

GMC Power Level Air Suspension Systems.

By: Rob Allen

Note: This article is specifically about the Power Level system used on GMC's until the mid '76 model year. The Electro Level and Electro Level 2 systems use a series of solenoid valves to do much of the same action as the rotary control valves. The EL 2 system uses two small air compressors and no air tank, rather than the larger tank on all other systems. I do not know the real problems of either of those systems, but many of the trouble shooting ideas here may help. In addition, some of the early Power Level systems had compressors and tanks in different locations, but I believe the operation and problems were similar.

The GMC coach has an interesting air suspension system for the rear wheels. It uses two air bags that, through a lever arm and bogie pin system acts as both a leveling and spring assembly. Although each part is rather simple, the total system can seem complex, and air leaks are common as well as sometimes hard to find.

The basic system.

There are 5 main parts of the basic air suspension system.

1. The air bags themselves which support the coach.
2. The leveling valves that automatically adjust the coach height.
3. The interior control valves that the driver may adjust to the positions of raise, lower, hold, or travel (auto).
4. The air compressor and tank system that automatically supplies the air for the three parts above.
5. The ¼" outside diameter nylon tubes and fittings that connect all of the parts.

In addition since the coaches are around 30 years old, previous owners may have made additions and modifications to the original system. Some of those modifications are good, some not so good.

Lets look at the 5 main parts of the original system and how they function individually and fit together as a total package. Later on in this article I will cover the common failure points, modifications, and upgrades for each of the 5 parts.

The Air Bags

There are two rubber and fabric air bags that support the coach. Each has two “cones” that move the forces to and from the rubber bag itself to the arms that transfer support to the wheels. The actual wheel loads are sent to the chassis via the bogie pins. The air bags are supplied with air pressure from the remainder of the system to do three things:

1. Maintain the correct chassis ride height when going down the road.
2. Transfer loads from one wheel to the other and act as a spring for both wheels.
3. Allow height adjustment when parked with a deviation of plus or minus 4 inches from normal ride height. This adjustment can be made independently on either side of the coach.

The air pressure that is from the original design is 120 psi maximum for full “raise” height, and is the maximum designed working pressure of the system. Normal operating bag pressure is lower at coach travel levels.

The Leveling Valves

The leveling valves are fixed in the wheel wells and connect to the suspension via an adjustable rod. As the chassis moves up and down, they add or vent air from the air bags to maintain correct travel ride height. They have a built in delay so they take a few seconds to respond to variations of wheel position. This keeps them from being too sensitive to bumps and minor road variations. They do not connect with air lines directly to the air bags, although located immediately adjacent to them. The connection between the air bags and the leveling valves is made at the interior control valves so that the air bags may be used as coach leveling devices when the rig is parked. The leveling valve is connected to the air bags only when in

motion, (Travel or Auto) although it does receive air from the air supply system at all times. This is an important fact to remember when looking for leaks in the system.

The Interior Control Valves

Understanding the function of the interior control valves is critical to many aspects of the air system in the GMC coach. Since there are two of them, you must think of them as “separate but equal”. They share the same air supply, but otherwise are independent from one another. Each valve has 3 connections to the system via ¼” nylon tubes: Air in, bag out, leveling valve in. Lets look at the 4 positions of each valve that the operator has control of, and what is happening in each position.

Hold:

In this position, the connection to the air bag is blocked off at the air control valve, and no air can flow into or out of the air bag. In “hold” the air bag should remain inflated for very long periods, and the coach should not settle. So, in the “hold” position, the only parts that can be a problem are the air bag, the tubing and fittings, and the rotary air control valve. If the coach remains “up” for at least 3 or 4 days these parts are not at fault, although the air control valve could be leaking in other ways.

Raise:

This position connects the air bag directly to the air tank. The coach will rise as high as possible given the maximum air pressure available. If you only want to raise the coach a bit on one side or the other, do it and return the control to hold. If the coach will not rise, and the compressor has been running, either the limits of the height adjustment have been reached, or the air compressor pressure is set too low. Always have the compressor running to raise the coach. Having the engine running is a good idea too, to keep the voltage to the compressor up to minimize strain on the compressor. The only other possible problem in raise would be an internal leak in the

control valve, bleeding off air so maximum pressure is not applied to the air bag.

Lower:

This position simply vents the air bag out at the control valve. You will hear a hissing sound under the dash of that air venting. Turn the valve to “hold” when the right height has been reached for your parked position.

Travel or Auto:

This position is the critical one. When set in travel the air from the compressor goes from the compressor to the air leveling valve in the wheel well, then up to the control valve on the dash, then back again to the air bag. The maximum amount of fittings, tubing, and all the valves are in play. As the ride height varies, the leveling valve either adds air to the bag from the compressor, or vents it out in the wheel well. But all of the air to and from the air bag and the air to and from the leveling valve must go through the dash control valve, either that being added or removed. To complicate things, remember that the wheel well air leveling valve gets the air supply directly from the compressor, not the dash valve. Any leaks anywhere will result in the compressor running often to supply air. Every part of the air suspension system is in operation in “Travel” so leak chasing is interesting.

The original rotary control that GMC supplied is not an engineering triumph. The revised one on later coaches is better, but still built to a price and it is serviceable, but not especially great. Many air suspension problems can be traced to the rotary control on the dash. Even if it is not leaking externally, it can have internal leaks that will drive you nuts to find why strange things are happening.

The Air Compressor and Tank system

The air compressor and air tank and associated controls are located under the drivers side hood in the vehicles with the Power Level systems. The original compressor was either a Brown single cylinder, or Dana twin cylinder 12 volt compressor. Most GMC's had

the Dana for their compressor. The air from the compressor goes directly through a check valve to the tank. Early systems may not have had a check valve, and rely on the internal valves in the compressor to hold tank pressure. At the tank a pressure switch, set to cut out at 120 psi, is wired through the ignition switch to operate the compressor. (On early rigs the pressure switch was at the compressor itself). The compressor can only operate with the key in run or acc positions. At the tank there generally (but not always) is a safety valve, and a low pressure warning switch wired to a light on the dash. In addition, there is a Schrader valve to add air manually, or to drain the tank of air and water. There were no pressure gauges on the original system so the actual pressure and leakage rates were hard to guess. Usually a pressure gauge has been added over the years since the coach has been built. If there was no check valve in the original system, often one has been added over the years. These often fail.

When the ignition switch is on, the compressor is free to run under the control of the pressure switch. The cut in pressure is generally 20 psi less than the cut out pressure, making the system a 100-120 psi source of air. The upper pressure is adjustable, but the lower pressure is a factory set differential pressure, and is not adjustable. Since the full "raise" position requires the entire 120 psi, it is necessary to have the compressor running near the maximum pressure while in the "raise" position. If the system is down to zero air pressure, and the air bags are deflated, it is a fairly long process to bring the coach up to ride height and fill the air tank for travel. Depending on the compressor and its condition, this can take up to 15 minutes, but that is the upper range of acceptability.

The ¼" Nylon Tubes and Fittings

Connecting all of the pieces and parts mentioned above are small nylon tubes and associated fittings. The tubes themselves are quite rugged and unless run too close to a heat source, or rubbing on something wears a hole in them, seem to be fairly bulletproof. The material is commonly available at most auto parts houses in case more is needed. The original GMC lines were color coded, which is nice for tracing which line does what. The service manual has the

color codes, but I have found that on my own coach at least one of the colors used was not the one shown in the manual. It is harder to get the colored tubes for replacement.

Air Bag Problems

There are some common air bag problems.

1. The cones that are at each end of the bags came in two varieties, aluminum and plastic. The plastic ones can fail without warning, and can cause personal damage and structural damage. Replace them if you have that type. The aluminum ones have ribs between the inner and outer part. Plastic ones do not have those ribs.
2. The nuts on the bags can rust and be hard to remove. Get new stainless steel ones from a GMC parts place and replace them prior to “on the road” problems. There is also an O ring in the assembly, and spares should be carried.
3. Some new air bags (up to 20%) leak. Test them in water prior to installation.
4. Air bags on GMC’s tend to “hot dog”, that is take a curve, which eventually will damage the bag and force you to replace it prior to the end of a normal life. Learn how to prevent this by rotating the bags every year or two. If you store your coach for long periods, and it is possible, let the pressure down so the coach squats to lessen this problem.

Interior Control Valve Problems

The original rotary control that GMC supplied was not an engineering triumph. The revised one on later coaches was designed better, but was still built to a price point and it is serviceable, but not especially great. The revised one is still available today. Many air suspension problems can be traced to the rotary control on the dash. Even if it is not leaking externally, it can have internal leaks which will drive you

nuts trying to figure out why strange things are happening. The early rotary controls were made from an aluminum casting that was not strong enough and would expand and deform under use. Once that happens, they either leak internally or externally and cannot be repaired. The later ones and the replacement ones still made today have a revised design (they do not look like an aluminum casting) and are better, and can generally be rebuilt. However, there is a set of new ones, complete with new fittings, available from JR Slaten. They are superior in all ways to the original. If both rotary valves are to be replaced, JR's cost about the same as the originals. See section 6 below, under leak chasing for more comments.

Air compressor and tank problems

As the system ages the original compressor generally becomes tired and may be unable to bring the air tank up to full pressure at all, or in any reasonable time. The check valve often sticks open due to rust or dirt, causing the air pressure to be held only by the air compressor valves themselves, and those compressor valves also commonly leak. I also have had a check valve stick closed, so the compressor could not add any air to the tank. That problem drove me nuts to find.

Over time, the original air tank may have developed rust inside, and then pinholes cause it to leak. The pressure switch may leak, as may the low pressure warning switch. Any added gauges may also leak internally, or the tubes connecting them to the system may leak. The overpressure pop off valve (if one has been added) can leak. Lots of potential leak points in the air supply system.

There was no air filter on the original system so any water or other contaminants that got through the compressor or introduced from the compressor were sent into the air tank, and then could cause problems at the various valves in the system.

In general, it is probably best to have the original compressor rebuilt or replaced, and many of the components around the tank usually need upgrading or replacement. New stainless steel tanks are also available from vendors who are listed on the GMC net sites. See resources below.

Air Tubing and Fitting Problems

Except for the earliest coaches, the original fittings were a plastic type that has long since become unavailable. The plastic gets brittle, or leaks when taken apart a couple of times, and cannot be repaired. Fortunately, most of the fittings are standard 1/8" or 1/4" NPT on the threaded end, and 1/4" OD compression on the nylon end. Brass replacements can be purchased fairly easily. However there are different qualities of brass fittings. Ones purchased at a truck supply house and rated for truck brake and air suspension service are best. Most of the compression fittings have to have a new ferule put on if they are removed, and a short section of nylon tube also must be cut off, shortening the tube each time anything is changed.

There are some "push on, pull off" fittings available that do not require cutting a section of tube off each time the fitting is opened. I am partial to those types, but they are not easy to come by and are fairly expensive.

The one fitting that is not easily available (if available at all) is the one that supplies the input air to the air leveling valves in the wheel well. I have not found a source for that fitting, and have been told that if it fails, you must purchase a new air leveling valve. I have seen some information on making your own replacements, but have not seen any source where they may be purchased. I recently have had a lead on a "do it yourself" source for making this connection, but have not yet had time to follow it up. (5/05)

Chasing Leaks

Perhaps the most frustrating part of GMC ownership is finding all of the leaks in the air suspension system. Many just give up and accept them, and let the compressor do the dirty work of replacing air when needed, be it a normal loss or a leak. But for others, leaks are a challenge to be overcome. The author falls into that category.

Lets start with a few basics:

The air tank on the GMC is quiet small, and a tiny leak will bring it down fairly quickly. My personal standard is that the system, in the Hold position, should not allow the coach to settle for a month or more. The tank pressure should not drop more than 10 psi a week. A lower drop is always better.

There are lots of places that air can seep out so slowly that it is hard to detect.

The original system is somewhat marginal in quality, that is some of the parts were not the greatest. Thirty years of aging does not help.

Soap solution spray is wonderful, but will not find everything. I understand that a product called Rector Leak (available at Home Depot) is better than homemade soap solution, but I have not used it yet. Some leaks are internal to the dash valve and cannot be detected directly. Some leaks are more seeps; they just don't blow bubbles, but cause pressure loss nonetheless.

With that said, here is my suggestion for a plan of attack to find a leak or many leaks (I had over 15 when I got my coach).

1. Run the compressor and put the rotary controls in the Travel (Auto) position. Go over all visible connections with a soap/water solution in a spray bottle. If the leaks are in original plastic fittings, replace them with new ones. It is probably a good idea just to replace all of the plastic fittings. If you have a leak on the plastic red line fitting (the air supply lines from the tank are red) going into the air leveling valve in the wheel well, cry a lot, tighten gently. It worked for me, so far. I am in hopes that someone will come up with a source for a fitting for that connection soon. (see above)
2. Try to get high quality fittings from a truck supply outfit, not Home Depot or Lowe's or the local hardware store. One of the GMC supply houses also can get you the good ones. I have had good luck with the "push on, push the collar and pull off" fittings. They allow me to remove nylon tubes without cutting the fitting off. I got

mine at NAPA, and truck supply places may also carry them. I have heard some reports of leaks from these fittings, but so far I have had no problems.

3. Use Teflon thread seal tape with caution. It is easy to get it over the end of the screw fittings and then pieces can lodge in the dash valves, leveling valves, or check valves and cause leaks. I use Teflon filled pipe dope paste for most connections. Home Depot or Lowe's carries these materials.
4. Once you have the "big bubble" leaks solved by using the steps above, it is time to get serious.
5. Pump the system up to normal level, and put the dash valves in hold position. Let the coach sit for a few hours (or days if needed) and see if the rig settles on one side or the other. Or both. If it does, first check the connections at the air bags or the connections at the dash valves for that side. If nothing shows up at either place, let the suspension down, and remove the nylon tube air fitting from the air bag and replace it with a Schrader type 1/4" fitting and pump the bag up to about 90 psi with an external compressor. Check for leaks with soapy water at the valve and let it sit. If it starts to settle over time, you may have to get a new air bag. They are hard to check on the coach for leaks, but if removed and submerged in water and inflated, you may see bubbles. If they are porous, they may just "foam" when sprayed with soap solution while still on the coach.
6. If you find nothing there at the air bag, put the original nylon line back on, and take the line from the air bag off of the rotary valve under the dash. Again, put a temporary Schrader valve on that line under the dash and inflate the bag to about 90 psi. Let it sit. If you have no deflation, you most likely had an internal leak in the rotary valve. (By disconnecting the line from the rotary valve, you removed it from being the possible leak point. As it is the last part in the air system when in Hold, it must be leaking internally).

If the rotary valve is an older one, made with an aluminum colored casting, it is toast. Those type warp and will never be successfully repaired. You might get lucky, but probably not. I only made mine

worse by attempting repairs. If it is a different color, it might be salvageable, but quite frankly, there are better solutions than repair or replacement with the original type valve. JR Slaten makes a valve set that is wonderful, and comes complete with a new aluminum panel and all the needed fittings for about the cost of two new rotary valves from a GMC source. It will absolutely solve your dash valve problems forever. And the frustration factor of “where is the leak” will be greatly reduced.

7. Ok, now you have the coach sitting tall for several days on “hold” but the air tank and compressor leak down. You have put an air gage on the tank and can see that pressure go down. My standards are 10 psi or less a week, you may be more liberal than that.

First, disconnect the red air line output line to the air suspension system and plug the opening in the tank with a ¼” pipe plug. Then remove the original check valve between the compressor and the tank (if there is one now) and toss it out. Period. Replace with a new stainless steel one or brass with stainless steel ball interior. Put a ¼” air filter and water separator between the compressor and the check valve. (Purchase these parts locally, or at one of the GMC supply sites).

Have nothing but the air compressor, air switch, low pressure switch, safety valve, check valve, filter and the gauge attached to the tank. Let the compressor run to bring the pressure up to 120 psi. Disconnect the air line between the compressor and the filter and let the new check valve do its job. Watch the air pressure gauge for a drop. If there is a drop, first check the open line to the compressor to see if it blows bubbles. If it does, the check valve is not working.

Soap all other taps to the tank, as well as the tank itself. Somewhere there will be a leak if the pressure drops. The tank itself may have a pinhole leak, as they rust internally. The compressor pressure switch or low air pressure switch may leak. You can quietly remove and toss out the low pressure warning switch, it doesn't really tell you anything important. Plug that opening.

The safety valve may be hard to check for leaks, just get a new one. A 150 psi rating will be about right. The compressor pressure switch occasionally will develop a leak, again, get a new one if in doubt. Remember, the system is about 30 years old, if the pressure switch has not failed yet, it may soon.

You will find the leak (or several) this way, I guarantee it. Look until you can have the tank hold pressure with only a 10 pound drop a week. Only then can you know that the compressor and tank are not the source of your leaks.

Check valves need a pressure difference from one side to the other to work properly. Occasionally, the internal valves in the compressor itself are so good that they allow the new check valve to loaf, and not close completely. But the compressor valves virtually always leak a bit, and the pressure slowly drops back through the compressor. That is why I suggest you remove the line from the compressor itself and check for leaks back through the new check valve. By the way, the air filter should be between the compressor and the check valve, not between the check valve and the tank. That keeps junk out of the check valve. Also, with that routing, if the filter leaks a little, it will not be a problem because it is prior to the check valve.

On my own coach, this test process was still a failure, and it drove me nuts. Then I finally realized that the previous owner had put a rubber, air pressure rated, hose between the tank and a visible gauge under the hood. When I disconnected that hose, the pressure held. The hose simply seeped air out, and although no bubbles showed up with soap solution, the pressure dropped about 25 PSI a day. I replaced that hose with a nylon tube and finally got the tank to hold pressure.

8. Now you know that you have good air bags and lines to the valves, and a good compressor and tank assembly. The only thing that is left is the leveling valve circuit from the tank to the leveling valve and on to the dash valve. Put the red air line back on the tank, and run the compressor until it shuts off in the "travel" or "auto" position. Then place the rotary valve in "hold". Watch the air pressure gauge for the next few hours or days. If it holds now, you are done. But if it drops, you have more work to do.

The air supply line goes, via T fittings, both to the rotary valves and the leveling valves in the wheel wells. Plug both the red supply lines to the rotary valves and the rotary valve air input holes.

If you still have a leak when the rotary valve air system supply is disconnected and plugged, the leveling valves or tubes are a problem. If air slowly leaks through those leveling valves, plug the output (at the rotary valve) to one side at a time to find out which one is leaking. This will test both the leveling valve and the nylon tubes and fittings from the air tank through to the rotary valves. However, remember that the coach must be in normal ride position prior to starting this test so the leveling valves are neither trying to add or remove air from the air bags. This test will not work if the air bags are low.

If you have plastic fittings on the leveling valves, don't disconnect the input [red] side, if it does not leak, as those fittings are not available and should be disturbed as little as possible.

This test will allow you to find if one or the other leveling valves has a leak, if the coach was level when placed in "hold". If so, it may be time for a new one, although I understand that they may be rebuilt by a real expert. (See resources at the end of the article). The leveling valves are expensive, so test carefully. Make sure it is not the air supply lines themselves that are leaking.

9. If the leveling valves check out, the rotary valve in the dash is likely leaking internally and venting the air out through the "lower" vent so slowly you cannot hear it or even soap bubble it. Again, replace those darn rotary valves with new ones or better ones. The original ones were marginal at very best.

In my case, I had leaks in the air fittings to the passenger side air bag, one of the leveling valve inputs, two air gauge leaks, one leaking tube to an air gauge, several leaking fittings, a leaky Schrader valve, a bad check valve, a bad overpressure valve, no air filter, a weak compressor and bad rotary control valves. So, I had most every leak imaginable. The compressor ran every 20 miles.

Remember that if you forget to put the coach in “hold” when parked, you will lose air pressure due to simply moving around inside as the automatic leveling system tries to work when parked. But once you level manually, and place in “hold” the coach should stay OK for days.

Common Modifications to the Original Air System

Some things that have been done to make the original air system better.

1. Add an air pressure gage under the hood. I like a second one on the dash.
2. The original air tank had a Schrader valve for adding external air, but it is difficult to use. Add a way of putting air from an external compressor to the system (prior to the air filter and check valve) so you don't have to run the 12 volt compressor to check for leaks, or when doing around home maintenance. I put a quick disconnect on that line and can use it for connecting a second 12 volt compressor, or the external shop compressed air.
3. Add a relay so the compressor gets full voltage from the battery rather than going through the coach dash electrical system. The original dash wiring then only carries power for the relay, not the 15 to 25 amps the compressor needs.
4. Add a new filter and check valve between the compressor and the tank.
5. Rebuild the original Dana compressor, or replace it with a newer style compressor. In my case I added a second compressor in parallel with the original, so I have redundancy. I can switch from one to the other.
6. Replace the old rotary controls with new ones, or improved ones.
7. Add air cutoff valves to the air bags. I am not convinced that this is needed once the rotary valves are replaced, but many owners

like the idea of being able to shut the air bag off (like on “hold”) at the bag rather than the dash, and also to be able to fill it manually at the bag. The down side is mainly that the brass fittings that are usually used at the air bag have a tendency to crack, making a field repair necessary, a problem that the modification created in trying to solve another perceived design problem. A tradeoff in my view. Many others differ with that.

The GMC air system is interesting, and can be made to work well if you understand each of the parts, and how they fit together. The service manual will help in understanding the original system, if you study it carefully. There are many web sites that will give you more detailed information on specific parts of the system. And if all else fails, let it leak, and go camping!

Resources:

Web site for links, phone numbers, and email for sources listed below:

www.bdub.net/GMCSupplierLinks.html

Note: This list is far from inclusive. I do not wish to slight or recommend anyone by leaving them out, or including them.

1. Almost any original GMC part you want is available from Cinnabar. They also have “Upgrade kits” for the air fittings, overpressure valve, check valves, and air filter. Not inexpensive, but can save you some time looking for the right items. Original rotary valves and leveling valves are available here too.

The other GMC supply houses such as Cooperative Motor Works will generally have the same items available.

2. Local truck supply and auto supply parts houses will probably have or can order fittings, nylon tube, air gauges, filters etc. They may even be able to supply ¼” stainless steel check valves. Costs are highly variable, but you don’t have to wait or they can get parts overnight. You do need to know specifically what it is you want, and

a good counter person who will spend some time with you looking in catalogs. You will not find rotary valves, or new air tanks here. The correct Leveling valves may also be tough or impossible to find.

4. The best new replacement for the original stile rotary valves is from JR Slaten. See web resources above for his contact information.
5. Stainless Steel replacement air tanks from Jim DeMaere. See web resources for his contact information.
6. Leveling valve repair: Dave Lenzi. See web resources above for his contact information.
7. Dana compressor repair or rebuild is available but I do not have the site. Ask on the GMC net. Replacement compressors are also available, and again the most current information is available by asking on the GMC net.

All of the above is based on my own personal experience and help from others with similar problems. If you have any questions or disagreements let me know at profmail@camasnet.com

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