Trouble Shooting the Diff-Lock Actuator Vacuum System

By Dr. Rainer Woitok

General Remarks

A. We're testing the vacuum system mainly by pulling vacuum hoses off their nozzles and listening for hissing noises. In order to not drown the hissing noises in the roars of the engine, for each single test we will only run the engine for a short period of time to fill the vacuum reservoir and then shut the engine off, pull a single hose off its nozzle and listen. If you hear some hissing make sure the origin of the noise is where it should be by alternately closing both, hose and nozzle with your thumb (in most cases the hoses should hiss, in some cases the nozzles should hiss, and in one case a hissing nozzle is a bad sign).

B. In order to not mix up the various vacuum hoses and the nozzles they're attached to, we will always pull only a single hose off its nozzle at a time, listen, and then re-attach it to it's nozzle.

C. If we pull a hose but can't hear any hissing, we will re-attach the hose, run the engine for a short period of time to make sure the vacuum reservoir is refilled, and then repeat the test.

D. In normal operation mode (that is with all hoses properly attached) there should be no hissing noises whatsoever. If there's hissing without you having removed one of the vacuum hoses you've got a vacuum leak which you must trace down using your ears (normally what's leaking are the rubber connectors between the vacuum lines and the nozzles at the differential lock switch or the differential lock actuator)

Testing Procedure

1. Apply the parking brake, put the tranny in neutral, run the engine for a short period of time, then shut it off, and repeatedly step on the brake pedal. The way the pedel reacts should change after a few times of pressing it. If not, your brake booster might be missing vacuum and that's the same vacuum needed to drive your differential lock or differential locks. So, if your Syncro fails this test you've got a problem more severe than just an inoperable differential lock, and you've got to solve this problem first.

2. Look under your Syncro, and find the little black and blue oval plastic box on the passenger side of the tranny right in front of the starter. That's the rear differential lock actuator. Note the two vacuum hoses attached to it. Should your Syncro be also equipped with a front differential lock you'll find an identical additional differential lock actuator on the passenger side of the front differential.

3. Keep the diff-lock actuator switch or switches on the dash pushed in, that is, in the normal, non-locking position and check the hoses at the rear and -- if existing -- at the front differential. At either differential exactly one hose must be hissing. A hissing nozzle at a differential lock actuator indicates a leak within the actuator and thus a need for replacement.

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4. Next, pull the rear and -- if existing -- the front differential lock knob at the dashboard console (remember that the front differential lock knob has to be turned clockwise before it can be pulled) and again check the hoses at the differential lock actuators. Now only the other hose has to hiss at each actuator. And again, a hissing actuator nozzle indicates a leaking diaphragm within the actuator.

Results so far: hissing at exactly one hose with knob in and exactly the other hose with knob out on every differential lock means the vacuum system tested ok. If a nozzle at the differential lock actuator was hissing the actuator is defect.

5. If the vacuum system did not test ok so far, test your differential lock switch or switches on the dash. For this pull each knob out, hold the shaft with needle nose pliers and turn the knob counter clockwise to unscrew it. Then remove the screws holding the dashboard console (one screw from either side and two screws from below. Maybe, you have also to remove the cover for the heating ducts below the differential lock switch console). You can now see the vacuum switch or switches and have perhaps to remove just another screw in order to be able to pull them out a bit so you can get at the hoses attached (there are three hoses attached to every switch)

6. For every switch remove one hose at a time until you've found the one hose (for the time being ignore any hissing nozzles) that is hissing. That's the input hose. Re-attach it to the input nozzle, and then in turn test the two output nozzles. Exactly one nozzle must hiss with the knob pushed in and one must hiss with the knob pulled out.

Results so far: if no input hose could be determined the status of the switch remains unknown but another problem is lurking upstream which we try to tackle in the next steps. If the switch tested ok but the hoses at the differential lock actuator did not, there's probably one (or two, depending on the former results) clogged vacuum line between switch and differential lock actuator. If at least in one position of the switch either zero or both output nozzles hissed, the switch is broken.

7. Look under your Syncro and find the tree balled vacuum reservoir (roughly the size of three baseballs) for the differential locks. It's located somewhere roughly in the middle of the van on either the driver's or the passenger side. There's a single short vacuum line running from the reservoir to a Y or T junction which connects via a check-valve to another T or Y junction which is directly spliced into the vacuum line from the intake manifold to the brake booster. The line leaving from the first Y or T junction next to the reservoir leads to the differential lock switches on the dashboard console. Remove this line and check for a hissing nozzle at the Y or T junction. If it hisses the line between the reservoir and the differential lock switches at the dash is clogged.

8. If there's no hissing, there isn't much left. Unplug the check-valve at both ends and test it by blowing it through in either direction. Airflow must be in exactly one direction: from the reservoir to the intake

manifold (we're dealing with vacuum here, that is, we're pumping the air out the reservoir!). Maybe clean the check valve. And make sure the Y and T junctions are not obstructed.

---------- **Removing the Differential Lock Actuator** ----------

Removing and Installing the Diff-lock Actuator

The diff-lock actuator is the oblong black and blue plastic box at the passenger side of the tranny (right in front of the starter), or -- if you've also got a front diff-lock -- at the passenger side of the front differential.

To remove the diff-lock actuator, do the following:

1. Mark the black rubber hoses that connect to the actuator so you will not interchange them upon re-installing the diff-lock actuator. Then pull both rubber hoses off their nozzles at the diff-lock actuator.

2. Use an open 8mm wrench to remove the two long bolts at either end of the actuator. Mind that normally the heads of these bolts are on top and that the nuts on the lower side of the mounting bracket are normally welded to the bracket (so there's no sense in trying to use the wrench to remove the lower nuts, and on the other hand there's no need to use a second wrench to hold the lower nuts while turning the upper heads).

3. Remove both bolts entirely and then cautiously pull the actuator out of its bracket as far as it will go (it's push rod is still connected to the tranny).

4. You will now see the actuator shaft that comes out of the tranny as well as a drift pin through this shaft (going from approximately five o'clock to eleven o'clock). Carefully drive out this drift pin using some piece of metal suited for that purpose (a short piece of welding rod, a nail or, if you really insist on doing it correctly: a drift punch). Apply your drift-pin driving tool at the five o'clock position. Make sure not to loose that drift pin (you'll need it again later, of course :-)! Either have a second person hold it with needle nose pliers, or attach a short string to it using duct tape, or be otherwise creative, but don't loose that pin!

5. Now that pin is out, carefully pull off the diff-lock actuator altogether. Always handle this plastic box with uttermost care in order to not break the actuator rod.

6. If you've also got to remove the mounting bracket (for example to remove the starter, poor boy :-), remove the c-shaped circlip around the bushing for the actuator shaft inside the mounting bracket and then remove the two bolts attaching the mounting bracket to the tranny.

Re-install by undoing all the steps outlined above in the reverse order. However, mind a few things:

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1. That rectangular plate sits between the mounting bracket and the tranny.

2. First insert the drift pin at the five o'clock position and lightly hammer it in a bit, so it will hold by its own but will not yet obstruct the bore in the actuator shaft. Then insert the actuator rod of the diff-lock actuator into that bore and cautiously drive in the drift pin. Make sure neither end of the drift pin stands out.

3. After everything is installed again make sure to test the correct operation of the diff-lock. Either on soft ground, or -- preferably -- still on the lifting platform. To operate the diff-lock you need vacuum, and thus a running engine. To test the rear diff-lock, at least both rear wheels (both wheels of one side is another, though less preferable, possibility) must be off the ground. The wheels must be able to spin freely, thus no gear, no parking brake. Pull the diff-lock knob at the dash and then slowly turn one rear wheel until it locks (if the other rear wheel is also able to spin freely, it will turn in the opposite direction until locking occurs). It should take less than 60 degrees (a sixth of a full rotation) for the diff-lock to engage. Check that the green light symbolizing the rear differential is on and then push the knob in again. Slightly wiggle one of the rear wheels, and the diff lock should disengage, the rear wheels should again be able to rotate freely, the green light on the dash should go out.

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