers of power rescue tools were invited to submit their power cutters for evaluation of their ability to cut through the Caliber or Jeep Boron steel structure. It became obvious that every hydraulic rescue tool manufacturer makes a power cutter that will not cut Boron.

The question as to which manufacturers have new generation cutters that can make it through the advanced steels will be addressed in Part 4 of the University of Extrication series.