Building A Stronger Rear Axel For IRS Triumph Sports Cars
By Chuck Arnold

So, you are making your TR 2-6 into a track/high performance monster. You are getting high horsepower, large rims and sticky tires! Good for you, running a TR fast on a track is quite a thrill whether you are racing, or just enjoying lapping days. Well, here is a rub you have to know about. It is not maybe, or if, it is for sure – sooner or later you will break a rear hub while at the extreme in a corner. The results are no fun – at best you have a rear suspension to rebuild, at worse you bang a wall and destroy the car.

The reason is a weakness in design related to the friction fit of the hub on the axle. Bob Lang described to me as follows:

> "The stock hubs use a taper joint with woodruff key. The design is faulty in that the woodruff key is staked to the tapered axle. This staking forms a perfect spot for cracks to form and propagate.
>
> It should be noted that racers have experienced stub axle failure since these cars were new. Here are two salient points:
> 1. Kastner's Comp. Prep manual for TR6 indicates that the rear hubs should be swapped out every FOUR races. It doesn't say, "rebuild".
> 2. The Group 44 TR6 had the Corvair hubs and a custom bearing carrier designed by Brian Ferstenau... these are still on the car (now owned by Bill Warner of FL.)
>
> Kastner's motto is 'never beaten by equipment'. If you know there's a limited duty cycle for a part, you swap it out before it becomes a problem. Yes, this is expensive. The question therefore is "how much is too expensive?"

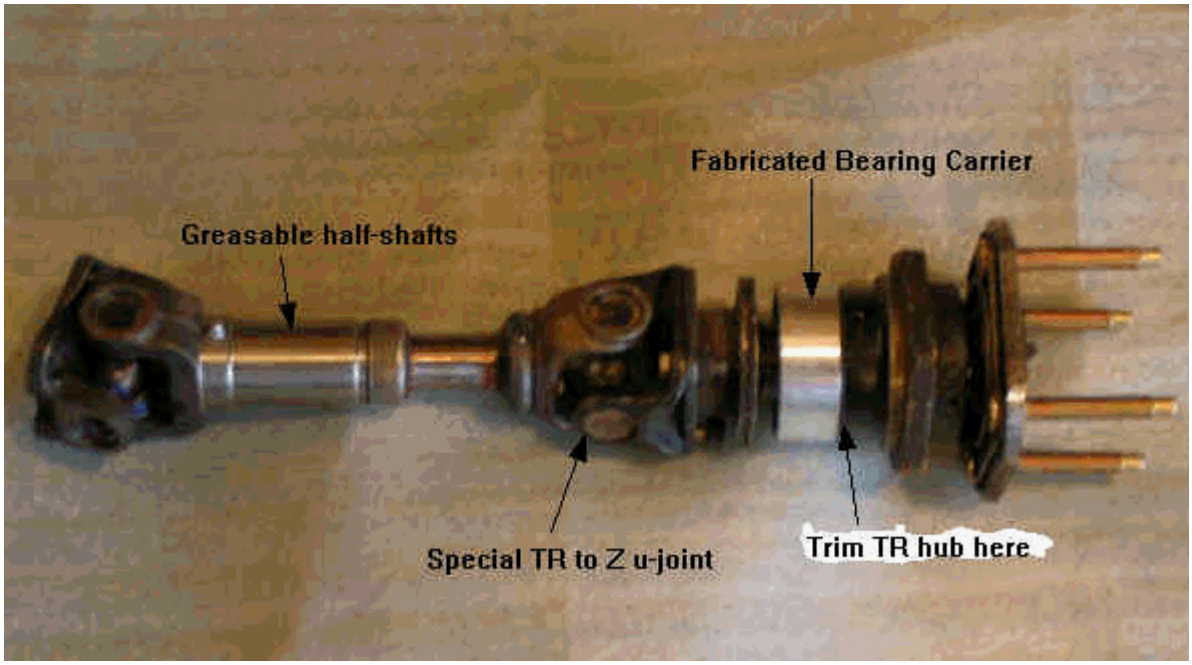
This problem has been recognized, and various solutions deployed since the era of Kastner and Group44 SCCA racing teams. As I understand it, they used Corvair, and perhaps Corvette axels. Corvair kits are occasionally still available, but the parts are becoming rare, and the cost high. Figure at least $1300 for this conversion. I could not locate a kit or the correct parts, so looked for another solution. I found a reference to someone who had adapted Nissan (actually given the years involved, Datsun) hubs to provide a strong solution to the Triumph weakness. The axels are stronger, the bearings larger, and the design for locating the axels in the hub better. I also bought and installed stronger Spicer half shafts and installed half inch by three-inch studs for securing the wheels.

This document describes how I built stronger rear hubs and installed them in my TR6. I used parts from a Nissan 280Z to provide the necessary axels. The steps involved are:

1. Source and dismantle the proper Nissan axel
2. Disassemble or source a TR hub
3. Source an adapter for holding the inner Nissan bearing and a special u-joint for linking the Nissan flange with the Triumph half shafts.
4. Machine the TR hub
5. Source 2 bearings and at least one special u-joint
6. Assemble the components
7. Do a little grinding on the TR training arm
8. Install the hub into the trailing arm

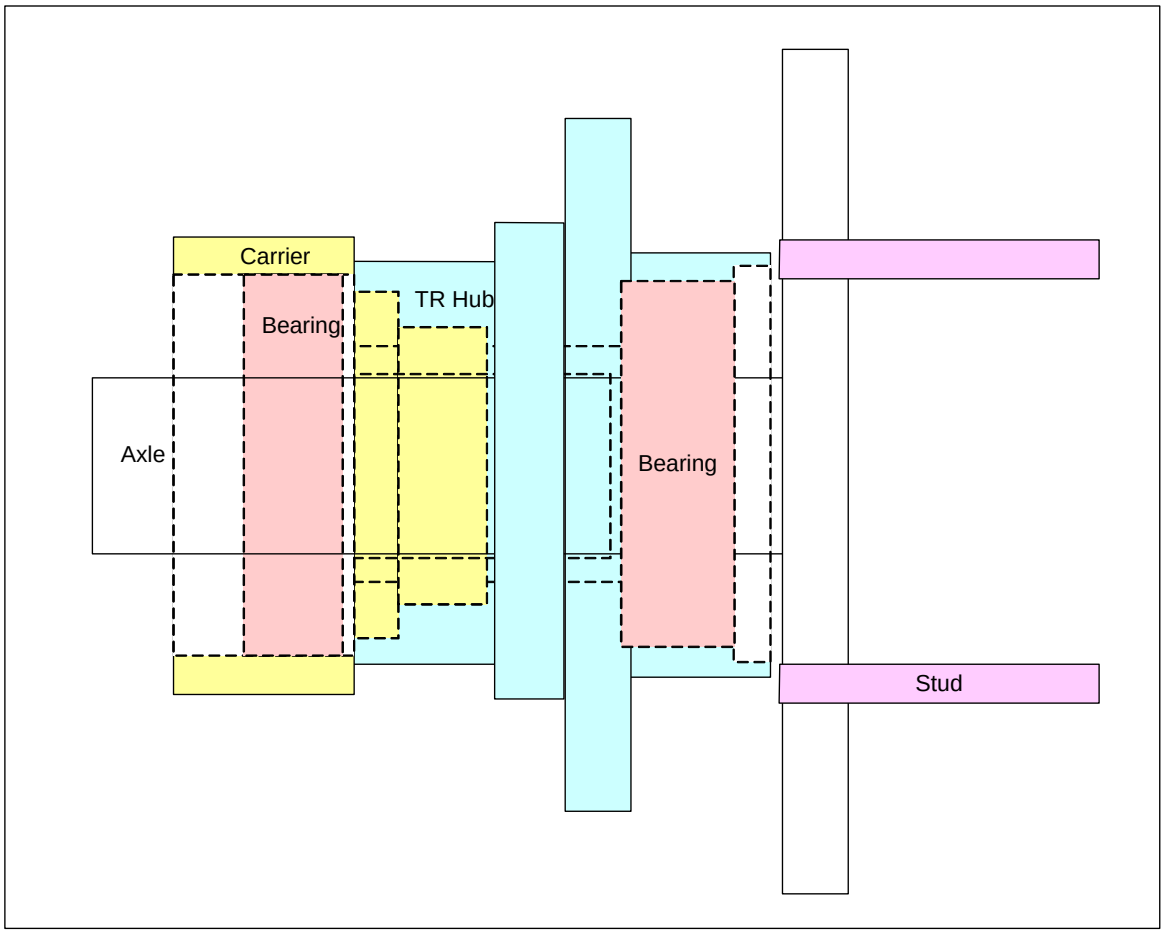
Figure 1 shows an annotated photograph of the new axel. A list of the parts I bought with their 2003 prices is provided at the end of the document.

Figure 1: Annotated Photo of the Assembly



Starting at the left you see the standard TR6 u-joint that goes to the differential. Next are new beefier Spicer half shafts. These are slightly shorter, but much stronger than the originals. They also have a zerk fitting so they can be kept lubricated. These were the most expensive parts, and not strictly needed. I had heard of issues with the original shafts, so I went ahead and got the better units. Next is the special Spicer u-joint that has TR sized cups in one axis and Nissan sized ones in the other. Next is a bearing carrier that I had machined to fit in the trimmed TR hub. The one shown here was my first version. A second version was longer to better fit to the Nissan axel flange. The bearing in this hub is sealed, as will be shown later. Not seen is the same sealed Nissan bearing that is in the outside of the hub. Refer to the Figure 2 for the schematic drawing. Also, you can see that I replaced the stock Nissan studs with longer, wider studs. I used three-inch long studs in case I ever wanted to use wheel spacers. In retrospect, two-inch long studs would also work and make changing wheels easier.

Figure 2 -- Schematic of the Hub and Axel Design.



This picture is slightly inaccurate in that both bearings are actually the same part and therefore the same size. The label TR Hub should read TR Hub Carrier.

Source and dismantle the proper Nissan axel

The final design I employed used an axel from a 1979 Nissan 280 ZX. Hugh Barber, a fellow 6-Pack member, did some research on axel diameters and bearing sizes of various Nissan 280 and 300 rear ends. His findings indicate that the 1980-1983 280Zs have the same bearings and axel diameters. His findings are shown below:

Model/Year	260/280Z / 1974-1978	280ZX/1979; 280Z '80-'83	300 ZX/'84-'90
Outer Bearing Part #	RW117	**RW125**	RW159
Bearing OD	2.75 inch	2.8346	2.8346
Bearing ID	1.25	1.1811	1.3780
Inner Bearing Part #	RW116	RW101	RW101
Bearing OD	2.75	2.4409	2.4409
Bearing ID	1.25	1.1811	1.1811
Width:	0.6875	0.6299	0.6299
Notes:	Requires making the bearing carrier internal diameter narrower	**The version I used. I used the RW125 outer bearing on both sides**	Note: used CV joints, not u-joints and half-shafts

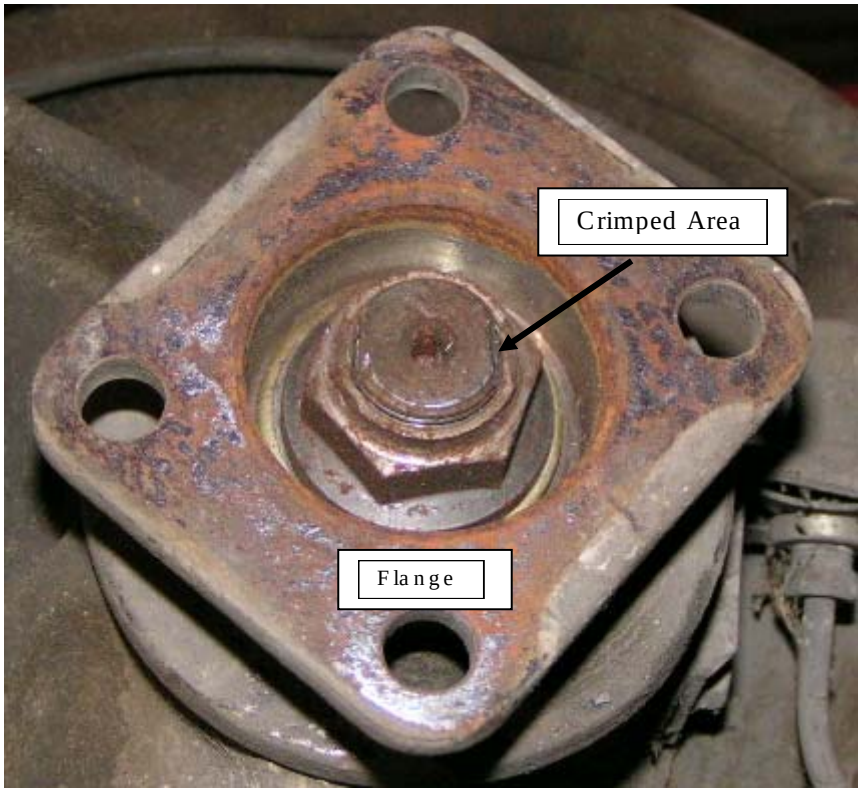
I purchased the used Nissan axels still installed in the hub carrier, complete with shock towers as shown below.

Figure 3: Nissan 280Z Rear Axel Assembly

This is the entire assembly. I got these from a salvage yard that specialized in Nissan parts. They cost about $50 each. I took the unit apart and discarded all but the axel, spacer and flange.

Disassembling the Nissan axel is not so easy. The nut securing the axel to the hub complicates disassembly. It is crimped into the threads as shown below.

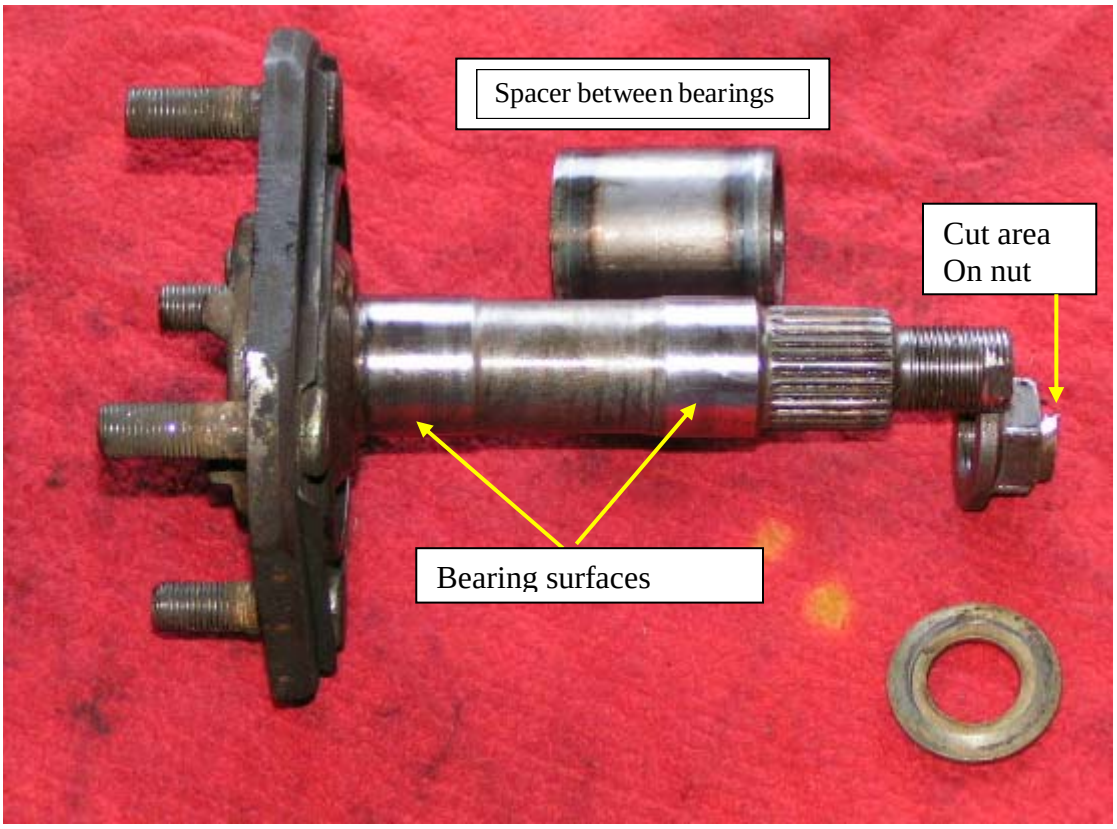
Figure 4: Flange and Nut



When I took the first one apart, I muscled it off. The net result was ruining the threads and hence the axel. The second and third ones worked better. I carefully used a thin cut off wheel in my die

grinder to trim off the crimped piece without damaging the threads. Unfortunately I did not take any pictures. After removing the nut, I placed the axel in my ten-ton press and pressed out the axel. I did not attempt to reuse the bearings.
The next picture shows the Nissan parts that are used, except for the flange piece shown above.

Figure 5: Nissan Axel Parts

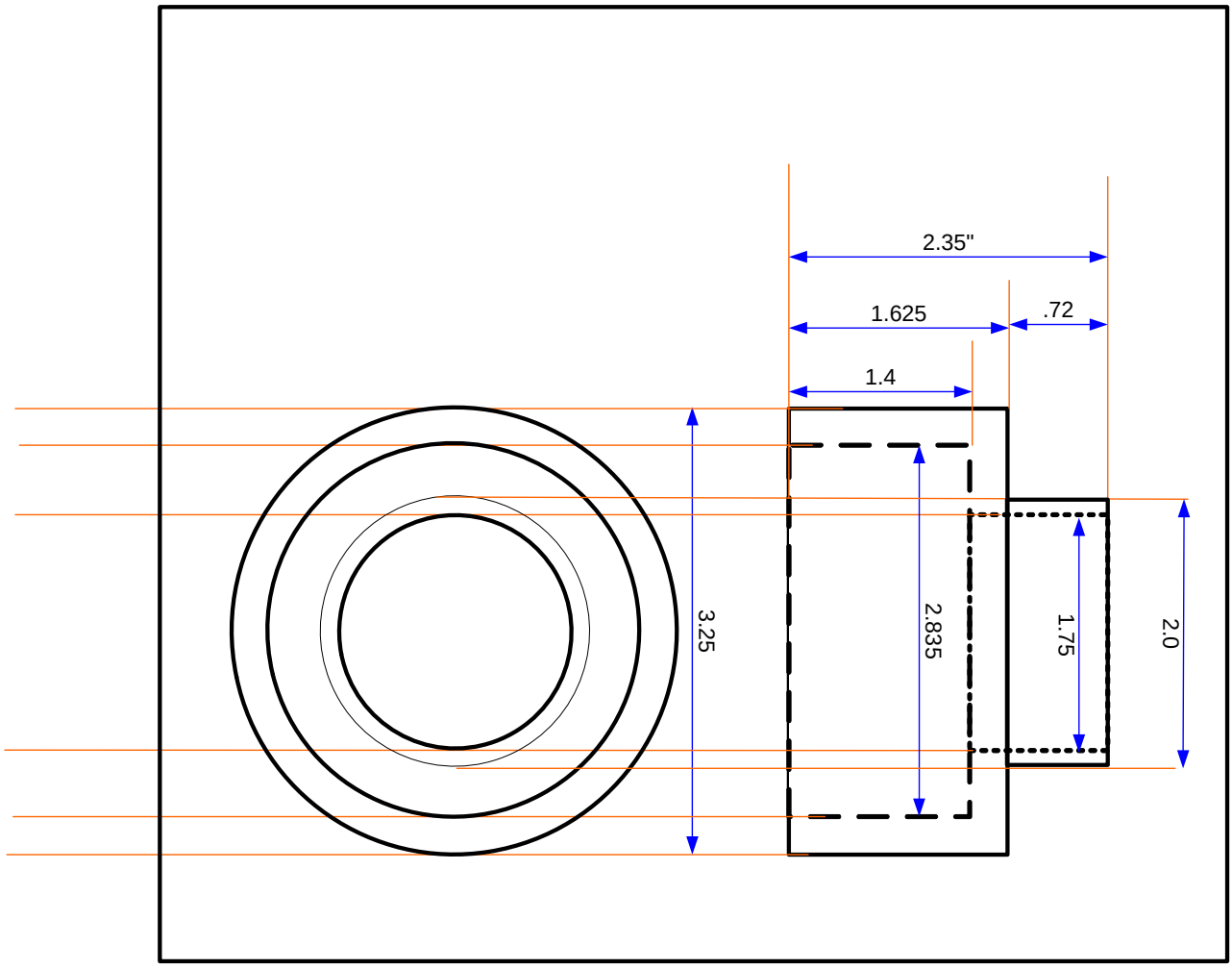


You can see from this picture the large surfaces the bearings ride on and that there is no key or cuts in the axel. Torquing the nut is what keeps the assembly together. You may be able to see that the top of the nut has been cut so it could be removed from the shaft. After I got to this point I sent the hub off to the machine shop to remove the studs and insert ½ inch by 3-inch studs. Note: I sourced one TR Hub carrier on e-bay. I obtained the other through the difficult process of disassembling a TR rear hub myself. I was not worried about preserving the TR axel flange, so I put in my press and slowly applied pressure. At full pressure (ten tons) it did not want to budge. I released it from the press, heated the hub carrier with a torch for about ten minutes, put it back in the press, and, as I applied increasing pressure, kept tapping it with a hammer. This time it finally let go with a bang!

Source a Custom Bearing Carrier

A custom-bearing carrier must be fabricated to hold the inner Nissan bearing. The dimensions of this unit are shown below. I had two different ones made. The first was of aluminum from a local machine shop. These were too short in the dimension now shown as 1.625 inches in the drawing. Marty Sukey made the second set of steel. He is also a member of 6-pack. Note, should there be enough interest, I will have him make several sets and then supply them to those who want to do this conversion. The cost will depend on the price of steel at the time. Figure around $150 for a pair.

Figure 6: Drawing of the Bearing Carrier



The following figure shows a close up of the carrier. It has already been pressed onto the modified hub assembly. At the bottom of the carrier you can see the spacer, which separates the two bearings. It provides a positive stop between the bearings and the axel rotates inside of it.

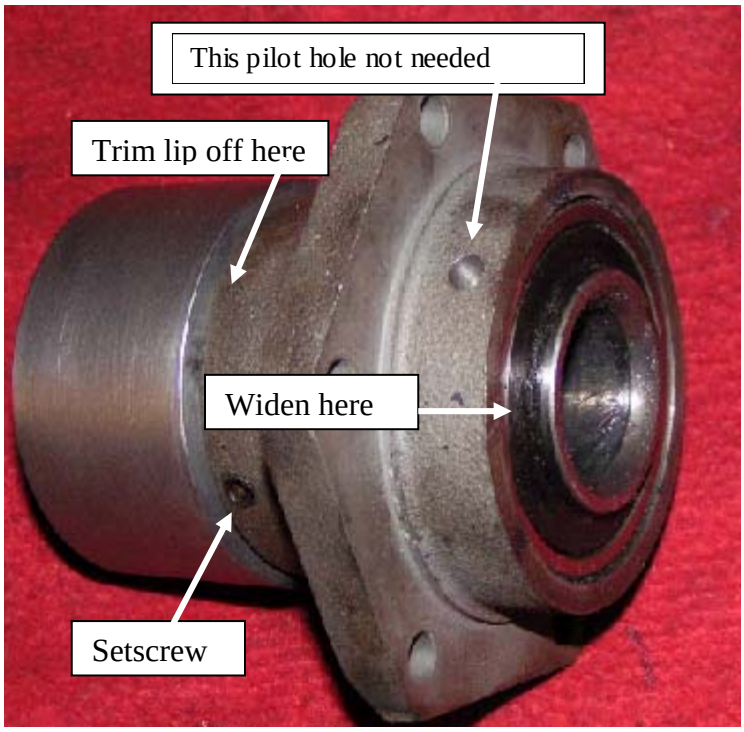
Figure 7: View of Bearing Carrier

Machine the TR Hub Carrier

The TR hub carrier must be machined in two places. There is a lip on the inner edge of the carrier that is machined off to allow the hub carrier to mate flush with the custom-bearing carrier and to allow that carrier to be wide enough to hold the bearing. The outer TR bearing is slightly smaller in diameter than the Nissan one, so the carrier must be machined out to a diameter of about 2.835 inches. This allows the Nissan bearing to be press fit into the hub carrier.

I also had two holes machined in the hub carrier and tapped for setscrews. These were used to assure the custom bearing carrier stays put once it is pressed in.

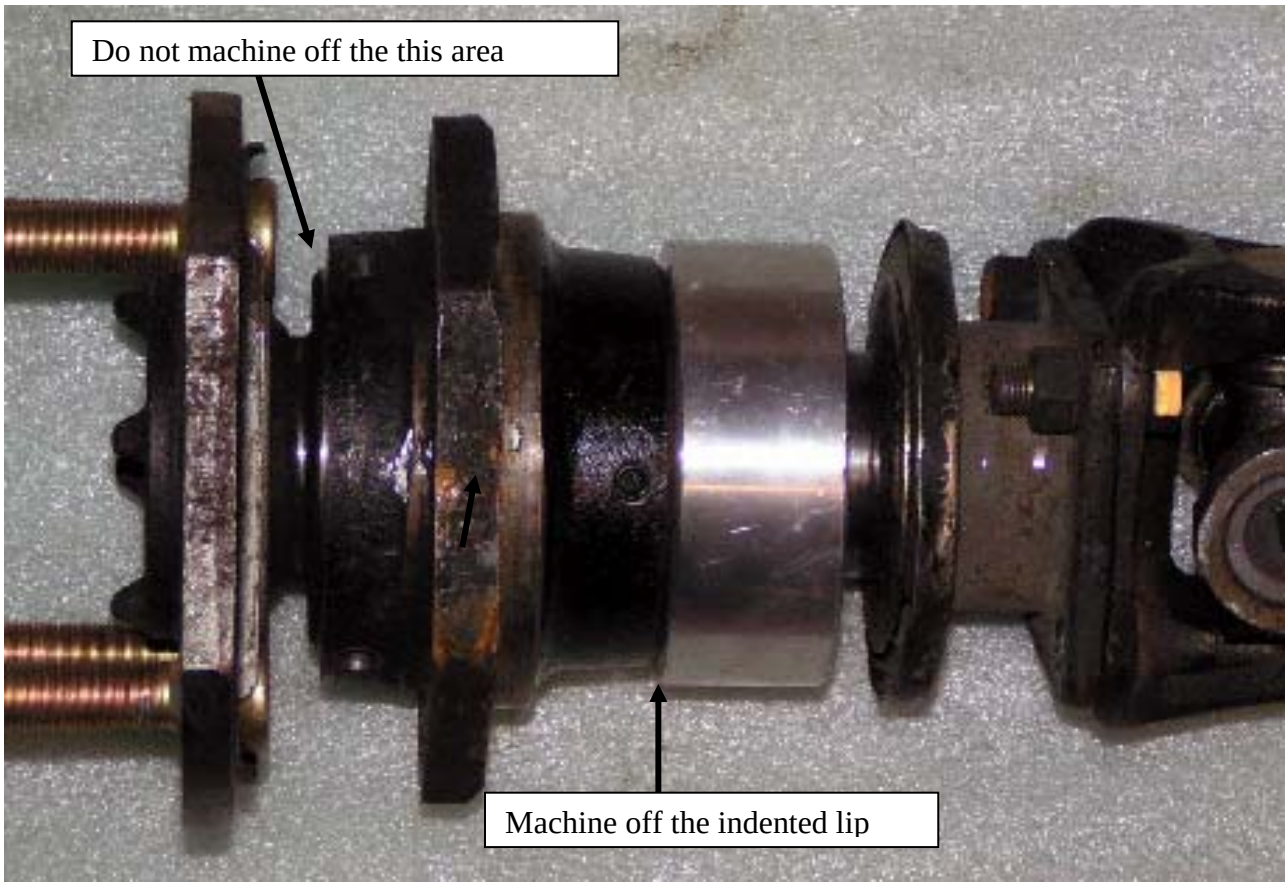
Figure 8: Machine Hub Carrier



The following picture shows an annotated view of the assembly with the bearing carrier installed in the hub.

When you look at your hub, you will notice it is deeper on the front side than the one shown here. I mistakenly had the machinist take off a quarter of an inch there also. This caused the hub carrier to sit proud of the hub flange more than necessary. Since the bearing is sealed this should cause no harm

Figure 9: Trimming Mistake

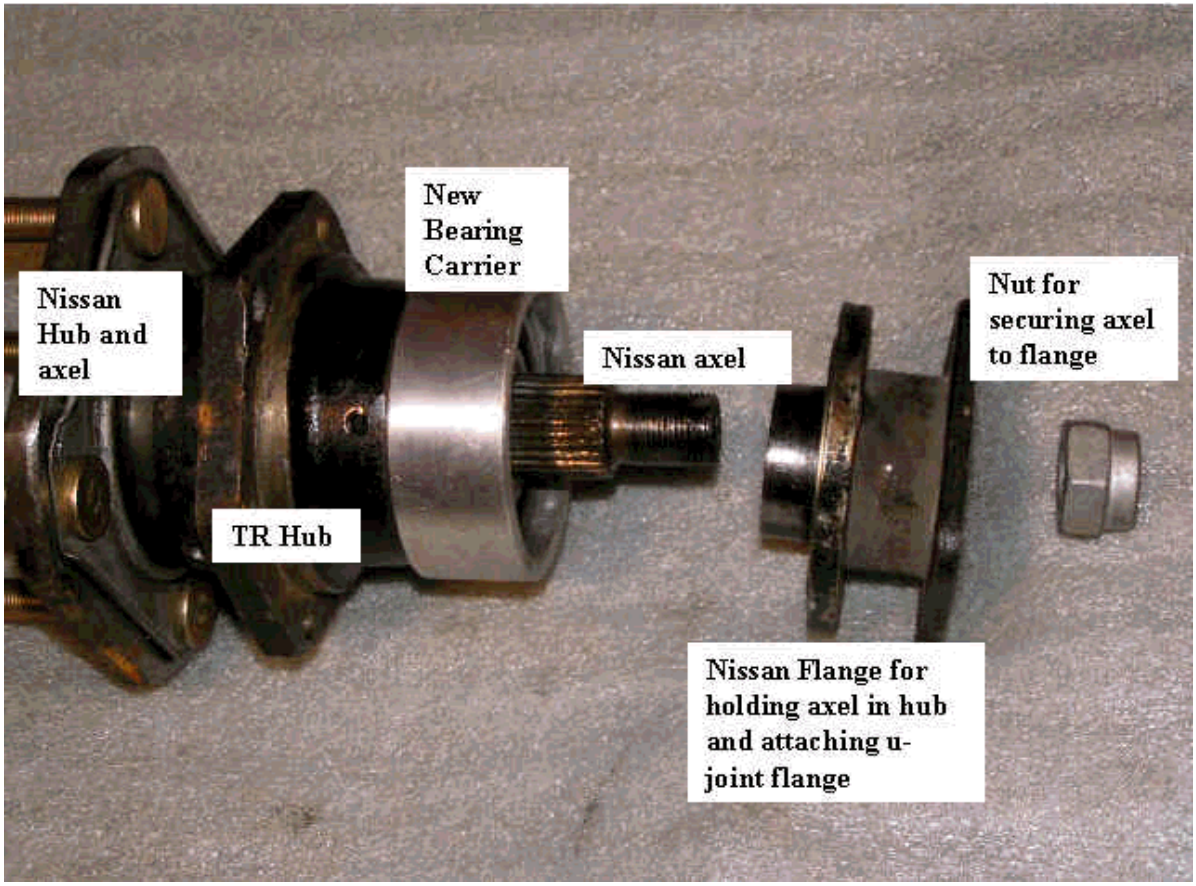


The first version of the bearing carrier is shown in the assembled unit above. It is not “long” enough. The second version was made longer to beater fit against the Nissan flange.

Assemble the unit

Once all the parts were ready, I assembled the unit. The pieces, already partially assembled looked like this.

Figure 10: Partially Assembled Unit



The nut shown here worked, but it would be better to get a new one from Nissan if possible.

The steps I followed were:

1. Press the bearing into the outer portion of the hub carrier. See Figure 8
2. Press the hub carrier onto the Nissan Axel.
3. Place the spacer into the hub carrier from the backside. See Figure 11.
4. Press the inner bearing into the custom bearing carrier. See Figure 12.
5. Press the custom carrier into the hub carrier and on the axel. Also Figure 12.
6. Insert and tighten the set screws
7. Press on the Nissan flange the mates to the u-joint and tighten with a (preferably new) nut I am not sure of recommended torque. I used 60 pound/foot and also applied Locktite.
8. Attach the u-joint to the flange
9. Attach the outer half shaft to the u-joint

NOTE: Before beginning assembly there is one other step needed, I forgot it and had to make a fix after the whole thing was assembled. You must drill a hole in the Nissan hub flange to allow access for tightening the nuts on the trailing arm studs. See Figure 14

That's it for assembly. There are a couple of other problems that need to be attended to get the axle installed and the hub carrier attached to the trailing arm. I will discuss these after the next series of assembly figures.

Figure 11: Installing the Spacer

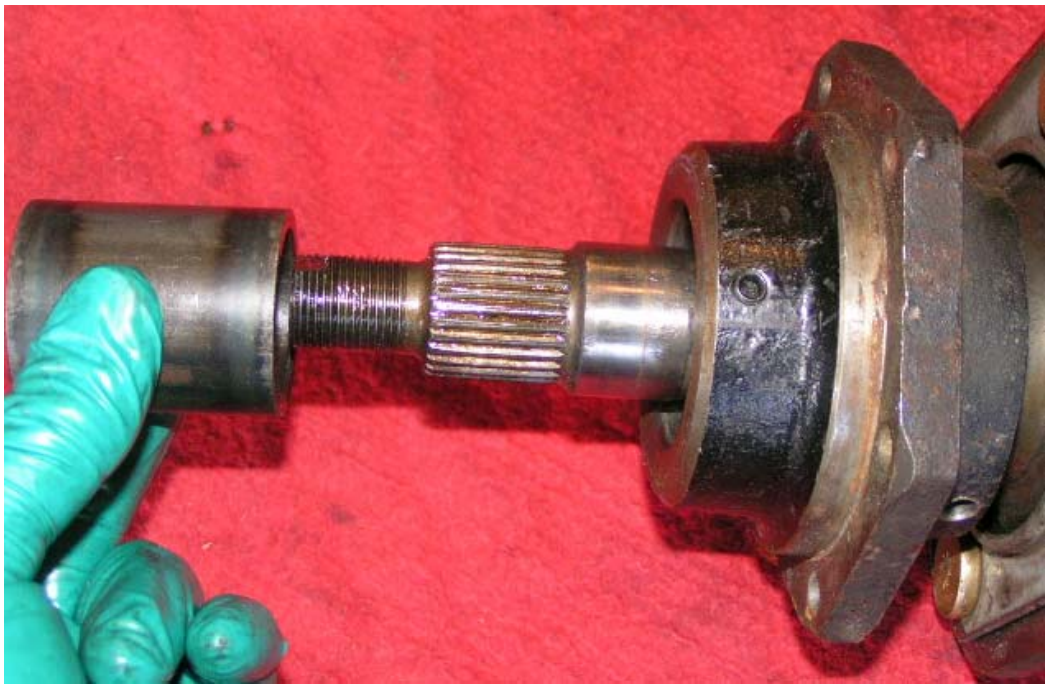
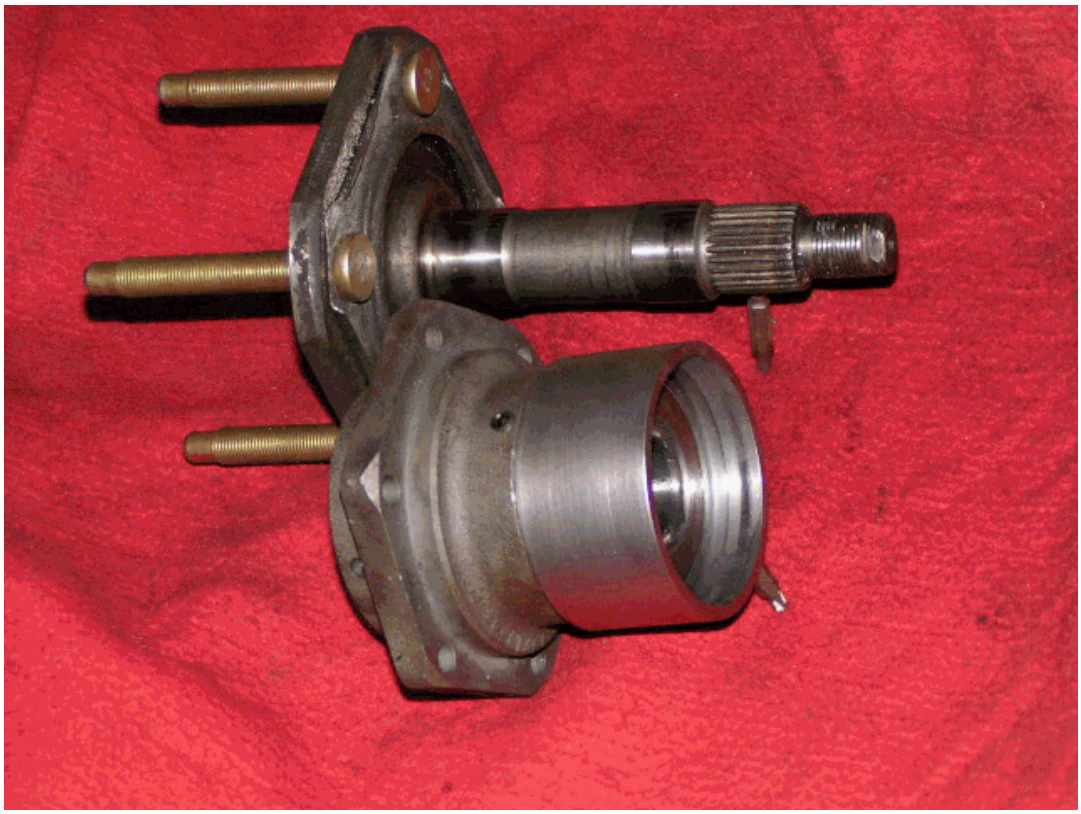


Figure 12, Bearing Pressed into Custom Carrier and Nissan Axel

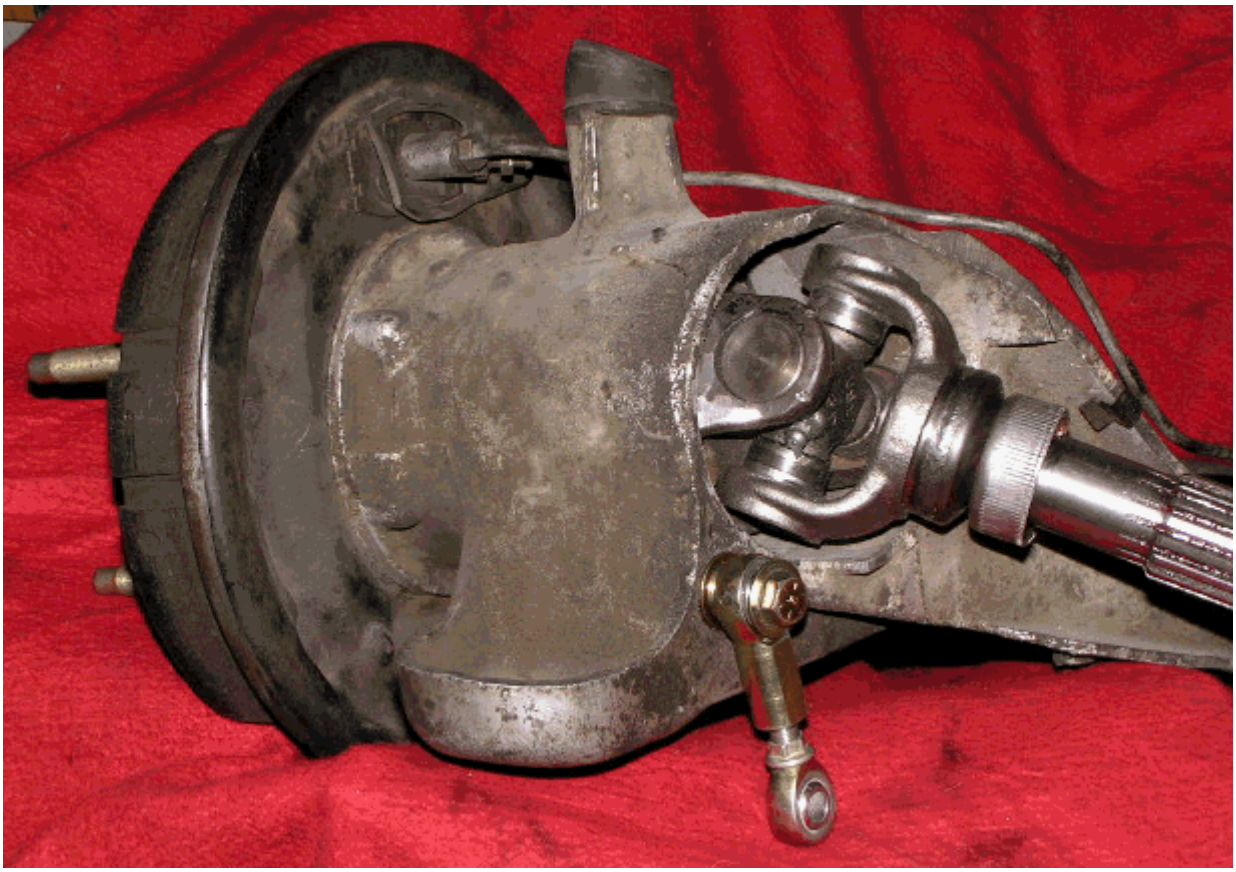


In the above photo you can see the bearing journals on the axel. For final assembly I actually pressed the hub carrier onto the axel, inserted the spacer, then pressed the inner bearing into the custom carrier, then pressed that unit onto the axel. I pressed the Nissan inner flange onto the axel as far as it would and tightly secured the nut. I used Locktite on the threads. Next I installed the Nissan to Triumph u-joint carrier and u-joints. I then bolted on the outer half shaft.

Some Assembly Issues

After I attached the flange, special Spicer u-joint and outer half shaft, I attempted to insert the assembly through the trailing arm. Nothing is ever easy! It would not fit! I had to take out the die grinder and remove portions of the trailing arm till the hole was wide enough to allow the u-joint to fit through. This probably took a half hour per side. This is a pain! Figure 14 shows the assembly in the trailing arm. The device below the u-joint is my attachment for the rear sway bar (I built a custom one from off the shelf parts – more information on that setup is available if you want).

Figure 13: Assembly Installed in Trailing Arm



Once I got the unit into the arm, I discovered one other small problem – there was no access for installing the huts to hold the hub carrier on the trailing arm. Recall that the TR hob flange has two holes in it to allow a socket to be inserted through the flange. I had to drill a hole in the Nissan flange for that purpose after the units were already assembled. *It would be much easier to perform this step prior to assembly*. The hole appears quite rough because the only bit I had with that large a diameter was one of those stepped versions.

Figure 14: Hole Drilled in Nissan Axel Flange

Once this was done, I bolted up the hub carrier, attached a standard Triumph Spicer u-joint to the inner half shaft, pieced the two half shafts together, installed the trailing arm and attached the inner u-joint to the differential. All done. I have over 500 high-speed track laps on these axels to date, and both appear to be holding up very well.

Source of Supplies/Service

My parts were sourced from:
Front Line Drive Lines
4000 S Federal Blvd
Suite B
Englewood, CO 80110
303-783-9954
Attn: Jim

I got 50% off list on the items except special u-joint. They also took care of getting the studs inserted into the axel flange.

The Spicer part numbers and list price as summer 2003 are:

1. TR 6 u-joint: Part number 5-153X List $19.78
2. Flange for TR6 u-joint: PN 2-2-329 $43.95 (This was needed to attach the TR u-joint to the new inner half shaft)
3. Slip Yoke [Outer "female" half shaft] PN: 2-3-128KX $75.42
4. Yoke Shaft [inner half shaft "male"] PN: 2-82-58X $231.60
5. Special u-joint Nissan to 1310 Spicer PN 3151-15 U-Joint $33.26
   Front Line sourced this u-joint from Power Train Industries – California 1-800-798- This supplier may have provided all the Spicer items to Front Line.

Check this web site http://www2.dana.com/expert/ [Dana owns Spicer]. Do not find #5 above by that part number. Might be a 5-460X tr on one side [1.0620 cap diameter] and a different, larger side on the other [1.1880

The bearing needed is: P/N: RW125 OD: 2.8346 ID: 1.1811. I got mine from Partsamerica.com

Figure 15: Bearing

Should you attempt this, I wish you good luck. It takes more perseverance and a good machine shop than anything else.

Chuck Arnold
June 16, 2005
I can be reached by email at Triosan@gmail.com