

TECH PROCEDURE

CV joint diagnosis, cleaning, replacement

by James Sly

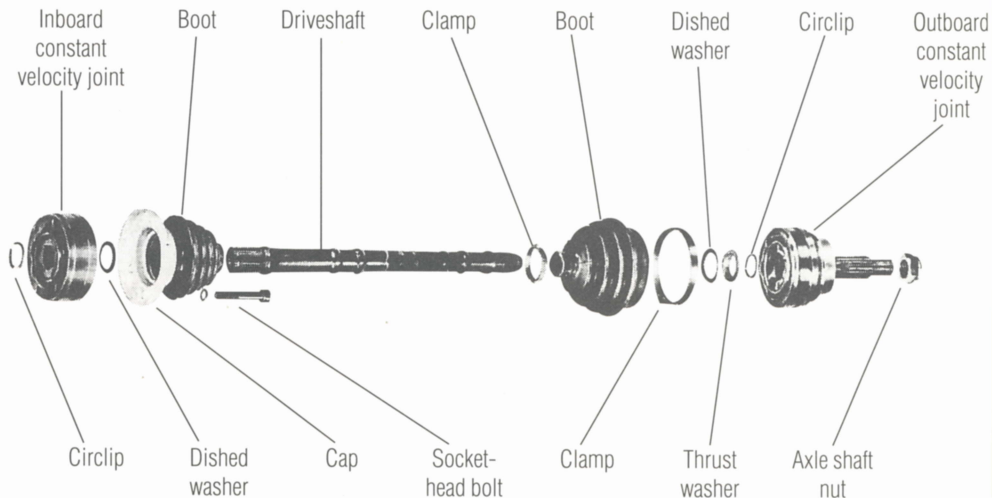
This basic tech procedure is important for all owners of Volkswagens as well as such cars as Audi, Saab, BMW, 914, 911 and other Porsches. Be sure to refer to a manual for your automobile to verify any differences before you dig in.

One of the least liked auto maintenance jobs is repacking or replacing CV joints. And it's not just that the parts are expensive; it's a most unpleasant job. We went to Ron Wood and the crew at VW Specialties for a look at this odious task. It's a dirty job, all right, but if you do it correctly, you won't need to do it often.

Most Volkswagens made since about 1968 have four of the little devils on the drive axles, of a type called Rzeppa joints. Just what are they for? When you're driving down the road, the transmission stays more or less in one place, while at the other end of the axles the wheels move up and down and, on front-drive cars, turn side to side when steering. The distance between the trans and the wheels changes a bit as the wheels go up and down, too.

CV joints "bend" the power around corners and take care of the small changes in length between the wheel and the transmission—and they do it quite efficiently. A CV joint is made of extremely tough induction-hardened inner and outer steel races, connected by hardened steel balls that actually transmit the power, sending each and every ft-lb of torque your engine generates to the wheels and down to the pavement—a demanding job. The CV joints require a lubricant that can stand up to high-pressure usage—a grease with molybdenum additive that accounts for much of the unpleasantness of repair: It's black, it soaks into your skin, it gets everywhere and is also difficult to clean up.

To the uninitiated, CV joints can be like a Rubik's Cube and just as difficult to reassemble. However, take our word on this: We never could solve a Rubik's cube, but we have successfully replaced CV joints on more occasions than we would like to remember. Thus inspired, read on.



With good boots and grease, late-model cars can go 75,000 miles without service. Early cars last about the same, even with the smaller boots. Boot quality seems to be getting better, at least the Löbro and OEM boots. For replacement, the genuine Löbro boot kits are the only way to go. Löbro is also the best for replacement CV joints and axle assemblies, according to all the experts we talked to.

Our subject car, a 1986 Jetta, seemed to be in need of new joints, so we contacted Rapid Parts, which supplied the Löbro joints we felt would cure the CV problem on this car.

Regular service consists mainly of inspecting the boots carefully for cracks. If you do your own oil changes, take an extra five minutes and inspect the CV joint boots. If there are any cracks or signs of leakage, take care of them *immediately*, before dirt or lack of lubricant ruins the CVs. You can also check the joints for axial play with the car up in the air. Hold one hand firmly on the axle shaft and move the tire with the other. The axle moves in and out normally. You should not be able to feel any back and forth play as you move the tire.

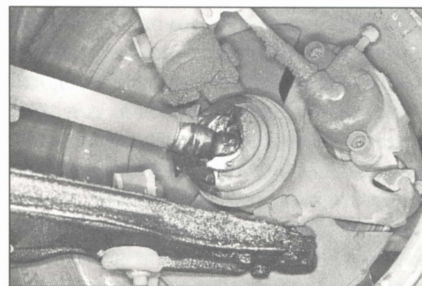
Other than regular inspection, the CV joints are usually okay until you hear a distressing noise (more on those noises later). You can add a small amount of fresh grease every 30,000 miles to help keep things happy. You don't even need to disassemble the joints if you use a grease gun with a special needle fitting, available at most automotive supply houses. VW Specialties uses Swepco Moly Grease #101 exclusively, even when grease is included in a kit, but the grease included in the Löbro kit is fine. Autotech is a source of the Swepco Moly Grease #101.

VW Specialties charges about \$60 per axle labor on late-model cars. The labor is about the same for replacement or cleaning and repacking. For a job everyone hates, that's quite reasonable. They are also experts in inspecting the joints for defects and could very well save you the cost of replacement with their expertise.

Diagnosing a Problem

Until a joint ceases to work, they can be difficult to diagnose. We mentioned one sign, the increased axial play. The other is strange noises. It's bad enough that a number of strange noises are attributed to CV joint problems. Even worse, it's not uncommon to have a good CV joint misdiagnosed as bad. Deal with a competent, experienced and honest shop.

How can you tell the difference between a good and bad CV joint? Some CV joint problems are painfully obvious. If you hear any kind of funny noise and check



If your outer CV joints look like this, you know you have problems. At the very least, you need the joint repacked and the boot replaced. If the boot has been like this for extended periods, the entire joint itself may have to be replaced. Note how the grease from the CV joint has soaked the lower control arm, brake caliper and everything else within reach. A quick inspection could have caught this problem before it became a major complication.

under the car and find a boot ripped open, you can usually be safe in diagnosing the problem. A catastrophic failure of an outer CV joint is easy: It no longer transmits power. You turn into a parking lot, push down on the gas, and get an engine that revs but you go nowhere. You may hear a clicking noise as you let out the clutch, but there's still no movement.

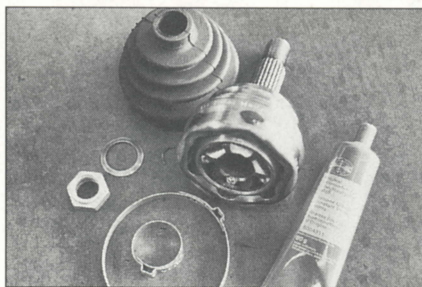
Early CV joint problems are less severe and are identified mainly by strange noises. The outer joint fails more often and is the easiest to identify. The noise is usually worse with the wheels turned. Aaron at APS adds, "It's usually accelerating away from a corner, say a right turn, that you hear the distinctive popping and crunching noise, that rotational knock that means it's time to get your hands dirty." A bad inner joint will make a similar noise in a straight line, decelerating or cruising. Some noises are not CV joints. A constant roaring is probably a bearing, not a CV joint.

If you have access to a hoist and a helper to listen down below, Marc Kalaydjian of AMS gave us this trick on finding the bad joint. With the car on a lift, put it in gear and accelerate lightly. Apply the brake lightly and turn the wheel while an assistant checks for the source of noise. The bad joint should be easy to identify.

Right inner joints by the exhaust pipe



Here's an example of a boot that is soon to fail. Replacing and repacking the boot is much easier and cheaper than buying a new one.



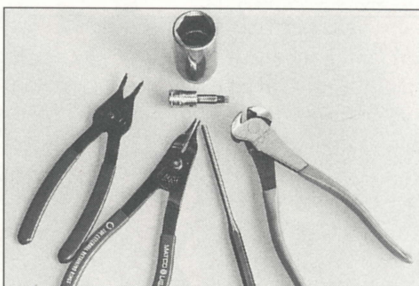
The Löbro kit from Rapid Parts is complete and includes clamps, a quality CV joint, new axle nut, washers, a package of grease and the CV joint boot. You'll find the price at a shop like Rapid Parts to be quite a bit better than the dealer.

tend to fail early, probably because of the added heat. A typical symptom is dried grease inside the joint. Dry grease has lost its lubricating qualities and CV damage is quick to follow.

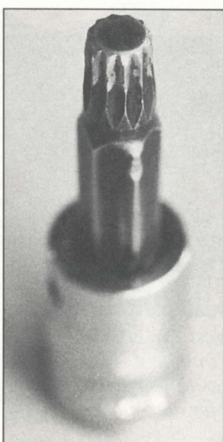
Finally, on an extremely high-mileage car that has been poorly maintained or abused, it is also possible to have axles that are completely worn out. In that case, when there is excessive spline wear and pitting on the fixed parts of the axle, it's usually best to buy a new axle assembly.

Ron Wood cautions against buying "reconditioned" axle assemblies, or CV joints, from dubious sources. He always specifies genuine Löbro joints and axles. Many reconditioned or off brands that have come through his shop were not worth the labor it took to replace them. Rapid Parts sells a specially rebuilt axle assembly, remachined and using oversized balls. They carry a lifetime warranty, and Rapid Part's Peter Bohrman reports no customer problems, despite even some race track use.

Some CV joint failures are caused by other problems. Inner joints can fail because the axle flange seal goes south, allowing gear oil into the CV through the flange. The stub axle then pumps the joint with gear oil—not the hot tip for long joint life. If you don't fix the trans seal problem when replacing the joint, you



A few special tools come in handy: snap ring pliers, punch, and end cutters for crimping the new metal seals. Some are absolutely essential, like the 8mm 12-point bit.



The infamous 8 mm "Triple Square" 12-point tool for CV joint removal. Don't even attempt to use anything but this exact bit.

will find the new joint will soon fail, too.

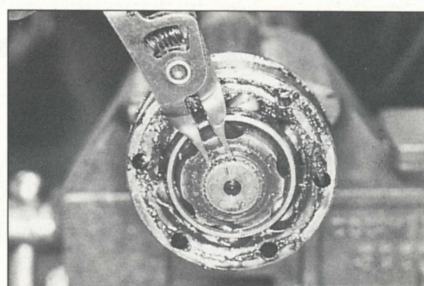
Luckily, replacing the stub axle seal (part #020 409 289B) is a simple affair. It pops right out, and reinstallation is a simple matter of tapping it in without damaging it. This fits everything from the '74 Rabbit on, except for Foxes. The Fox has a different design and doesn't use a seal.

Repack or Replace?

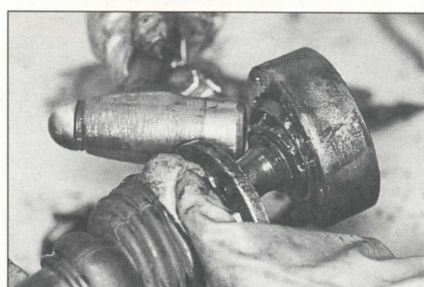
Unless you have a completely failed joint, you need to inspect the cleaned joint carefully. Can it be repacked and reused, or does it need to be replaced. There's the catch: If you buy joints ahead of time from a VW specialist, you can save money. What if you don't need the joint? Buy them locally or at the dealer at the last minute and you can pay through the nose. Or, third option, leave the car apart and order what you need and wait. Remember: To service the CV joints, the drive axles need to be removed. Decide what's best for you. Having a specialist do the service can be a simpler way to go. If the joints are bad, they'll have them in stock. If they're good, you get the service and are quickly back on the road.

Tools and Materials

Mechanics working on newer cars require special tools for the job to be done correctly. Some tools are essential; others



The first step to CV repair or replacement begins with removing (expanding) the circlip that holds the joint in place.



Some gentle persuasion may be required to slide the joint off the axle. Be sure to tap evenly so the joint doesn't get cocked and don't hit the cages because they break easily.

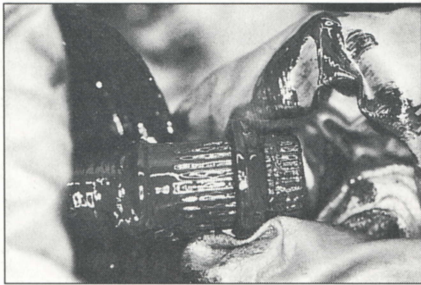
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just make the job a little easier. Many of the tools for CV joint replacement fall into the first category.

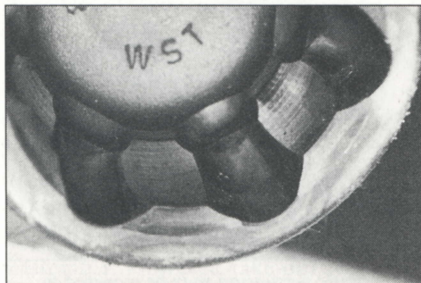
The stub axle nuts require a 30mm socket. These are high-torque fasteners, so a 1/2-in. drive is required, and an impact wrench is a handy accessory if available. The inner CV joints use a special fastener with a recessed bolt. A special tool, with a star-shaped tip called an 8 mm Triple Square (or 12-point) bit, is required. Don't try to remove or replace the bolts with anything else. And plan ahead. This may be a difficult tool to find on a Saturday afternoon. Some CVs use circlips with internal holes for snap ring pliers; others just require the pliers to expand the rings. Have both on hand to be sure. You also need a way to clean the joints and grease to repack them. Don't discount the value of kitchen gloves to keep those fingernails clean.

Getting Started

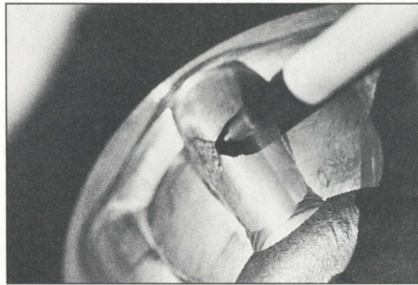
You've got the right tools in hand, you have the parts you need, and you've got approved jack stands. Begin!



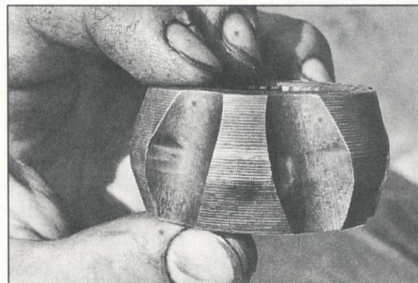
After the CV joint slides off, there are two washers that follow. You may want to use gloves as the molybdenum grease is very messy.



The outer CV joint has a cup-like race that the balls roll in. This one has normal wear patterns and is acceptable for reuse.



This outer bearing shows signs of pitting. The joint should be replaced.



Both races of the CV joint and each of the balls must be carefully inspected. This inner CV joint bearing race exhibits normal wear patterns, and no cause for alarm.

Motion Penalty

One major reason for wheel bearing failure is rolling the car without the axles installed. Exactly like when you are rebuilding your axles. In spite of being easy to avoid, this failure mode still occurs frequently. (It happened even to us.) You pull the axles at the same time, repack the CV joints, and have them cleaned and sitting on the workbench, ready to reinstall.

It was hard enough for you to clear a space in the garage, but when you found out that you need to move the car to get the ping-pong table out for your little brother, or something equally inane, the car has to be moved. So, without thinking, you simply lower the car off the jack stands, roll it back ten feet, let it set overnight. The next day, you roll it back, jack it up and complete the rebuild, bolting the axles back in place. You'll be in for a surprise before long, as that roaring of the failed axle bearings comes to your ears.

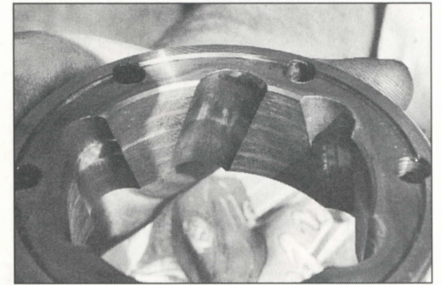
As difficult as it is to believe, rolling the car on the front axle bearings without internal support is enough to trash them. The cure? Obviously, don't roll the car without the axles installed. If you're going to have the axles out for long, here's a simple solution: Take a old outer CV joint stub and put it in the bearing. Next, torque it down with an old axle nut before rolling the car around the shop. Your bearings, and your pocket book, will thank you.

1. Undo the stub axle nut. The axle nut requires a 30mm socket, and the torque is quite high. This takes some muscle, so it's best to loosen it with the car firmly on the ground instead of on jack stands. Don't ever roll the car with the axle nuts loose or the axles removed—it can damage the bearings. Most shops use an impact wrench to take this nut loose, which makes the job easier.

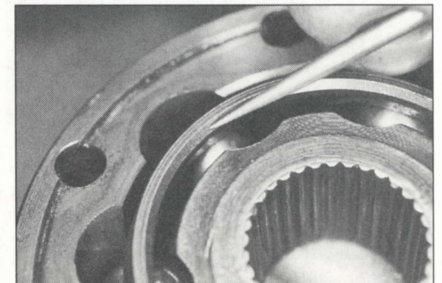
2. Raise the car and place it securely on jack stands. Never work under an unsupported car. Jack stands work better than ramps as you can check the axial play with the wheel moving freely, and rotate the wheel to access all of the bolts holding the inner joints on.

3. Using the correct 8mm Triple Square bit, loosen the bolts, turning the road

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This outer race of an inner CV joint shows the shiny spots of normal wear. Nothing to worry about here.



The most confusing part of putting a CV joint back together is getting it started correctly. On the inner CVs, the cage chamfer goes to the inside of the car, away from the wheel.



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wheel to gain access to each bolt in turn.

4. With all bolts loose, pull the CV joint away from the stub axle and lift the axle up for the clearance you need to pull the stub axle from the hub, and then lower the assembly down.

Cleaning

5. Start with the outer joint with the stub axle. Cut or clip the old clamp off the boot and fold back the boot, which will be covered with messy, sticky grease, if any is left. The outer CV joints are held in by a recessed circlip that you can't get to. You take a soft-faced hammer—copper or plastic—and drive the joint off the axle. You need to hit it hard enough to drive it off the circlip without damaging the joint.

6. As you slide the joint off, remove the circlip, thrust washer and dished washer. Tilt the center section of the joint and slide the balls out, taking care not to lose them. Clean the old grease from the CV joints. You will have to use multiple changes of an approved solvent—not gasoline—to get them clean. Keep the balls for each joint separate.

7. Now for the inner joint. Remove the circlip holding the joint to the axle. Using a punch, drive off the metal plate from the boot. With a soft-faced hammer, gently tap the joint out of the axle. Remove the dished washer from the axle. Tilt the center section and remove the cage and balls. Clean the old grease and you're ready to inspect the joints.

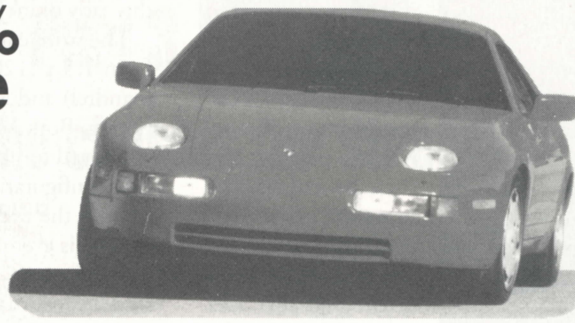
The Bentley manual recommends keeping track of which ball went where. In practice we have seen few people bother. We think you are safe just keeping the balls from each joint together.

Inspection

Start by inspecting the axle shaft and the splines for damage and wear. Usually the axles will be okay. Next, check the CV joints and ball races. Some wear is normal. On the outer CV joints the most severe wear will normally be on the outside race, on the inner CV joint it will be on the inner race. Check the races that the balls roll in. Normal wear, slight cupping and shiny spots are acceptable, and if the ball races are not worn through the joint can be re used. You can see the paths that the balls have taken, but there are no signs of pitting in a good joint. Pitting and a rough surface, however small, means that the joints are history and need to be replaced. Check our photo examples to be sure. Take the time to carefully look over

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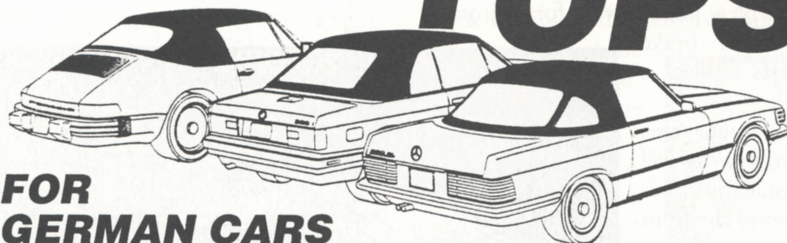
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the boots for signs or age or cracking, too.

Putting Them Back Together

If you are reusing joints, you'll need to put them back together. If you have new components, switch to the next section. Assembly is the reverse of disassembly. Grease the cage with moly grease. Begin by putting the center section in the cage, and install the balls one by one. The chamfer on the cage goes to the outside of the car. Next, line up the halves and slide them together. On the inner CV joint, the chamfer goes to the inside of the car. The small inner segments line up with the large outer cage segments, while the large inner segments line up with small inners. Confused? it's really quite simple. And on the outside joint, it's even easier. Every thing is symmetrical and the outside is clearly the outside. The cage also has a slight chamfer,

Torque Specs:

Inner CV joint fasteners: 33 ft-lb
Stub axle lock nuts: 195 ft-lb

Typical Pricing

Note: Standard Golf and Jetta units are considerably cheaper but are not interchangeable.

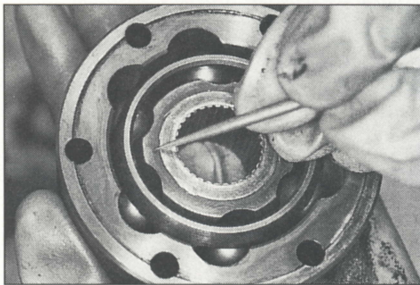
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left side	191.498.201	
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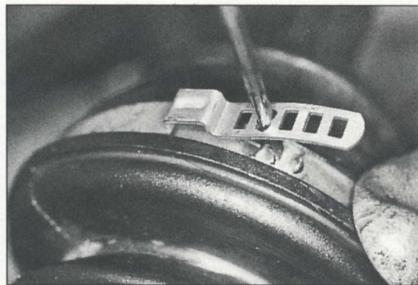
pointing to the axle just like the other end. The Bentley Manual for your car has several pages of detailed explanation. The CV joint slides together firmly, but should take no force. The assembled joint should move freely.

If assembled wrong, the inner joint can lock almost instantly, and takes carefully hammering to split apart. The cages are very hard and thus quite brittle and can easily be cracked. Take care, proceed slowly, and get it right the first time.

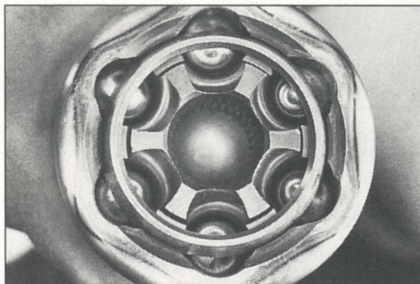
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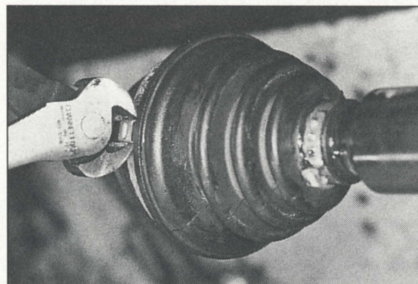
If you assemble the CV joint incorrectly, it will lock up, and taking it apart is tricky. The small inner segments line up with the large outer cage segments, while the large inner segments line up with the small inners.



Whether rebuilding a joint or installing a new one, always use a good quality boot. A small screwdriver can be used to pull the clamp into position before tightening it down.

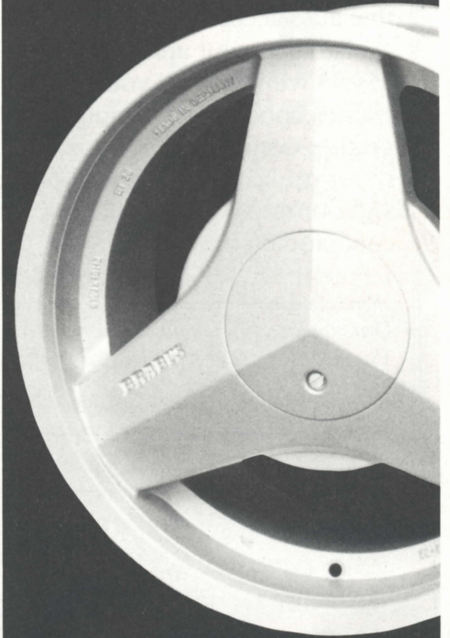


The assembled outer CV joint ready for some Svecpro grease. Notice the wavy lines of discoloration that follow around the outer housing. That's not damage, but factory induction hardening that makes the joints strong and durable.



Once the clamps are in place, crimp them with a pair of end cutters. That completes the outer CV joint assembly.

BRABUS



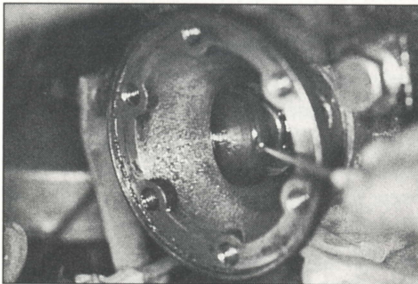
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Replacing the Joints

Reassembly on the axle is the same, whether you use new joints or your rebuilt joints.

Start by installing the outer boot. Place the steel band around the boot and hook it on the tightest notch you can with a small screwdriver. Next, install the dished washer, thrust washer and circlip. Gently drive the joint over the axle. Each joint takes about 3 oz (90 grams) of grease. Place about 2 oz on the outer side, and the remaining grease on the inside. Slide the boot over the joint, and add the other steel band. Hook it on the tightest notch you



The stub axle seal is easily removed with a small pick or screwdriver. Don't forget to check this important area as a leak can destroy a new CV joint.

can with a small screwdriver. Crimp both bands with an end cutter.

Sometimes people are tempted to leave the inner band off, particularly if they forgot to put it on the axle before beginning. Leaving the band off is a bad idea as the axle boot joint can seep and lose grease. On the outer CV joint, tie wraps in place of a factory steel band are an equally bad idea, as the high speeds may cause the joint to open and not seal properly.

Next, assemble the inner joint onto the axle shaft. Start by sliding the boot into place. The inner joint uses no bands or clamps on the boot. Install the dished washer with the dished side facing out. Gently tap the joint onto the axle shaft and install the circlip into the groove. Properly installed, the circlip should be able to turn freely. Slide the boot cap over the CV joint and tap or squeeze it into place as necessary.

Reinstalling the Axles

Installation of the repacked or rebuilt axle assembly can at first seem confusing. Here's the trick for reinstalling the axle: Start by putting the inside end of the axle above its normal location. That gives you

space to work with on the outside. With the inner end of the axle in the air, the outer CV joint slides into the splined hub. Lower the inner side down and carefully start the bolts.

The official party line is that axle nuts are "one time use only." In fact, you normally can use them a couple of times, if you use LocTite® or a suitable thread-locking compound. When these nuts come loose, they not only create an extremely dangerous situation, they also can let the wheel bearing get damaged (see sidebar). Check the axle nut after a test drive and a couple of days after completing an axle service to be sure that it is securely fastened. ❏

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