

## ABS Adventure

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Not many of us would describe troubleshooting ABS brakes as an adventure, but my recent efforts were a bit of one. They involved a little reconnaissance, some initial trial paths leading to dead ends, a search for alternate paths, and finally—success. In case you have ABS troubles with your Milano, I'll tell you my story.

First, I need to credit the sources I used in attacking my ABS problem. The basic source I used is the Milano Workshop Manual (MWM), which has an extensive section on the ABS (Teves or ATE Mark II) system in the car. There is a long trouble-shooting section as well as many tests, though some require specialized equipment. A second source of information was the World Wide Web. Many of you may already know that some of the Alfa Owners Club chapters not only maintain web sites, but also keep extensive lists of Tech Tips from the pages of their newsletters. Among these is the St. Louis site (<http://www.catenary.com/isaluti/>) in which Rich Hirsch has put several articles on ABS systems, including one on how to remove the system altogether. These were very helpful even though I decided not to remove mine. A third reference, possibly mostly for background, was a book *Brake Systems OEM & Racing Brake Technology*, by Mike Mavrigian and Larry Carly. This book has lots of general information on brakes, and some very useful information on ABS systems, including a list of which vehicles used which ABS systems. More on this, later.

For those of you unfamiliar with the Milano's ATE Mark II ABS system, it is an integral type system, meaning that the ABS system is not an add-on to a regular braking system—it *is* the system. While there are significant engineering advantages to this system, one disadvantage is that if the ABS system is really kaput, your brake system may be too. The basic system is composed of a brake 'master cylinder' with a number of solenoid controlled valves in it to control where and when brake fluid is delivered to brake calipers, a fluid reservoir on top of the master cylinder, a hydraulic pump to pressurize the brake fluid controlled by the master cylinder, a hydraulic accumulator to store pressurized brake fluid (so the pump doesn't have to run all the time), and wheel rotation sensors and an electronic control module. The system is fairly complex, but in operation the basic idea is that the brake pedal is in part a source of energy as in a conventional or even vacuum assisted system, but mostly it is a proportional switch. The switch allows pressurized brake fluid from the accumulator to flow into the brake lines based on how hard it is pressed (or how far) and on the wheel slip calculations from the ECU. If the ECU decides to invoke the ABS function, one or more of the valves to the brakes (I think there are 3 channels, RF, LF, and Rear) is closed for about 1 second, preventing brake fluid pressure from actuating that channel of the brakes. Two important parts of the system, and ones apparently susceptible to age, are the hydraulic pump and accumulator system. In the ATE MK II system, the accumulator has a rubber bladder to separate brake fluid from pressurized nitrogen, pressurized to 180 bar (about 2650 psi). You might note that this pressurized fluid allows the ABS system to switch only, not actuate brakes. It also serves as a brake booster, as a vacuum booster might on a non-ABS car.

The initial indication of problems was the occasional 'ABS' light being lit after motoring off in my '87 Milano Platinum. The 'ABS' light indicates a variety of faults, as outlined

in MWM, including low pressure and no sensor signal, for example. Usually, a little fiddling with the electrical connector to the brake fluid reservoir/master cylinder system would make the light go out, suggesting it was only poor or dirty electrical contacts.

More recently, I had a steady 'ABS' light and the hydraulic pump ran nearly continuously. It might eventually stop, but after each brake application, it was on (light and pump) again. The various sources suggested one should get from 8 to 15 brake applications from one accumulator 'charge' before the pump had to come on again. From Rich Hirsch's articles and the MWM, the diagnosis seemed to be a failed accumulator. So, I tried to find a replacement accumulator. I tried 'the usual suspects' to paraphrase Claude Rains. No luck. Apparently, they are no longer stocked (but try your favorite Alfa parts supplier—I didn't try them all). At this point, some of the comments from the Alfa Digest came to mind in terms of other vehicles that used the same system. The Mavrigian and Carly book lists quite a number of cars using ATE Mark II systems as well. I would not interpret the fact that the 'same' system was used in these cars to say parts are interchangeable. I have seen enough cases where a vendor (like ATE) will make modifications to the system to suit a big buyer. Mavrigian and Carly indicate as much in their description of the fault codes displayed for the ABS system. Depending on the vehicle, a large number of specific faults may be indicated, or all may be lumped into a single idiot light (like Alfa) which only indicates there is a fault, not what it is.

One car with this system discussed on the Alfa Digest was a 198? Merkur. I called the local Ford dealer to see whether accumulators for some late 1980's Merkurs were available. He was quite helpful, as he figured out it had to be a 1988 or 1989 Scorpio (that was in the book, but I forgot). But...no longer available. My next hint was a Buick Reatta. As Mavrigian and Carly show, there are 15 or 20 cars with this ATE Mark II system, mostly 1988 and 1989 GM products, with some Fords as well. I called my local Buick dealer to ask about Reatta accumulators. He was almost *too* helpful. He wanted my car's VIN to be sure he had the right part. I thought I had been caught. (You've all had the experience in the car parts store where as soon as you say *Alfa Romeo* they say 'we don't have any parts for that' even if all you want is a light bulb.) I mumbled something about the car being at home and I was at work. That seemed to get me through. Anyway, he had one and would hold it for me. I raced over and picked it up. I still wasn't sure it was exactly the same as the OEM Alfa part, so I gave it a good look. As near as I could tell it was identical—even made in Germany. The part number was AC Delco 255 35686.

I replaced the old accumulator with the new one and figured I would be all set. Wrong. Turning on the ignition (energizing the hydraulic pump) started the pump, then it stopped and the 'ABS' lamp was on. The pump fuse had blown, and continued to blow after replacing it. The consensus from my sources was grim—the pump was probably toast. Apparently it could pump against a leaky accumulator, but not a good one. Back to the phones. My local dealer was dubious about a pump for my 'Reatta'; he wasn't sure if he could get one or when. I wasn't even sure it would work, since there are slight differences among the installations of this system in the different vehicles. I went to the web (WWW, search on Buick Reatta parts, ...) and found a dealer who had one for not too bad a price (AC Delco part no. 255 28382). I ordered it and it came a few days later.

Opening the box, I was a little disturbed. The basic pump was similar (still made in Germany), but the mounting locations for the accumulator and the banjo fitting to the

master cylinder were in different locations from the Alfa unit; the connector to the pressure switch was also different from the one on the Alfa wiring harness. I wasn't sure the pressure turn-on and turn-off points would be the same either. I decided to go ahead and try it, but first I removed the new pressure switch from the new pump and put the old Alfa switch on. If I had thought of it I probably could have gotten the right GM connector, but I didn't. If you do this pressure switch swap—be careful. The housing is aluminum so gentle wrenching is needed.

Anyway, I installed my new pump, and fired it up. I got lots of pump noise, but it didn't stop after 20 seconds or so, which would have indicated the accumulator was up to pressure. The only idea I had was a bit far out; what if GM (or ATE) had decided to reverse the power connectors (12v and ground) from the way they were in the Alfa OEM system pump? Since most DC motors will happily run backwards if wired up backwards, the fact that it ran didn't rule this out. Anyway, swapping the leads did the trick. The pump ran, slowed as it used to under load as it came to near the system switch pressure, and then stopped as the accumulator pressure reached the set point. The combination, despite the slight change in location for the accumulator mount and the banjo fitting, worked well.

Since the accumulator-pump replacement, the system has worked well, suggesting that even my initial problems that appeared to be wiring related, may have been an indication of incipient accumulator and pump problems.

I hope my experiences may help others with Milano ABS problems. I do not claim to be an expert on braking systems, but I think I have found a way to repair my ABS system. The references I found were very useful and I urge anyone interested in the Teves (ATE) Mark II system to check them out.



