The Brakes Are Binding????

By Steve Jekogian
The brakes are binding because????

This is a conversation I have been having with Dennis Meehan all summer. In fact Dennis will not take his car to Encounter because one of the pistons on the front caliper will not release after the brakes are applied.

Dennis and I have been discussing the cause and what to repair. As you all know it could be so many things.

- Is it rust in the caliper?
- Is the piston pitted?
- Are the O rings around the piston frozen up?
- Are the discs binding in the caliper?
- Is the master cylinder not releasing?
- Is the servo to servoing? Dennis bypassed that years ago so that is not it.
- Is the Flex hose blocked?

Let's start with what is happing. When he applies the brakes the car stops (that's good) and when he starts to move he can feel the one caliper still gripping. Not enough to lock up the wheel but enough so you can feel it. What's the harm of a "slightly frozen" piston/disc? Well heating up the brake fluid which could vaporize is not good and will make it real exciting at the next stop sign.

So what is the first thing you do, rebuild the caliper. Yep Dennis enlisted Bob Pense's help and a careful rebuild of only the sticking piston was orchestrated. Dennis said he repaired the other piston in the caliper years ago. With Healey owners I always ask "was that before you child was born? (and most of us have teenagers right?). After a long day and cleaning up the piston (that was "slightly" pitted) it still would lock up. Now is when you really get mad.

My vote was the piston was pitted and that would make it bind. Dennis was saying it was the rubber flex pipe. Many of us have heard of the flex pipe creating a "return blockage" as it swells or as in humans get "hardening of the arteries". I suggested a test –stép on the brakes, release them, then open the bleed valve, if fluid spits out under pressure that mean there is "return blockage".

Now taking an original flex pipe off is really a hard job. Years of rust and crud around those threads, limited work space, and tools that do not "really fit" make it tough. Dennis said it " x*#k@ fought all the way out"

The new one went in easy enough and yes Virginia that was the problem.

A dissection of the hose revealed another hose inside and the blockage and the way it would swell would limit or slow the fluids return. So there you have it, when in this situation go for the hose.

TECHNICAL SERVICE BULLETIN

Healey Brakes - Bleeding the System

Mike McPhail, Dripping Springs, Texas, Gulf Coast Healey Club

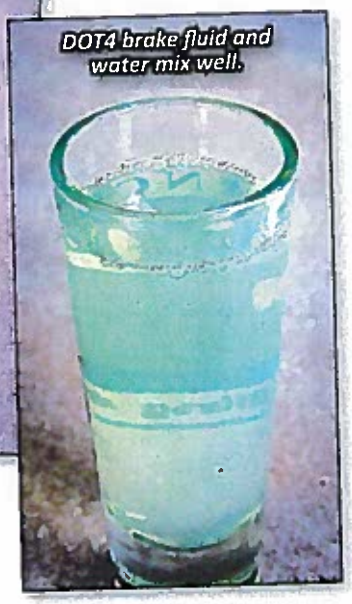
It took three months, but now all four wheels have as-new brakes! Well, not so fast. What about the other stuff? Brake boosters may need some attention, and a brand new one will almost certainly improve braking. Some styles of booster can be rebuilt at home, but a new unit, or at least one that has been professionally overhauled, is probably best. Brake rotors often need changing due to wear or warping, and replacements are fairly cheap.

Of course, no brake job is complete until the master cylinder has been taken care of. Unless you are a glutton for punishment, a brand spanking new one is the way to go. If you chose to recycle, repair kits are available for next to nothing. Just be sure that the cylinder bore is smooth and rust free. Pay careful attention to the surface at the end of the bore that seals off the reservoir. A leak here will cause some of the fluid to escape when the brakes are applied. Press on the pedal and watch the level in the reservoir to identify this potential problem.

You might need this stuff.

Silicone (left) and DOT 4 brake fluid.

Silicone brake fluid (the brown-yellow stuff) doesn't mix with water.



DOT4 brake fluid and water mix well.

A car that has been sitting for a long time will probably have serious pitting in the cylinder bore, while the cylinder from a runner will be the best candidate for rebuilding. Follow the same procedure as with wheel cylinders, although you will find that master cylinders are more complicated. You might want to look in the repair manual before getting too carried away! After reassembling the master cylinder, blow into the reservoir or reservoir line to be sure that the passage to the master cylinder bore is open when the piston is "at rest." Press the piston into the bore slightly, and the passage should be sealed off. You may be able to plug the brake line orifice with a spare bleed screw and test the cylinder's ability to hold pressure. This is pretty easy if the reservoir is attached and you are able to get brake fluid into the bore.

Speaking of brake fluid, let's talk about Castrol LMA versus silicone. These are the only fluids that this writer recommends, so don't you dare use anything else! Most conventional brake fluids are nearly clear, while silicone fluids are often purple or some other queer color. If you are not sure of what is in your system, add a few drops of the fluid to an ounce of water. For you metric system guys, that is about a shot glass full. The conventional fluid will disappear, while the silicone will not mix. As you know, conventional DOT4 brake fluid is cheap and is also an excellent paint remover.

If you are using silicone, watch the knucklehead at the state inspection station, because he will surely top you up with some brand-X fluid. Rumor has it that mixing the two will cause instant brake failure and necessitate a complete rebuild!

This may be hard to believe, but I certainly would not chance it. For this reason, don't switch from one to the other except when completely overhauling the entire system.

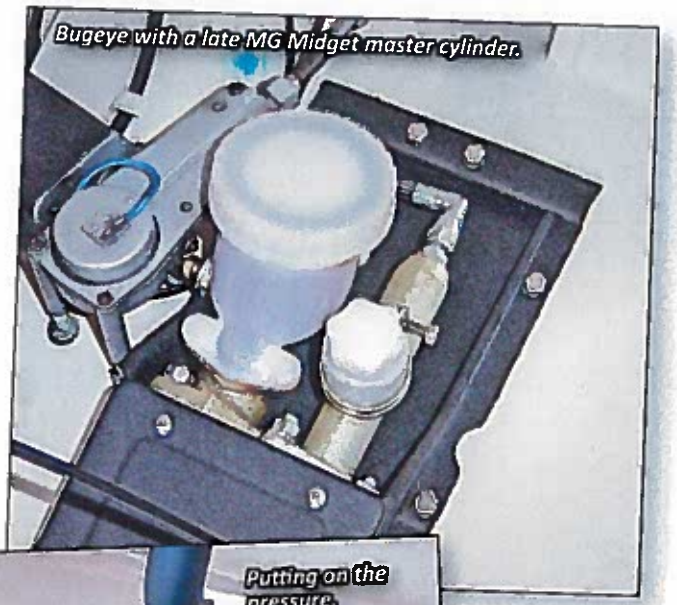
If you are not worried about getting brake fluid onto the car's painted surfaces, then there is no reason to use anything but the Castrol product. The price of a container of silicone brake fluid is several times that of regular fluid, but there is the advantage of saving your fancy new paint job. The major disadvantage of silicone is that air dissolves quite easily into it, giving it a spongy feel. This can be avoided by not using the traditional "pump the brake pedal to bleed the brakes" procedure. However, I found that a trip to Leadville, Colorado, (elevation 10,152 feet) will remove excess air from a system using silicone fluid. If this is not convenient, use an alternative method to bleed the brakes.

The tried and true method of bleeding the brakes requires an assistant who can distinguish the brake pedal from the clutch pedal and follow simple instructions without argument. This eliminates the possibility of help from the wife, so buy some more beer and give your best buddy a call.


Silicone and DOT4 brake fluids mix pretty well.

Start with a full reservoir, and then gently tap the brake pedal to coax as much air out of the master cylinder and into the reservoir as possible. Next, go to the wheel furthest from the master cylinder and loosen the bleeder screw after placing a clear length of vinyl tubing over the end. Put the other end of the tube into a suitable container. Wrapping the threads of the screw with Teflon tape will keep the air from passing into the cylinder around the bleeder. Have your buddy press the brake pedal to the floor when you open the screw half a turn. Close the screw while the pedal is down, and then have him let the pedal up. Do this until no bubbles appear in the fluid, or until at least two ounces of fluid come out. Check the fluid level often. Follow this procedure on the other wheels. When all four wheels are bled, check the pedal for firmness. If the brakes are mushy, repeat the bleeding process. Since you have the rear brakes adjusted up tight, the pedal should have very little play. If satisfied, adjust the rear brake drums so that they just barely drag.


Bugeye, 100-Six, and 3000 master cylinders.


Bugeye with a late MG Midget master cylinder.


Putting on the pressure.


Wrap the bleed screw threads with Teflon tape to help prevent air leakage.

If you are like me and don't have any friends, there are a couple of other ways to bleed the brakes that don't require anyone to pump the pedal. You can modify a master cylinder reservoir cap to allow about 10 psi of compressed air to force fluid to the bleeders. This works really good! Or attach the Mighty-Vac to the bleeder screws and suck the fluid out. These are the recommended ways to bleed the system when using silicone fluid. When you are satisfied that all the air is out of the system, wipe off excess fluid, replace the caps on the bleeder screws and go for a test drive. When you get back, stick your head under the car and check for leaks. If all is well, you may want to sit down and finish that six-pack. If not, you will definitely want to sit down and finish that six-pack! HM

Tech Tips • Clips

Richard Ippoliti – North Jersey AHSTC

(Editor note) Rich wrote this question about his brake issue and then totally redid his whole brake system.

Here is one for the AHSTC technical Brain trust to solve.

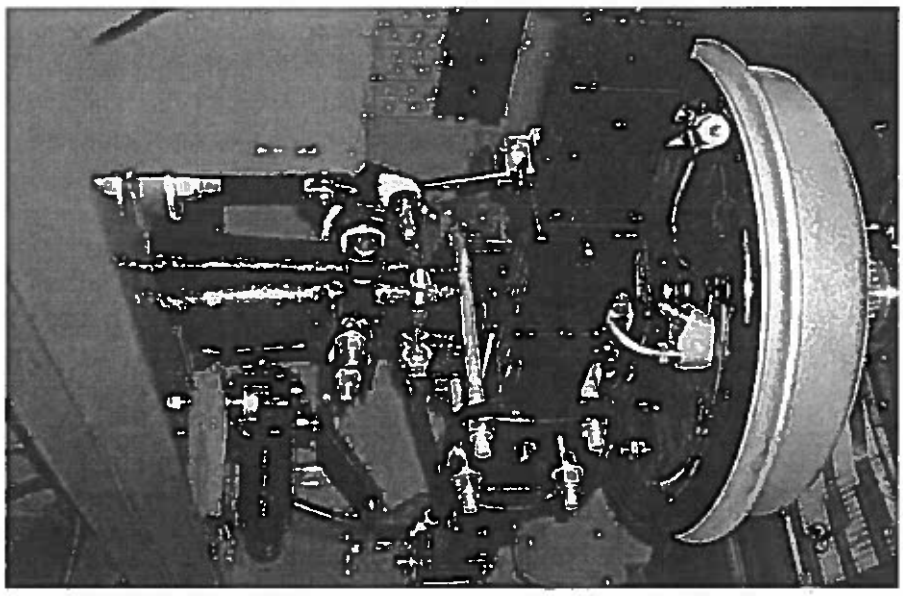
Late last year coming home from the *North Jersey Fall Tour*, I began experiencing a soft brake pedal; softer than normal that required a few pumps to get a good brake. Barbara and I arrived home safely and the next day I began my odyssey of locating the source of my problem.

I jacked the Healey up and pulled the drums off the rear wheels. Found a leaking wheel cylinder and replaced cylinders on both wheels. Also found one wheel cylinder was frozen and not applying pressure to one half of the brake shoes. Fixed this and started bleeding the brakes more times than I want to remember. No improvement in the pedal (going almost to the floor and coming up with a few pumps). Moved to the front wheels. Rebuilt all wheel cylinders with no change in pedal pressure; only to find that rebuilding is not the way to go. They leaked. Purchased and installed new wheel cylinders and still no change after bleeding multiple times. Thank goodness for my wife who has the patience of a Saint. Last stop was the master cylinder. When applying and holding brake pressure, the brake pedal continued to depress ever so slowly; an indication of a bad master cylinder? By the way, you are probably asking "did you check for leaks?" Yes I did and no there were none. Another note; all brake shoes were snugged up to the drum before bleeding took place.

I cannot describe the frustration at this point. I took to the internet to research my particular problem to find I was not alone. There were many ways to correct the problem all of which I tried. The one solution I continually read was to depress the brake pedal all the way, hold it in place with a board and leave it overnight like this. What did I have to lose? Seemed simple enough. I tried it and the next day removed the brace and stepped on the pedal and to my amazement, I had a hard pedal that only moved about 2 inches. Took the Healey out and drove it around and it stayed firm.

OK AHSTC BRAINTRUST.

WHY DID THIS LAST ACTION CORRECT MY PROBLEM?



TECHNICAL SERVICE BULLETIN

Front Brakes Caliper Overhaul

Mike McPhail, Dripping Springs, Texas, Gulf Coast Healey Club

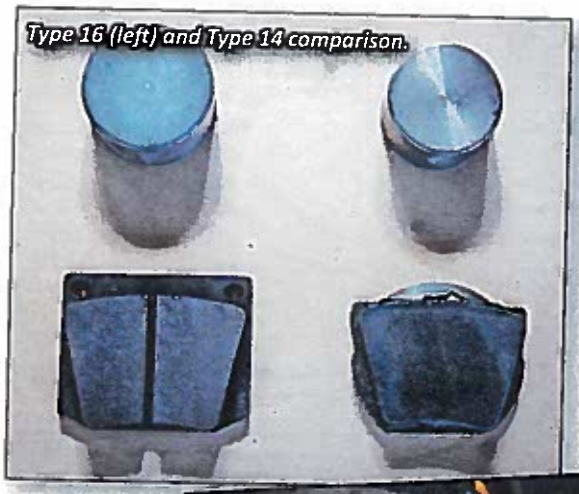
Maybe this month we can get that Healey down off the jack stands … well, maybe not. I think last time we gave up on the back brakes and decided to move forward and rebuild the front calipers.

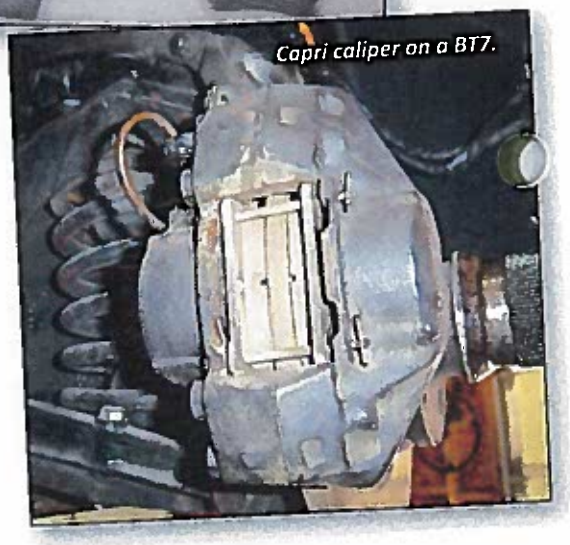
Remove the front wheels to gain access to the disc brake calipers. Afflicted with CRS? Do one side at a time so you will have the other to show what it looks like when it's still all put together.

Disconnect the flexible line at the flare nut end. Watch the brake fluid drip all over your newly painted frame. Fetch some water and paper towels to clean up the mess … quick, before the paint peels off! Remove the solid line at the caliper, then the two nuts that hold the brake line bracket, then the large bolts now revealed securing the caliper to the front axle assembly. Pull the caliper off the car and watch for some bow-tie looking shims that may be between the caliper and the axle. Fish them out of the puddle of brake fluid on the floor. If you don't find any, now you know why there is a groove worn into your brake rotor.


Type 14 caliper.


Split Type 16 Caliper.


Type 16 (left) and Type 14 comparison.


Capri caliper on a BT7.

Big Healeys used a Girling Type 14 caliper until being replaced by a larger Type 16 on the last BJ8s. As you can see in the picture, the Type 16 has bigger pistons and pads. The main advantage in using the Type 16 is thicker rotors and wide selection of pads and rotors. Unfortunately, the Type 16 will not bolt up to an earlier car, but a 1970s Mercury Capri caliper will – Google it! By the way, Sprite caliper rebuilding is very similar to what we are doing.

Place the caliper in a large vise for disassembly. Remove the clips, pins, pads, and anti-squeal shims. If you don't find any shims, now you know why your brakes squeal. Use compressed air to pop the pistons out. You can use a grease gun, but that sure makes a mess! Apply increasingly higher pressure to the line until the pistons move. Place a piece of wood between them so that they won't come flying out like little mortar shells. *Above all, keep your fingers out of harm's way.* If one piston moves, but not the other, wire the free one in place, so that the other will move instead. If neither one moves, use a C-clamp to push them in a little, thus breaking them loose.

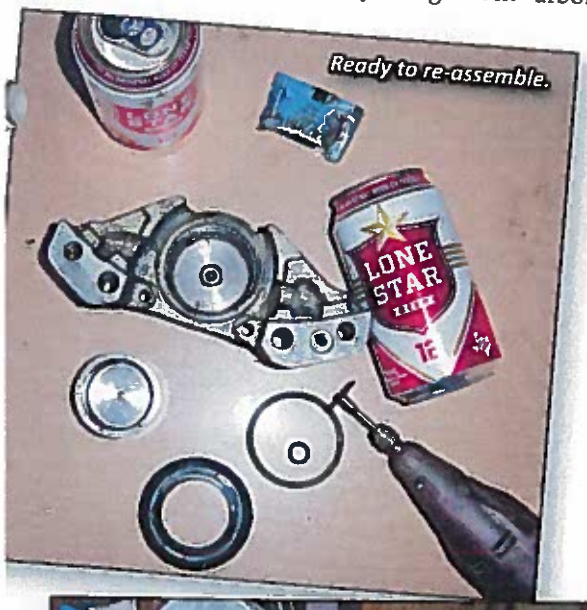
Now it is time to do the unthinkable. Yes, we are going to split the caliper! There is a legend stating that this is beyond the scope of what you should try at home, but the origin of this myth is mostly the unavailability of the little seal that goes between the caliper halves (*but several* HEALEY MARQUE *advertisers now have them! –Ed.*].

With the caliper split, blow the pistons the rest of the way out, taking care not to shower yourself and nearby objects with fluid, or knock yourself in the head with a flying piston. For safety's sake, you had better wrap a rag around things. Remove all vestiges of the rubber seals and crud from the pistons and caliper bore. A Dremel tool does a nice job on the grooves, and a Scotch-Brite or Brillo pad will do for the rest. If the piston is not perfect, replace it. The bore only has to be clean, with grooves capable of holding the new seals. Once everything is cleaned, sneak in the house and wash the caliper halves in hot soapy water in the kitchen sink while the wife is watching HGTV. Blow the clean halves dry, then lube the bores with brake lube (red rubber grease).

Put a little lube on the piston seals before installing. You may have a little or a lot of trouble getting the pistons into the bore. Better have an extra rebuild kit on hand, since you will probably screw the first one up. Take care pressing the pistons into the bore, as the piston seal can be damaged if the piston does not go in perfectly straight. An "arbor press" gives just the right feel for this operation. Don't have one, do you? However, you should be able to set the caliper half on the workbench and press the piston in with a small block of wood, using just your body weight. For those of you under 98 lbs., squeeze it together with a C-clamp and hope for the best. When in doubt, pop the piston back out and check for a damaged seal. Practice makes perfect!

Gold Rustoleum - marvy!


Finished product.



Ready to re-assemble.


Sprite baby brakes.


Pressing engagement.

Bolt the halves back together. Then unbolt them and place the little seal that you forgot between the halves like you should have done in the first place. Bolt them back together again and torque all bolts to 2½ grunts [*Is that Whitworth or BSF grunts? –Ed.*]. You might as well paint it before reassembling on the car. I was out of Hot Pink Caliper Paint, so I used Gold Rustoleum Hammered Paint, which is impervious to brake fluid and looks marvy.

Whew! That was quite a job. Crap! You still have the other side to do. Better stop and drink a beer, and in order to drink all the beer before it gets warm, the rest of this job will have to wait until next month! HM

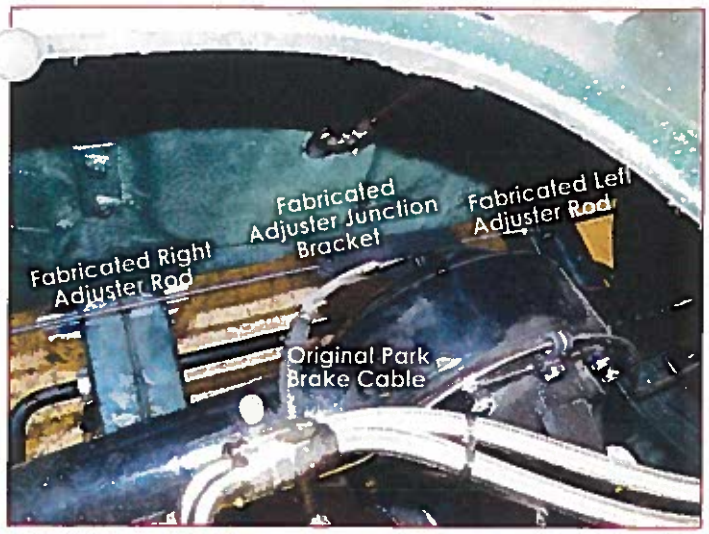


PHOTO 3: This is a top view of the newly fabricated Adjuster Cross Rods and Adjuster Rod Junction Bracket. Note how the Original Flexible Cable joins the cross rods near the Rear Axle Case.

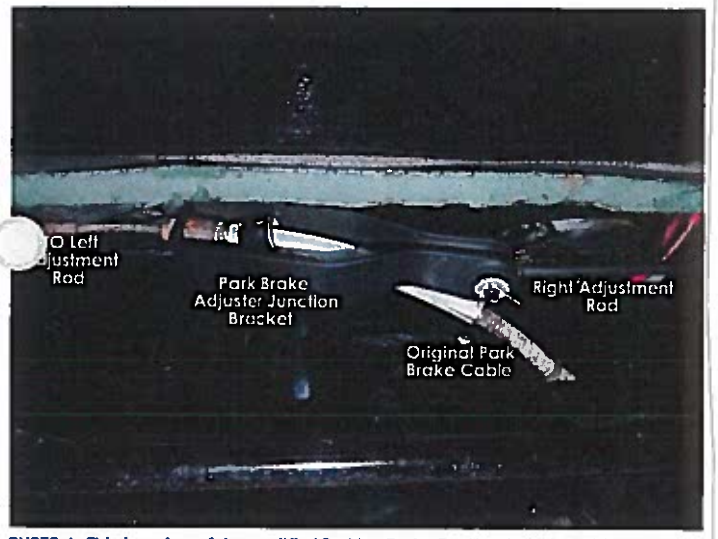


PHOTO 4: This is a view of the modified Parking Brake Set-Up when viewed from underneath the car.

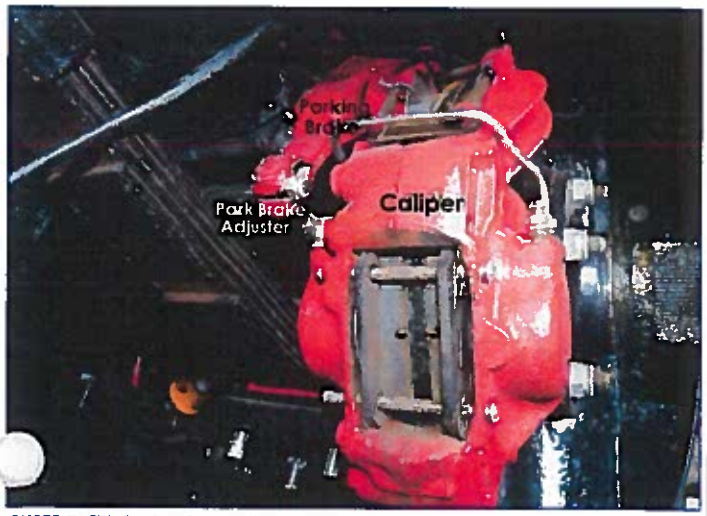


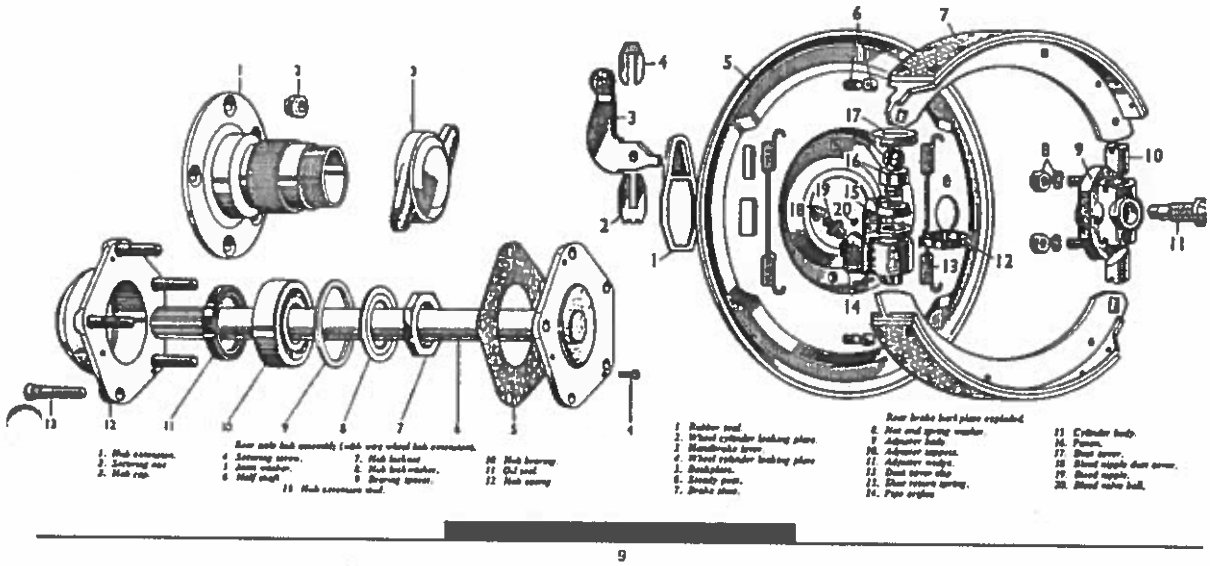
PHOTO 5: This is shot from under the car looking up. Note the right rear leaf spring, the Nylock Adjusting Nut (for Parking Brake Application/Adjustments) and the physical relationships of the Parking and Primary Brake Calipers.

How to Make It Stop

By Steve Jekogian

How to make it stop

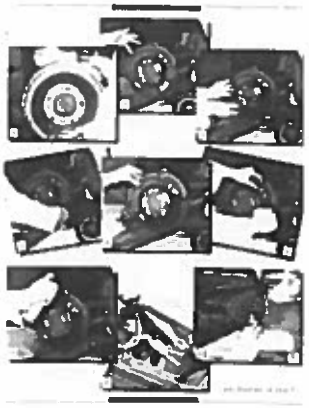
Every year more and more Healey's being restored, painted, new motors, new chrome, etc., but how about the stopping power. That's right, are the brakes working correctly. Specifically are the REAR brakes working at all? When was the last time you looked at your rear brakes? Often overlooked, correctly functioning rear brakes improve the cars drivability and are an important safety issue. Usually brake fluid from the wheel cylinder or oil from the rear oil seal, leaks causing one rear wheel to LOCK up when the brakes are lightly applied and then you have no choice but to replace the shoes as well as fix the leak.



Axle and Brake diagram

A rear brake job, shoes, wheel cylinders and cutting the drums is an easy job and not that expensive to do yourself. You don't have to be master mechanic to do this job and simple tools are all you need. This Photo Tech session brake job will guide you step by step and provides added information to the service manual instructions.

Photo #1



Photos 1 – 9 click to enlarge

1. Remove wheel and Spline 2. Loosen brake adjusting screw-on back plate, turn counterclockwise about 5 turns. 3. Remove the two Phillips screws holding the brake drum on. 4. Lightly bang the brake drum with your knock-off hammer and pull off. DO NOT BREATHE THE DUST.

Photo 2, 3, 4 and 5

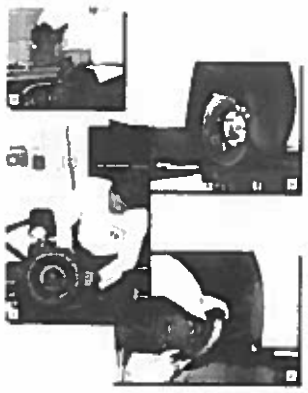
Examine the shoes; look for signs of brake fluid leaks from the wheel cylinder and oil from the rear. Lift one shoe out of the slot in the adjuster link and wheel cylinder piston. Remove the other shoe.
IMPORTANT: Keep the front shoe and rear shoe separate as well as the springs. This will help you put the new ones on correctly. Also, if shoes have oil or grease on them, you will HAVE to replace them.

Photo 6 and 7

Remove the adjuster's tappets (see diagram) and remove brake adjuster from back plate. Now remove the adjusting wedge (it comes out through the hole in the FRONT of the adjuster). Wire brush and clean all these parts and clean the bore of the adjuster (fine sandpaper). Clean the back plate with gas or better yet "Brake clean". Don't forget the back you will be working there also.

Photo 8 and 9

The best trick of the day; put a vise grip on the rubber hose between the rear axle and body, this will keep the fluid from dripping out when you remove the wheel cylinder. If the brake cylinder is leaking decide whether you are going to rebuild or replace it. If you are going to replace it good luck removing the pipe from the back of the wheel cylinder. Many times it bends and the pipe breaks. If it does, no problem. You can go to the local parts store and buy a new metric pipe the right length and gently bend it to desired shape. To get the wheel cylinder out, you must take 2 small screwdrivers and from behind the back plate lift up the leading edge of one of the locking plates around the wheel cylinder, you will see 2 tabs, slide the tabs over the other locking plate.



Photos 10-13 click to enlarge

Photo 10

Put white brake grease on the wheel cylinder lock plates, handbrake lever, adjuster wedge threads, and adjuster tappets. Put wheel cylinder on back plate and slide locking tabs together. NOTE: The wheel cylinder is supposed to move around slightly on the backing plate. Put brake adjuster back together and put on backing plate.

Photo 11

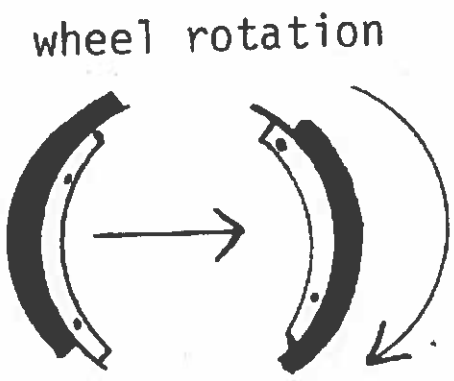
If your hub was leaking a small amount of oil around the edge, the paper joint washer between the half shaft and hub casing could be bad. Remove the Phillips screw and pull the half shaft out put it in new seal. I used "Spraytack" also, it is a spray gasket cement sold in auto parts stores. Replace the half shaft and tighten the Phillips screw.

Photo 12

Have the brake drums cut by an auto parts machine shop. It is worth the $15-$25. It stops the pulsing when you press down on the brake pedal. Or consider sending them to Hendrix wire wheel (see ad in the Flash) for balancing which I hear eliminates vibration.

Photo 13

CLEAN YOUR HANDS. NOW you can touch the brake shoes. NOTE: The brake shoes have to go on a certain way. The forward or leading edge of the shoe, closest to the brake cylinder (see photo 5) has NO brake pads. This is the same for both sides.



Shoe direction

Mount the top shoe, hook up the springs, now attach the springs to the bottom shoe and using a screwdriver pry the shoes apart and fit them into the slots in the brake adjuster and wheel cylinder. It sounds easier than it is, so just keep trying.

Step 14

1. Put the drum back on; 2) tighten the 2 Phillips screw 3) put the hub on; 4) tighten the lug nuts; 5) adjust the brakes and 6) slacken two clicks, make sure the drum rotates freely. Bleed the brakes and you're done.

Step 15

There is one more check you should do to ensure the brake shoes are correctly aligned and the brake drum and half shaft are seated. Spin the wheel with the handbrake pulled up slightly so the brake shoes drag slightly on the brake drum. 1) Loosen the brake adjuster a little more and 2) take off the lug nuts, hub, Phillips screws and brake drum. 3) Look at the rub marks on the brake shoe lining and inside the brake drum. 4) Are the rub marks even across the lining or just on the inside edge or outside edge? 5) If the marks are on the outside or inside edge of the lining (not front or back but inside near the backing plate or outside nearest you) the steady post (little threaded thing the brake shoes rests on) can be adjusted in and out from behind the backing plate. I have heard from some mechanics that this is misaligned on many Healeys and the brakes are not as effective because of it.

Bob Pense also has a good suggestion, especially if you did any work on the half shaft, the sequence we went through of tightening the lug nuts in Step 14 helps seat the half shaft, and now try to tighten the Phillips screw on the half shaft again, you may find you can move it a little more. Put it all back together and away you go

Bleedless Brake Light Switch Replacement

by Steve Feld

The brake light switch on my 1959 BT7 recently failed. This switch is located in the 5-way brake pipe connector just above the right front frame and below the generator (alternator in my case). To replace this switch, I learned how to do so bleedlessly, although not necessarily bloodlessly given the cramped location.

First, turn the master electric switch in the boot to the "Off" position. Open the brake fluid reservoir and cover tightly with a Saran type plastic wrap and secure with rubber band(s) to seal the brake system.

Place a rag or other suitable material under the 5-way connector to prevent brake fluid from dripping on any painted surfaces. Then remove the two wires connected to the brake light switch and unscrew the switch itself. Fill the hole in the new switch with fresh brake fluid – an eye dropper or other similar device is useful to get the fluid into the small opening. Very little fluid is needed to fill the hole.

Next, get a helper (human is best but a board of suitable length will do and save you a beer) who can apply very light pressure on the brake pedal while you screw the new switch into the connector. The pressure on the brake pedal should be only enough to bring the fluid level up to the brim of the opening in the 5-way connector. You will want to keep the hole in the switch upright as long as possible so the fluid has little opportunity to leak out. (BTW-Do not use anti-seize compound or Teflon tape on the switch threads.) Keeping the pressure on the brake pedal until the switch is about halfway into the threaded connector opening should be sufficient to insure no air seepage. Finish tightening with a spanner. Lastly, remove the plastic covering on the reservoir and reconnect the two wires to the switch (it doesn't matter which wire goes to which screw.)

This method prevents air from seeping into the brake system and also insures that the switch is activated by brake fluid and not by air. I have done this twice and neither time did the brake system need to be bled. (Thanks to Bob Pense and Larry Gerstner for this method.)

This entry was posted in Brakes on June 10, 2014 [http://www.austin-healey-stc.org/tech-articles/brakes] by rick.

A Fairly Simple Bolt-On Rear Disc Brake Conversion

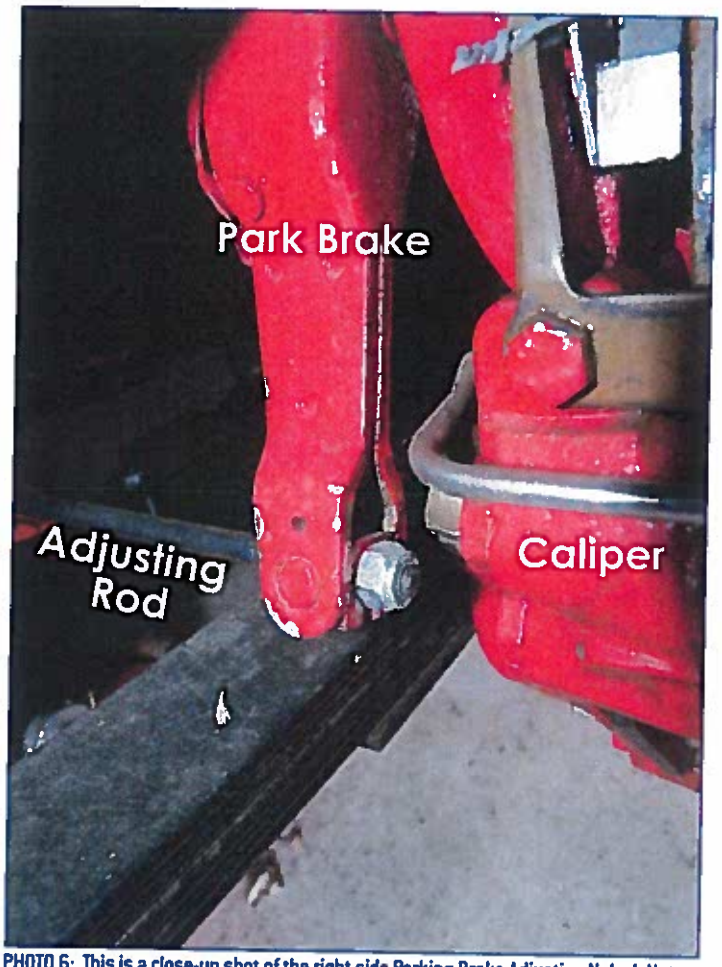


PHOTO 6: This is a close-up shot of the right side Parking Brake Adjusting Nylock Nut, which is threaded to the "open" end of the Adjusting Cross Rod. The left side would be installed similarly.

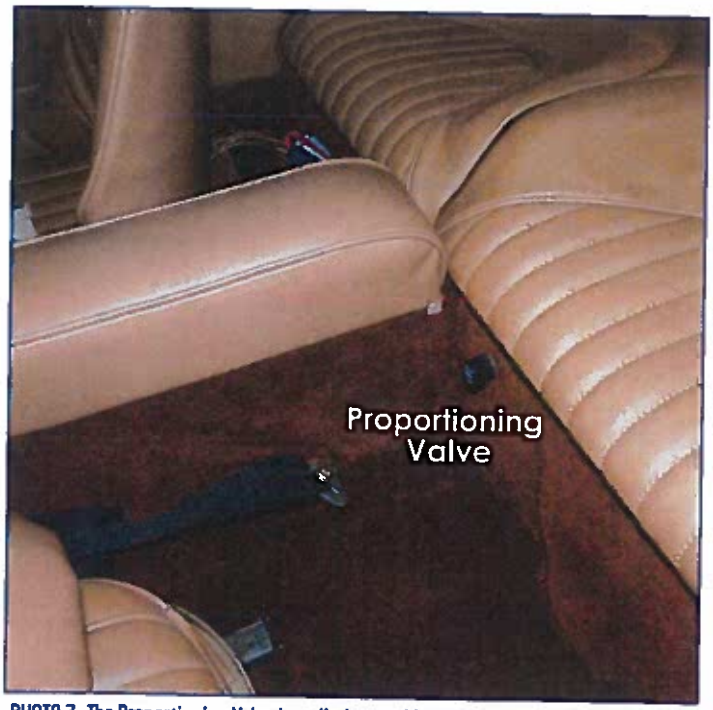


PHOTO 7: The Proportioning Valve installation on this car is at the rear seat bulkhead, which places it within easy reach of the driver.

along the upper portion of the rear axle case. When the park brake lever was applied, the cable would cause t cross rods to retract and pull the rear brake shoe against the drum.

The disc brake conversion requires that the parking brake mechanism be modified to allow for the independent parking brake caliper to operate. The original flexible cable is utilized, but new cross rods must be fabricated. These cross rods link to the cable by means of a fabricated junction bracket (see Photos 3 and 4) and the cross rod ends are threaded. These "open" threaded ends are placed through the park brake caliper and secured with a Nylock nut (see Photos 5 and 6). The action of applying the Parking Brake Lever pulls the cross rods and locks the parking brake caliper in place. When the lever is released, the cross rods push the parking brake caliper to disengage the pads from the rotor.

Proportioning Valve and Brake Line Installation: The final step is the installation of a Brake Proportioning Valve and the re-running of the Brake Lines (Pipes). As the new rear disc brakes have superior stopping power to the Original Equipment Drum Brakes, compensation must be made so the braking power of all four wheels is balanced.

In order to balance, or "proportion", the proper braking strength front-to-rear, we add a Proportioning Valve (see Photo 7). When spliced into the brake lines, the valve will enable the driver to adjust the front-rear braking force so that the car will stop evenly without dragging at the re These valves are available at any Automobile Parts Sho especially those selling competition parts (we used to refer to them as "Speed Shops"). Due to the addition of the rear disc brake calipers and the proportioning valve, the lines must be fabricated, routed and bled for proper operation.

Once the brakes are "tuned" for the appropriate braking pressures under normal driving conditions, the proportioning valve will rarely need to be adjusted again. The end result of the Rear Disc Brake Conversion will be a safer Healey and added protection for your Classic Gem!

by Tom Mason
Minnesota AHC

I have these odd storage drawers in my mind that I can pull open and I find myself writing a tech article and putting it in one of these drawers. From time to time I pull it out and work on it, sometimes when I am driving or just when I have an odd moment. I open the drawer and work on the idea or story. I have had two going in my head for quite a while and this is the first time that I had a moment to finally empty the drawer onto paper.

Brake Repair

I did a brake repair on a 3000 for a gentleman. When he came to pick up the car we were talking and he said, "My son wanted to fix those brakes and I almost let him do it."

I smiled and thought about his remark. I wondered to myself if he knew enough to do the job. Eventually you realize that if one part of the brake system fails or quits or leaks that it is probably time to renew all the parts and seals. The first time my front disc brake began to drag, I took it apart and cleaned it. The second time I took it apart and put in a new seal kit. The third time I took it apart, cleaned the bore and put in a new seal and a new caliper piston. The third time was the charm. If you have a sticking front brake you have to do all three or it will not work. All these things ran through my mind. It takes several times to do a brake servo. It is very sensitive and there are lots of places to go wrong. When someone pays for a repair, they are getting the benefit of my experience and mistakes. I did a servo for a fellow. He had done it twice and I sort of wished that he kept at it. I admired that he had tried. The problem was that he had not centered the drum seal, and it was binding just a little and would not work. (I had to do mine three times to get it right the first time I tried.)

Replacing Flexible Brake Hoses

To ensure that the vehicle braking system remains in good working order and provides the essential safety and reliability, flexible brake hoses should be examined at regular intervals for chafing, cuts, general deterioration and leakage. (Refer to the routine maintenance chart in appropriate vehicle manufacturer's workshop manual). Where there is any doubt concerning the condition of the hose(s) it should be renewed. It is recommended that all flexible hoses are renewed every 36,000 miles, 60,000 kilometres or three years, whichever occurs first. During brake hose replacement other unsuspected faults may be discovered, therefore it is advisable to carry out this job on a day when the local motor factor is open.

IMPORTANT POINTS:

1. **If experiencing any problems in fitment refer to the appropriate vehicle manufacturer's workshop manual.**
2. **Always replace hoses in the same way as they were originally installed. Never clean hoses with petrol, use only water to remove heavy caked-on road dirt.**
3. **When applying underseal, take great care to protect the brake hoses by "masking them off". Careless use of paint, mineral oil or petroleum based sprays and grease causes unseen damage to the hose outer surface.**
4. **Whilst renewing brake parts the need for absolute cleanliness is essential, therefore ensure that hands are free of grease and dirt. Always use fluff-free cloth or paper towelling for cleaning purposes.**
5. **Take great care to prevent both dirt entry and contamination especially in the mouth area of the master cylinder reservoir during filling or "topping up" of the hydraulic system.**
6. **If possible brake fluid should always be stored and dispensed from the original tin or bottle. Remember to have sufficient Delphi Lockheed brake fluid available for "topping up" purposes. Never re-use brake fluid bled from the hydraulic system.**

Hose removal and fitting

To alleviate the risk of contaminating the hydraulic circuit, thoroughly clean all pipe connections and surrounding bodywork prior to removal. **Do not use petrol or paraffin.** With a suitable tube nut spanner, grip the hexagon of the flexible brake hose and using a second spanner slacken off the brake pipe tube nut, trapping any escaping brake fluid in a drip tray. Still retaining the flexible hose remove the plain nut and lock washer and withdraw hose from the support bracket. Seal the brake pipe(s) ends to prevent fluid loss and ingress of foreign matter **(see fig.1)**. Where a locating plate is fitted to the support bracket it will be unnecessary to retain the flexible hose with a spanner. The method described is a conventional way of retaining the flexible hose to the metal brake pipe at a fixed point on the vehicle. On certain applications this may be different, therefore refer to the appropriate vehicle manufacturer's workshop manual. To remove the flexible hose and copper sealing washer (if fitted) from the brake caliper, apply a spanner to the hexagon and permit the entire length to rotate. Seal the exposed caliper fluid port after removal. Refitting is a reversal of the removal sequence, but particular attention must be given to the following:

When fitting replacement hoses, ensure that they are not twisted or kinked and are clear of any part of the vehicle liable to cause chafing. It is easy to see the pattern moulded into the hose rubber, it must be running perfectly straight, any twisting during fitting could put a permanent torsional load at the end connections which can result in premature hose failure. If protection collars are fitted ensure they are located in the same positions as the original hose **(see fig.2)**. Tighten hose fittings sufficient to prevent leakage, do not overtighten. Refer to the recommended tightening torques. Thoroughly bleed the hydraulic system as described in the vehicle manufacturer's workshop manual. Always keep a careful check on the fluid level during bleeding, it is most important that a high level is maintained throughout. Should air enter the system via the master cylinder reservoir the complete operation must be repeated. When completed re-check the fluid level in the reservoir, "top up" if necessary and refit the filler cap. Remember brake fluid is injurious to paintwork, care must be taken to prevent any spillage while filling or "topping up" the master cylinder reservoir. Should any contact the bodywork, wash the area immediately with plenty of water. Check the 'feel' of the brake pedal which should be firm and free from any 'sponginess' that would indicate air still present in the system. Discard any expelled brake fluid. Finally with the aid of an assistant examine the connections, metal pipes and flexible hoses for leaks before road testing the vehicle.

Recommended tightening torques

Cases have been reported where damage has been caused to certain hydraulic assemblies by overtightening brake hose connections. Great care must also be taken not to overtighten other associated components such as tube nuts, banjo bolts, bleed screws, etc. Therefore for guidance, maximum recommended torque figures are listed below for both Unified (UNF) and Metric threads.

Unified Threads		lbf.ins	Nm	Metric Threads		lbf.ins	Nm
1/4"	Bleed Screws	50	5.6	7mm	Bleed Screws	55	6.2
3/8"	Bleed Screws	100	11.3	10mm	Bleed Screws	90	10.1
3/8"	Int & Ext Tube Nuts	115	13.0	10mm	Int Tube Nuts	97	11.0
3/8"	Hose Fittings	120	13.5	10mm	Hose Fittings	142	16.0
3/8"	Banjo Bolts	170	19.2	10mm	Banjo Bolts	250	28.0
7/16"	Bleed Screws	170	19.2	12mm	Bleed Screws	160	18.0
7/16"	Int Tube Nuts	140	15.8	12mm	Int & Ext Tube Nuts	210	24.0
7/16"	Hose Fittings	170	19.2	12mm	Hose Fittings	160	18.0
				12mm	Banjo Bolts	350	40.0

Metric and Unified threads

Certain METRIC threads are similar in size to Unified (UNF) threads, therefore it is important that they are correctly identified. If any doubt exists do not use a spanner but first screw the component fully home by hand, if the fitting is tight or unduly "sloppy" check the thread type. Such parts as tube nuts, bleed screws and hose end fittings etc., with METRIC threads are coloured pale gold, similar parts with Unified (UNF) threads are coloured silver. It is important to note that hoses with Unified (UNF) threads use a copper sealing washer **(see fig.3)**. When replacing the hose it is recommended that a new copper sealing washer is fitted. METRIC hoses identified by an 'M' marking seal on the tapered end, therefore there will be a visible gap between the hexagon and the face of the hydraulic unit.

Fig.1 Conventional hose connection

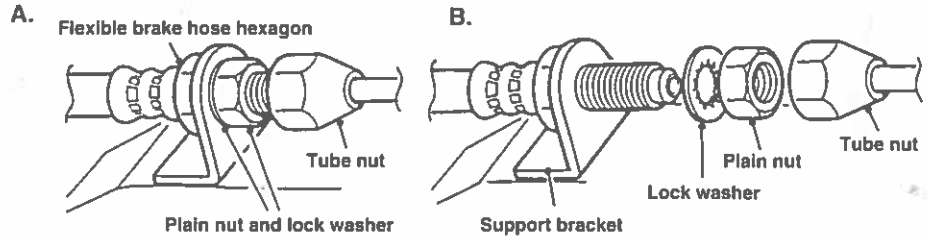


Fig.2

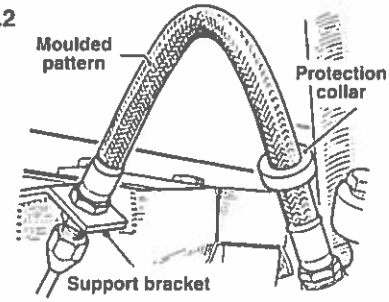
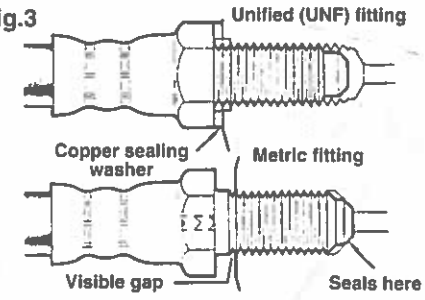


Fig.3



This product should only be used, installed and maintained in accordance with the instructions approved by the vehicle Manufacturer or **Delphi Lockheed**

Brake Drum Balancing

By Allen Hendrix
Hendrix Wire Wheel

Did you know that many brake drums are not balanced? We have not found one yet that did not need balancing. They are ranging from as little as ½ oz. to 6½ oz. out. The way you check this is as follows:

Take off your brake drums and turn them over. You will notice that the center has been machined off center. You can tell by looking at the wall thickness in the center. One will be thinner than the other; this will throw your drums out of balance. If you have tried everything else and still have the dreaded 55-60 mph "scuttle" shake, this is likely the problem. Your Healey will be more fun to drive once you have your brake drums properly balanced.

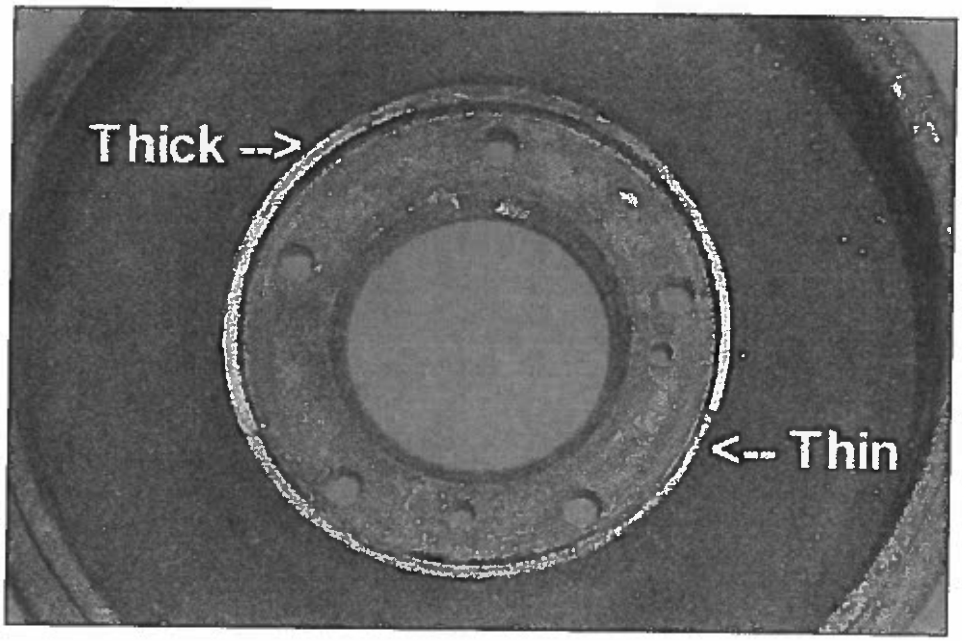
Tupperware Tip

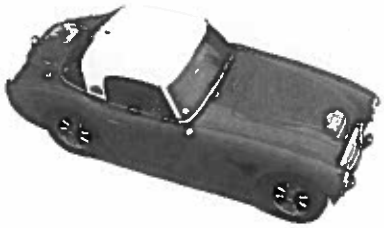
Reprinted from Healey Hi-Lites, *publication of the Bluegrass AHC.*

Tupperware makes a pie holder that fits perfectly under the spare tire and can hold untold amounts of tools, parts, etc. If you paint the top black, they are invisible to the eye. I wish I could take credit, but it was seen at the Healey Conclave in Indianapolis.

Tupperware has an office in Jeffersontown, KY. They make a 12" pie taker, 12" in diameter and 2¾" high. The list price on these is $13.50. If you can get an order for 10 or more, the price will be better.

Contact Jim French at LucasEled aol.com or 502-425-5717 if you would like to order one.

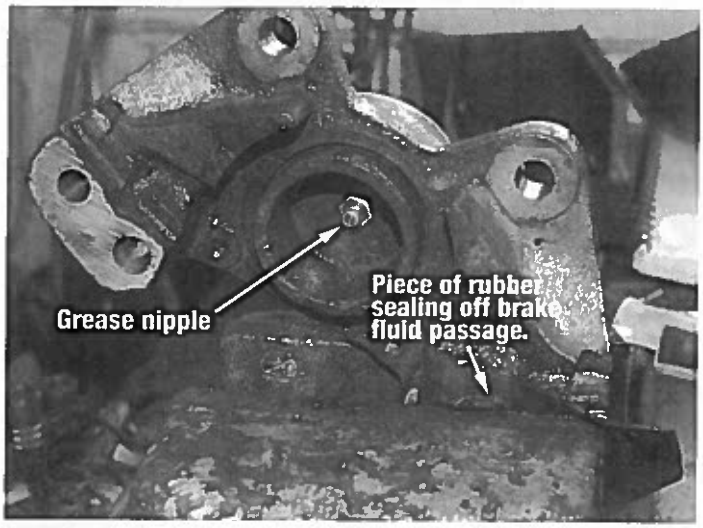




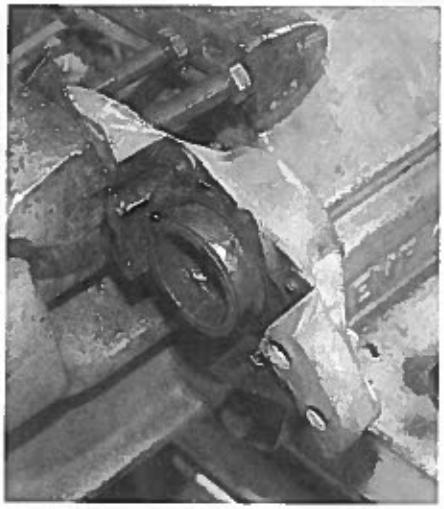
STUCK BRAKE CALIPERS

Magnus Karlsson
Boras, Sweden
492karlsson@telia.com

Stuck pistons in the brake calipers can sometimes become really stuck. The normal method to "unstuck" them is to blow compressed air into either one of the holes for the bleed nipple or into the brake pipe nipple. To do this, first make sure that the other hole (the bleed nipple or the brake pipe nipple, whichever one you're not using to blow in the compressed air) is blocked. Then insert a piece of wood between the pistons in order to dampen the impact when the piston releases.



A piston that wouldn't let go, even though grease was inserted through the bleed nipple hole.



Caliper bolts are used so that the caliper half can be clamped in a vise.

than the compressed air method will. However, if the pistons really are stuck, chances are that you will not be able to keep the pointed end firmly enough against the hole and thus the grease will leak out.

Now is the time to become "radical." First yo split the calipers. This is something that many people are afraid to do since it is stated in Girling manuals that this is strictly forbidden. However, Girling gives no reason as to why this practice should be avoided. I cannot take any responsibility for what can happen if someone reads this article and decides to split his calipers, but I can say that I have done it with many calipers and never had a problem. Myself, I prefer this practice to

Tapping a hole in the piston in order to fit a grease nipple

If the compressed air method is not successful, try the grease gun method. It works along the same principles, but you fit a pointed end to your grease gun and hold that pointed end very tight to one of the brake fluid holes in the caliper. This method will exert a much higher pressure on the pistons

A restored caliper half with fitted with new seals and a stainless steel piston. Note the small, correct rectangular-section O-ring (flat, like metal washer) at top left

trapping calipers with stuck pistons. It also gives one the opportunity to change the seal between the caliper halves, the condition of which can leave a lot to be desired after 40+ years. It is important to use a rectangular-section O-ring (flat, like metal washer) for this as it has been manufactured to function in a brake fluid environment. An ordinary O-ring (with a round section) may not be compatible with brake fluid, since most of them are manufactured to function only with oil and gas.

After your calipers are split, you next drill a hole through the piston with a suitable diameter drill, so that the hole can be tapped to fit a grease nipple (see photo). Then you block off the brake fluid passage by clamping the caliper half in a vice with a piece of rubber mat covering the passage. One of the caliper halves is easy to clamp in the vice. In order to clamp the other half you must use two of the caliper bolts as seen in the photo.

Then attach your grease gun to the nipple and start pumping it. You will find that the stuck piston comes out very easily and in a very controlled way. I have yet to experience a piston that will not release when subjected to this treatment.

After completing this operation you will of course have to replace the pistons, the seals and the dust seals. I recommend that you fit stainless pistons as they are available for both types of calipers used on Healeys.

Them's the Brakes

How to Upgrade Healey Brakes for Track or Street

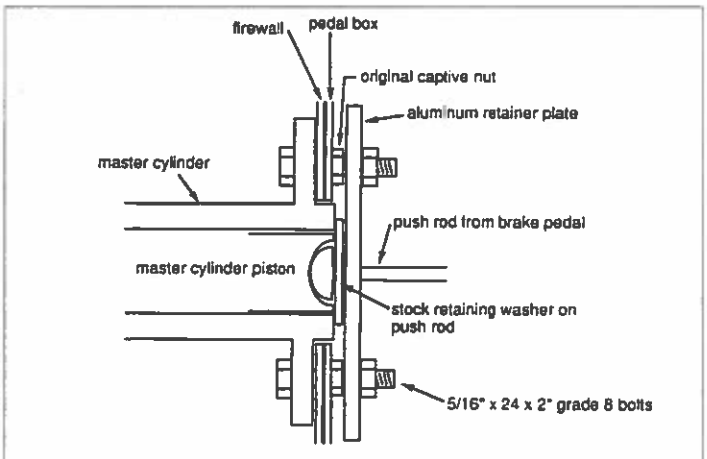
by Fred Crowley
North Texas AHC

So you've got your Healey running, you've entered it in umpteen All-British Car Shows, your Healey spouse and yourself are almost back on speaking terms after participating in a bunch of rallies, you've driven the Healey to hundreds of club meetings and tours, you've attended about every Healey social event you can remember—so now what?

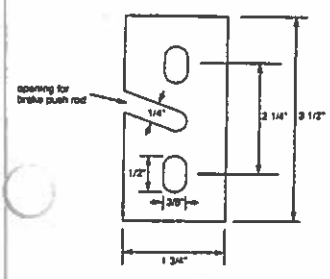
First—don't ask your spouse! Women are trained from birth to look for the slightest wavering of men's resolve, and to then pounce on it, and with superb cunning and skill, they will have you convinced that "yeah, maybe we should consider getting rid of the Healey and using the family 'Heapmobile'." Guys, listen up. Never, ever, show the slightest wavering in your interest in the Healey. The consequences are mind numbing. To help generate some ideas that may help you in those rare moments of weakness, the world of "performance ...ng" is a fantastic euphemism for let's "...e" the Healey for what it is really well suited for—driving it seriously. Most every regional Healey event has a gymkhana, and unless you haven't been paying close attention these past few years, vintage racing is growing at a terrific rate.

The Healey is a tremendously strong car for vintage racing. As with most things in life, there are a myriad of ways of approaching the technical elements of preparing a Healey, whether for a gymkhana or for all-out vintage racing. While vast quantities of books have been written on auto racing and competition preparation (both technical and emotional), the key element to consider can be summarized very simply: "What is your objective, and why are you doing this?" It's really very easy to spend megabucks and build a fire-breathing dragon out of a Healey. It's a lot harder to spend modest bucks, convince your spouse that she doesn't need to see a lawyer, and develop your Healey into a strong, safe machine that meets your emotional needs.

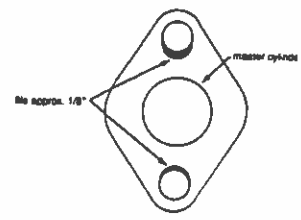
While Bugeye and square body Sprites have always been actively campaigned (and still are) in H-Production SCCA, the big Healeys are not seen so often, yet they provide one heck of a good platform with which to go vintage racing. Previous articles in *CHATTER* have provided some general information with respect to getting involved with the vintage racing scene. *Victory Lane* magazine is a must for anyone interested in vintage racing (they also have a great booklet on "Getting Started in Vintage Racing"), and it is highly recommended that you acquire a copy of the Terry Jackson book *Vintage Racing British Sports Cars*. These reference sources will at least whet your appetite and will help provide some insight into what's involved. A major concern expressed by Healey folks wanting to get started in competition is, however, what specifically needs to be done, or should be done, to make the Healey safe, reliable, and fun to drive in competition. Most information currently available



CROSS-SECTION OF MASTER CYLINDER MOUNTING



ALUMINUM RETAINER PLATE FOR BRAKE PUSH ROD



MASTER CYLINDER FLANGE

Many Healey people's preparation for gymkhanas consists of removing the spare tire and other loose bits and pieces, whacking the knock-offs a couple of times, tightening up the seat belt an extra notch, borrowing a "crash" helmet (love that term!), practicing a "devil-may-care" dramatic facial expression (to mask the internal feeling of "why did I let myself get talked into this!"), and maybe for the more serious competitors, pumping up the tires a few extra pounds.

It doesn't take too long, however, for those nagging questions to start arising. A key point for myself was that regardless of what I did to make the Healey go, I wanted to make sure it would stop. Doesn't take much before a Healey driver can become paranoid real quick about driving the old beast, let alone start flogging it around in a vigorous fashion. As a result, you may want to consider the following which is applicable both to gymkhanas, street use, or vintage racing.

Separate Front and Rear Hydraulic Brake System

The car that the following relates to is a '62 BT7 tri-carb. The modifications should be the same for all 100-6 through 3000 Healeys (haven't had a chance to check the applicability of Healeys using brake servos).

The stock master cylinder is a single cylinder with a 5/8" diameter bore. This means that a single reservoir feeds the master cylinder, and the piston inside the master cylinder simultaneously compresses the fluid in both the front and rear brake lines. Most vintage racing groups require a system such as this to be modified to provide a separate front and rear hydraulic system.

A common method, although expensive, is to install two separate master cylinders (one for the front and one for the rear). This requires a different brake pedal box which is obtainable from Dennis Welch in the UK and from Pegasus Auto Racing Supplies in the US, and requires some modification to the firewall to mount the master cylinders.

A much cheaper approach is to use a dual piston master cylinder. Several different ones will work, but I've had a lot of success with using one from a late-model Fiat Spyder (the early model master cylinder is identical, except that the fittings for the reservoirs are smaller in diameter). The bore diameter is slightly larger (3/4" versus the stock 5/8"). This means that a slightly higher brake pedal pressure is required for the equivalent braking action of the stock master cylinder. The big advantage (besides having separate hydraulics for the front and rear brakes) is that the higher brake pedal pressure translates into a much more secure

feeling when braking. Pushing hard on the brake pedal gives a real solid feel—something that is lacking with the stock master cylinder.

Technical bits:

Master Cylinder: Fiat Spyder: Fiat part # 793298 (approx. $60). Bore diameter: 3/4" (Note: Evidently a Nissan master cylinder will work, but details as to the make and model of car it's from, as well as bore size, is unknown.)

The original reservoir can still be retained and can be used to feed the clutch master cylinder and the rear brake hydraulics. Another master cylinder reservoir is required to feed the front brake hydraulics. Some options are to use another stock reservoir and plug one of the holes in the bottom that would otherwise be used for the clutch. Another approach is to replace both reservoirs. Reservoirs are available from Pegasus Auto Racing Supplies.

Brake lines: 1/4" for reservoirs to master cylinder; 3/16" for master cylinder to brakes

Proportioning valve (optional): Obtainable from Pegasus. Approximately $85.

To mount:

1. The bolt holes on the mounting flange of the Fiat master cylinder need to be filed slightly (the spacing of the bolt holes on the flange are approximately 1/4" greater than the mounting holes on the 3000).

2. The stock pushrod from the brake pedal to the master cylinder can be used, but a retainer plate is required to hold the push rod end against the cupped piston head in the master cylinder. The stock master cylinder utilizes a circlip to hold the pushrod head in place. I made a simple plate from some scrap 1/8" aluminum plate that bolts right on, to do the same job. (Note: See diagram. The stock pushrod length is correct, but make sure that the rod doesn't bind where it passes through this plate.)

3. To bolt the master cylinder in place, I replaced the stock mounting bolts with grade 8 bolts 5/16" x 24 x 2". These replacement bolts use the stock captive nuts, but of course protrude into the pedal box under the driver's side dash. The aluminum retaining plate from step 2 is then bolted to these protruding bolts.

Connecting up the brake lines:

Since I didn't want to mess up my stock lines, I purchased an inexpensive tube bender, a flaring tool, and some straight steel brake line tubing (1/4" from the reservoir to the master cylinder, and 3/16" from the master cylinder to the brakes). To find the right size fittings, I took the master cylinder and reservoirs over to my friendly auto parts store and went through their trays of fittings until I found all the right sizes.

Reservoir to master cylinder:

Steel brake lines can be run from the reservoirs to approximately 6" from the master cylinder. Since the fluid lines from the reservoirs to the master cylinder are gravity feed (which means the lines aren't under pressure), and the corresponding fittings on the master cylinder are plastic, I used rubber tubing suitable for oil to mate the end of the steel lines to the plastic fittings (don't forget to use clamps at either end of the hose).

Master cylinder to brakes:

Front: Again, since I didn't want to mess up my stock lines, I removed the stock lines and used 3/16" steel lines to make some new ones. Since the original lines are installed prior to engine installation, I found the easiest way to make new lines was in sections, and then use unions to join the sections of line. For the front brakes I ran a line from the rear piston of the master cylinder to the existing brake line manifold on the right front fender. I then disconnected and removed the line running to the rear br[illegible] from this manifold, and plugged the re[illegible]ant opening in the manifold with a suitable fitting (reference above trip to the parts store). This approach meant that the stock brake lines could be used for the front brakes.

Rear: Although not really necessary, I elected to use a brake proportioning valve to adjust rear braking force. This wasn't really necessary since I was using the stock drum brakes on the rear, but gives me some flexibility in adjusting braking action for gymkhanas as well as the track. The front piston of the Fiat master cylinder is used for the rear brakes. Without the proportioning valve, the rear brake line can be routed parallel to the front line (under the front of the engine by the front cross-member) over to the passenger side of the car, and then run up inside the right frame rail (as was the stock line), down to the rear mounting bracket to mate up with the rear flex hose. Since I wanted to use the proportioning valve, I ran the rear line parallel to the clutch line within the engine compartment (that is, it followed the stock line directly back to the firewall, across the rear of the engine compartment under the rear hood lip). I ran the line down through an existing grommet in the passenger foot box t[illegible] proportioning valve mounted on the r[illegible]t hand parcel tray in the passenger compartment. I can still reach the valve while belted in the car, and yet it's out of the way for a passenger when using the car on the street. This mounting meant that no additional holes had to be drilled, other than two small holes in the bottom of the parcel tray for the valve mounting. From the valve, I ran the line back out through the same grommet and routed the line down along the right hand frame rail as per the stock layout.

I've used this set-up for approximately six months (four races) and have dropped approximately three seconds off my lap times (1:33 down to 1:30), using stock brake linings. The primary difference has been in the security of having a real solid brake pedal under-foot.

Additionally, it is real straightforward to return to the stock setup.

For further reference, contact:

Pegasus Auto Racing Supplies (catalog)
2475 South 179th St.
New Berlin, WI 53146
414-782-0880

Victory Lane Magazine
2460 Park Blvd. #4
Palo Alto, CA 94306
415-321-1411

Next time: "Suspension Stuff"

On Rebuilding Brake Calipers (Discs)

by Tom Mason

Minnesota AHC

Rear wheel cylinders are so inexpensive that they should be replaced and not repaired, although brass sleeving may be a good repair with longevity in mind. Disc brake calipers need to be repaired; exchange units are expensive and repairing them is a good thing to do.

The caliper itself should be clean and lightly sanded with a 400 or higher grit to remove pits and rust. However, the true sealing surface is the O-ring and the piston itself. With the O-ring removed, the piston should fall easily to the bottom of the caliper. It is a good idea to replace the piston assembly if any rust or pitting shows. If the caliper has been sticking or dragging, it is imperative to replace the pistons!

Occasionally the piston may be hard to remove. Try air pressure first, although this generates only 125 psi. I learned a trick from Brad at Quality Coaches. Put a grease fitting in the supply line and then pump grease into the caliper to push out the pistons. This puts 3000 psi into the calipers and is guaranteed to push them out—a good trick to know about. *(See related article on "Caliper Pistons" below.)*

A good brake job, then, is rear cylinders, new hoses, and rebuilding the calipers. Why not put in a master cylinder kit? Finally, make sure your emergency brake is working because it's really your fallback, like a dual system. Take care.

Caliper Pistons

by Ray Scott

Bluewater AHC

(Reprinted from Bluewater Banner, *March, 1996)*

Removing the pistons from old brake calipers is always a chore. One way to do it is to hook up a grease gun and pump them out with grease. This works well (I did it with an MG), but the problem is that you are left with grease in the inner passages, which is very difficult to get rid of. You can't use solvents because it will affect the inner seals, so I boiled the calipers in water and blew them out with compressed air. No guarantee that you get it all, and besides grease is so messy to work with.

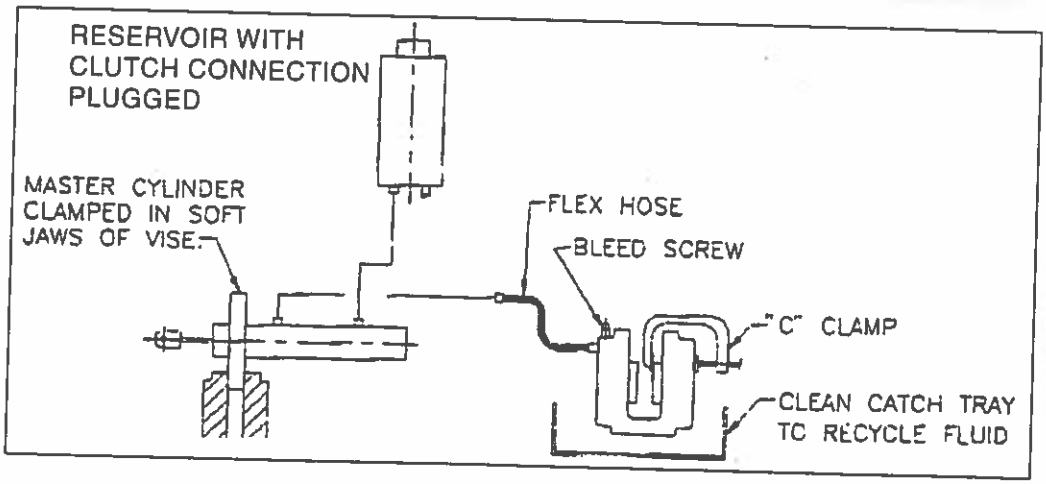
With the Healey I had a flash of [illegible] and decided to use silicone brake [illegible]. I set up a spare master cylinder (it would be better to use one with a built-in reservoir) and piped it up as shown. Open the bleed valve and pump until you get flow; then close it and pump until the pistons start to move. Usually one will start before the other. Keep pumping until it almost pops out and then hold it in position with a "C" clamp, and continue pumping until the second one pops out. You can then remove the clamp and jiggle the first piston out.

I was able to set this up and strip four calipers in less than an hour. Now you are left with internally clean calipers and dirty, probably pitted and rusted, pistons.

New pistons are available both chromed as per original or in stainless steel, although they are quite expensive.

We are very lucky in the Sarnia area in that we have some excellent machine shops who can make first class replacements at a much more reasonable cost.

Replacement, as the book says, is a reversal of dis-assembly.



Silicone Brake Fluid and Brake Hydraulic Systems

By Roger Moment, Rocky Mountain AHC

This is a story about brakes locking on, an event that resulted in a 100-mile trip home for my car on a flat bed truck. Consultation with a half dozen experienced British car experts across the United States and in England and a call to Lucas/Girling provided substantial insight into brake hydraulics design and resulted in my making a slight modification to my master cylinder that may prevent another lockup problem in the future.

First let me say that brakes are probably THE most critical system on a car, and I am extremely reluctant to make any changes over original component designs, at least until I've had an opportunity to study the details and apply basic engineering judgment. However, as I got deeper and deeper into what might be the cause for my brakes locking up, I developed an awareness of some subtleties (and shortcomings) in this particular brake system's hydraulic design. While you may not totally agree with my diagnosis or fix, I do believe that what I learned may be of help to others with similarly-designed hydraulic systems, both in diagnosing problems they might encounter, and possibly even effecting a fix.

The brake system I will be describing is in a 1955 Austin-Healey 100. This same system was used from 1953-1956. On Austin-Healeys, design of the master cylinder was changed with introductions of the 100-6 model in 1957 and later changes to other components of the system came about with introduction of front disk brakes in 1959 and vacuum assist around 1963. The wheel cylinder design found on the 100 is very typical to that found on other drum-brake cars, and the master cylinder of the 100's design was also used with other English cars of 1940s-1950s vintage.

The Problem

About three years ago I was out on a drive with our Healey club when I noticed that my brake pedal was becoming hard and had little to no free travel before the brakes would become applied. Concurrently, I noticed some dragging to the car's wheels. This same situation had occurred some years earlier and at that time I found the "fix" was to put in a new rubber kit into the master cylinder.

This time, as the problem developed, I immediately realized that my brakes were locking on (and the shoes were, of course, dragging, causing the drums to become overheated, etc.) in a repeat of the previous experience. The immediate solution was to stop and release the brakes by loosening a bleed screw to relieve line pressure, and then to drive on slowly, essentially without using the brake pedal, letting the engine and down shifting do any needed slowing, until I could locate some help. As I said, the car ended up being trucked home, as it was much too far to risk driving in this manner.

In both instances where I encountered brakes locking on, I had completely rebuilt the hydraulics about 5-7 years prior, and had used silicone brake fluid when I filled the system.

Subsequent discussions with a number of Healey experts revealed that mine were not the only cases of brakes locking on. But among Healey owners, the problem seems to be limited to the 100. In fact, I had driven my 3000 for some 15 years using silicone brake fluid without any such problem occurring.

Why Silicone Brake Fluid

I have been driving and restoring Austin-Healeys for more than 30 years, and for some time now my interests have turned to concours and extreme accuracy in restorations. For me, Silicone brake fluid has two significant benefits:

1) It doesn't absorb moisture so corrosion in brake cylinders and lines should not be a problem over time.

2) It will not attack paint. Brake fluid vapors will condense to create a light film of fluid around the cap of brake system reservoirs, and bleeding or any hydraulic system servicing almost always results in a little fluid getting on backing plates or the chassis. So there will be many opportunities for fluid to spill onto paint, but with silicone no damage will occur.

However, beyond wanting my cars to look right, I am just as concerned that they perform as well as possible.

So far, with the exception of the problem with my 100's brakes discussed here, I have been totally satisfied with silicone brake fluid and my car's braking performance.

Brake Hydraulics Basics

Hydraulic brake systems are quite simple in design. A piston in the master cylinder pushes brake fluid through metal lines and rubber hoses to the wheel cylinders where it displaces the wheel cylinder pistons that in turn push out against the frame of the brake shoes. In caliper-type brakes, the pistons press the brake pads directly against the rotors.

When your foot is taken off the brake pedal, very stiff springs at each wheel retract the brake shoes, thereby pushing fluid from the wheel cylinders back through the lines and into the master cylinder. (With disk brakes, the "retraction" force comes from very slight wobble of the brake rotor which pushes the pads back just far enough until they stop rubbing.)

If brake fluid cannot flow back through the lines, when the master cylinder piston is retracted (from taking your foot off the brake pedal) a bit of a vacuum is created in the master cylinder chamber and this will draw replacement fluid in from the brake fluid reservoir. And, of course, the brakes will still be on since the fluid that had previously had flowed out to the

wheel cylinders when applying the brakes is still trapped in the lines. In effect the brake system is "filling up" from the reservoir and the brakes are being kept out of the "on" position. The resulting symptom is that now there is next to no movement of the brake shoes the next time the brake pedal is depressed and they start gripping the drums immediately, so the pedal appears totally "hard" and there is no free play.

Analyzing the Problem

So what keeps brake fluid from returning to the master cylinder when pedal pressure is removed? The situation didn't just happen after one application of the brakes, but rather developed over a period of an hour or less during which a number of brake applications occurred. There are a number of possibilities:

1) Internal swelling in the rubber brake hoses thereby constricting their internal passages and restricting or preventing fluid to flow back from the wheel cylinders to the master cylinder.

2) Swelling of the wheel cylinder rubber pieces thereby restricting the cylinder pistons from retracting easily.

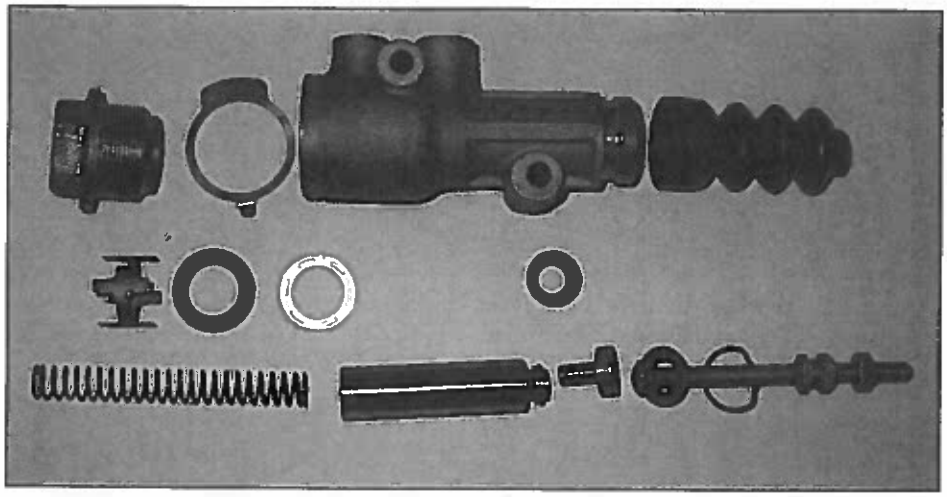
3) Broken brake shoe springs resulting in loss of retraction pressure against the wheel cylinder pistons.

4) Something internal to the master cylinder that was blocking return flow of excess fluid from the lines through the master cylinder and into the brake reservoir.

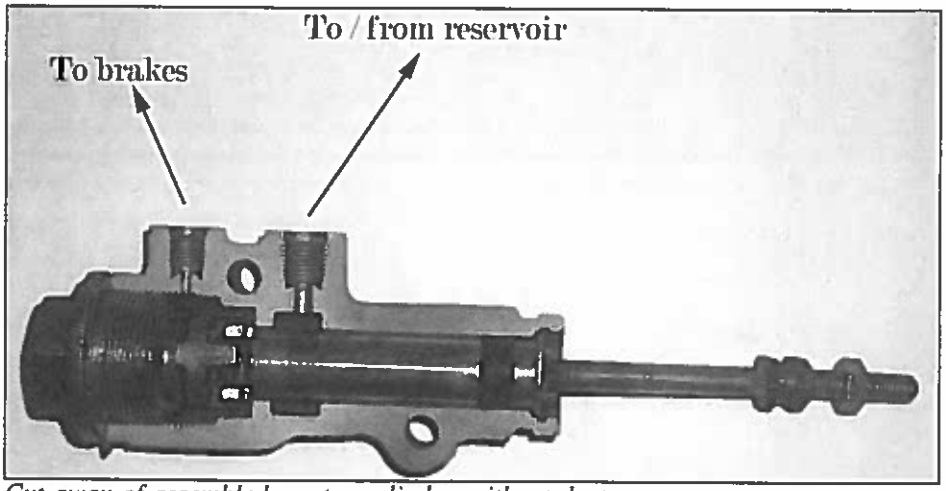
I removed and checked all the brake hoses, but they were completely open and their bores showed no signs of restriction compared with new hoses. Also, there were no broken brake shoe springs. There was some noticeable swelling of the wheel cylinder rubber "cups" and this possibly might have slowed down their retraction. This was expected, to some degree, as it is known that additives are used in silicone brake fluid to cause some swelling and thereby ensure proper sealing of the rubber parts.

This left the brake master cylinder for study. In the 100 this cylinder uses a lance piston, whereby the piston plunges through a fixed seal and displaces fluid from the main chamber. I don't know the reasoning behind this design, and it is less common than one where the piston sweeps the cylinder. With the Austin-Healey 100-six and 3000 master cylinder, the port leading to/from the reservoir is located at the forward end of the cylinder chamber, and the piston has a full cylinder diameter seal attached to its forward end. In addition, protruding from the front of the piston is a wand to which a second spring-loaded rubber cup-seal is attached. When the brake pedal is depressed, motion of the piston first positions this cup over the fill line port, closing off the chamber and allowing pressure in the brake lines to build as the pedal is depressed further. When the brakes pedal is released, full retraction of the piston allows the front cup seal to draw back from the port leading to the reservoir. This is a significant difference in design, and helps explain why the locking-on problem is encountered with the 100s but not the later 6-cylinder Healeys.

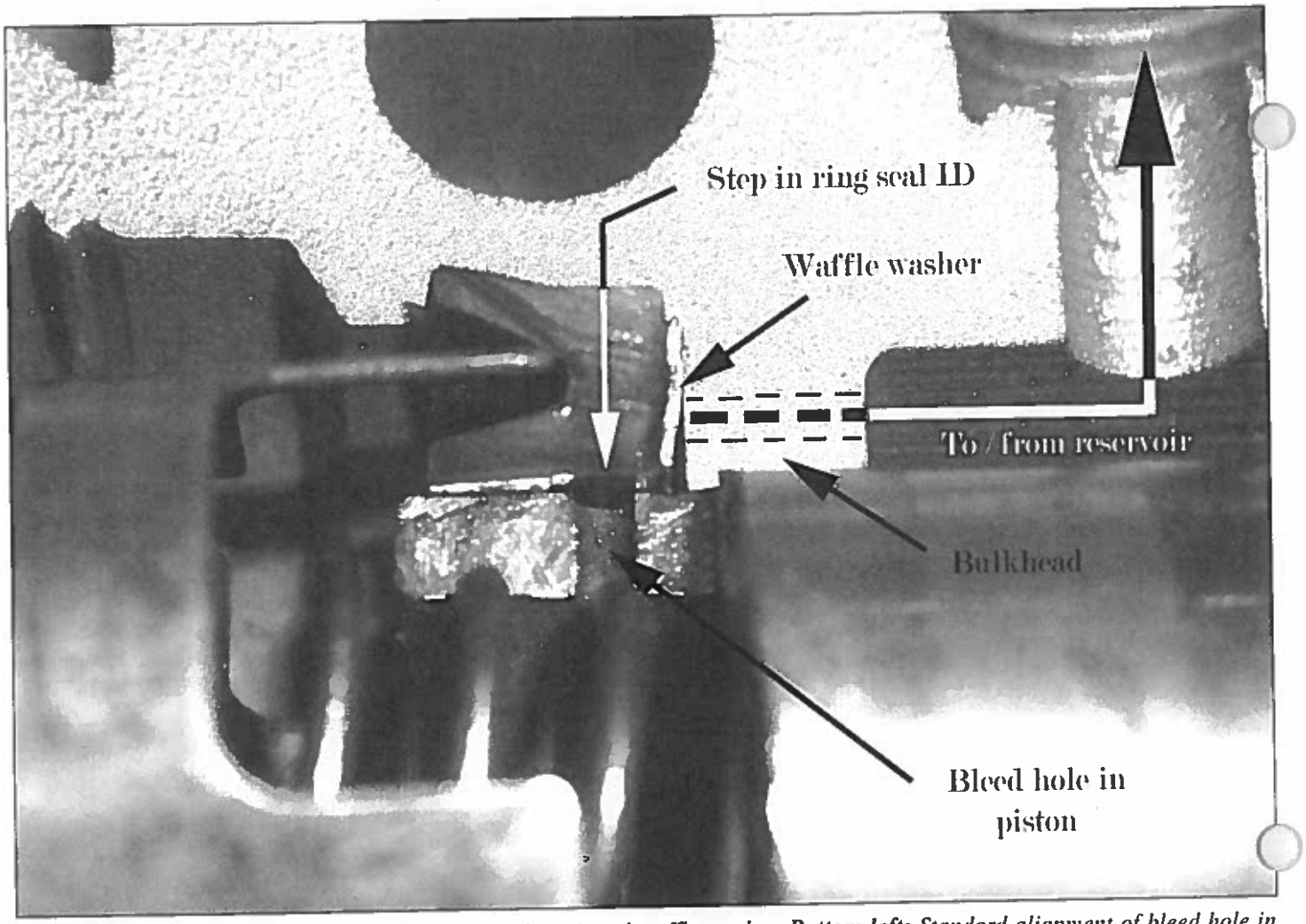
I have sectioned a 100 master cylinder to aid in understanding how it is designed and supposed to work. Starting at the rear, a domed push rod presses against a cavity in a "pusher piece" that in turn captures a rear seal on the working piston. This piston has a deep bore at the front into which the return spring nests. There are two radial bleed holes set back about 0.2 inches from the piston's end. This piston slides through a rubber ring seal at the rear of the main chamber. When the brakes are applied, once the two bleed holes have traveled forward past the lip of the ring seal, fluid within the main chamber is trapped and will be displaced into the brake lines. However, with the piston retracted, the bleed holes are positioned back of the ring seal's lip and fluid should be able to travel back from the main chamber, exiting from the piston cavity through the holes.



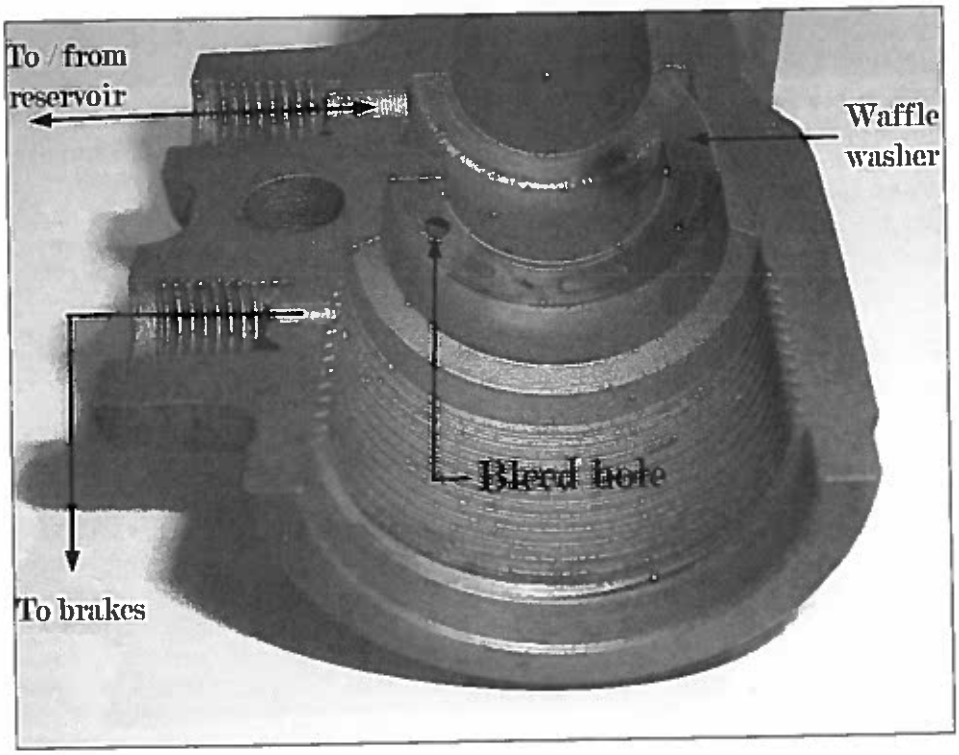
Components of the Austin-Healey 100 master cylinder. Left to right: Top row - end cap, copper gasket, body, dust cover, Middle row – ring seal retainer, ring seal, waffle washer, Bottom row - return spring, piston, pusher piece, push rod with retaining washer and circlip.

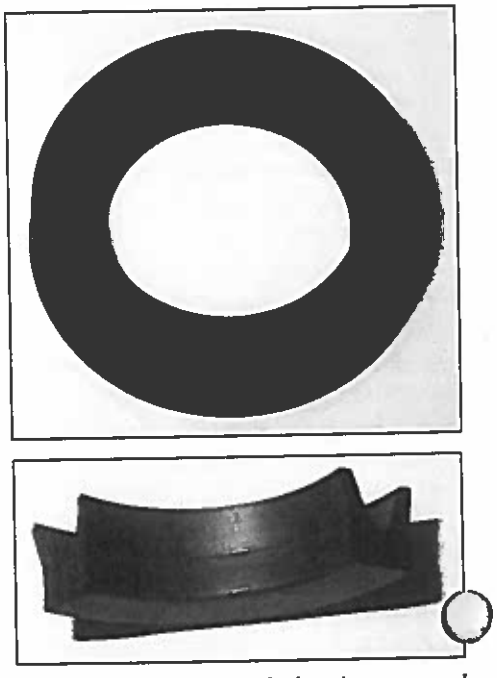


Cut away of assembled master cylinder, without dust cover.



***Top:** Close-up of bulkhead showing bleed hole and sectioned waffle washer. **Bottom left:** Standard alignment of bleed hole in piston end with ID of ring seal, waffle washer and bulkhead. The piston has been cut away to show details at its end. Swelling of the ring seal can close off fluid from passing back through the bleed hole.*





Two views of ring seal showing stepped ID at rear of bore.

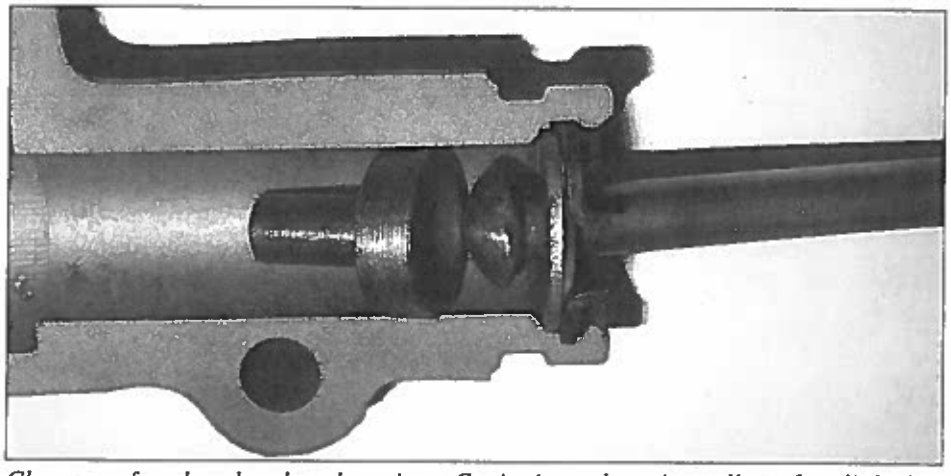
Other features of this type of master cylinder design include an internal bulkhead forming a chamber through which fluid can flow from the brake system reservoir. This bulkhead has a number of holes drilled in it that connect forward to the backside of the rubber ring seal. To allow fluid to flow from the piston's bleed holes back through this bulkhead and to the reservoir, a "waffle washer" of pressed steel is set between the ring seal and bulkhead. This washer has raised ribs pressed into its surface alternating from front to back that create gaps between this washer and both the backside of the ring seal and the front side of the bulkhead.

The last and most critical design detail is the configuration of the ID bore of the ring seal. It is about 0.015" larger in diameter over the rear half of the seal thickness, which creates a very narrow annular gap inside the rear of the seal.

When fully retracted, rearward travel of the piston is stopped by a retaining washer against which the pusher piece rests. This creates a "hard stop." In this position, the two radial bleed holes near the end of the retracted piston are still buried inside the rear half of the ring seal. Thus, the reason for its enlarged bore – without the annular cavity that is created, fluid trying to exit from the main chamber through the bleed holes would find passage blocked by the ID of the ring seal. However, the annular gap allows fluid to continue rearwards over the outside of the piston and into the gap between the waffle washer and the forward bulkhead, through the bulkhead holes into the middle chamber, and finally out through the line leading to the reservoir.

Now we can see a possible cause for the locking brakes. Knowing that the seal rubber will swell from reaction with silicone brake fluid, if it were to swell too much the annular gap surrounding the piston's bleed holes could be eliminated over time, and rubber on the ID of the ring seal could press tightly enough against the piston to prevent proper flow of brake fluid back to the reservoir.

Not knowing the engineer's thinking behind this master cylinder design, there are possibly other subtleties of operation that I have not described. In addition, I'm not really sure why fluid will have difficulty flowing to the reservoir from the brake system, but apparently not have trouble flowing in the opposite direction.



Close-up of push rod and pusher piece. Cavity in pusher piece allows for slight free play by push rod to assure piston fully retracts when brake pedal is against floorboard stop.

Perhaps "filling" of the pressurized system is caused by heated fluid from braking expanding and not being able to bleed back, and not so much from replenishment from the reservoir.

In any case, both times when the locked-brake problem occurred, it was fixed by fitting a new rubber kit to the master cylinder. This solution points to a swollen internal rubber seal as being the culprit.

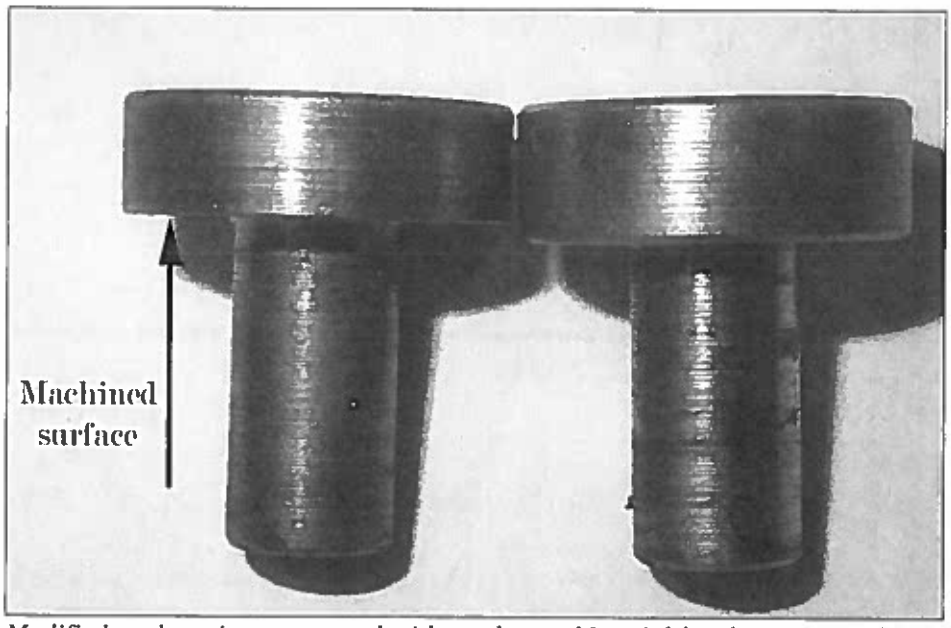
Master cylinder design used with the 6-cylinder Healeys, as described earlier, doesn't involve any close rubber-metal tolerances that could shut off return fluid flow as in the case of the 100. This would explain why similar brake problems aren't encountered with these models.

A call to Lucas/Girling in England only confirmed that rubber used in their brake components (and rebuild kits) is ***not*** compatible with silicone DOT 5 brake fluid. The person I spoke to could not give me any more of a technical explanation as to why or what problems might be encountered, but he did say, in response to my questions, that there were no plans (or apparent interest) for issuing brake kits made from DOT 5-compatible rubber.

Solutions

The immediate obvious solution to avoiding excessive swelling by the MC rubber seal and resulting lockup of the brakes would be to just use original LMA

(continued on page 21)



Modified pusher piece compared with stock one. Material has been removed from back surface only.

DRUM TO DISC CONVERSION . . .

Article and images provided by

. . . OF FRONT BRAKES ON 1959 AUSTIN HEALEY 100-6 BN4 WITH WIRE WHEELS

REMOVAL OF WHEELS AND COMPONENTS

Remove wire wheels, brake drums and brake shoes

- Disconnect flexible brake hose; drain brake fluid
- Remove grease cup with 5/16 fine nut and vise grips
- Align hole in hub with top of split pin securing the axle nut
- Straighten split pin and push up through hole in hub. Remove split pin with needle nose pliers
- Remove axle nut; used 30mm socket on extension bar
- Remove wheel hub with all components; bearings, races, shims, distance piece and washer. Set aside for cleaning and greasing later. (Refer front suspension/hub pic)
- Remove back plate with wheel cylinders still attached. *(Pic 1 below)*

Dry Fitting of new Components

- Clean Swivel Axle and all components before dry fitting
- Install Caliper Bracket
- Mount Rotor to Caliper. Used wedges to insure Rotor was centered in Caliper
- Mount Caliper and Rotor to Caliper bracket. Checked for fit and clearance.
- Insert Hub with associated components checking for fit and clearance.
- Remove all parts.
- Checked for cracks in Swivel Axels using Magna Flux dye penetrant.
- Replaced front brake lines since they were never replaced

Final Assembly of New Components

- Install Caliper Bracket with new bolts and nylocks *(Pic 2)*
- Mount Rotor to Wheel Hub with AN6 bolts. *(See discussion later) (Pic3)*
- Install inner bearing then Wheel Hub and Rotor to Swivel Axle
- Install wheel Hub Components, Washer and Axel Nut
- Used Dial Indicator to set bearing clearance *(Pic4)*
- Mount Caliper to Caliper Bracket using appropriate BN7/8 bolts
- Insure Rotor is centered in Caliper and clearances are good
- Remove all components
- Grease Bearings *(Pic 5)*
- Install Oil Seal rear of Hub
- Install Inner Bearing
- Install wheel Hub w/Rotor and Components;

Washer, Axel Nut and Split Pin

- Install Grease Cup. Do not pack cup with grease
- Install Brake Hose Bracket to bolts on Caliper *(Pic 6)*
- Mount Caliper to Caliper Bracket
- Connect Brake hose to Brake Line and Brake hose

Bracket

- Form a solid Brake Line from Caliper to Flexible Brake Line (Pic7)
- Install Brake pads, with slightly greased edges
- Install anti squeal shims and Pad Pins
- Fill Brake Fluid Supply Tank. Follow standard Brake Bleeding Practices

Discussion

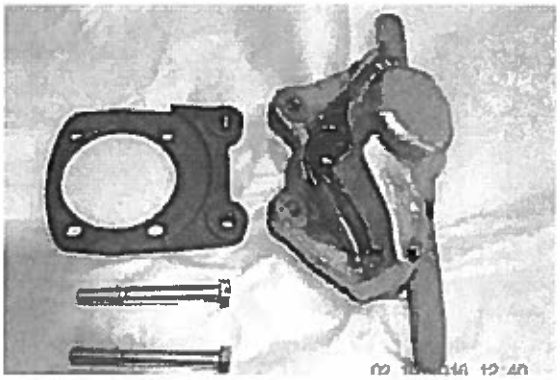
The Rotors purchased contained 5 holes for mounting. The Wheel hub contained 4 holes. Rather than purchase new hubs, they along with the Rotors were sent to a machinist for alignment and drilling of holes. Also, one Rotor did not have a large enough opening to slide on to the Wheel Hub fully and also went to the same machinist for enlargement. All connections used Thread Lock and Penetrating sealer where appropriate.

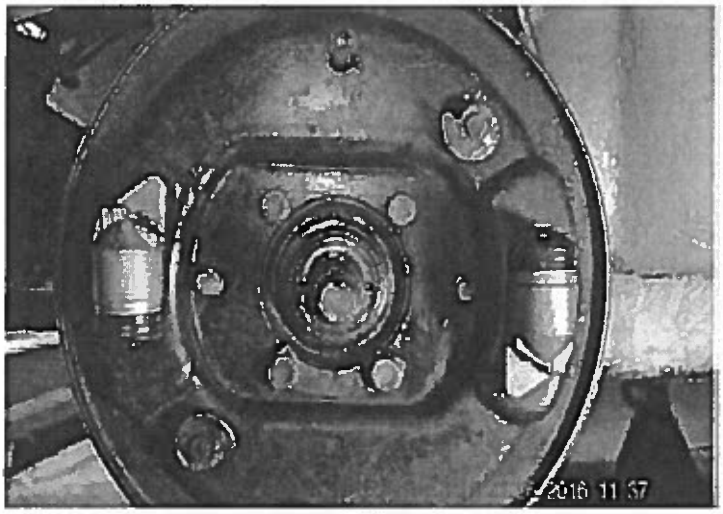
All bolts torqued to appropriate torque with torque wrench

Materials List

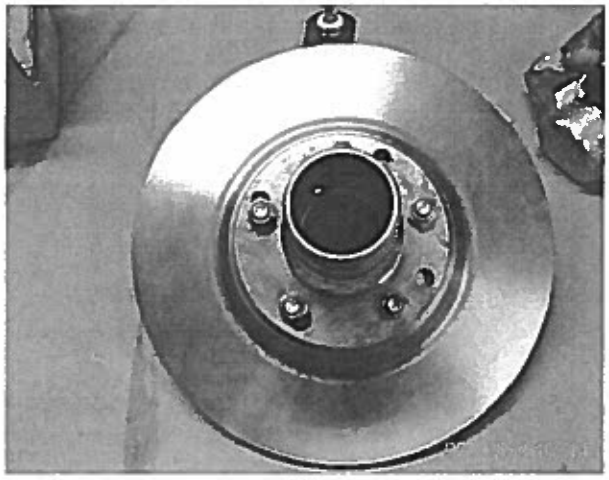
- Brake Pads
- Shim, Brake Pad anti- squeal
- Brake Hose Brackets
- Bolts Caliper to swivel axle
- Caliper Brackets –Pictured below
- Calipers – Pictured below
- Rotors
- Brake line and fittings
- Braided Stainless Steel Brake Hose set; Including rear hose
- Miscellaneous bolts

Caliper & Caliper Bracket

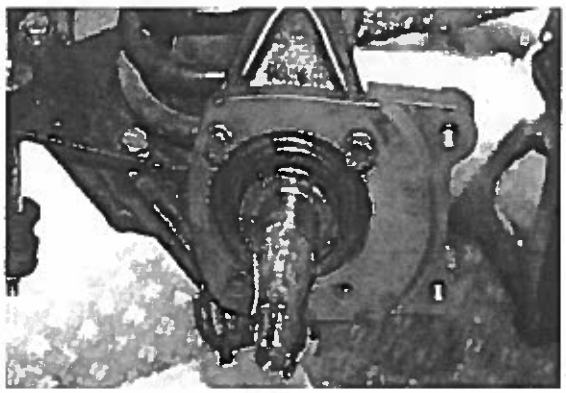




Pic 1

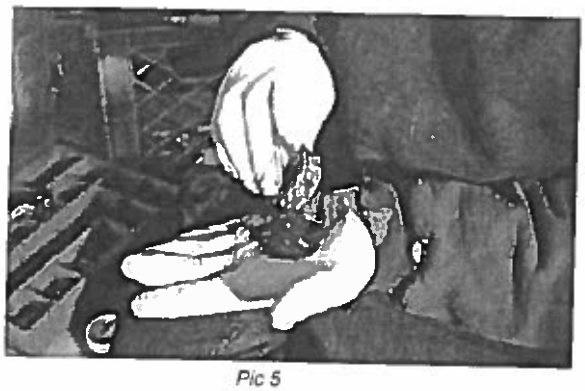


Pic3

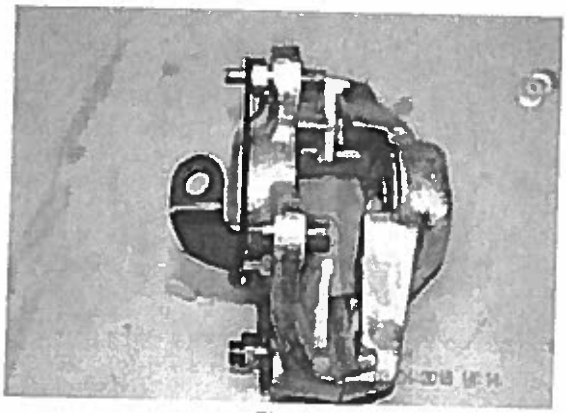


Pic 2

Pic 4

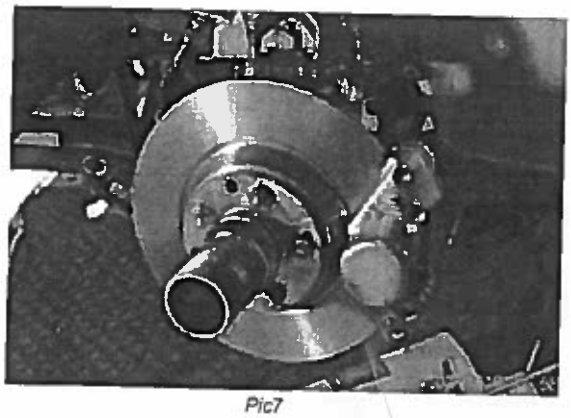


Pic 5



Pic 6

Pic7



Pic7

(6) The removal of the brake backplate is described fully in the section on brakes.

To Assemble and Replace

(1) Insert the inner ball bearing race into the hub with the side of the race marked "thrust" facing the distance piece.

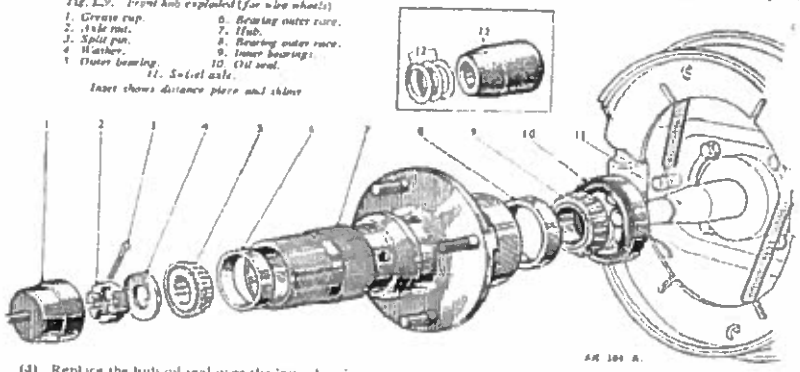
(2) Pack the hub with recommended grease and then insert the distance piece so that the domed end faces the outer bearing.

(3) Replace the outer bearing so that the "thrust" side faces the distance piece. Use a soft metal drift to replace both bearings, tapping them gently and alternately on diametrically opposite sides of the bearing to ensure they move evenly into their respective housings on the hub.

Fig. L.9. Front hub exploded (for wire wheels)

1. Grease cap. 2. Axle nut. 3. Split pin. 4. Washer. 5. Outer bearing. 6. Bearing outer race. 7. Hub. 8. Bearing outer race. 9. Inner bearings. 10. Oil seal. 11. Swivel axle.

Inset shows distance piece and shims



(4) Replace the hub oil seal over the inner bearing so that the hollow side of the seal faces the bearing. Renew the seal if it is damaged in any way.

(5) Replace the hub on the swivel axle, using a hollow drift which will bear evenly on both the inner and outer races of the outer hub bearing. Gently tap the hub into position until the inner race bears against the shoulder on the swivel axle.

(6) Place the swivel axle flat washer into position and tighten the nut. The split pin should be inserted to lock the nut.

(7) Tap the hub cap on to the hub after first packing the cap with grease.

(8) Replace the brake drum and secure with the countersunk screw. It is important that the drum is fully home before this screw is tightened and, if necessary, the drum should be pressed in position by tightening two wheel nuts.

(9) Refit the wheel. The wheel nuts are best finally tightened when the car is off the jacking blocks, but readjust the brake shoes if necessary before the car is lowered to the ground.

Section L.8

FRONT HUBS
(Wire Wheels)

To Check for Wear

The inner and outer bearings of the front hub are of the taper roller type and are therefore adjustable. To check for wear of these bearings the car should be jacked up until the wheel of the front hub to be checked is clear of the ground. Movement between the wheel and the back plate denotes wear of the hub bearings. Should a very positive movement be apparent, the front hub bearings will need renewing.

To Remove and Dismantle

(1) Jack up the car until the wheel is clear of the ground and then place blocks under the independent spring plate. Lower the car on to the blocks.

(2) Remove the "knock-on" hub cap (direction of rotation marked on cap) and pull the wheel off the splines.

(3) Release the nuts and washers holding the brake drum, then gently tap the brake drum clear of the