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## DATA SHEET

**project:** building and living with the first-ever Factory Five 818 kit car.

**part 1:** the origins of 818 (December 2013).

**part 2:** stripping the donor car (February 2014).

**part 3:** starting the build—finally (this issue).

**part 4:** ~~xxxxx xxxxxxxxxxx xxxxx xxxxx x xxxxxxxx~~

**SOME**

**ASSEMBLY**

**REQUIRED**

**Part 3: We put an engine in our Factory Five 818.**

story by tom suddard  
photos as credited

**L**et's start this story off with an apology: During the first part of this project car series, we've barely even mentioned the turbocharged drivetrain from our wrecked Subaru WRX. The one that will be mounted midship in our Factory Five Racing 818 kit car. The one that should propel our latest project car to ludicrous speeds. The one that, on the Internet, stirs up stronger opinions than climate change. The one on which this installment of our 818 build will focus exclusively.

Better? Good, because we've got a lot of work to do.

### Under Pressure

We only budgeted three weekends to build our entire fiberglass component car, so it was tempting to cut corners wherever we could, especially when it came to the engine. Common

It's starting to look like a car: Time to place the Subaru WRX engine into our Factory Five Racing 818's tube chassis.

# FINALLY, IT WAS TIME TO INTRODUCE THE 818'S CHASSIS TO ITS HEART—A PROCESS THAT, SURPRISINGLY, WASN'T HARD AT ALL.

wisdom says all sorts of preventative maintenance should be done while the engine is out of the car, but who has time for that? After all, the engine ran fine before it was driven at a high rate of speed into a solid object, loaded up at night in the rain by a tired tow-truck driver, abandoned in a dirt parking lot for months, dragged to an auction, sold to us, and loaded onto a trailer one final time.

See? An easy life, hardly worse than being owned by an old lady who loves watering flowers.

Okay, not really. With this terrible past in mind, we decided the first order of business should be a thorough cleaning. Our publisher, Tim Suddard, went to work with a pressure washer and a bottle of degreaser. Pro tip: Avoid shooting water into the engine itself. To keep the water out, we put some tape over the intake and exhaust openings.

Once the engine was clean enough to touch, it was time for a compression test. Put simply, this test would measure the health of our engine. The verdict? Great, actually. Our engine had above-average compression for a 2.0-liter Subaru that had covered 100,000 miles.

Now we could move on to preventative maintenance. The first item on that list was a timing belt change. Our Subaru engine features an interference design, meaning that if the timing belt breaks, an expensive co-spatial event involving the valves and the pistons tends to occur.

Put kindly, once the Subaru engine is placed into the 818's chassis, access to the timing belt is rather restricted. We figured that the smart move was to replace the belt while the engine was out.

Belt replaced, we could begin doing prep specifically for the 818 installation. Power steering and air conditioning are necessary in a heavy sedan like the WRX, but not so much in an 1800-pound road-

ster like the 818.

In the interest of reducing weight and complexity, Factory Five's kit does away with both of those niceties. Simply unbolt the power steering pump and the air-conditioning compressor, and then install a shorter, Factory Five-supplied belt. We went a step further and bolted a trigger wheel onto the crank pulley with a Hall effect pickup. This will be used by our Electromotive ECU to measure crank position.

The engine was ready to go in, but its partner—the transmission—still needed work. In a Subaru WRX, the transmission drives all four wheels. But in the 818, it will only drive two. How does one transmission do both jobs? Simple: with a little bit of major surgery.

## What's the Differential?

A Subaru WRX has three differentials, each of which transmits power to two shafts while allowing one to rotate faster than the other. The first two are fairly obvious—one in the front for the front wheels, one in the back for the back wheels—but the third one's location often leaves people scratching their heads. It's in the middle of the car, and it splits engine power between the front and rear differentials.

It's this center differential, which lives in the back of the transmission, that is the main focus of Factory Five's two-wheel-drive conversion. The 818's rear wheels are driven by the stock front differential, which is also built into the transmission.

In a normal four-wheel-drive system, one that doesn't have a center differential, the rear driveshaft could just be disconnected. But on the Subaru, this would cause the center differential to send all the power to the now-disconnected rear wheels. To fix this, the center differential needs to be locked so it always sends

power to the front differential.

Factory Five's solution to this locking problem is remarkably simple. It's a round block of metal that sort of looks like a big socket, and it bolts onto the front and rear output shafts, replacing the stock center differential. This block of metal effectively locks the front and rear differentials together. Just throw away the old center differential and rear driveshaft output, bolt on the supplied block-off plate, and you're the proud owner of a front-wheel-drive Subaru transmission.

Maybe that doesn't count as major surgery, but it is a little jarring for the average home mechanic. Full details can be found in our series of build videos at [grassrootsmotorsports.com](http://grassrootsmotorsports.com) for those more curious about the process.

We'd neutered the transmission, maintained the engine, and cleaned the entire driveline. What next? Reacquainting them with each other. But before we could bolt them together, we had to install a new clutch and flywheel. In professional terms, ours were at the end of their service life.

Because we planned to spend time on track with our 818, we decided to go with a lighter, stronger aftermarket clutch and flywheel. A Spec Stage 2 clutch kit fit the bill nicely, along with the company's lightweight aluminum flywheel. This setup should help the car rev faster. Plus, it's up to the challenge of handling the torque of a modified WRX.

## Transplant Complete

Finally, it was time to introduce the 818's chassis to its heart—a process that, surprisingly, wasn't hard at all. We just hooked the engine up to the hoist, rolled it into the back of the car, and bolted it down. The whole process took about 15 minutes.

An engine that is only bolted in doesn't do much good, though. The next step



1

Our Subaru WRX donor car gave up its engine and transmission. First, ours needed a bath.



2

A simple compression test showed that our engine was healthy. Every cylinder had more than 150 psi of compression. Now we could prep it for the swap.



3

Subaru flat-fours have a convoluted timing belt arrangement, but not changing it can be an expensive mistake. Since access would be rather tough once the engine was installed in the 818, we decided to change it now.

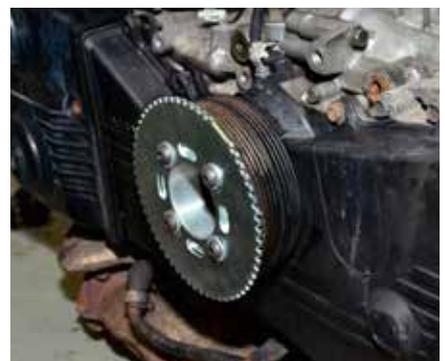


4

Subaru timing belts have yellow marks that line up with the timing marks on the cams.



5



The top of the engine is cluttered by the a/c compressor and the power steering pump. The kit calls for these to be removed. Factory Five supplies a shorter belt. We also installed a trigger wheel that our aftermarket Electromotive ECU will use to measure crank position.



6

The 818 places the WRX engine in the middle of the chassis. It retains the stock transmission, with the front differential powering its rear wheels. We'd have to crack open the Subaru transmission to convert it to two-wheel-drive operation.



7

The Subaru's center differential links the front and rear differentials. Even though the rear differential will be tossed, the transmission needs to think that the front and rear differentials are still present. Factory Five supplies a part that locks these two differentials together, fooling the center differential into believing that all is well.



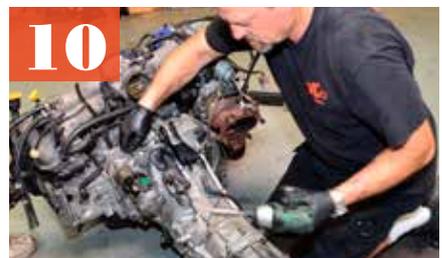
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The donor car's clutch had certainly seen better days, so we made plans to replace it.



9

Our solution: a Spec stage 2 clutch and flywheel, which should be able to handle 400 ft.-lbs. of torque.



10

Time to rejoin the modified transmission to the engine. A few of our bell-housing bolts were stripped, so we had to replace them.



11

Bolting in the engine was easy. We used scraps of roll-cage padding to protect our powder-coated frame.



12

To connect the transmission to the wheels, we had to combine our stock axle parts with the Factory Five-supplied shafts.

was connecting it to the wheels. Stock Subaru axles wouldn't work. Remember, on an 818, the original Subaru rear hubs are driven by the front output shafts on the transmission. For some reason, Subaru uses different axle splines and different CV joints for the front and the rear.

Factory Five's kit comes with the solution to this problem: a set of custom driveshafts, one end splined for the stock inner-front CV joint, the other splined for the stock outer-rear CV joint. After spending some quality time with our snap-ring pliers and our grease bucket, we turned the stock WRX axles into a set of axles that would fit on our 818.

Our 818 now had an engine and a transmission, but it was still a long way from driving. In our next installment, our 818 will start looking more like a car and less like a pile of metal tubes. Oh, and it'll be airborne.



## SOURCES

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Dozens of videos detailing our 818 build can be found in the Project Cars section of our website, [grassrootsmotorsports.com](http://grassrootsmotorsports.com).