01

Each modeling block is labeled with its outside diameter (in our case, 1.75 inches), bend centerline radius (CLR), and features both indexing arrows and witness marks. When the arrows line up on a series of blocks with the same CLR, you can replicate the section in steel from the same J- or U-bend. In other words, the indexing arrows are important, and when lined up, represent both a cost and weld savings. The witness marks are spaced 30 degrees apart and are valuable position reference points when recreating the design in steel.

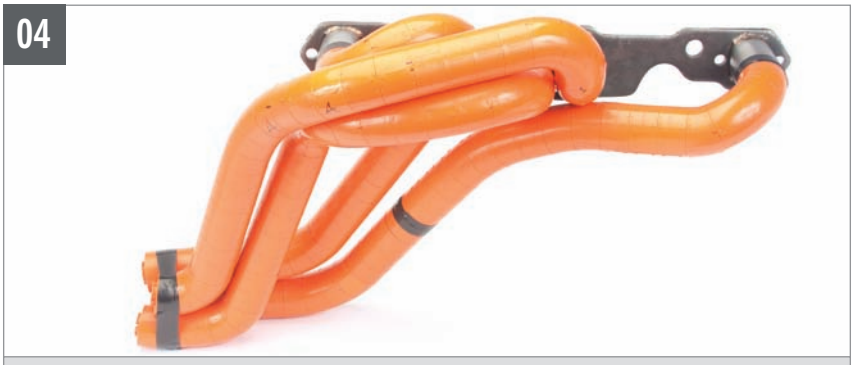
02

Each icengineworks™ Precision Exhaust Header Modeling System features straight pieces as well as modeling blocks with two-, three-, four-, and six-inch CLR bends. Having the flexibility of four different CLR sizes makes fine-tuning a design for optimal fitment and clearance as easy as swapping blocks.

03

The icengineworks™ Pro Kit includes eight block adapters, which anchor the blocks in starter tubes. The adapters expand when tightened and prevent the initial block in the header primary from rotating. We designed our header from the top down, starting after the two-inch starter tubes.

04

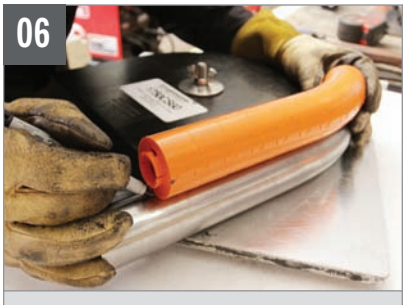


In a matter of roughly six hours, we had a finished, full-scale, 3D header model! In that time, we experimented with a number of designs focused on achieving equal length primaries and maximum clearance all around before determining the best design. Ultimately, after counting the blocks, we were able to get the longest and shortest primaries (cylinders two and eight respectively) within four inches of each other (29 and 25 inches). While not perfect, it's an acceptable variance for a street driven car and better than any off-the-shelf header we've seen.

05

With our design finalized, we dissected the model and marked each section of tube on a visual tubing shopping list provided by icengineworks™. Next, we contacted SPD Exhaust in Rancho Cordova, CA, to purchase the necessary tubing, collectors, and what turned out to be the nicest set of header flanges we've ever seen.

06

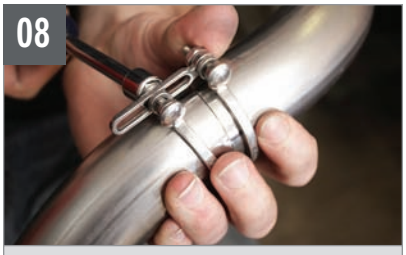


Next, we began the process of transferring the design to the steel tubing using the icengineworks™ pivoting cutting table and the corresponding tube cutting spacers. After marking and cutting the sections, we labeled each one with the cylinder and its position in the series (4A, 4B, 4C, etc), copied the indexing lines from the models, and indicated the exhaust flow direction.

07

To cut a section out of a six-inch CLR mandrel bent tube, we installed the pivoting table on our vertical band saw along with the corresponding six-inch CLR spacer and started cutting. The table and spacers ensure precise cuts that are always perpendicular to the centerline, which greatly simplifies the welding process.

08

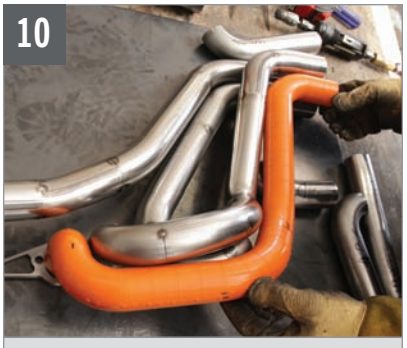


The icengineworks™ tack welding clamps are an absolute pleasure to work with. The clamps create strong temporary joints, which ensure a gapless welding surface and allow hands-free tack welding of complex sections. We can't help but wonder why they weren't invented sooner.

09

Using a TIG welder, Gary Simpson of Outcast Kustoms in Eagan, MN, tack welded a series of indexed sections in the same primary all held together by the easy to use tack welding clamps.

10



Before tack welding the tubes to the header flange, we test fit both the plastic and steel primaries to ensure each tube was identical to its counterpart.

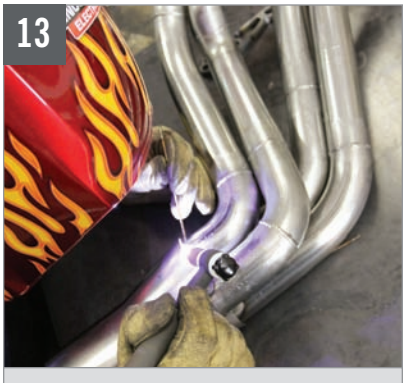
11

With the header completely tack welded, including the collector, we test fit it in the vehicle to verify the plastic model hadn't shifted or changed in any way from the initial design. Even a slight change could've led to fitment issues with the steel version.

12

Once we knew the steel header fit as well as our icengineworks™ 3D model, we gave Gary the green light to begin the finish welding. Notice the D-shaped end of the tube; Gary formed the tube to fit the header flange perfectly, which matches the exhaust ports in the cylinder head.

13



Gary used silicon bronze filler rod for both the collector and the flange welds to ensure quality penetration and a strong seal. The clean and precise welds produced by a TIG welder are second to none. From our experience, TIG welding is the only way to go when building custom headers.

14

Placed side by side, our icengineworks™ 3D plastic model is identical to the finished steel header. With only roughly six hours invested in designing the header, including time spent optimizing each primary to minimize the number of welds, we don't know how building a set of custom headers could get any easier. The Precision Exhaust Header Modeling System from icengineworks™ has revolutionized header design and fabrication and has eliminated the costly expense of wasted tubing previously associated with building headers.

SOURCES

ICENGINEWORKS™
icengineworks.com
(800) 597-3312

LINCOLN ELECTRIC
lincolnelectric.com

OUTCAST KUSTOMS
outcastkustoms.net
(651) 492-9565

SPD EXHAUST
spdexhaust.com
(888) 778-3312