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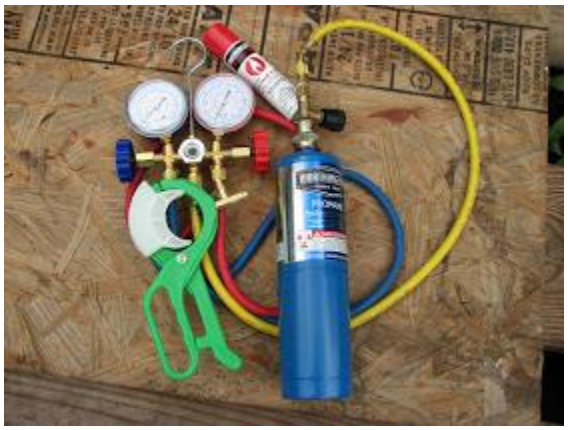
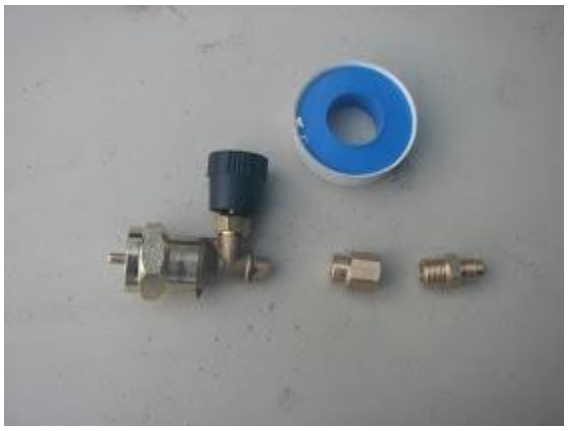
Saving it here just in case his site goes down.

Propane Refrigerant for Automotive Air Conditioning





I have posted in the past (here and here) about automotive air conditioning. This post is not redundant, though. It is intended to be a more comprehensive description of how it is possible to resurrect a nonfunctional car air conditioner. Possible, but not necessarily legal. I know that the use of hydrocarbon refrigerants such as propane, isobutane and commercially available blends thereof is outlawed in some US states, and direct replacement of R12 with such refrigerants is illegal throughout the US. I also believe that mixing refrigerants directly in the AC system (as opposed to mixing in a separate container) is illegal in the US. If you are in Canada, you may be subject to much less-restrictive law. Either way, you are responsible for knowing what you can and cannot legally do. This information is therefore not a recommendation, but educational only.

Lots of us frugal types drive a vehicle old enough to have left the factory with an R12 based air conditioning system. As you may remember, sometime around 1994 the governments of the US and most other countries banned further production of R12 Freon refrigerant. R134 replaced R12 in new cars in the US and most of the world, and automotive repair shops did big business converting existing cars to R134a when they needed service. In fact, we owners of R12-based systems were told that R134a was the only way to go, other than paying increasingly high prices for dwindling R12 supplies.

The big problem was that cheap R134a conversions often resulted in major air conditioning system failure in short order, necessitating a complete system rebuild. The only sure way to avoid this, we were (and still are) told, was to rebuild most of the system to begin with. This included replacement of all hoses with the new barrier hoses because R134a, with its much smaller molecule size as compared to R12, leaked out much faster than R12 did. Some people didn't convert, though. I was one of those.

I and others like me heard the horror stories of failures and huge repair bills resulting from simple 134a conversions, and balked at paying a thousand bucks to do it "right." So we paid 900% more for R12 when we could afford it, not to mention paying shop labor charges because another new law required certification and licensing to even purchase R12. When that charge of R12 leaked out, if we didn't have $300 to have it recharged again we fell back on "4-60 air conditioning" (four windows down, 60 mph). A few people even drove their cars to Mexico whenever the AC quit working, to get a cheap R12 recharge where it was still unrestricted. About this time, I started hearing stories of some people simply recharging their AC with propane.

At first glance it seemed like a really bad idea, and a lot of people get bent out of shape if anyone even alludes to it in their presence. Just do a search on some automotive forums and you will see what I mean. But in some countries such as Japan and Germany, hydrocarbon refrigerants have been and are used extensively with few to no problems. In fact, although I haven't verified it, I have heard references to BMW using HC refrigerants in some markets after the R12 ban. Straight propane works pretty well as a refrigerant, and being lighter than CFCs, it takes less than half (closer to a third) the amount by weight that the same system would use of R12 or 134.

This helps a bit with the safety concerns when you consider that the typical car AC only needs one pound or less of propane for a complete charge. The problem is that EPA expressly forbids the use of any unapproved refrigerant, including propane, as a direct replacement for R12. They do however have a list of refrigerants that are approved as a replacement for R12. Among these are Freeze-12, R406a, Free Zone, Ikon 12, SP34E, Autofrost, and a few others in addition to R134a. To the best of my understanding, once a former R12 system is converted to one of these approved refrigerants, later conversion to propane or other hydrocarbon refrigerant no longer constitutes a conversion from R12.

Therein is the gray zone that allows the sale of prepackaged hydrocarbon refrigerants such as HC-12a: EPA doesn't specifically ban it (as of yet, as far as I have been able to ascertain); only its use to directly replace R12. The bottom line is that as far as I can tell, it is not necessary to go for a complete system rebuild (as with R134a) to convert from R12.
Just do the far simpler and cheaper conversion to an approved refrigerant that is actually designed and approved to directly replace R12, such as the well-known Freeze-12. Contrary to popular belief, it is not hydrocarbon-based. In fact, it is mostly R134a, but has some other stuff added to make it live with the mineral oil in R12 systems.
The point is, it is cheaper than R12; and if it leaks out too quickly for your liking or you simply want to use something cheaper, you will no longer be replacing R12. You did that last time, when you switched to Freeze-12 (or R406a, or whatever).
By the way, a search of eBay will turn up sellers who list refrigerants that they claim are fully compatible drop-in replacements for R12, R134a, R22 and just about anything else, with no changes necessary. These products are propane/isobutane blends just like you can make at home.

A couple of examples are Enviro-safe and Super Freeze. Both of these are marketed as direct replacements for R12. If you go to the manufacturer's website, you might find a cryptic reference to "first generation" and "second generation" R12 replacements. That is just their way of referencing the EPA law without coming right out and telling you that using their product as a direct replacement for R12 is illegal.
I personally have no problem with either those manufacturers and sellers, or DIY’rs who do convert directly to non-approved refrigerants. More power to them if they get away with it. In my opinion, that is one of many stupid laws anyway, that unnecessarily hinder individuals and small businesses in order to profit the government and the big corporations that are in bed with the government. But I do believe in covering my own assets, and helping others do the same. Therefore, convert to an approved replacement before you even seriously consider using an unapproved refrigerant.

Now, more about those HC refrigerants. As mentioned, some people did and do use straight propane. There are a couple of things to consider about using propane.

First, it is best to steer clear of the bulk tanks, like the 20-pounder that powers your grill or the appliances in your RV. That stuff just has too much moisture in it. A better plan is to use the disposable bottles like you buy for torches, lanterns and camp stoves. At 14.1 to 16 ounces, they are also just about the right size for a full fill.

Second, be aware that propane will run at higher pressure (on the high side) than R12, although lower than R134a. That is ok and lots of folks accept that, but the prepackaged HC refrigerants like HC12a, Duracool 12a, OZ 12, etcetera add isobutane to the mix. The isobutane lowers the head pressure to the same as R12, and the resultant mix is actually more efficient (cools better and with less horsepower input) than R12, and substantially more than R134a.

The ideal mixture is 79% propane and 21% isobutane. This is the mix that the above-mentioned HC refrigerants all use, and is what the EPA calls "Hydrocarbon Blend B." The thing is, you can buy it for about $10 per can and use an R134a charge hose, but you will have to buy it online and pay shipping. But what some other people do, and what I am about to describe here, is mix it at home.
Before I go on, just let me say that this mix is fully compatible with R12 and R134a, so if there is any residual refrigerant of either type in your system, it won't wreck your system. In fact, some people have illegally topped off existing systems with propane, with no ill effects noted. But don't do that. You are supposed to evacuate and capture the existing charge of whatever might be in there before recharging with anything. It also makes the measurements easier, although those measurements are in no way critical. Here is what you need, should you be planning to try this:

1. A low-side fill hose with gauge. I bought a cheap, $22 manifold gauge set and am amazed at the quality for the price. I have included a link to the same set, below. You will also need an adapter to fit from the low-side hose to the R134a connectors you had to retrofit when you converted from R12, if your vehicle originally used R12.
2. A way to connect the disposable propane tank to the charge line. I read accounts of people buying a brass propane torch head, hacksawing off part of the tube, drilling out regulator valves, and threading the tube to accept the threads on the hose. I have a much better and easier way to do it, which I will detail a bit later.
3. A can side tapper. This is for the isobutane.
4. Two, 1.48-ounce cans of Ronson Multi-Fill Ultra Butane Fuel. I got these at Walmart. Make sure the ingredient is listed as "Isobutane, CAS #75-28-5." I read all kinds of stuff about searching for backpacking stove gas that contains a certain percentage of isobutane to propane, avoiding the ones that have butane instead of isobutane, etc. But then I found this, which is cheaper ($2.47 a can), more readily available, and is pure isobutane.
5. One, 14.1-ounce cylinder of propane. I already had one, but two or three bucks should get you a new one.
6. A vacuum pump. You can build your own, or buy one.

Here is how I made my propane tank adapter:

Harbor Freight sells a propane torch kit that has a hose between the actual torch and the tank attachment point. It is perfect because it has the valve, which attaches directly to a standard disposable propane tank, and is threaded to accept the hose.

It was not dirt cheap, but when you are not using it for air conditioner service you can still use it as a torch. I just unscrewed the valve, took it to my local home-improvement store and bought the fitting I needed to adapt it to the one-quarter inch flare fitting that is on the fill hose of my gauge set .

Now, what I did after having the remaining Freeze-12 evacuated from my system by a friend who has a license, was to simply refill with propane. Straight propane does run higher head pressures than the refrigerant that the system was designed for, but according the information I found there is no problem as long as you monitor the low-side pressure as you fill the system, and do not allow it to exceed 60 psi when the compressor is running. Here is how I did it:

1. Connect the fill hose to my propane valve (from the torch kit). Before I did this, I made sure the valve was closed. I also made sure both valves on the gauge set were closed.
2. Tighten the fittings on the gauge set, then open the propane valve. Crack open the low-side valve on the gauge set just long enough to purge the air, but not long enough to release propane. Re-close tightly.
3. Connect the low-side hose to the low-side port of the system.
4. Start the engine, lower the windows, and switch on the air conditioner to its maximum-cold setting. Yes, I know that the compressor will not cycle. Bear with me.
5. Set the throttle at a fast idle by whatever means available. If necessary, utilize a helper for this part. Allow the engine to run for five minutes or so, then:
6. Locate the sight glass (usually near or on the accumulator) and clean it with a shop rag. Hold the propane tank upside down and slowly open the low-side valve of the gauge set. If the gauge set has a sight glass (mine does), watch it and adjust the valve so that some liquid is passing the sight glass, but do not allow it to become fully liquid.
7. When the system reaches its minimum pressure threshold, the compressor will begin cycling. The gauge will fluctuate between high pressure (when the compressor is not running) and lower pressure (when it is running). The low pressure is the important reading. The compressor will initially cycle on and off rapidly, and will run for longer and longer periods as the system fills.
8. When the pressure reaches 28 psi, start also watching the sight glass (of the system, not the gauge set. I have been keeping an eye on the gauge set sight glass continuously, to monitor the propane flow.). Unlike charging with the original refrigerant, the sight glass should never become fully clear. If it does, the system is overfilled.
9. Occasionally stop, reach into the passenger compartment and feel the output of the vents. It should be getting colder.
10. When the line between the evaporator and accumulator is cold, the sight glass shows liquid with bubbles in it and the output of the vents is cold, stop filling and close the low-side and propane valves. The low-side pressure should be at least 28 psi, but less than 60 psi. At this point I remove the gauge set, close the hood and start enjoying my air conditioning.

If I decide I want to have even more efficient air conditioning and lower head pressures, the propane/isobutane mixture works better. Since it is illegal to mix the two components directly in the system, I have to do it into a separate container. An empty 16-ounce propane tank works well for this. This requires a second propane valve. The procedure is as follows:

1. Connect the propane valve to the empty tank. Connect the vacuum pump to the valve. Pull a vacuum on the tank, then close the valve and disconnect the vacuum pump.
2. Connect the can tapper to the fill hose. Connect the fill hose to the propane valve.
3. Place a 1.48 oz. can of isobutane (Ronson Multi-Fill Ultra Butane Fuel) in the can side tapper. I had to use a small wood block as a spacer to make it work. Squeeze the handles to puncture the can, and hold them closed while opening the propane valve and allowing the contents to empty into the propane tank. Close the propane valve. Remove the empty isobutane can and repeat the procedure with the second can.
4. Remove the can tapper and replace it with the second propane valve. Attach a fresh, full 14.1 oz. propane tank to the second valve.
5. Open both valves and hold the full 14.1 oz. tank upside down above the 16 oz. tank until all of the propane drains into the 16 oz. tank.
6. Use the 16 oz. tank of propane/isobutane mixture to charge the air conditioning system, in the same manner as described for straight propane.

If you decide (on your own responsibility by the way; not mine) to make your own mixture, make absolutely sure that your can of lighter fuel specifies "Isobutane, CAS # 75-28-5" as the ingredient. Regular butane will not work, and might destroy your air conditioning compressor. This is because regular butane is still a liquid at the pressures found in an air conditioning system.

COMMENTS

1. Tracy:

   fantastic blog.

   I hesitate to comment here, because I don't want to repel other potential readership.
   (I seem to have that effect on blogs...) Keep up the good work.

   Reply

2. 

   TracySeptember 11, 2012 at 2:02 PM

Thanks, IDU. Your comments are always welcome. They haven't killed the blog yet!

Reply

3. **Anonymous**May 27, 2013 at 12:42 PM

   My son was talking to me about this a few years ago. He approached a Canadian outfit that sells this Propane coolant and they seemed very interested in getting my son to market the stuff in TX. He declined, but seems like a very affordable and much more efficient coolant. Too bad you have to slink around and do this quietly to avoid Big Brother coming down on you as he protects Big Corps profit making.

   Reply

4. **Anonymous**August 6, 2013 at 3:59 PM

   "Bernzomatic 5.5 oz. Butane Refill" is also 100% isobutane. http://www.homedepot.com/p/Bernzomatic-5-5-oz-Butane-Refill-329853/202185023

   Reply

   Replies

   1. **triangles**July 6, 2016 at 10:33 AM

      According to the MSDS on the Benzomatic butane it is 78% Isobutane CAS 75-28-5 and 22% butane CAS 106-97-8

      Reply

5. 

   TracyAugust 9, 2013 at 10:37 PM

   Thanks! That's good to know.

   Reply

6. **Fringeless**April 13, 2015 at 8:36 PM

   A few questions. Were you using this blend to replace 134a or 12? I understand that the ideal ratio (according to publications) to replace 12, with simliar operating parameters is a mixture of .60/.40 propane(r290)/isobutane(r600a) by liquid volume. For the lay person, this equates to an approximate mixture of .71/.29 of (r290/r600a) by liquid weight. If my calculations are correct, your

formula of 14.1oz(r290) to 2(1.48)=2.96oz(r600a) by liq. weight should yeild a ratio of .83(r290):.17(r600a). Instead of the 71:29 ratio that you mention. I suspect that 14.1x.21=2.96 is close to the 2 cans of iso. But a 71:29 ratio should look more like 11.14oz of propane(r290) to 2.96oz (two cans) of isobutane(r600a).
This would yield a more exact mixture. Please correct me if I am wrong.

Reply

Replies

1. 

TracyApril 13, 2015 at 10:07 PM

You are correct.
I was using this mixture to replace 134a, but in a system that was originally designed to operate with R12.

2.

Bill Carpenter Sr June 30, 2016 at 12:34 AM

You can purchase enviro-safe by the case, 12 cans for $4.25 per can, no shipping cost on eBay. Just received mine today it!s my second case.

3.

Bill Carpenter Sr June 30, 2016 at 12:40 AM

Update. Those cans of enviro-safe are 6 ounce cans equal to 16 ounces of 134a.

Reply

7.

FringelessApril 16, 2015 at 3:22 PM

I got that whole thing wrong, it is supposed to be 60/40 by weight, so 7.04 oz of propane to 2.96 oz of butane.

Reply

8.

Dave McMullen June 15, 2015 at 3:18 PM

I used to deliver propane in Montana, and studied it a little. LPG is usually a mixture of Butane and propane, and other Liquid Petroleum gases, blended for the area where they are sold and expected to be used. Pure propane has a "sea

level boiling temperature" of lower than 50 degrees below zero F. Butane "sea level boiling temperature" is closer to 28 degrees F. (Just below freezing). In Montana LPG is nearly pure propane (with some 'stinky' oils added). In AZ. (where I live now), it is more nearly Butane. In both cases with other gases mixed in. I have not tried to mix the gases myself, or to use the small torch bottles as refrigerant, but I have (here in AZ.) used LPG (the mix that is available in this area) as a r3efrigerant in an older care that I had. It worked fine, but I quit using it, because the system had a medium slow leak. A charge of LPG would work just fine for about three weeks, and then run out, but meanwhile the odor was not pleasant

Reply

9.

MikeApril 6, 2016 at 6:06 PM

I vacuumed to -30hg and then charged my system to about 45 psi with propane and it did not work, the compressor would not kick on. I replaced the dryer, rebuilt the compressor, replaced the expansion valve and tried it again with no luck. I would get the same pressure on the high and low sides. I then vacuumed the system back down to -30hg and charged with 134a and it is ice cold. Any ideas on what I did wrong? Could it be because I have the expansion valve and not an orifice tube?

Reply

Replies

1. 

TracyApril 6, 2016 at 10:30 PM

Was the engine running and the A/C switched on high while you were adding the propane? If not, you might have overcharged it. Also, what is your source of propane? I only use the 14 oz or 1 lb canisters.

Reply

10.

BenMarch 28, 2017 at 10:37 AM

I have a '87 F150 that I plan to convert over. I think it has been converted to R134 because the fittings are correct, but there is no pressure in the system.

I can't find a sight glass on the system so how will I know when it's full?

Another post said once it stops cycling at high idle it's good. Would that method work?

I am anticipating the system to leak so I'll to a quick charge, bubble test, and then a full fill once it's fixed.

Reply

Replies

1. 

TracyMarch 28, 2017 at 12:09 PM

I would pull a quick vacuum on it first, then fill until cycling slows. It will begin cycling on and off quickly, then begin staying on longer. At that point it is full or very nearly so. Be careful not to fill much beyond that, because it reaches a point where it stops cooling.

2.

BenMarch 28, 2017 at 2:51 PM

I was thinking of flushing the system with propane since I don't have a vacuum pump. Would that get enough potential moisture out?

Do I need oil with Propane? Should I flush and then add some?

3. 

TracyMarch 28, 2017 at 3:56 PM

Yes, you still need oil with propane. Moisture is not the only reason to vacuum it. It has air in it now, and when you start adding propane it will at some point reach the explosive air/fuel mix. If you don't have a vacuum pump, one of the chain auto parts stores would probably vacuum it for you and maybe even check if it has oil.
BTW, my sources indicate that either type of oil will work. Just don't mix types.

Reply

11.

EvanpnzJune 15, 2017 at 7:16 PM

Vacuum pumps for as low as $60 at Harbor Freight Tools. I bought an old industrial/lab one years ago on eBay, and built a tube frame for it from old lawnmower handles.

Reply

Replies

1. 

TracyJune 16, 2017 at 3:38 AM

You can also build your own vacuum pump from the compressor out of a discarded refrigerator or window air conditioner.

Reply

12. 

CH Restore December 15, 2017 at 8:42 PM

I aim to re-gas the R12 system in my 80 Series Land cruiser using propane. The original gas leaked out over time and I have since used the opportunity to remove the evaporator and clean all of the build-up of dust from the fins that was blocking most of the air flow. I will need to pressurize the system and find any leaks, then vacuum the system. I assume some of the original oil will have leaked out and some will be removed during vacuuming. How much oil should I add before recharging with propane?

Reply