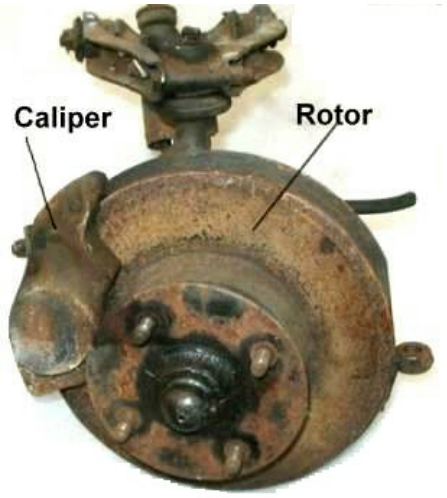
TR250 & TR6 Brakes
Overhauling Front Brakes

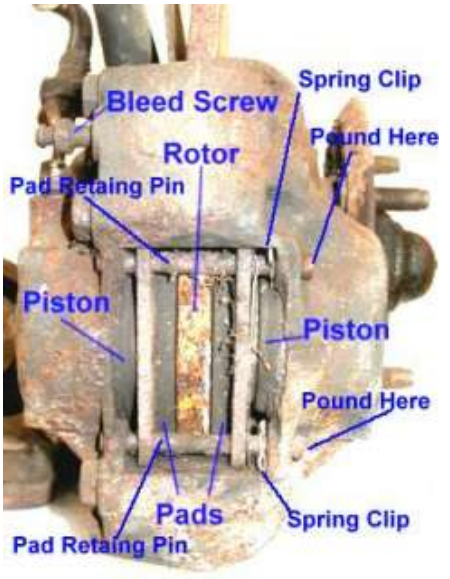
These notes describe what I did on my car for my personal use and are provided here for entertainment; they are not meant to be instructions for others to do maintenance on their vehicles.

This section describes how I overhauled the front brakes for my '70 TR6. As mentioned earlier, the car is completely disassembled and I was able to take the front suspension assemblies to the workshop to do the work. Everything done here could have been done with the suspension assemblies still on the car.

The photo on right shows the caliper and rotor to get us orientated. This is the right side. The left side is the mirror image with the calipers to the rear and slightly above the axle on both sides. The left side and right side calipers are different in that they are mirror images. (This contrasts with the rear brakes where the two wheel cylinders are identical.) The pipes that connect to the calipers are also different between the two sides ---- a mirror image bend. As mentioned in the Overview, the same caliper was used on the TR250 and early TR6. At commission number CC29929 (69?) a minor change was made to the pistons to accommodate a different style boot. . At commission number CC81079 (mid '72) the calipers were changed to use metric threads. However, any car might be equipped with any of the pistons. For example, most the replacement pistons for the early calipers are the ones that require the later type boots. Also, Moss says that all replacement calipers it sells are the standard thread version that use the later style boot. I'll discuss this point more carefully when I look at a disassembled caliper.



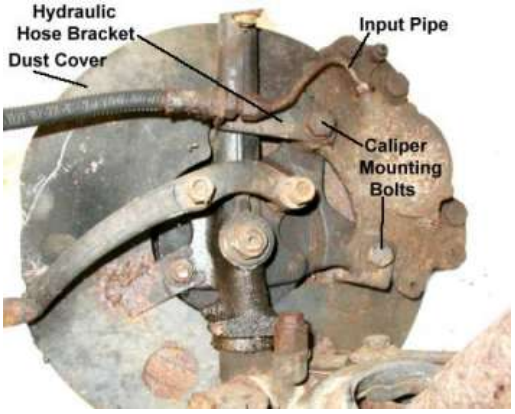
PAD Replacement: The pads are designed to wear through use and must be replaced periodically. I usually replace the pads when they get down to about 1/8 inch thickness or 5/16 inch including the backing. (An old Haynes manual says the min pad thickness is .06" to .012". I don't understand why they have a range for the minimum. Some of the rotors have an statement cast into the rotor that the minimum pad plus thickness including the backing is 0.24 inches.) I can usually get 40K to 50K miles on a set of pads both for my TRs and my late model America cars. The pads should be replaced before the pads wear so thin that the metal backing rubs against and gouges the rotor necessitating that the rotor be removed and resurfaced. Many newer cars have spring steel screechers attached to the pads that rub against the rotor and screech when the pad wears thin notifying the operator that the brake system needs attention. (This screeching should not be confused with front brake squealing that is a TR feature of providing feedback to the driver that the brakes have been applied.) The first step is removing the pads is to force the pads away from the rotor so that there is room to get the old pads out and insert the new pads. I use a large old screwdriver to pry the pads away from the rotor and press the pistons as far as they will go into the calipers. (There are tools available to push the pads away from the caliper. I always forget to pick one up when I'm at the auto store.) When the pistons are pushed into the calipers, fluid is pushed out of the calipers and into the reservoir where it might force the cap off and overflow all over the place. I attach a hose and bottle to the bleed nipple and open the nipple so that the excess fluid flows into the bottle.



The book says to remove the spring clips and then slide out the pad retaining pins. Like they're going to come out that easy. Those pins seem to corrode to the caliper in 24 hours or 100 miles usage, whichever comes first. Fortunately the spring clips last a little longer --- a year or two. The problem is apparently that there are no inexpensive surface coatings that will survive the high heat the brakes generate. I used pliers to remove all of the clips I could and then used a pin punch and large hammer to drive the pins out of the caliper. This is another task that usually provides observing children an opportunity to expand their vocabulary. Once the clips are out, the old pads can be slid out and new pads slipped into position and the pins and spring clips replaced. See discussion later about anti-squeal devices. I always bleed the

brakes to remove any air that might have entered the system when I opened the bleed nipple. See separate note on bleeding the brakes.

Removing the Caliper: The caliper is fastened to the caliper mounting plate of the front suspension by the two bolts noted in the left photo below. I got them loose without too much difficulty using a long breaking bar and a 4 foot length of 1 inch pipe wedged into the suspension to keep it from turning. Before removal it's a good ideal to disconnect the input pipe if the pipe is to be salvaged. In my case, the pipe was trash so I cut it off. Once the bolts are out the caliper slid off and the dust shield and hydraulic hose bracket can be removed. The bare caliper is shown on the right. I then used the process described above to remove the pads.



Removing the nipple & fittings: Sometimes the fittings and bleed nipples are hard to remove and this set proved no exception. I usually soak around the input pipefitting and bleed nipple with PB Blaster and let set overnight. I use a 6- point socket so the head isn't rounded. This time I got impatient and only waited through a long lunch. I managed to twist off the bleed nipple on one of the calipers. I ran a 21/64 drill down the hole in the center of the bleed nipple in preparation to tapping the hole 3/8-24, the original threads for this non metric caliper. When the drill passed the end of the threaded part of the nipple, the narrower part at the tip separated and started rotating --- couldn't drill any further. Turned it upside down and rapped it a couple times on the bench and the end piece fell out. I then ran the tap down the hole and it merely shoved the remaining threaded part of the nipple out of the threads in the caliper ---- cleaned up the old threads just like new.

Removing the Pistons: These calipers had been out of use for about 12 years and the pistons were stuck. I first removed the boots around the ends of the pistons (tore them off in pieces) and sprayed PB Blaster around the outside of the piston. After a short time to let the Blaster work, I shoved a steel block between the pistons and used a hammer on each side to drive the pistons into the calipers (left photo). This broke the pistons loose. I then injected compressed air into the caliper using the same adaptor as used on the master cylinder (center photo). One of the pistons moved out. I then used hammer and block to push it back in. I repeated this several times until it moved fairly easily. I then pushed it in and held it (the loose piston) with a clamp (right photo) and applied air again. This caused the other piston to come all the way out. I then tapped the grove in the loose piston a little on each side to work it out. (If you folks look very closely you'll see that these three photos are of the left caliper -- I had already disassembled the right caliper and forgot to take pictures during the process).

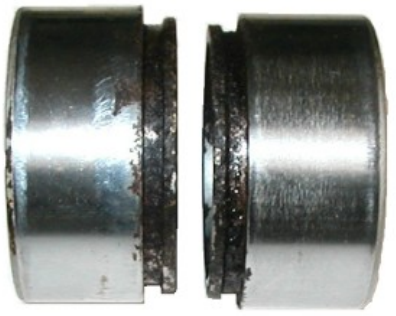
Opening the Caliper: The instructions with the rebuild kit says to not separate the two halves of the caliper. I'm not sure why, maybe because the kit doesn't contain a replacement for the little seal between the two halves and you're likely to loose the seal or forget to put it back in. I've also been told that once you take them apart, it's impossible to reassemble them properly, they'll always leak. I think that is an old wives tale propagated by armchair mechanics that probably have never touched a real dirty grimy

caliper. I've been taking them apart for years and it's about the only spot that I haven't experienced a leak.

A disassembled caliper with pistons, pads. pins, etc is shown on the right. The funny shaped thing in the lower right corner is an anti-squeal shim. This caliper (we're back to the right one here) has been split in half to show the inside. I'm going to powder coat these calipers and I was concerned that little seal in-between the two halves would be damaged by the 350 degree temperature I use for curing. After researching the the fluids (see note on fluids) I'm not so sure that the powder coating temperature will damage the seal since the brake calipers an get to temperatures around 300 degrees F or higher. I'd probably be OK if I kept the powder coating temperature down to around 300 degrees, which will work if I bake them a little longer.

Another concern is that the little seal is over 30 years old and probably near it's useful life so it should probably be replaced. The seal is ~ .068" thick for a .062" deep recess with 1/2' OD and11/32" ID. Moss lists the replacement as part number 583-820 in their TR2,3 & 4A catalog.

Pistons: The pistons from one of the calipers are shown on right According to the Moss catalogue the original pistons were made of mild steel with an industrial hard chrome plating. They are really fine looking with a neat finish --- except for the part that extends beyond the seal that rusts, in spite of the boot. The pistons here are heavily corroded in the area under the boots and must be replaced.



Caliper Variations: There were two changes in calipers during the TR250-TR6 manufacture. The first change at commission number CC29930 (early 69?) was to the front of the piston to accommodate different style boot (the later boot had a spring clip to retain it to the caliper) The photo at the lower right shows the difference in the pistons. These are new stainless steel pistons; the later style is on the far right. The type number on the casting was changed from TYPE 16P to TYPE 16BP when the piston style was changed. There was no change to the caliper castings at this time other than the number. The two style pistons are exactly the same size 2.125" (2 1/8") diameter and 1.140" depth. The 16P caliper is from my '70 TR6 commission number CC53270. The factory equipment for that commission number was the Type 16PB. My guess is that rebuilt calipers were installed at some time and with the early castings and late pistons.

Piston Boots: The early pistons have the narrow groove as shown above. The edge of the boot fits into the groove. The other side of the boot rides on the side of the piston. The boot is shaped such that it naturally spreads toward the front edge of the cylinder to complete a sort of seal. The photo on right shows such a boot installed on an early piston.

The boot for the later pistons have a collar type structure on each end. The smaller collar stretches over the grove in the end of the piston. The collar on the other end of the boot fits over the lip on the face of the

caliper and is retained by a spring wire clip.. Photos of the installation of this type boot are shown further down.

Metric Calipers: The next change, at commission number CC81079 (end of '72) was to convert the calipers to metric. The caliper type was not changed at this time, it stayed 16 BP. I pulled the caliper off the suspension from a '73TR6 I junked a while back. That car was purchased in the early '80s and I'm pretty sure the brakes are original as there were no indications that the car had had any prior maintenance. This caliper has TYPE 16BP cast into the side, as would be expected. The bolts that attach the calipers are clearly different as shown in photos the right. The bolt for the early standard thread type caliper is on the left and the one for the metric caliper is on the right. The actual threads on the end of both bolts are the same to match the caliper mounting plate that wasn't changed. The head of the metric version is 3/4 inch ~ 19 mm. The body of the bolt for the metric caliper is larger diameter matching the larger diameter holes in the calipers. You won't find one of those bolts at the neighborhood hardware store.

The metric caliper had smaller holes (3/16" vs. 1/4") for the pad retaining pins. The holes for the input pipe and bleed nipple are threaded 10 mm with a 1mm pitch (0.394" - 25.4 TPI) rather than 3/8-24 threads. Interestingly, the threads are close enough that I could use the air insertion hose with the 3/8-24 threads to get a piston out. The pistons in these metric calipers are identical to those used on my '70 pictured above.

Caliper variations Summary: Based on these data and checking the various catalogues I conclude the following:

- Either piston type will fit in all TR250 & TR6 caliper castings.
- Any style replacement caliper might be found on any year TR250-TR6.
- When rebuilding the calipers, the important information is the style of pistons because different rebuild kits are required for the different style pistons.
- Moss says all replacement calipers they sell are the TYPE 18 BP (later piston) with standard (non metric) threads. This matches the factory equipment for '70 through '72.
- Some catalogs indicate one rebuild kit and replacement piston for TR250 through '72 TR6 and another kit and piston for after '72. This is an error; the change for the pistons (and rebuild kits) was at commission number CC29930 (early 69?).
- It is necessary to know whether the calipers are metric or not if the input pipe, bleed nipple, attachment bolts, pad retaining pins or pads are being replaced. This change was made at commission number CC81079 (end of '72).

With that all said, I plan to use only the later style pistons whenever I have to replace the pistons because I think the later style boot is a more effective shield. Since the pistons are the same size I see no reason why the different version of calipers can't be mixed on a car. However, it could get very confusing with different rebuild kits for each side due to different style pistons or different type bolts and fittings due to metric or non-metric. I don't think I'll mix calipers on any of my TRs.

Caliper Seals: The photo on right shows one of the calipers after blasting and about ready for powder coating. The three seals are pointed out, the two in the cylinders and the little washer between the two haves. Note that the seals are inside the cylinders instead of on the pistons as is the case for the master cylinder and the rear wheel cylinders. This means that the fluid seal is between the rubber part in the cylinder and the

entire side of the pistons. Imperfections in the side of the piston where it might come in contact with the seal can cause a leak so the piston sides must be smooth and defect free. (Recall that we hone the insides of the master cylinder and wheel cylinders to make them smooth and defect free for the seals that are part of the pistons.)

The next step I did was to powder coat the caliper halves. One could follow the same process if painting the caliper. The rubber seals were removed from the inside of the cylinders, as was the little rubber washer seal between the two caliper halves. All the holes were plugged and old pistons were inserted into the cylinders to keep the paint out of there and the machined surfaces where the two haves mate were carefully masked. The photos below show the powder coated halves of one caliper.

The next thing I did was run a tap though all threaded passages and then blow out all passages. I then covered the cylinder with a light coat of brake fluid. It is very important that no petroleum based grease or oil get into the brake system so only brake fluid and the Girling or Lockheed Rubber grease were used on the parts.

Rebuild Kit: The components in the rebuild kit for late style pistons are shown on the right. The kit for the early style pistons contain the different style boot shown previously and no wire clips.

I coated the inside of the cylinders with brake fluid and then rubber grease. I then inserted the seal, coated the piston with rubber grease and pressed it into the cylinder. Once the piston was in place I stretched the dust cover over the piston (center photo), pushed the piston in as far as it would go and then stretched the dust cover over the cylinder and secured with the spring clip as shown in right photo.

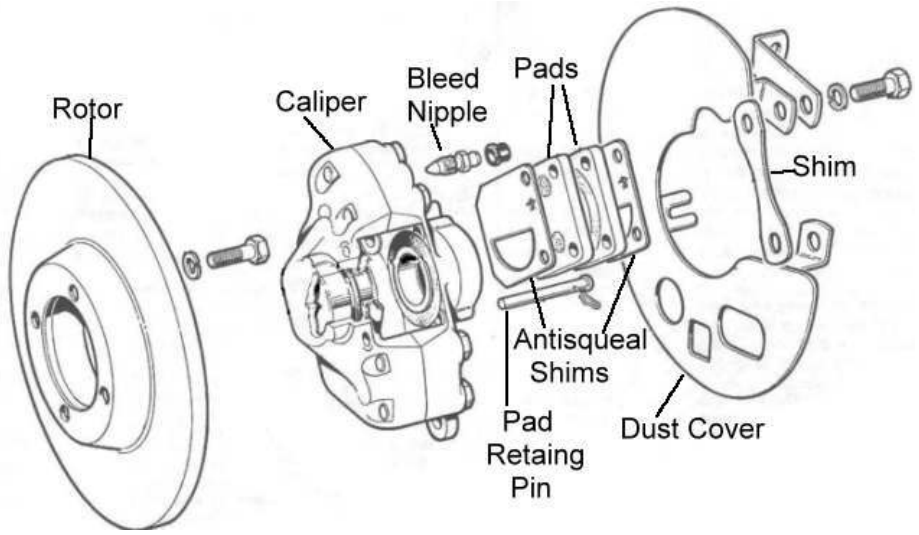
I then inserted a new seal (Moss part # 583-820) in the passage between the two halves of the caliper and bolted the two halves together. I found the little seals listed in the moss TR2, 3 & 4A catalogue. On the same page as the seal was the following caliper tip: ***Girling "split" calipers should not be separated for any reason. They were not designed for separation and reassembly and proper torque specifications are not known, other than the inner and out bolts are torqued differently.*** The inside bolts are 7/16" diameter and the outside bolts are 3/8" diameter. I torqued the outside 3/8" bolts to 40 ft-lbs and the inside 7/16" bolts to 70 ft-lbs. I then coated the bleed nipple threads with rubber grease, screwed it into position and covered the end with a new cap from the rebuild kit.

Rotors: There is always a question as to whether the rotors should be resurfaced. I don't have the rotors resurfaced unless they have been gouged (pads wore through) or the rotors are not running true. I removed the rotors from the hubs on the first TR I rebuilt. After I reassembled everything I found that the rotors didn't run true and kicked the pads back so that the pedal went to the floor each time I applied the brakes. If I pumped the brakes quickly I could get the pads against the rotors and the brakes would function. I must have reassembled the rotors to different hubs or got the orientation different. Resurfacing fixed this. I have an old Haynes manual that says to be sure to make a locating mark on each piece if separating the rotor from the hub. (Should have read that before I took the rotors off the hub.) They also list the maximum run out at .002 inches. Neither the Factory TR6 manual nor the Bentley manual mention resurfacing the rotors or list any specifications as to the minimum thickness. I polled the 6-PACK e-mail list and Dick Taylor passed on that the new rotors are about 1/2 inch thick and several others pointed out that some rotors have markings on the inside that say the the minimum thickness is 0.45 inches. I had two sets on rotors in the workshop, one set was unmarked and the other set had the 0.45 minimum thickness cast into the rotor.

The rotors I decided to use for his project originally came off a '76 and were later used on a '73. They have a thickness of 0.50 inches indicating they have never be resurfaced. The rotor surfaces were heavily pitted from corrosion. I degreased and basted the hubs along with the the brake dust shield and the hose bracket. These components are shown in next photo below. If you look closely you can see the pits in the rotor surface. This was before I had them resurfaced.

Recall that the rotors were 0.50 inches thick before resurfacing. After resurfacing they measured ???? (I'll fill this in when I actually get them resurfaced)

The sketch below is from the TRF TR250 catalog and then processed to show the points I wanted. Note there is a shim shown by the dust cover. I've taken apart many front suspensions and never seen one of these shims. The shim goes between the dust cover and caliper and serves to move the dust cover away from the rotor. I have seen cases where the dust cover was too close to the rotor and rubbed against it. I've always been able to deal with that problem by bending the offending part of the dust cover away from the rotor.



Replacement Pads & Shims: The pads removed from the calipers had plenty of life remaining. However, both the pads and shims are heavily corroded. The concern I had was that the corrosion might have weakened the bond between the pad and the steel backing so I purchased new pads. I've always used the standard pads from TRF and have encountered no problems. Some suppliers sell higher priced pads and well as cross-drilled rotors, etc. I've never felt a need to use anything but the standard OEM product. However, if I were racing or had encountered brakes problems due to unusual usage I would investigate those products.

I have encountered front brake squealing on most my TRs from time to time. At the moment my '76TR6 doesn't squeal and my TR250 does. The '76 doesn't have the anti-squeal shims. I'm not sure whether the TR250 has the shims. However, I do remember some of the worst squealers had the shims installed. The squealing is caused by vibrations between the pad and piston. In the past the anti-squeal shim kit from TRF contained a little packet of grease. This time it didn't so I bought a tube of brake grease from the Auto Works.

I found I had a new pad retaining pin kit so I used it rather than cleaning up the old pins. The pads, anti-squeal shims come in sets that do both sides. The components for one side are shown in the left photo below. The assembled rotors are shown in the right photo. Assembly is straightforward with the caution that the shims must be oriented such that the arrow points in the direction of rotor rotation (when going forward). Apparently the anti-squeal kit doesn't help much when braking while traveling backwards. I applied the brake grease to both sides of the anti-squeal shims.

Finished Photo: I'll add a photo here of the front suspension with brakes installed after I get the suspension cleaned up, pained and reassembled.