



## STAR WARS AXLEHOUSINGS

### This is Not your Father's Ford 9-Inch Axle

**T**he 9-inch Ford rear axle is used in everything from street rods to drag racing to road racing to the Winston Cup. They've also been used in everything from the lowliest (slow) streetcars all the way up to Top Fuel dragsters. And they're used in Chevys with regularity. Unfortunately, in stock form, the Ford 9-inch housing isn't as strong as its reputation. Almost 15 years ago, pro drag racers were plagued with rear axle housings that bent. Sure, the race teams and chassis builders fortified the housings with countless braces, supports and brackets, but the often-massive torque loads still managed to turn even the stoutest pieces into metal macaroni. In some instances, the axle housings would bend and remain bent. In other more mysterious cases, the housings would bend during the initial launch and then snap back into form as the lap down the quarter-mile was completed—acting much like a huge, transverse spring (and this isn't exclusive to drag racing—we know of a very well-heeled and famous road race team that experienced the same dilemma).

## WHAT'S WRONG WITH THE FORD?

We spoke to Chris Alston about the pitfalls of the Ford, and he elaborated on the inherent problems found in the 9-inch Ford housing: "The Ford 9-inch is a very popular housing, but you have to remember that the 9-inch hasn't been built for over a decade. That means the newest junkyard part you'll come across is at least 10 years old. Aside from age, there are three major drawbacks to the 9-inch: First, the housing axletubes are not round. Not only do they taper from 3 1/2 inches down to 3 inches, the tubes all have "flats" which are more or less squashed onto the tubes. Both of these factors force a chassis builder to custom-build every bracket because they aren't symmetrical. Finally, the OEM Ford housing face is approximately 24 inches wide. Because of this, you have to weld brackets to the face in some cars. This means you lose adjustment holes for items such as the four-link."

Another problem that's seldom discussed with Ford 9-inch housings is the rear brace. The almost-standard brace does nothing to stop downward bending on the rather flimsy Ford housing. A second brace is usually needed to eliminate downward flex. Another point to consider is the actual rear "cover" in the housing. The backplate isn't one piece; it's usually pressed into the housing. The chassis builder is forced to weld the rear cover to the housing, but that doesn't stop another problem: the hypoid action of the third member still tries to force the rear end out the back of the housing, which exerts forces on the assembly. In order to stop this, at least one of the chassis builders we spoke with, Mike Pustelny (of MPR in Detroit, Michigan) has reverted to welding a series of small tubes radially between the face of the housing and the rear cover plate. Most often called a "cage," this apparatus stops the center portion of the housing from flexing fore and aft.

## IS THERE SOMETHING BETTER?

With all of the cutting and pasting, the fabricator usually begins with only the skeletal remains of the stock Ford housing, and then starts from scratch. It's not hard to see that this isn't a very cost- or time-efficient way to build a rear axlehousing. There must be something better. And there is. Instead of using marginal factory components, some housings are now built entirely from scratch. One of the first to fabricate an all-new housing was George Cathey of Pro Designs. Cathey's new, completely fabricated sheetmetal housings



**The Chassisworks Fab 9 is a different approach to fabricated housings. While not as costly as a scratch-built Pro Stock housing, this design is equally at home in a high-horsepower vehicle. Chassisworks offers this housing in a number of different configurations, including several different bolt-in designs. The least costly (and by far the simplest) housing in the Fab 9 family is this piece. It's a bare housing without any brackets or a rear brace installed (although the brace hardware is shown in this photo). Included in all Fab 9 housings are machined housing ends. In this case, they're supplied loose for customer installation.**

didn't rely upon marginal junkyard parts for the foundation. They didn't bend; they were brutally strong and very resistant to extreme torque loads. Just as important, they were lighter than the heavily braced Ford 9-inch housings that were standard equipment under the quickest cars. Racers being racers, the advantages became immediately clear. Soon the housings were seen under Pro Stock cars. With the decidedly different shape of the housing, the drag race media quickly came up with the term "Star Wars housings." While Cathey has moved on to other projects and doesn't build housings on a regular basis, his original housings have forged a path for several new, completely fabricated housing designs.

Are these new fabricated housings restricted to race cars only? Absolutely not. There are plenty of applications, race cars and otherwise (including your street-driven Chevy) that can make use of similar housings. Given the "trickle-down effect" of motorsports, several manufacturers recognized the fact that many of these cars had plenty of heat under the hood, too. And much like their professional racing counterparts, they too were twisting, bending, and otherwise mangling rearend housings. As a result, there are countless Bow-Tie applications that can make use of a contemporary sheetmetal axlehousing. It

should be noted, however, that there are also plenty of cases where it just makes sense to use something like a modified 12-bolt. In some cars, you may not require the beef of a completely braced housing. And in some applications, it simply may be more economical to use a conventionally reworked Chevy housing (which, by the way, can prove plenty stout for performance use).

Does the chassis configuration of your Chevy restrict the use of sheetmetal housings? Several of the manufacturers can build a sheetmetal housing to any width you desire, while others are geared toward narrowed assemblies. In other words, you don't have to have a full tube frame Pro Stock chassis or a Top Fuel car to enjoy the benefits of the fabricated housing. A good example of this is the series of "Fab 9" housings offered by Chassisworks:

Chassisworks offers the Fab 9 in at least six different incarnations. Chassisworks manufactures "bolt-in" housings for First-Generation GM A-bodies ('64-'72 Chevilles), '67-'69 Camaros (and Firebirds), '62-'67 Chevy IIs and '78-'88 A- and G-bodies (Malibus, Monte Carlos, etc.). These housings are engineered as direct replacements and maintain original dimensions and suspension mounting points. In addition to these bolt-in assemblies, Chassisworks also offers the Fab 9 in a basic format which includes a fully



A unique aspect of the Chassisworks Fab 9 program is the fact that they offer the housings as bolt-in assemblies for a number of stock-width Chevy applications. As you can see, these bolt-in housings come complete with a rear brace installed, housing ends, rear filler cap, and a drain plug. The housing on the right is obviously for a coil-sprung Chevy application (a good example is a '64-'72 Chevelle), while the housing on the left is designed for a leaf-spring application, such as a First-Generation Camaro. And yes, other Chevy configurations are available.

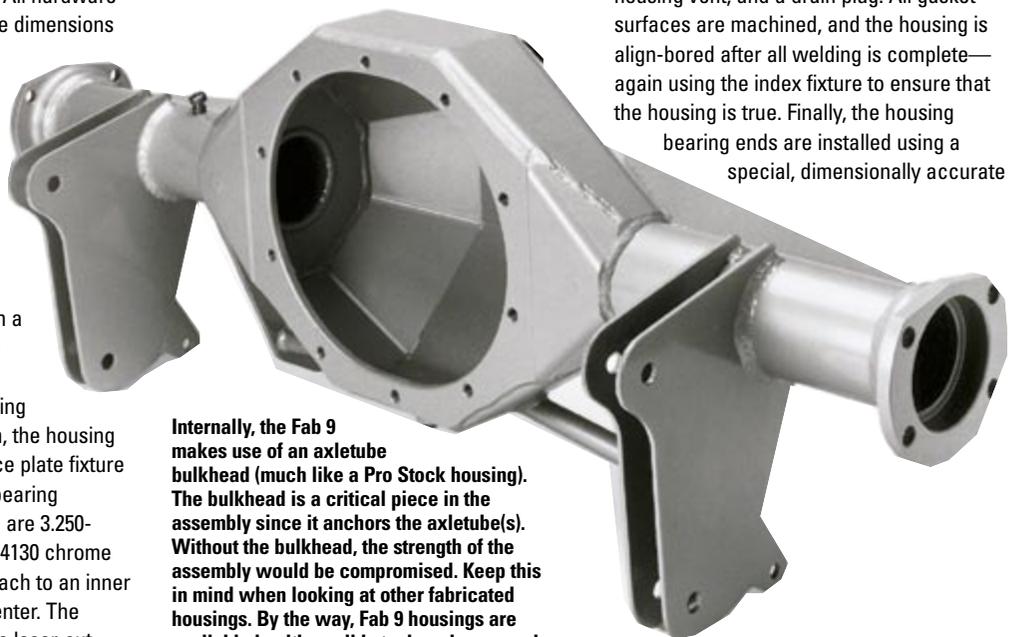
welded center section, axletubes installed, any style of machined housing end (housing ends are included with all Fab 9 housings), a filler cap and drain plug installed, along with all applicable hardware. Finally, the same housing is available with a back brace, an axle vent tube installed, and Chassisworks' Eliminator II four-link brackets. All hardware is installed and welded to fit the dimensions of a given chassis.

## HOW ARE THESE SPACE-AGE HOUSINGS BUILT?

How is a typical sheetmetal housing constructed? Using a Jerry Bickel housing as an example, each housing is constructed on a purpose-built, machine-ground surface plate. This keeps the housing dimensionally true during fabrication (under construction, the housing is indexed to the special surface plate fixture which orients the case to the bearing centers). The axletubes (which are 3.250-inch-diameter, 0.250-inch wall 4130 chrome moly steel) run inboard and attach to an inner bulkhead inside the housing center. The faceplate and backing plate are laser-cut

from 4130 chrome moly steel plate, and are designed to support the folded chrome moly sheetmetal case and brace assembly. A set of 360-degree four-link brackets is welded to the tubes and also support the case assembly, which effectively adds four more bulkhead supports. Jerry Bickel also points

out that his fabricated housing is available in a variety of four-link centerline dimensions from 17.00 inches (minimum) to 21.00 inches (maximum). These housings are equipped with wishbone (centering device) brackets, shock mounts, wheelie bar mounts, tie-down hooks, a large-diameter fill/inspection cap, a housing vent, and a drain plug. All gasket surfaces are machined, and the housing is align-bored after all welding is complete—again using the index fixture to ensure that the housing is true. Finally, the housing bearing ends are installed using a special, dimensionally accurate



**Internally, the Fab 9 makes use of an axletube bulkhead (much like a Pro Stock housing). The bulkhead is a critical piece in the assembly since it anchors the axletube(s). Without the bulkhead, the strength of the assembly would be compromised. Keep this in mind when looking at other fabricated housings. By the way, Fab 9 housings are available in either mild steel or chrome moly.**



This Fab 9 housing on the right has been assembled with Chassisworks' suspension links for Chevy A-bodied vehicles. As you can see, the lower links incorporate a urethane bushing system, while the top links are adjustable, using a urethane bushing on the housing end, and a spherical bearing on the chassis mount end. With this system, it is possible to adjust pinion angle in the car (which basically allows you to "tune" the suspension). You'll also note that the urethane links on the lower bars incorporate grease fittings. If you've ever experienced the squeaks and squawks that accompany many urethane bushings, you'll certainly appreciate this feature.



Stars Wars housings? As you can see by looking at this fabricated rear housing from Jerry Bickel Race Cars, the latest in rear axle housings looks nothing like a Ford 9-inch, reworked or not. There's an incredible amount of work involved in building these components. JBRC requires one full week of fabrication time to build one of these pieces. While the looks are certainly space-age, the level of performance is superior. Nothing in this fabricated housing is stock. The faceplate is laser-cut from 4130 chrome moly steel plate, and along with the backplate, is designed to accept the folded chrome moly sheetmetal case and brace. As you can see, the axletubes are anchored externally (welded into the faceplate). In the following photos, you'll see the other anchor points.

Another problem with 9-inch Fords is the downward bending forces. When strengthening a stock Ford housing, a tube mounted below the housing (between the respective 4-link brackets) is mandatory, especially in a high-horsepower application. This technique is also used in the JBRC fabricated housing. Bickel's housings include this four-link shock absorber wheelie bar bracket assembly on either end. The four-link brackets encircle the axletubes and are designed to support the case assembly. This effectively adds four more bulkhead supports.

fixture manufactured by Mark Williams Enterprises. By using this fixture, Bickel is assured vertical and horizontal alignment with zero tolerance.

As you can see in the photos, the welds are all accomplished by way of the proven Heliarc process. The axletubes are firmly planted in the center section, and are not only welded around the circumference of the

tube, they are also welded horizontally to the center section (twice per side). In the end, no short cuts are taken. Included in the housing package is a set of unique internal gussets. As shown in the photos, the gussets are triangulated and prevent the center section from moving fore and aft. As mentioned previously, the hypoid action of every ring-and-pinion (Ford or otherwise) will always try



Compare the previous photos of fabricated housings to this shot of a clean junkyard Ford housing. This housing is about to undergo almost a week of surgery before it can be pronounced suitable for a high-horsepower car. Figure the time it takes to repair, then fortify the housing, and you can see just how quickly the fabricated 9-inch housings begin to make sense.

to force the ring gear out the back of the housing or carrier. The more power available and the better the traction, the more aggressive the fore-aft action. With the gussets in place, this fore-aft movement isn't possible. The result is more power to the ground and significantly improved ring gear life.

Another factor influencing gear life is the shape of the housing internals. By carefully laying out the design, Bickel has been able to limit the amount of oil drain back away from the ring and pinion. Why is this needed? Simple. At race speeds (say 9,000 rpm), there simply isn't any rear axle lube on the ring gear in a stock rear axle assembly. The design of the fabricated housing is conducive to maintaining lubricant on the ring-and-pinion assembly.

Jerry Bickel Race Cars offers two different basic versions of the fabricated housing: One is designed around conventional axles, while the other is designed for use with full-floating axles. By using a floater housing, the axles never see any bending loads (they only see torsional loading). The bending loads are carried by the spindle and housing. Typically, a full floating housing is used in extreme horsepower combinations, such as a nitrous or Pro Mod application.

## THE JENNY CRAIG DIET PLAN

What's the difference in weight between a fabricated sheetmetal housing and a braced 9-inch Ford? Bickel (who builds both designs) points out that a typical fabricated housing for a Pro Stock application will tip the scales at approximately 41 pounds. Meanwhile, a fully reworked, similar dimension Ford 9-inch housing (with all of the surgery necessary to make it live) will weigh in at 46 or more pounds. When comparing a full width, bolt-in housing such as the Fab 9, Chris Alston reports weight savings of anywhere from 10 to 15 pounds, depending upon the application. Of course, this weight loss is effectively unsprung, which means the shock absorbers actually have less mass to control. In turn, this can mean more performance gains than just a simple weight loss. As you can see, the sheetmetal housing wins from both the strength and weight perspective.

So how long does it take to build a housing? Typically, a fabricated housing from Bickel requires at least a week of fabrication time. Meanwhile, a conventionally braced Ford housing can absorb a considerable amount of shop time, as well. Not counting the search for a decent (non-rusted, non-bent) core, then

factoring in the time it takes to clean it, a chassis builder can spend anywhere from 16 to 20 hours (or more) in the rework. Obviously, the difference in shop time is reflected in the price. Typically, shops charge in the range of \$1,600 for a completely braced Ford housing. A fabricated sheetmetal housing from Jerry Bickel Race Cars can cost \$2,800, while a Fab 9 housing from Chassisworks ranges in price from just over \$300 to \$1,000 (both in mild steel), depending upon the application.

Aside from the space-age looks and lightweight, a sheetmetal housing will invariably feature tubes, which cannot be twisted out of the housing. They're straighter than even the best modified housing and finally, the housings are significantly stronger than a modified FoMoCo housing. Best of all, there isn't a stock Ford part in the thing. And your Chevy certainly won't reject it! ●

## SOURCE

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