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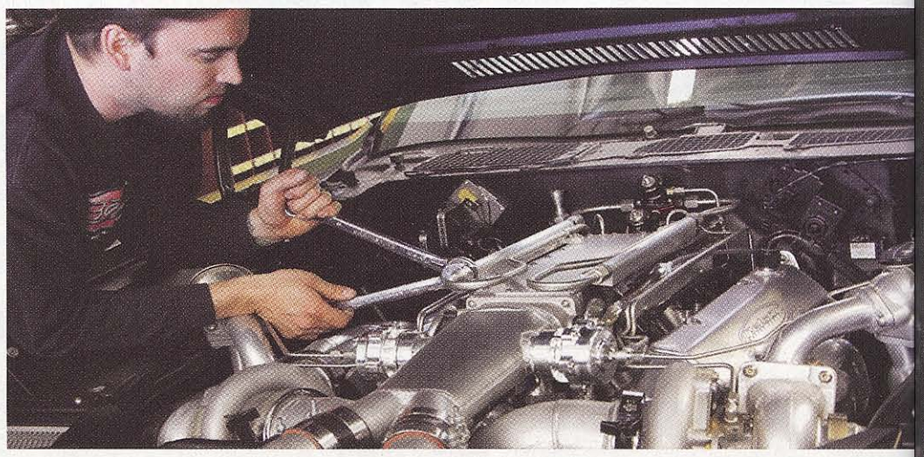
HOT ROD WHERE IT ALL BEGAN

GET IT BENT

Mark Bohlen of Bent Custom & Performance Shows Us the Basics of Custom Hard-Line Bending.

By David Freiburger

Photography: David Freiburger and Mark Bohlen



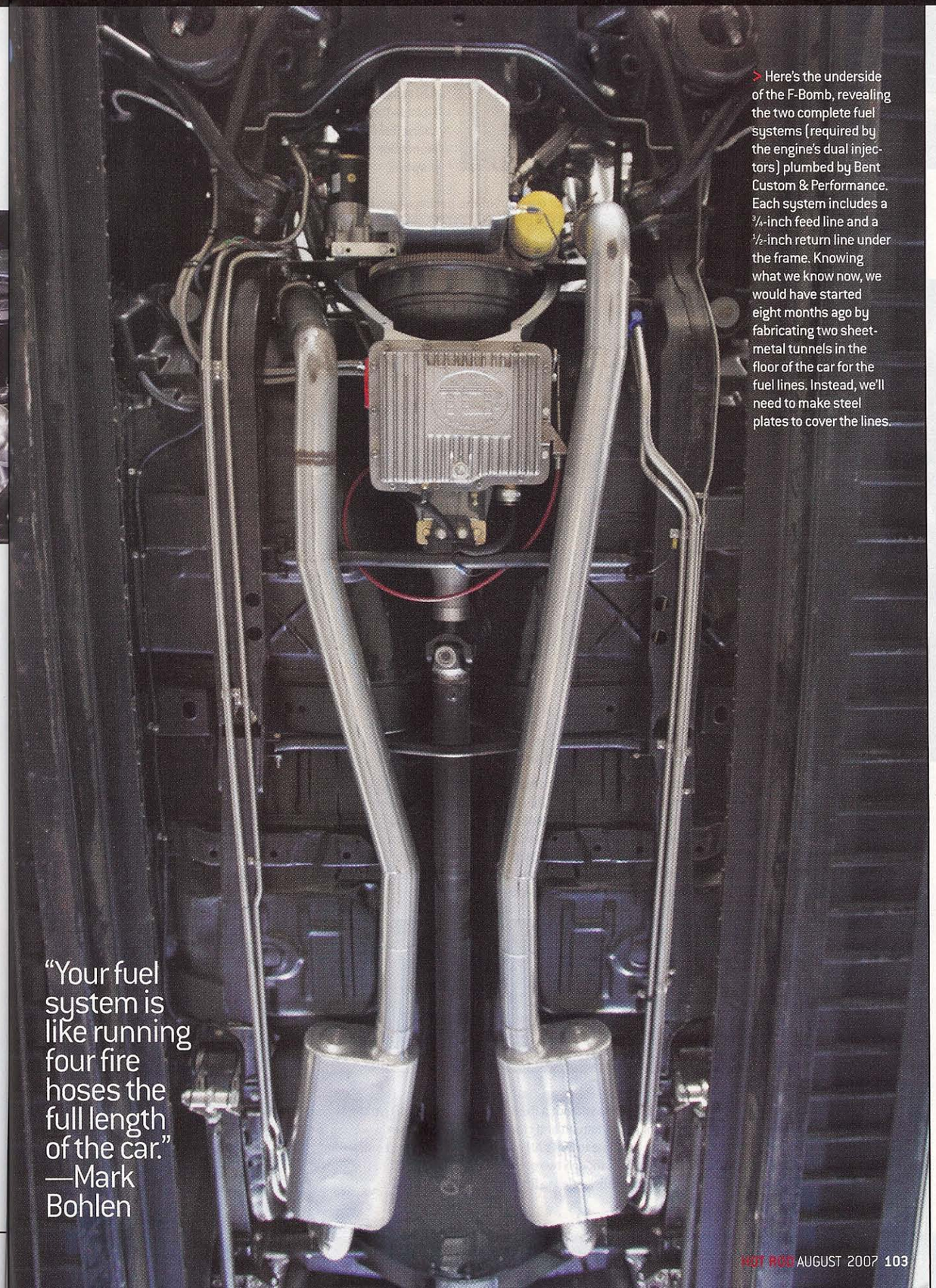
> Mark Bohlen of Bent Custom & Performance got his start in fabricating by fiddling with hard- line bending as early as age 14. Today his customers include chopper guys, Ridler-award contenders, show-car geeks, racers, and car designers such as Steve Strope.

Penultimate. It means next to last, and this is it. Our twin-turbo F-Bomb Camaro has been lingering around these pages for six issues—this month we're finally done showing you how to build it, and in the September issue we'll be able to gloriously reveal what it's like to drive the thing. For a lot of the players, that moment will culminate with one big sigh of relief. That's certainly true of Mark Bohlen, who's the last in a long line of F-Bomb craftsmen we've introduced you to.

Along with his wife, Michelle, and Twig, the ubiquitous Italian greyhound shop dog, Bohlen operates Bent Custom & Performance out of a supertidy shop that's in the same industrial complex as Nelson Supercars, the instigator of the Bomb. While Bent is a full-service fabrication shop—regularly handling mini-tub jobs, chassis modifications, and street rod setup—he's become known around here as the go-to guy for custom-bent hard lines for anything that carries automotive fluid or air. Applications include fuel systems, air conditioning, brakes, oil coolers, vacuum lines, airbag-suspension plumbing, and anything else you can think of.

The Bent shop creates all the hard lines for Nelson Racing Engines' twin-turbo engines, and that's how we got hooked up with Bohlen for the F-Bomb. In addition to the engine plumbing, he handled all the complex fluid conveyance systems on the chassis. Ninety percent would be hard line; flexible braided line would only be used in areas that need vibration damping, such as between the engine and frame, and in spots that require quick-release AN fittings.

The first step with hard line is to choose the material. While some racers prefer it for its light weight, Bohlen rarely uses aluminum tubing, telling us, "It's easy to bend by hand, but you can hardly ever get it perfectly straight since it always comes in rolls. It's so soft that it flattens out if you try and unbend it, and AN flares in aluminum gall up after a few times being connected or if you overtighten them. It can be polished, but it gets dull quickly." Another option is mild-steel tubing, which has the advantage of being easy to bend. Even so, Bent does not use it often because it has a seam that can be problematic, and because it cannot be polished. Bohlen's material of choice is aircraft stainless tubing, despite the fact that it is the hardest material and the most difficult to bend. However, Bohlen says, "Stainless is great because if you leave it unpolished it looks race, or the show guys can polish it and it stays shiny forever. Small dings can be polished out. It's hard enough that you can use single flares rather than the double flares that you have to do with soft mild-steel tubing. It might take more effort to make an actual bend in it, but it's cleaner to work with overall." Even so, Bohlen warns that some so-called aircraft-quality stainless tubing still has a seam inside it. He's found that the seam leaves a hard bump anytime a flare is added to the tubing, and that the imperfection can cause sealing problems at the junctions. Bent sells its own true seamless stainless tubing to avoid those problems. Bohlen

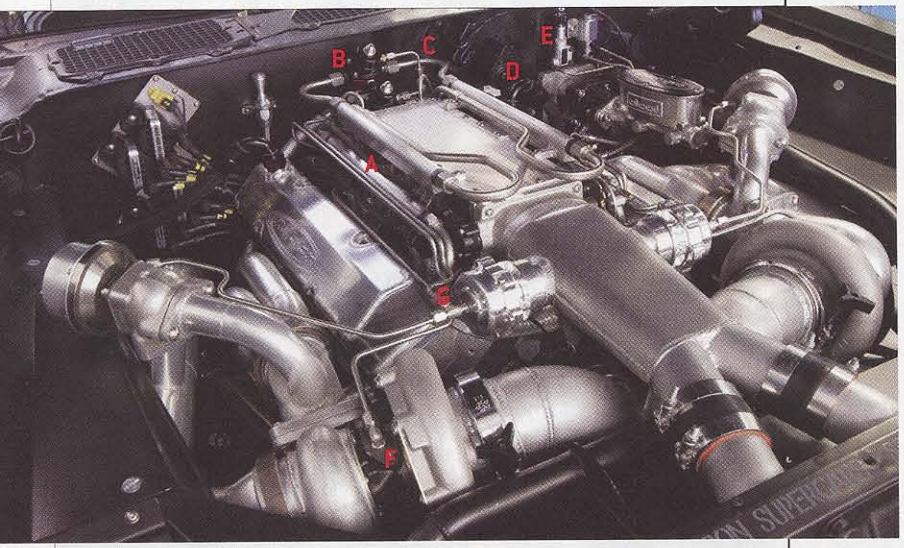


> Here's the underside of the F-Bomb, revealing the two complete fuel systems (required by the engine's dual injectors) plumbed by Bent Custom & Performance. Each system includes a ¾-inch feed line and a ½-inch return line under the frame. Knowing what we know now, we would have started eight months ago by fabricating two sheet-metal tunnels in the floor of the car for the fuel lines. Instead, we'll need to make steel plates to cover the lines.

"Your fuel system is like running four fire hoses the full length of the car." —Mark Bohlen

> Here, on a different car, is another solution to dual fuel lines: a Bent-fabricated Y-block. The company will soon offer CNC-cut, billet-aluminum blocks for this purpose.

> While Bent often must fabricate custom line clamps, our car used out-of-the-package pieces from Kugel Komponents. These clamps and brackets are available for most tubing sizes in both single- and double-tube designs. Note that Bohlen put a bend in the tube to clear the attachment screw; he never lets hard line rub on other objects.



> The F-Bomb engine, as seen on our Oct. '06 cover, has lots and lots of plumbing by Bent with the turbos, twin fuel systems, power steering, and Hydratech hydroboost. This guide will help you know what's what. A) Tandem fuel injector rails; B) twin Aeromotive fuel-pressure regulators (return lines extend from the bottom of each one); C) boost-reference line to both regulators; D) braided flex lines from the power steering pump to the Hydratech booster; E) brake proportioning valve and Line-Loc; F) oil feed to the turbos (the oil return to the pan is a flex line on the underside); G) boost-reference lines to the dual blow-off valves and wastegates. What you can't see are the oil and trans cooler lines underneath.

> Bohlen advises, "Never connect hard line to flex line without a fixed attachment point. If you just leave it flopping, it's ugly and the hard line will probably work-harden and crack." This shows a bracket welded to the Bomb's frame where the fuel lines merge from hard line to Earl's AN hose through bulkhead connectors.
> Here's another example of welded frame brackets, though two of these are hard line to hard line, providing both a tight, 90-degree direction change and a quick-release fitting for servicing the parts.

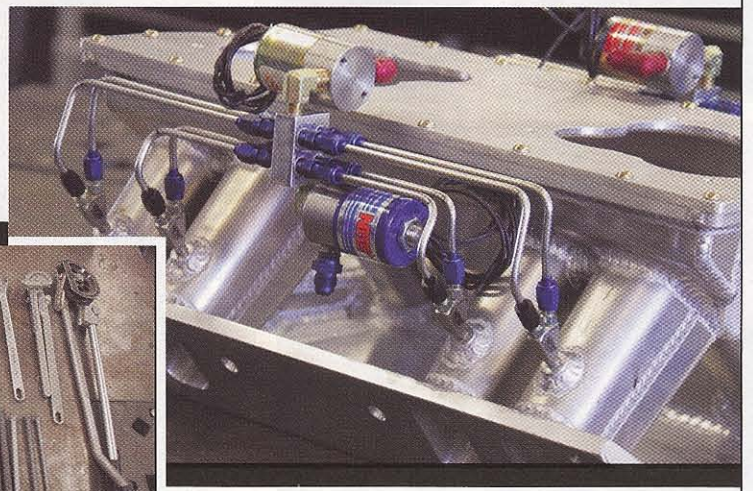
"Black is the new chrome."
—Mark Bohlen

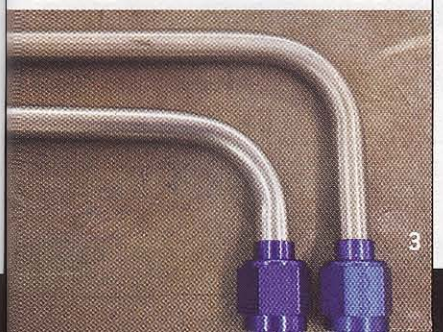
typically uses 0.035-inch-wall tubing in sizes ½ inch in diameter and smaller, and 0.040-inch-wall for ⅝ inch and up. The thicker walls on the bigger tubing help prevent it from collapsing in hand benders, which do not have a mandrel inside them to support the i.d. of the tube as it is formed.

The F-Bomb uses all Bent aircraft stainless, but all the assorted fittings came from Orme Brothers down the street. While Orme Brothers is a local supplier for Bent, it is also a sponsor of street car racing sanctioning bodies and a mail-order firm that can send you any AN or industrial plumbing or hydraulic fitting you can dream of. The company can also supply custom-made, pre-terminated flex lines for brakes, power steering, or any other application. For the F-Bomb, most of the fittings from Orme Brothers are either natural stainless to match the unpolished lines or are nickel-plated. Where anodized aluminum was the only option, we chose black (though Nelson cheated and painted some fittings that were only available in blue).

In all, the bending job helps the car look very orderly and purposeful, and is easier to work on than it would have been if we'd done everything in flex hose. This story will show you some tips and ideas from Bent, using the F-Bomb and a few other cars, so you can get the same look for your ride.

> **Left:** Bent never runs hard or flex lines through holes in the frame without supporting them with bulkhead connectors. This example on a Hemi Challenger built for Dependable Dodge shows how custom threaded tubes welded through the torsion-bar crossmember were used as attachment points for AN fittings. This also shows how stainless tubing may be polished. > **Below left:** Another advantage of stainless tubing is that stainless fittings may be TIG-welded to the tube (arrow) to clean up and shorten a connection that would otherwise require a series of fittings. > **Below:** Bohlen specializes in custom nitrous and fuel hard lines and can do work via mail-order if intakes and carbs are sent to him. He will not bend lines based on coat hangers bent to shape and sent to him via the mail.





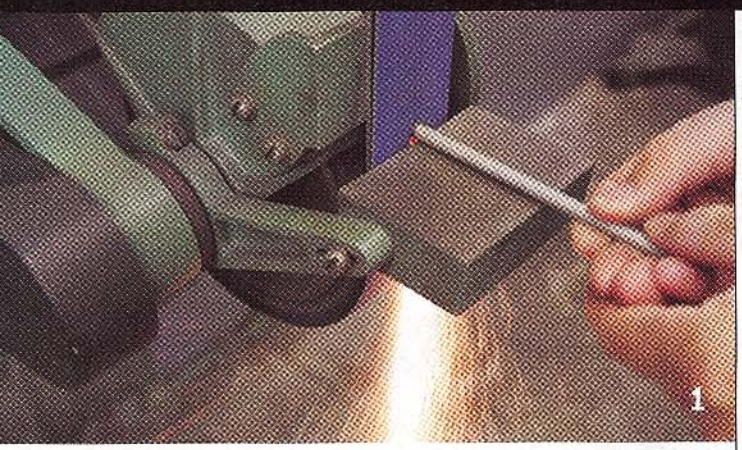
BENDING TIP

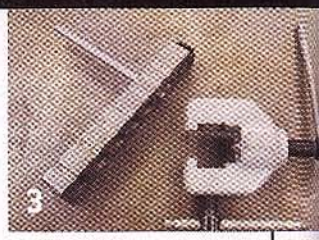
> 1. Here's Bohlen's 15-year collection of hand-benders in a number of tube sizes and jaw styles. The various brands clamp the tubing in individual ways, allowing different shapes to be formed without the bent tube interfering with the tool itself. Don't buy electrical conduit benders.

> 2. While the benders have clamps that hold the tube, Bohlen has found that he can often get the bend closer to the end of the tube—especially when a fitting is in the way—by holding the tube closer to the die using a pair of pliers with the teeth ground off of the jaws to prevent galling. Note that the bender is marked in degrees; this tube has been bent just past 90 degrees, though it will likely spring back to a clean right angle.

> 3. Here is an example of a tube bent using the normal method (top) versus one held with the pliers. Note how much closer the bend is to the end. This is also handy for getting lines parallel with each other, as shown.

"eBay is tubing-bender heaven."
—Mark Bohlen





FLARING TIPS

> 1. While some insist that you should not cut tubing with a hacksaw, Bohlen does it every day. He recommends a 32-tooth-per-inch blade and never uses a regular tubing cutter. After hacking, he squares and cleans the end of the tube with a sander, as shown, making sure not to overheat the material, which will tend to reharden the annealed stainless.

> 2. After sanding, the end of the tube is further cleaned using two deburring tools to clean the i.d. and a fine file to smooth the outside.

> 3. While Bent has a trick aircraft flaring machine, tubing can also be hand-flared. This is a Ridgid single-flaring tool available at Home Depot or other hardware stores. It can be used with stainless tubing.

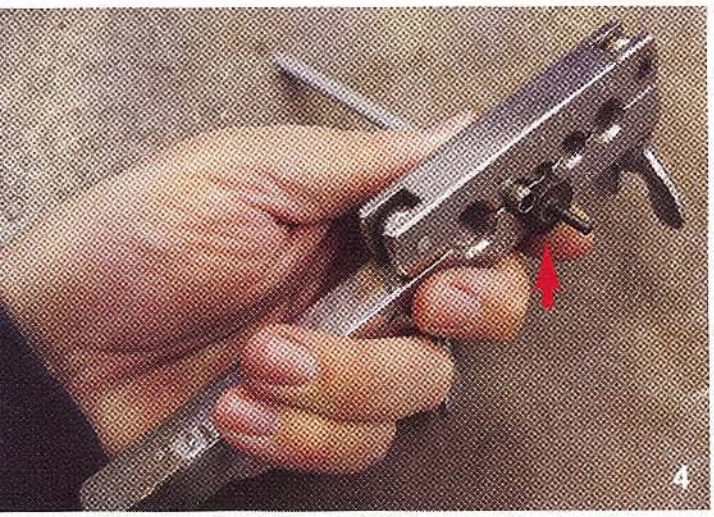
> 4. If you are working with mild steel, the tube must be double-flared with a tool like this that includes dies (arrow) used to fold the tube in on itself. These tools are always pretty frustrating to use.

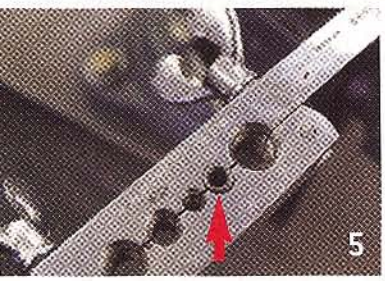
> 5. To double-flare the mild steel, you first flare it with the die, then remove the die and advance the tool's cone-shaped bit into the mouth of the tube (arrow) to ensure a double layer of metal that helps prevent cracking.

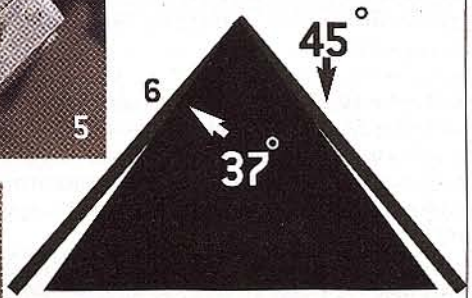
> 6. Remember that in the world of flares, there are two common types: 37 degrees in the AN world and 45 in the automotive and industrial hydraulic venues. Most 45-degree fittings are brass or steel, while AN is usually aluminum. It is by far best to mate 45 to 45 and 37 to 37, and stainless-to-stainless tapers need to be the most concentric because the metal is so hard. Going aluminum to stainless, you can often get away with mating 37 and 45 degrees, though the sealing surface is smaller so this is not optimal.

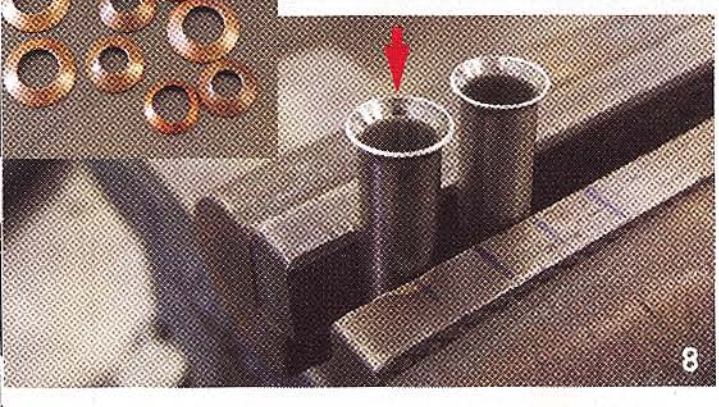
> 7. If you have a poor seal in a tapered fitting, these soft brass tapered washers can help by making a soft surface for the taper to seat upon. They are available through Orme Brothers.

> 8. Look closely at the arrow and you can see the hard spot that is created in the tubing when you flare a stainless tube with a seam in it. The tube to the right is Bent's seamless tubing.





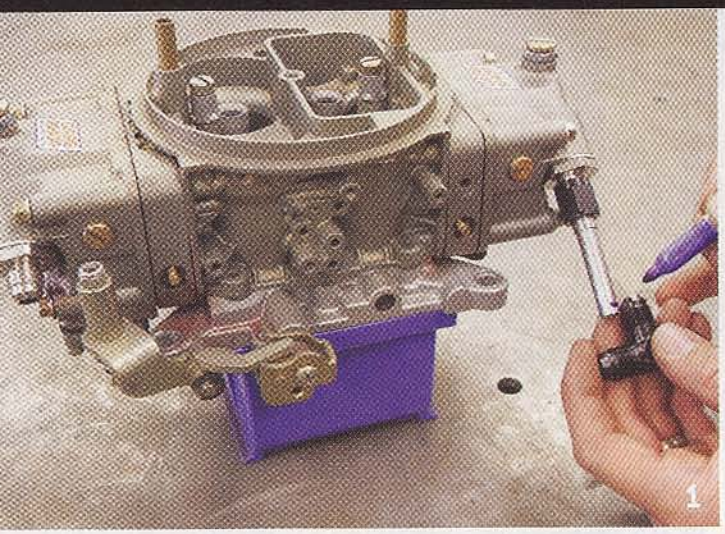


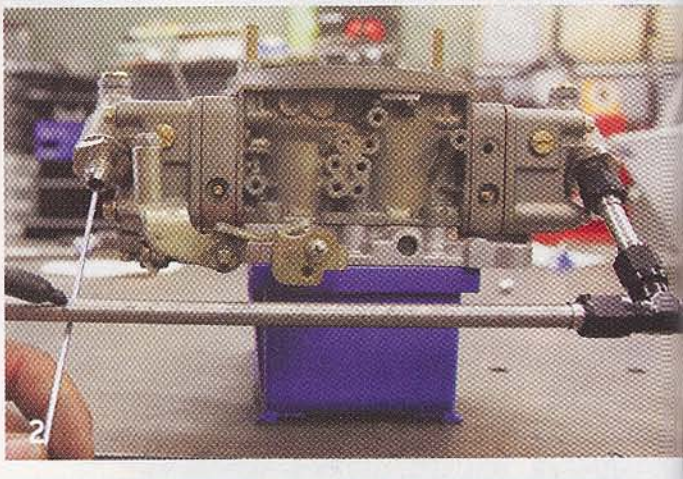


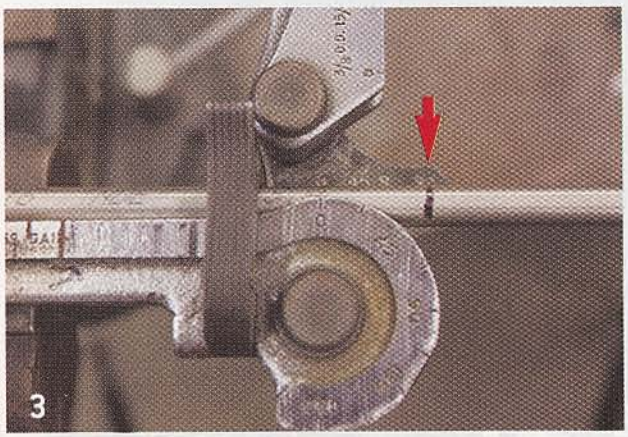
TUBE SIZES TO AN SIZES

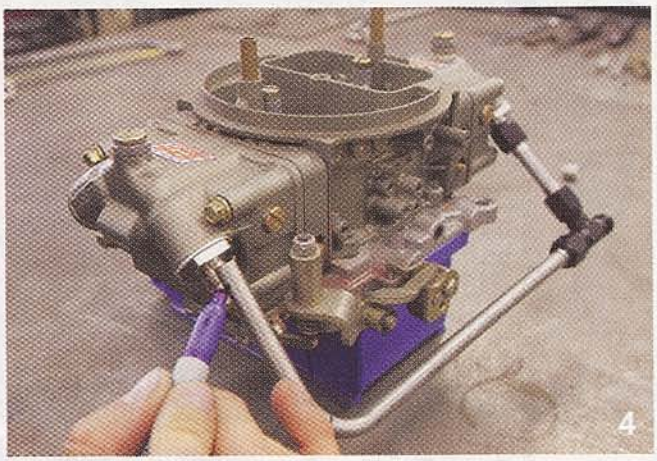
TUBE (in)	AN
1/4	-4
5/16	-5
1/2	-6
3/8	-8
5/8	-10
3/4	-12

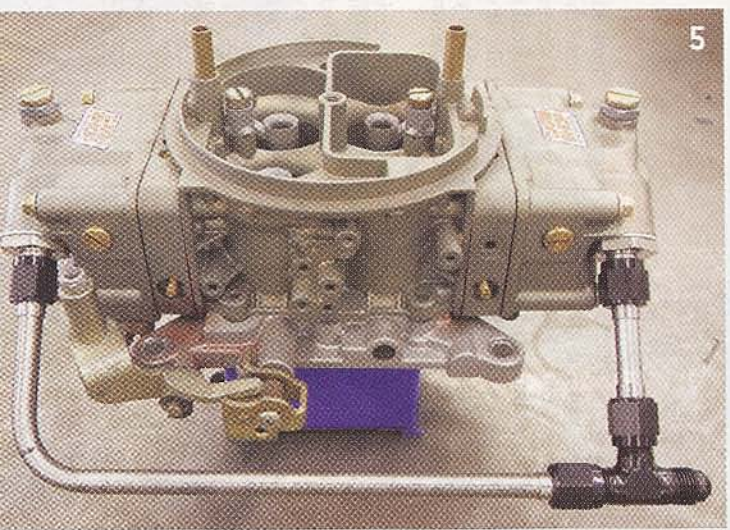
Note: -5 is uncommon, but trans cooler fittings are often 5/16, so you can use adapters in the transmission and the radiator or cooler to upsize to 3/8, or -6.











CARB INLET HOW-TO

> 1. Want to make your own carburetor hard inlet kit? You'll need 3/8-inch lines, two male -6 fittings that fit your float bowls (Holley and Demon are different), a -6 tee, and three sets of -6 nuts and sleeves. Start by deciding how long the front line must be to clear the carb linkage, then cut the line to length. Don't forget to install the nuts and sleeves before flaring.

> 2. Flare one end of a length of tubing and attach it to the front tube with the tee. Using a pen and a piece of hanger or welding rod, mark the center of the secondary inlet.

> 3. Next, put the tubing in the bender, lining up the mark you made with the 90-degree indicator on the tool (arrow). Shape the tube, and the center of the bend should end up right at the mark.

> 4. Finally, eyeball the location of the flare on the carb fitting to determine where to cut the tube, then slip on a nut and sleeve and flare the end.

> 5. There you have it—your first custom bending project. If you're too lazy, Bent Custom & Performance sells premade carb inlet kits like this starting at around $65. **HRM**

SOURCES

BENT CUSTOM & PERFORMANCE; Chatsworth, CA; 818/701-6147; www.bentcustomandperformance.com

ORME BROTHERS; Northridge, CA; 818/885-1414; 877/ORME-BRS; www.ormebrothers.com

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