

# Rubber Donut Conversion to Volkswagen CV Joints

For BMW Isetta 600 — by Gary Rannefeld

When I first acquired my BMW 600, the rubber drive donuts (Coupling, Plate 4, Key 113) were in terrible shape and I was not aware of a source of new donuts that would be likely to duplicate the supposed durability and quality of the original. Besides, I was immediately concerned that the non-reinforced rubber design, no matter how good it was made, would always be a potential failure point that would cause other damage if and when the failure occurred.

I was very familiar with Volkswagen constant velocity (CV) joints from my past ownership of a 1969 Beetle and a 1972 Bus. This system is very compact and reliable, and most kinds of failure would probably not involve nearby parts. In fact the only “problem” I ever had with these CV joints was the development, over many thousands of miles, of a humming or growling noise coming from them in the Bus. But the fix involved almost no money, only my labor. All I did was remove both axle assemblies marking all parts left or right, clean and re-lubricate all four CV joints and reassemble the axles keeping the same parts together. The important last step was to install the axle assemblies on the opposite side of the vehicle from where they were removed. This in effect puts a whole new set of internal surfaces into play inside the CV joints that had received little to no wear up to that time. The beneficial effect was immediate; no further humming or growling was heard from the CV joints and I never had any issues with them again (for many more thousands of miles).

One caution about the above repair procedure is this: the same effect cannot be achieved by flipping an axle end-for-end on the same side of the vehicle. If you analyze it properly, the same, presumably worn, surfaces would still be the principal actors.

On to the conversion of my BMW 600 donuts using VW parts. As I have said in another article, my philosophy, where practical, is not to permanently modify my 600 unless there is no other way to achieve some desired improvement. I think I have met that standard here; no drilling or welding *on the BMW* was required and everything can be removed if desired. There is welding involved, however, and a small modification to four BMW parts is required. This modification would not be significant, or noticeable, if an owner wanted to go back to the use of the rubber donuts at some point.

You will need some parts from an air-cooled VW from about 1968 or newer. Having owned both a Beetle and a Bus, I know that there are at least two sizes of CV joints that were used. I am not aware if the other cars VW made at the time utilized other than these two sizes, but for the tiny BMW 600, the smaller size CV joints used on the Beetles seem more than adequate. VW parts required:

- Two (2) complete VW rear axle shaft assemblies with a CV joint on each end. Each assembly is the BMW equivalent of the Output Shaft, Plate 4, Key 112, plus the donuts.
- Four (4) flanges from the output of a VW transaxle. This flange is the BMW equivalent of the Coupling Flange, Plate 3, Key 126.

For my conversion I obtained all used parts from several cars, but that was quite a few years ago when used parts were easily available at many dismantlers. The four flanges above only come two to a car, so finding four of these may pose a bigger challenge today than it did then.



Using VW parts in the BMW 600 requires some modification to both the above parts and to a couple of BMW parts (although as stated above the BMW modifications are relatively minor). I found a good local machine shop that could also perform the small amount of welding involved while maintaining concentricity in the finished parts. This last part is important; welding introduces stresses that often result in warpage in spite of perfect alignment prior to welding. Your fabricator needs to be able to compensate for any such warpage that occurs so that you end up with pieces that will run true.

Here are the parts that should be delivered to your fabricator for modification:

- The two VW bare axle shafts only, after the CV joints and boots have been removed.
- The four VW flanges from a VW transaxle.
- Two (2) BMW Coupling Flange, Plate 3, Key 126.
- Two (2) BMW Rear Axle Shaft, Plate 4, Key 117.

The last five (5) pages of this article are a set of drawings that the fabricator will need to modify and fabricate everything. The fabricator must furnish what I have called a flange adapter (Sheet 2 of 5) in preparation to then produce a welded flange assembly (Sheet 3 of 5). The BMW parts, both kinds, are modified as shown on Sheet 4 of 5. The VW flanges and axles are modified as shown on Sheet 1 and 5 of 5 respectively.

A few notes about what may appear to be strange symbols on the drawings:

- Dimensions in (parentheses) are not to be modified and are the way the parts I used were supplied by VW. They are for reference only.
- The “boxed” symbols are a crude, and probably now an obsolete interpretation, of geometric dimensioning and tolerancing (GD&T). (Please ignore my inconsequential errors that are surely present.) It’s just another—some would argue better—way of expressing the size and relationship between various dimensions on drawings. Basically what is intended in the drawings I have provided is that the run-out  that is exhibited on the finished parts is not more than a very small amount (< 0.005 inch) in relation to some basic (datum) feature. 

All that aside, what you want are finished parts that run true without appreciable wobble.

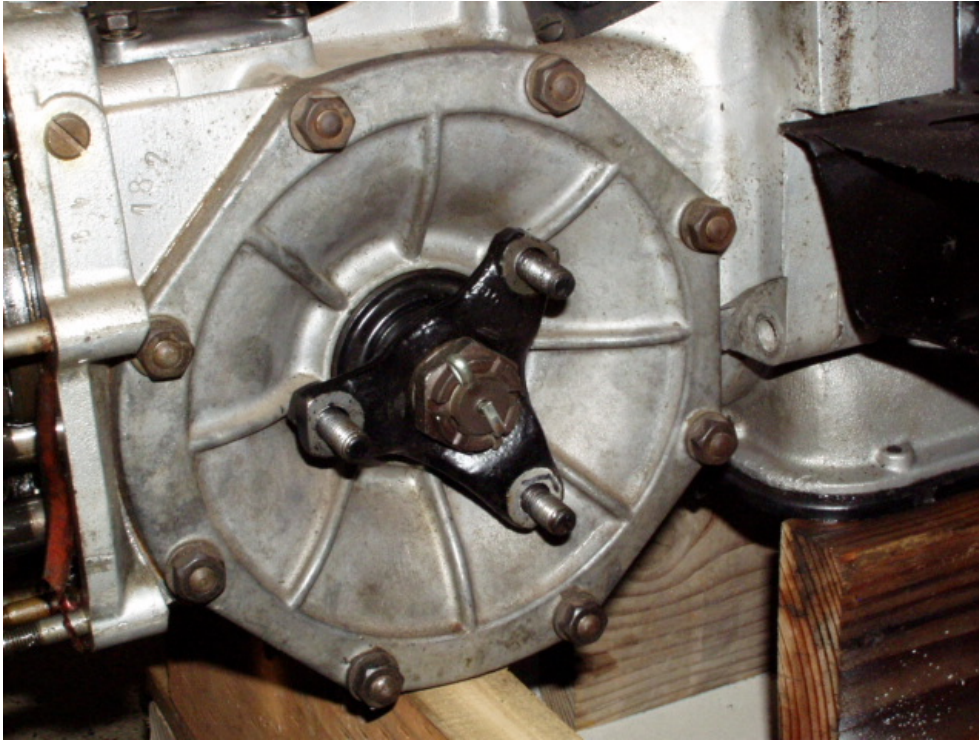
Here is a picture of a modified (and painted) VW axle assembly after the shaft has been shortened (note weld in center of shaft) and the new flange adapter assemblies have been added to each end:



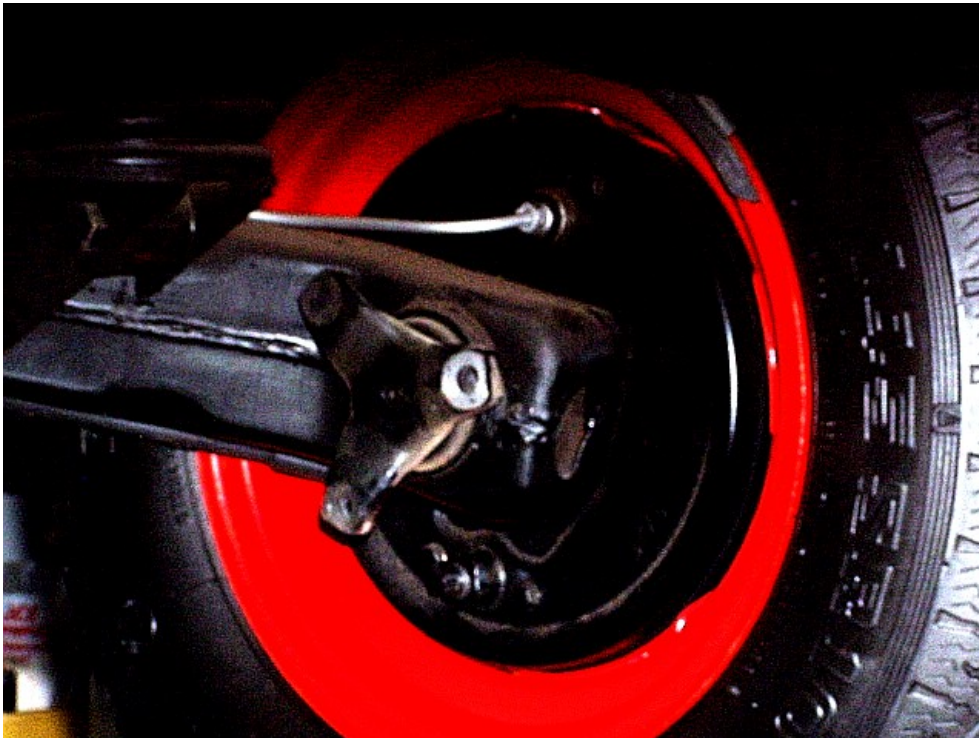
Volkswagen CV Joint Assembly with shortened shaft and the addition of new flange adapters to each end.

Of course the time to clean and re-lubricate the CV joints, if in used but good condition, is before they are put into the assembly above. The assembly above is ready to be installed into the BMW.

Here are pictures of the modified BMW parts that have been reinstalled on the transaxle (gear box) and rear suspension:




Modified Coupling Flange (Plate 3, Key 126) reinstalled on the BMW transaxle (gear box).



Modified Rear Axle Shaft (Plate 4, Key 117) reinstalled in rear suspension arm.

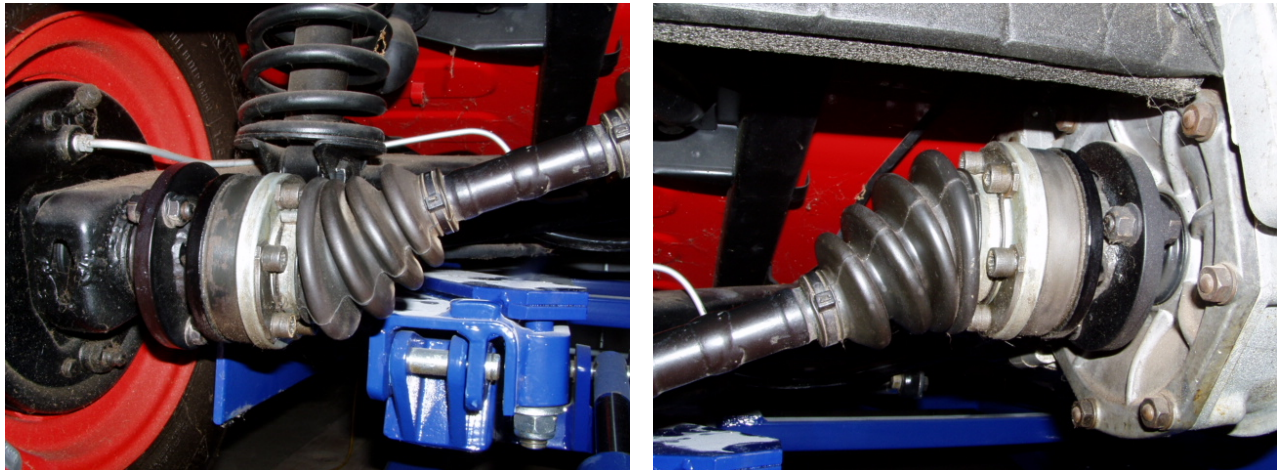
Note that the trimmed “ears” of the parts shown above are to be made to fit snugly inside the diameter 3.970 inch dimension of the fabricated flange adapter (Sheet 2 of 5 of the drawings).



Assembly of the modified VW axle shaft assembly (shown on Page 2 above) to the modified BMW transaxle and rear suspension parts (shown on Page 3 above) is made with a dozen (12) 3/8-16 NC x 1.25" long bolts and nuts. Be sure to use at least a Grade 5 bolts and nuts. Since space is tight, I used  flange nuts instead of separate washers and compensated for the lack of lock washers with the use of thread locker liquid during assembly.

Particularly on the transaxle side of each shaft assembly, space to install the attachment bolts is very limited. At least the first time you should install the bolts in the modified BMW flanges before re-installing the flanges to the transaxle. You may find later that you can install and remove these bolts without this step, but it may save a duplicate step if the bolts cannot be inserted last.

Here are pictures of a finished CV shaft assembly installed in my BMW 600:



The CV joint angle shown here with the wheel off the ground is just short of the maximum permitted by the CV joint design. This angle is the result of the maximum extended length of the rear shock absorber.

I wish I had been able to publish this article when this conversion was originally done, over 20 years ago. But I didn't get the car back on the road until January of 2011 (Many of us know *that* story.), so I really couldn't authoritatively say anything about how well it worked since I had no way to test it . . . until now. I can say that except for the fact that I know this conversion has been done, I wouldn't have a hint while I'm driving. I've put about 800 miles on my 600 at this writing and repeatedly had it up to 60+ MPH (GPS verified with a good tailwind and a long stretch of smooth road). So I can now recommend without reservation this conversion to anyone who has the desire and skills to get it done.

**Note:** My thanks to Bill Rogers of South Carolina for all his help and encouragement with my BMW 600 project. As this article was written, Bill's Isetta website is <http://www.isettadoc.com>. For questions or comments about this article, please contact me at [Rannefeld@aol.com](mailto:Rannefeld@aol.com).

NOTES:

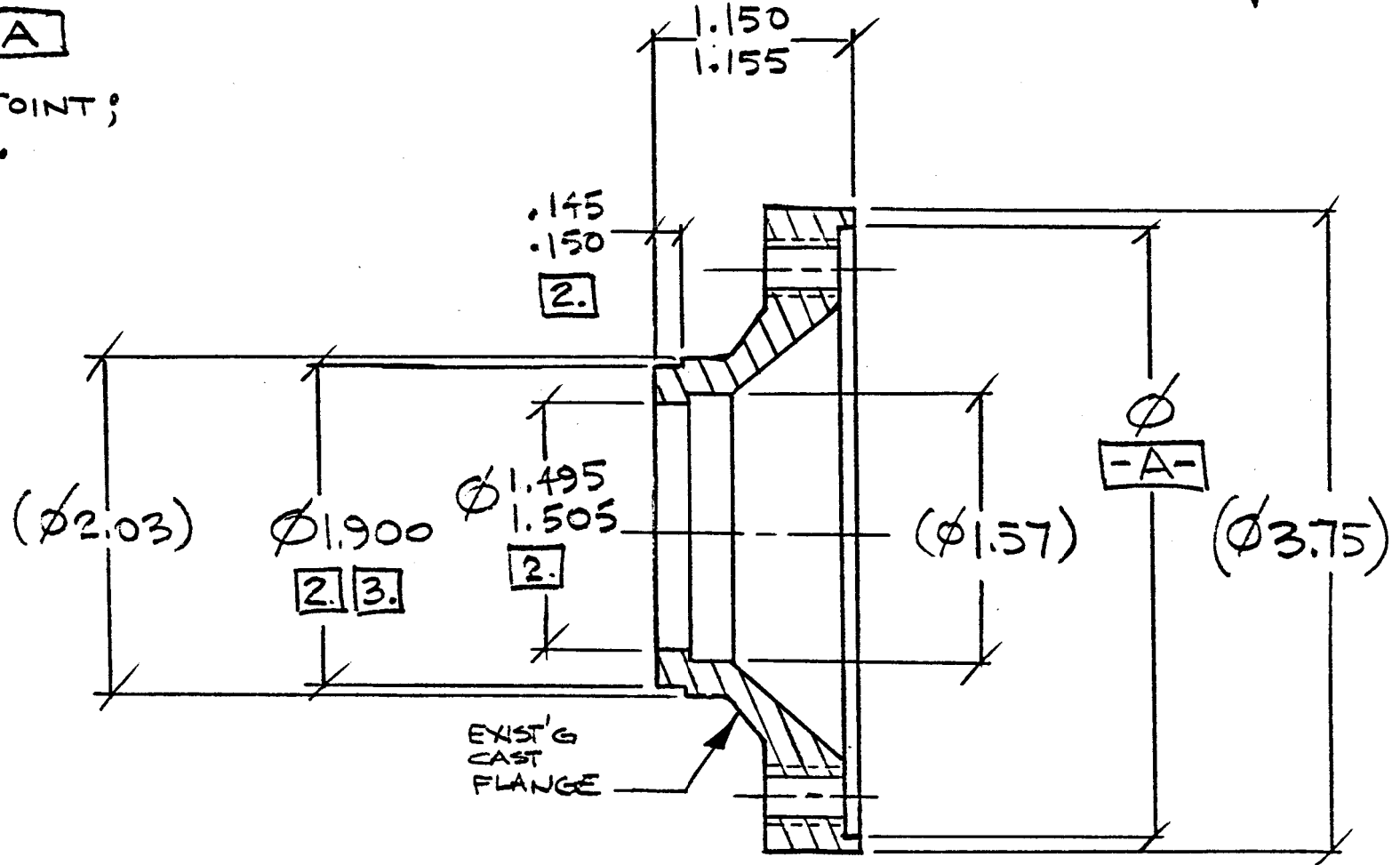
1. DEBURR AND BREAK SHARP EDGES .005 MAX.

2.  $\sqrt{A}$  .005 A

3. ASSEMBLY JOINT; MATCH SIZE.

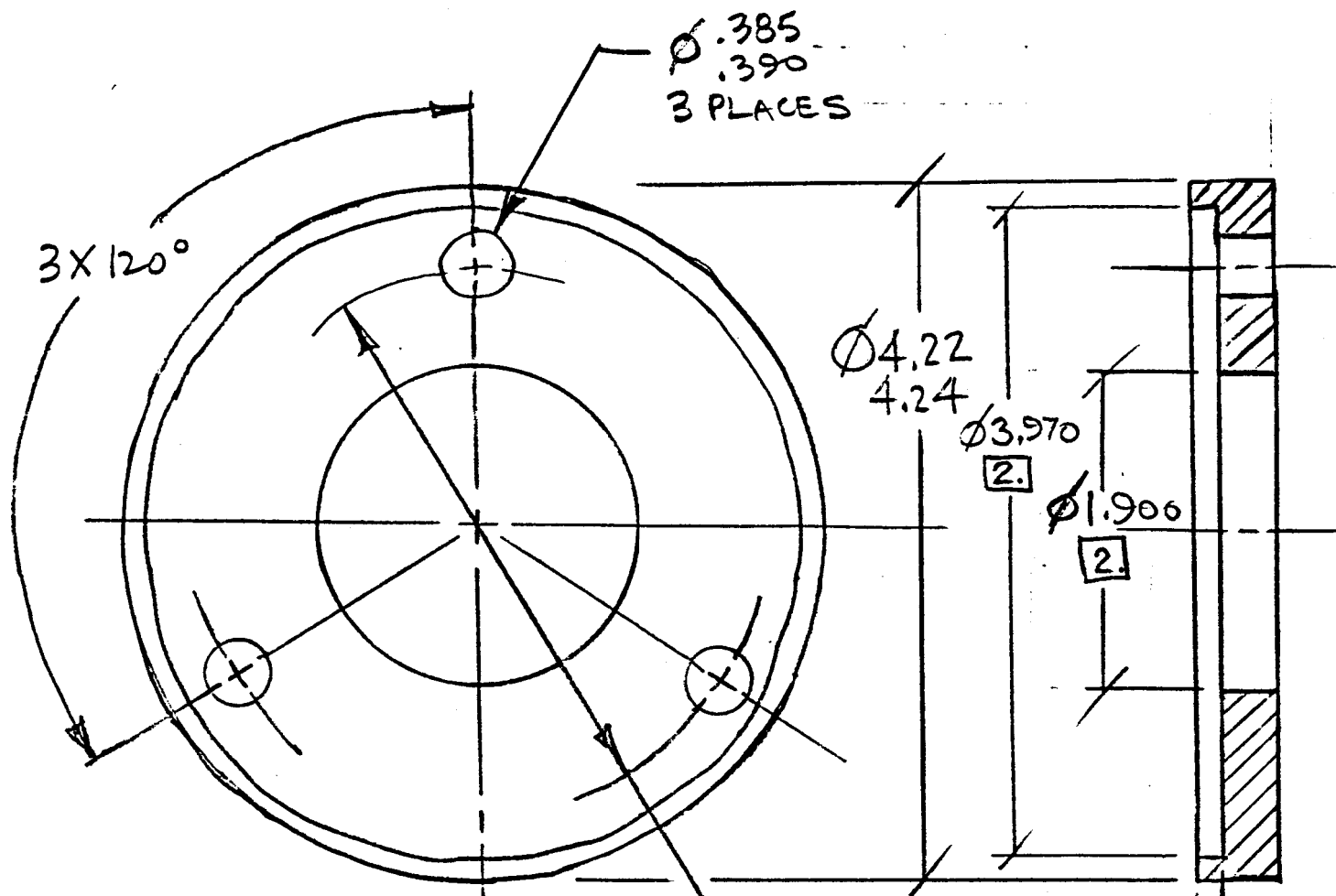
25 Nov 89

JMK  
Sheet 1 of 5



MODIFIED FLANGE (vw)

4 REQ'D



- NOTES:
1.  $\phi$ 's CONCENTRIC WITHIN .005 FIM.
  2. ASSEMBLY JOINT; MATCH SIZE.
  3. MATERIAL: STEEL, 4140

.255	.005	E
.260		
.370		
.380		

# FLANGE ADAPTER (NEW)

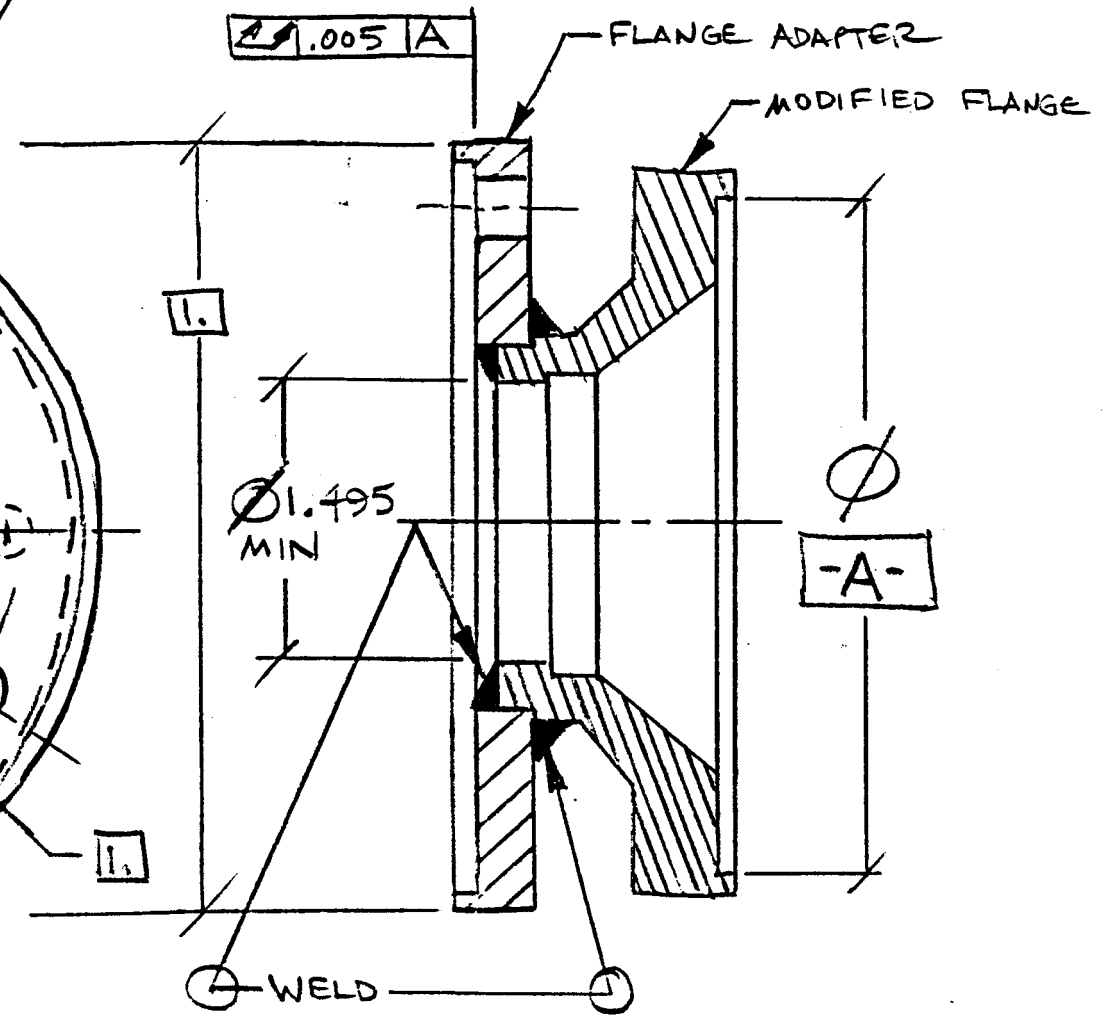
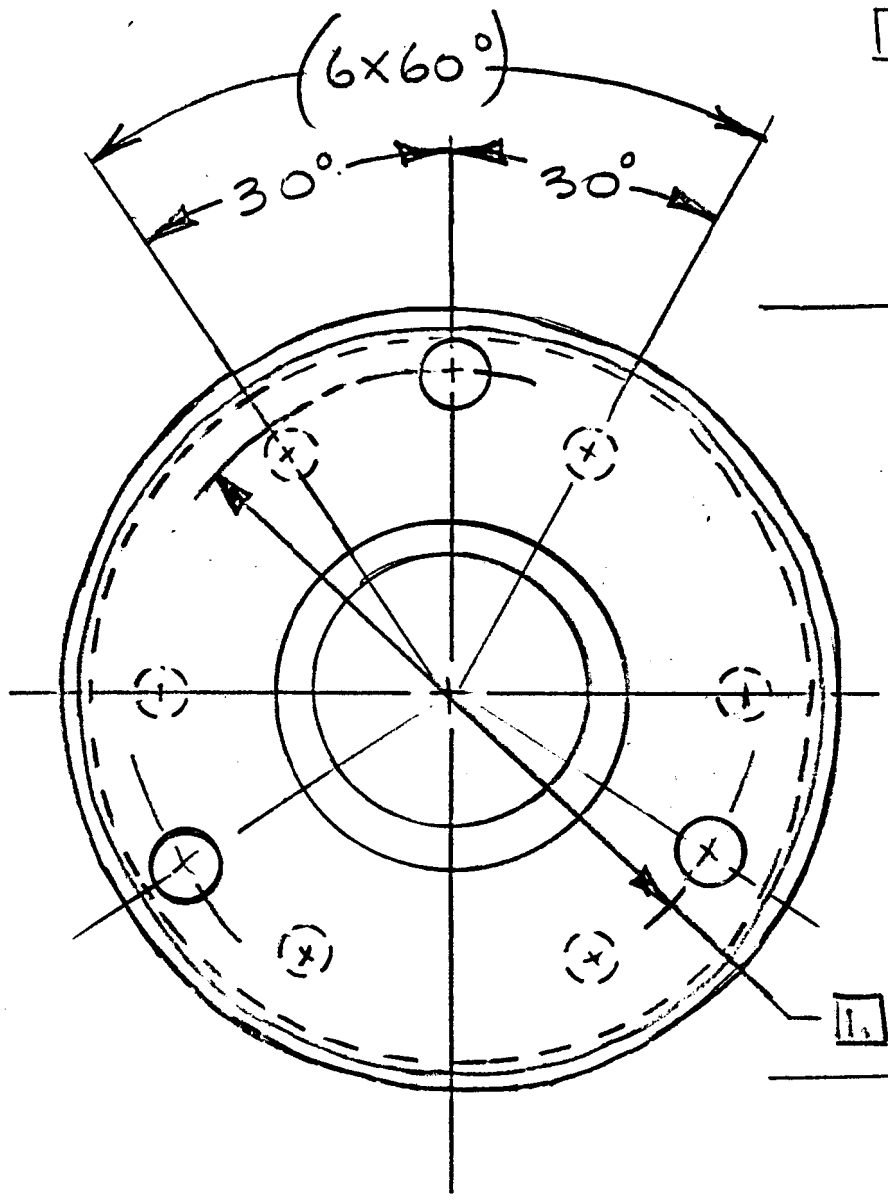
4 REQ'D

25 Nov 89  
MHR  
Sheet 3 of 5

NOTES:

1.  $\sqrt{A} .005 A$

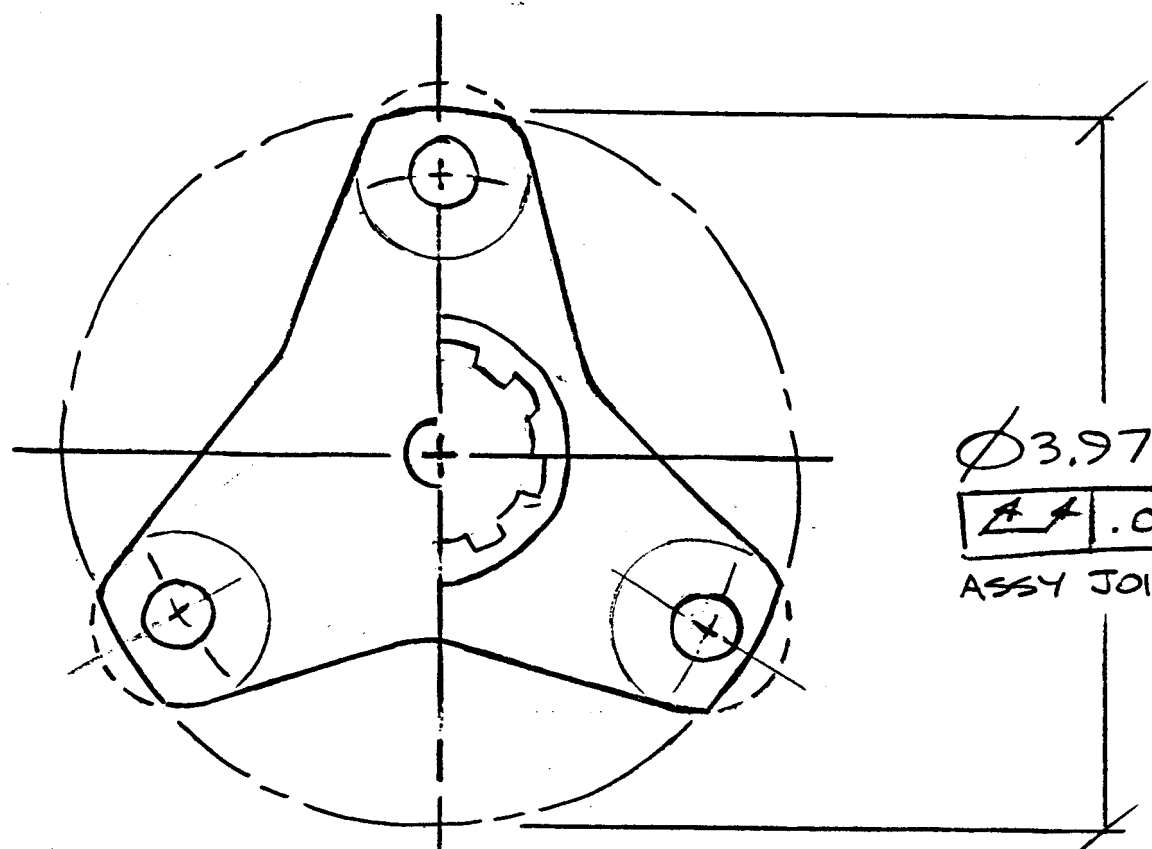
2. ALIGN HOLES AS SHOWN.



FLANGE ASSY

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Sheet 4 of 5



$\varnothing 3.970$

A .005

ASSY JOINT; MATCH SIZE.

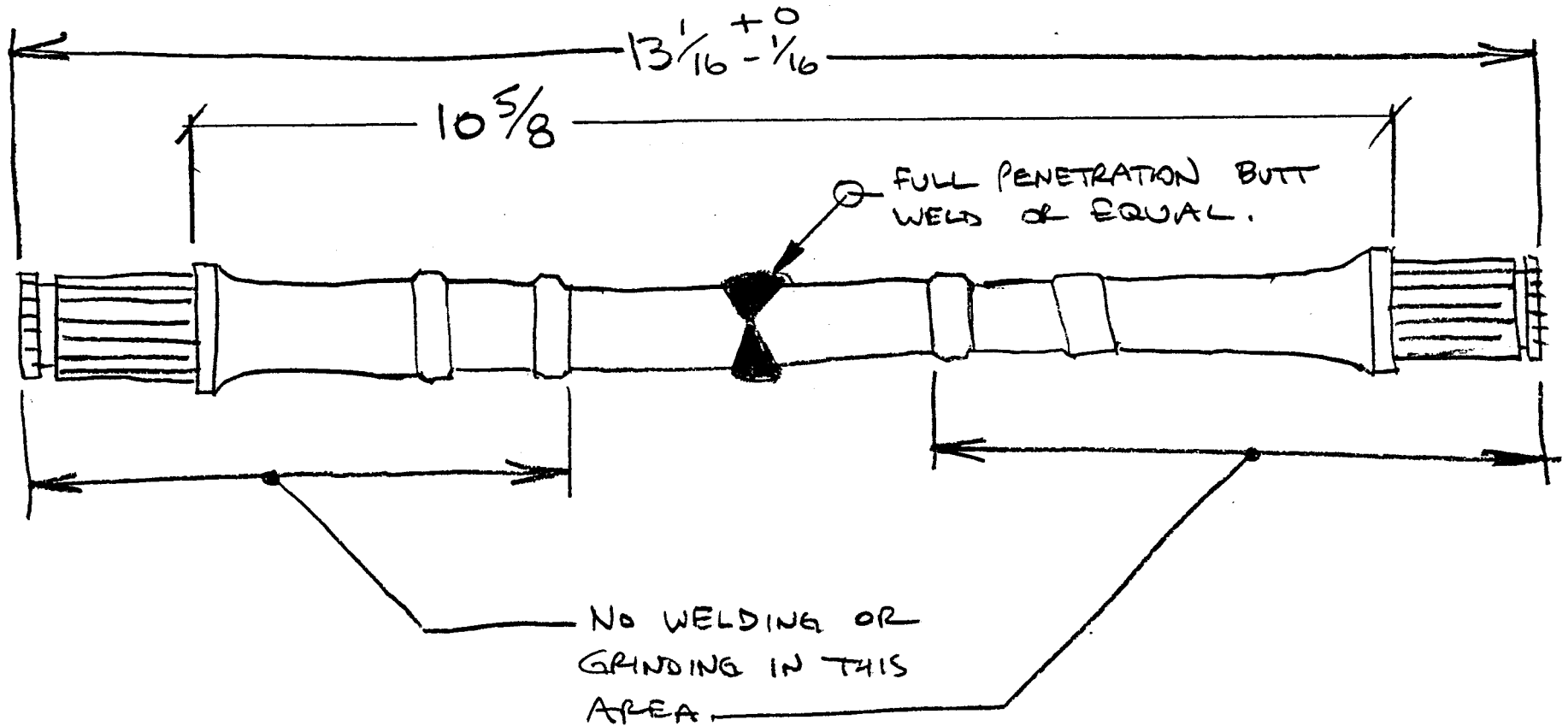
(BMW)  
MODIFIED  
AXLE  
2 REQ'D

(BMW)  
MODIFIED  
HUB  
2 REQ'D



NOTE: SPLINED SHAFT ENDS  
MUST BE CONCENTRIC.

2 Feb 90  
MMR  
Sheet 5 of 5



(MODIFIED VW)  
AXLE SHAFT  
2 REQ'D