Steve S., Virginia, USA

Pete-
Here's my rewrite of the article that Dan mentioned above. I think that you'll find it to be a bit more useful-

After many tens of thousands of miles, wear in the differential is inevitable. This wear normally manifests itself as a 'clunk' being both felt and heard initially upon acceleration and upon deceleration. If your MGB has wire wheels, first check that the hubs and splines are not worn, as this can also be the origin of a 'clunk.' A diagram showing profiles for various degrees of wear can be seen at http://www.britishwirewheel.com/faq.htm . If your splines and hubs are sound, or if the car is fitted with steel wheels but the clunk persists, then the condition of both the universal joints of the driveshaft and its splines are worth investigating. If these and the driveshaft are sound, then the noise may be due to wear in the thrust washers of the planet gears of the differential. If care is taken, replacement of these inexpensive thrust washers is quite straightforward, the two different types used each being of one size only. Doing so will help to prolong the service life of the rear axle.

As with all work under the car, first remove the battery ground (earth) lead to prevent accidental starting, chock the front wheels, then lift and secure the rear of the car on axle stands.

While you have the car up on axle stands, now is the perfect opportunity to pull off the brake drums and check to see if the halfshaft (quartershaft) seals are leaking. You can also take a fast look at the brake linings to see if they are worn down close to the rivets that secure them to their steel shoes. Grease the U-Joints, driveshaft splines, and the parking brake cable, too. May as well get it all done at the same time while it is up on the axle stands, right? A Halfshaft (sometimes also called a Quartershaft or an Axle Shaft) is the shaft that transmits power from the differential mechanism to the drive wheels. The halfshaft (quartershaft) seal is the seal that keeps the oil in the axle from leaking out into your brake drums. Look on page 213 of your Bentley manual. It is #43. Just look and see if you spot any oil leaking out. The oil will ruin your brake shoes. Spray the brake system with CRC Brakleen and inspect everything carefully. While you have the drums off to inspect the seals, you can clean off the rust and paint them with VHT engine paint. Remember, rust is a heat insulator, and it is heat that triggers brake fade.

Once the rear brakes are reassembled, set the parking brake so that the Halfshafts (quartershafts) cannot move. That way your measurements will be as accurate as possible. Grip the differential flange that connects to the rear U-joint of the driveshaft and rotate it to take up any freeplay, then scribe a mark on its edge and a corresponding mark on the axle housing. Next, rotate the flange in the opposite direction and scribe another corresponding mark on the axle housing. If the marks are 4.5mm apart (6° of rotation), you have a like-new differential. If the marks are 8mm apart (10° of rotation), you have a usable differential. If the marks are 10 mm apart (13° of rotation), you have a worn differential.

Of course, before you can do anything with the differential you will need to drain the oil out. This potentially simple operation is made more difficult because the British decided to use a ½" BSP square drive drain plug. This is a rather quaint plumbing item. Of course, the British like to do things their own way, so their plug has a square hole in it for the wrench. The tool necessary to remove this charming drain plug from the bottom of the differential housing is a 7/16" extension for a square pipe plug. Do not bother trying to use a hexagonal Allen wrench. You'll just end up with a ruined Allen wrench trying to get the plug out that way. It is well worth purchasing the correct tool for this job as it makes life so much easier. MAC Tools makes them - I know because that is where I got mine. Sometimes you can get a cheap one from a plumbing supply house. Once you have gotten the drain plug out you have the option of swapping it for an American-made stainless steel ½" BSP plug from a hardware store/plumbers shop. They never rust in place, and to remove them all you need is a simple 3/8" Allen wrench.

Do not be surprised at what you see when you drain the old oil out. It is not unusual for this maintenance task to have been totally neglected. The Owner's Manual always said to "Check oil level, and top up if necessary." Not a single word about how often to change the oil. Naturally, this led to neglect. It is entirely possible that the oil in it is the original oil. When you drain it out, it may look and smell like something that oozed up out of the ground prompting you to expect to see old dinosaur bones floating in it, but do not worry too much about it. The Salisbury tube-type axle is a grossly over-engineered piece of design work, originally intended for use in light trucks and vans. Usually, the only thing that damages it is letting the oil level drop too far. This often happens when the breather on the top of the tube on the passenger side (right above the horizontal bracket) gets plugged up with road crud. Air then is trapped inside the axle, the differential gets hot and causes the air trapped inside to expand, then the gasket starts to leak as a result of the internal pressure. When the axle cools, air is drawn in through the leaking gasket. The process is repeated every time the car is run until the oil is gone, which usually takes a very, very long time. Once in a blue moon a dedicated garage mechanic will check the level and top it off, so outright failures are unusual. Allow the oil to drain into the container and replace the drain plug securely.

Cleaning the breather is a simple affair, but most DPOs do not even know that it is there on the top of the right side axle tube. Just clean around the top of the axle tube so that crud will not get into the threads, unscrew it, and spray it out with carburettor cleaner, carefully clean the threads with an old toothbrush, then put it back in after it dries. Simple. Once that is done you can proceed with the replacement of the old cover gasket.

Loosen and remove the self-locking nut that secures the compensating lever to the bracket on the differential. Disassemble, clean, and repaint the compensating lever mechanism. If it does not work properly, then the rear brakes will not apply equal force. See those two cables that traverse the axle and go out to the brakes on each side? They attach to the brake mechanisms. Look and you will see a clevis pin attaching the cable to each of the levers of the brake adjuster mechanism. Remove the cotter (split) pin that secures the clevis pin, then pull the clevis pin out and set it aside, along with its washer. When you put it back in, be sure that it is pointing downward with the cotter (split) pin on the bottom. Use a stainless steel cotter (split) pin only.

In order to proceed with the replacement of the thrust washers it is necessary to move one of the halfshafts (quartershafts) by about six inches. Using a pair of pliers remove the cotter (split) pin of the main hub nut and use a 1 5/16" thin-wall socket to remove the nut. If your socket has a cupped mouth, you may need to grind it down in order to prevent it from slipping on the shallow nut. You will need to apply the parking brake to prevent the shaft from rotating. Next, loosen the brake shoe adjuster by about three quarters of a turn and remove (wire wheels) the four nuts or (disc wheels) the two countersunk screws that help secure the drum in place. Release the parking brake, then gently tap the hub with a rubber hammer or a block of wood and pull it off of the halfshaft (quartershaft). The coned spacer can also be slid off from the shaft and set aside with it.

While it is possible to carry out the next procedure without disconnecting the braking circuit, it is inadvisable to do so. This is due to the high chance of damaging the brake line which obviously has very severe safety implications. Therefore, first disconnect the handbrake cable from the lever. Next, remove the brake master cylinder top, place some cling film over the opening, and then replace the cap. It is now possible to remove the rear brake line from the rear wheel cylinder with minimum loss of fluid. The four bolts that secure both the brake backing plate and end cap of the axle in place can now be loosened and removed. Next, lift the backing plate away from the end of the axle. Finally, remove the oil seal collar, bearing hub cap, and the oil seal from the halfshaft (quartershaft). Inspect the oil seal for damage and replace if necessary. Be sure that its lip is facing inward when you do so.

Ideally, a slide hammer can be used to release the bearing and half shaft out of the axle housing. If this tool is not available and the rear axle assembly has been removed from the car, replace the hub and retaining nut back on the half shaft and, using a block of wood to protect the hub, hit it

with a club hammer on the opposite side until the shaft releases itself. If the rear axle assembly is still on the car, another, better approach is available. The books show using an old drum and beating the axle out of the housing, there is a much easier way: once you have removed the brake assembly, dust shield, and the axle bearing cover, replace the flange just far enough to thread on the large flange nut. Place a couple of large sockets between the flange and the differential housing and then tighten the flange nut. A few turns and the bearing slides right out, no beating, no cussing. Once the bearing is out, set both it and its inner spacer aside. The shaft can now be pulled out about six inches by hand. Be sure to repack the bearing with fresh grease before reinstallation.

Use a wire brush to thoroughly clean up the area around the rear differential cover prior to removing the cover plate. Make sure you clean both the bolt face and surrounding area of the axle casing to ensure that no dirt falls into the differential. Once the area is clean, release all of the securing bolts making a mental note to where the handbrake pivot point is attached and the location of the top clips for securing the brake lines. The rear cover can now be gently pulled away.

You are now able to see the components of the differential mechanism. Clean everything with cheap carburettor cleaner so that you can inspect the gear teeth. Inspect the crownwheel (the large gear on the left of the differential cage) for any wear lines, cracks or chipping. If there is any visible damage you will need to seriously consider replacing the entire rear axle unit with a used one as that would be less expensive than replacing the crownwheel.

First, rotate the differential cage around until it reveals the roll pin that holds in place the main shaft of the top and bottom planet gears, and then drift the roll pin out. After the roll pin is removed, turn the differential cage again until the other end of the main pin is facing you. You can now start to drift the main pin out of the carrier. Take care not to push the pin too far through as it is very easy to jam the pin against the casing of the axle with no way of pulling it back, which would render your axle useless! Observe when the pin has started to move and as soon as it does, rotate the differential cage around again so that the pin can be pulled out from the top. Place a thin rod through the roll pin hole in the main pin and use this to pull the main pin completely out of the differential cage.

Once again, slowly and carefully rotate the differential cage and watch the top and bottom gears move away from each other. One will come out at the front while the other tries to fall out at the back. Put your hand in to remove one along with its worn thrust washer and place them on a clean cloth in the same orientation as they were in when they came out of the differential housing. The other gear and its thrust washer should be removed in the same way. Remember that the gears have worn into matched pairs, so take care to keep the pairs separate from each other.

Now that the top and bottom planet gears have been removed, the other two sun gears can be removed one at a time, their worn fiber washers removed and replaced with new fiber washers, and then the sun gears can then be reinstalled.

The top and bottom planet gears now need to be reinstalled. Should they prove to be badly worn, the easiest way to do this is to turn the differential cage until you can get a hand on either side of the carrier. Then place the two planet gears opposite each other, hold them in place and have an assistant slowly rotate the differential cage again. You are aiming to be in a position to look down the hole where the main locating pin secures the gears in place and see all the way through. If you are a tooth out with the alignment one of the planet gears will not line up. If the planet gears are in the correct position, then slide the new metal thrust washers into place between the carrier and planet gears. Once all of the planet gears and washers are positioned correctly, drift the main pin back into position and secure in place with a new roll pin. Insert a cotter (split) pin through the roll pin to ensure that it will not come out.

The halfshaft (quartershaft) can now be felt back into position and, making sure that the mating

surfaces are clean, install the axle end cap and the back plate. Use the four bolts to pull the whole assembly together slowly by tightening opposite bolts a little at a time. Replace the coned spacer, hub and the castellated nut, followed by the brake drum, which needs to be secured with the two Philips screws. When reinstalling the splined hubs of a wire wheeled car, note that the hub with a stamped “RH” goes on the right halfshaft (quartershaft) and that the hub with a stamped “LH” goes on the left halfshaft (quartershaft). The mounting spinners for the wheels are also so marked. This is so that the mounting threads of the hubs will tighten the spinners when the car is moving forward.

The handbrake lever and cable can now be attached and the brake pipe screwed back into the wheel cylinder. Release the cling film from the master cylinder and bleed the brakes. You can get any residual air bubbles in the brake lines loose by tapping on the lines with the handle of a screwdriver. With luck you may only have to bleed the side you have removed the pipe from. However, if the brake pedal feels spongy, then bleed the whole system. Reset the rear shoes by using the adjuster on the back plate.

You might also want to inspect the pinion seal for signs of leakage and decide if you want to replace it while you still have the car up on the axle stands (National Part # 224470). If you choose to do this, be aware that although this can be a mechanically risky undertaking, if proper procedures are adhered to, there should be no problems. Mark the flanges of both the driveshaft and the pinion to ensure correct reassembly, and then disconnect the driveshaft. Measure and record the torque required to rotate the pinion with the wheels removed from the rear of the car. While preventing the pinion from rotating, remove the flange retaining nut and its washer, then remove the pinion flange. Remove and throw away the old oil seal. Closely examine the oil seal track area of the pinion flange for damage. Grease the periphery and the sealing lip of the new oil seal and fit the seal flush into the axle casing. Refit the pinion flange and washer. At this point it is necessary to proceed strictly according to procedure. Screw on the retaining nut, tightening gradually until resistance is felt. Rotate the pinion to settle the bearings and measure the amount of torque necessary to rotate the pinion. If the amount is less than that which was previously recorded prior to the removal of the oil seal, tighten the nut a very small amount, then resettle the bearings and recheck the torque reading. Repeat this procedure until a torque reading equal to the recorded amount but not less than 4 to 6 In-lbs is attained. E.g., if the Original Recorded Figure = 9 In-lbs, then adjust torque to this figure (9 In-lbs). If the Original Recorded Figure = 0 In-lbs, then adjust torque to 4 to 6 In-lbs. Caution: Preload buildup is rapid, so tighten the nut with extreme care. If an Original Recorded Figure that is in excess of 6 in-lbs is exceeded, then the axle will have to be disassembled and a new collapsible spacer installed.

Ensure that the mating surfaces of the axle and its cover are cleaned by removing all of the old gasket, dirt and grease. Hopefully the old gasket will come off easily. Do not be surprised if it comes off in sections and pieces. In order to have a leak-free rear axle, first you have to get the entire old gasket off and have a clean, oil-free sealing surface. A razor scraper that uses single-edge razor blades does nicely at this task, but use it patiently or you will snap off the blade. Whatever you do, do not make the classic Beginner’s Mistake of spraying any of it with solvent. You will remove the oil and it will be as hard as a rock, forcing you to shave it off a few hundredths of an inch at a time. If you make this mistake, you will end up going through a box of single edge razor blades by the time you are done. Once you have the entire old gasket off, clean the metal face of both the differential housing and the sealing flange of the sheet metal cover with good old-fashioned rubbing alcohol. Next, check the sealing flange of the cover for distortion. Whenever a leak develops, the common tendency of DPOs is to put a wrench on the cover bolts and tighten them down to three grunt-pounds, crushing the gasket, distorting the cover, and thus worsening the leak. Drip, drip! Use the old Petroleum-Jelly-and-Mirror technique to check the sealing flange of the cover for flatness. If the sealing flange is distorted (and it often is), you can usually flatten it out by placing it on a flat surface and putting a socket open-end-up over the bulge, placing a piece of wood on the socket, and gently striking it with a hammer. Make sure that the socket is the same size as the bulge. Do not hit it too hard or you will thin out and displace the metal, creating a warp that you will not be able to get out. You will have to purchase another

cover from Victoria British (Part # 5-1030, $69.95) if you do. As always, work slowly and carefully and you will be fine. Hopefully, your cover will not be distorted, but do not count on it.

By all means, replace those nasty old nuts and bolts. A “torque reading” is really just a measurement of friction between threads. You really cannot get a worthwhile reading if the threads are dirty, rusty, or deformed. Personally, I like to use stainless steel machine bolts and nuts on the underside of the car. I get them at a hardware store because the quality is higher and the price is lower than at an auto parts store. Be sure that all of the bolt holes on the mounting face of the differential housing and their threads are clean. Get one of your children’s old tiny toothbrushes and some carburettor cleaner and clean them all out really well. Do it right the first time and it will never leak again. I put everything together with antisieze compound on the threads so that if I ever have to take it apart again, it will spin right off. Do not worry; antisieze compound is not a lubricant. Once properly torqued down, it will not come loose.

The differential cover gaskets from Moss Motors and Victoria British are about as thick as a piece of typing paper. They are typical junk gaskets. I make my own from the best gasket material that I can find at the local auto parts suppliers. They are not hard to make. All you need is a sharpened pencil to trace around the outside of the cover and to draw the circles for the bolt holes and a cheap extendable razor knife cutting tool. You can pick up one of these at any Home Depot type store for very little money. If you consider that to be too much hassle, you might try getting a new gasket from Brit Tek as theirs are of decent quality, but not near as good as you can make yourself. When you total up shipping and parts cost, you are no better off financially than doing it yourself. Just tell the person behind the counter what you are going to use the gasket material for and tell him that it needs to be thick (a little compressibility is always good for getting a better seal).

Using the new gasket and sealer, smear a thin layer of Permatex onto the outer edge of the gasket to glue it into place on the differential housing. Apply the Permatex only to the outer half of the gasket. Why? When you torque the cover down you do not want the Permatex to ooze into the inside of the differential housing where it can break free and damage the internals. Next, apply the gasket and again smear Permatex onto the exposed outer half of the gasket, replace the cover and torque the bolts in an alternating pattern a few Ft-lbs at a time to no more than 14 Ft-lbs. Any more than 14 Ft-lbs will deform the cover and it will leak. Be sure that you have cleaned all of the threads or you will get a false torque reading. When you replace the axle cover, remember that the brake line clips at the top and handbrake pivot on the left.

Refill the rear axle with EP90 hypoid gear oil until it drips out of the filler hole, replace the road wheels, earth (ground) lead, and then lower the car. Once the car is on its wheels the hub nut can be fully torqued up to 150 Ft-lbs and a locking cotter (split) pin bent into place.

Clunking from the axle should now be much reduced, or barely audible. However, if there is no improvement, then providing you have checked the hubs, wheels, and the driveshaft universal joints, you may need to consider a replacement axle.