Ferrari 328 A/C System Inspection, Leak Detection, Compressor Seal Replacement, & Recharge

Carl Rose
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The 328 uses a conventional expansion valve (non-accumulator) air conditioning system originally equipped with R-12 (Freon) refrigerant. Circuit consists of:

Compressor with magnetic clutch ⇨ (discharge) line to condenser ⇨ condenser ⇨ line to filter-dryer ⇨ filter-dryer with low-pressure switch ⇨ line to expansion valve ⇨ expansion valve ⇨ evaporator core (with blower motor & ducting) ⇨ return (suction) line to compressor

[Electrical aspects of the system comprise: thermostat & blower motor switches, relays, & resistor, magnetic clutch engagement power lead, condenser cooling fan, and low-pressure compressor shut-off circuit]

Compressor is located near firewall on top of passenger side of engine (York 206 for US version, Sankyo 507 for non-US), suction/discharge lines run along right sill, condenser & dryer are just ahead of right front wheel (visible opening hood), expansion valve is covered with gooey black insulation adjacent to brake master cylinder under fiberglass cowl cover, and evaporator core/blower is buried in underdash ducting. Condenser has small dedicated cooling fan. A low-pressure switch on the filter-dryer disengages the compressor clutch when system pressures fall below a preset point.

My 1988.5's A/C system began blowing warm air about 11 months after R-12 recharge during 30K service, prompting this article. Entire 328 series is identical, 308s are slightly different but principles similar.

A few thoughts:

- This job is involved & requires patience, but even purchasing all the specialized tools will be significantly less expensive than having work performed by dealer or A/C shop. And said tools can be used on other vehicles.
- Always a good idea to replace the filter-dryer once the system is opened, especially if >10 years old (desiccant material has been known to break down & circulate, clogging the expansion valve).
- If you can isolate the compressor as faulty component options are repair (economical but unknown duration) or replacement (with new or

remanufactured). Replacing the compressor front shaft seal is certainly economical but given difficulty of access had I known a perfectly matching compressor was available would have simply replaced.

- Replacing the Schrader valves is also a good idea; do not have exact NAPA cross-reference but suspect they are #209578 (standard) or #409914 (metric with neoprene seal for R-134a).
- If you are looking for parts at NAPA look in both the passenger car & "Farm and truck" A/C parts catalogs. Expect the expansion valve is also a standard version.
- Replacement of the A/C belt requires removal of compressor lower bracket and "dropping down" of compressor unit; technically this is functionally similar to complete removal of compressor thus unless belt recently replaced this is a very opportune time.

Authorities vary on recommendations regarding continuing to use R-12 versus converting to R-134a/HCFC blends, proper oil evacuation/flushing of system during conversions, etc. This article will not address these issues – refer to excellent Internet resource site www.aircondition.com (current as of 11/2003). I chose DuraCool HCFC blend as it is available without a license, is relatively inexpensive ($5/can), does not require flushing of R-12 systems (uses mineral oil), and as I wasn't certain my system was perfectly sealed did not want to spend a fortune on R-12 only to have subsequently leak out. Major drawbacks include: 1. illegal for sale in 18 states, 2. potential flammability as partially composed of propane, and 3. most refrigerant parts warranties specifically prohibit use of HCFC blends. A/C shops may also refuse to discharge system into recyclers. Reference website is www.duracool.com. I understand a license to purchase R-12 in bulk can be obtained online for about $20 (www.epatest.com).

Time required:

Compressor removal – 2-3 hours
Clutch removal and front shaft seal replacement – 30 minutes.
[with discharge, leak testing, and recharge – plan for an entire day]

Special Tools required:

- A/C gauge set with 3 hoses (specific to R-12 or R-134a, depending on refrigerant currently in car; Mastercool, Robinair, Snap-On are quality brands)
- A/C vacuum pump (purchased mine a few years ago at pawn shop for $100)
- Refrigerant (as above) with can tap to install. DuraCool runs about $5/can, R-134a $4.50/can, R-12 last I checked was about $30/can (with license)
- Fluorescent dye A/C leak kit (Mastercool #53585 illustrated) $70. Small LED light on flexible stalk worked very well for inspecting tight engine bay

- 17mm combination wrench with reversible ratcheting end (I had to purchase separately from Sears for about $20 - not currently offered in any sets, but well worth it)
- Compressor clutch puller also would be useful; can typically borrow (with deposit) from local Autozone store.
- Krikit (Gates 150) belt tension gauge [Gates part #91107/7401-0071] $10 at Carquest.

Mastercool UV dye kit:

Gates Krikit belt tension gauge:

Standard Tools:

- ¼" & 3/8" metric short & deep sockets 10, 13, 14, 17mm, 7/8" with short/long extension bars & universal joint
- Large combination wrench or good adjustable wrench for compressor fittings
- Philips screwdriver
- Torque wrench
- Telescoping magnetic pickup (for items dropped into inaccessible spots)
- Large strap wrench or aforementioned compressor clutch puller.
- Wheel lug bolt socket (Snap-On 7/8" aluminum-lined #AS 281 pictured).
- Combination wrenches 10, 11, 13, 17, 19mm (2), small 10mm ignition wrench especially suited for removing compressor-to-cambelt cover ground bolt. Metric flare wrenches optimal for fittings.
- Jack & stands, wheel blocks

[Be smart - always wear goggles or glasses when working on/under car and with refrigerants.]

Parts:

- Filter-dryer Ferrari #129101/114730 $110-150 for canister + $60 for switch. Replacement w/low-pressure switch Four Seasons #208625

(matches to 1980-86 Saab 900 8-valve engine); purchased locally at Carquest for $63. Both OEM and replacement are identical & manufactured by Parker.

- York replacement compressor listed as 209/210 type #278108 (new)/#258108 (remanufactured) with proper suction/discharge port orientation and Rotoloc fittings; #278108 is $330, #258108 is $179. If you elect to replace the compressor will also need two 3/8 x 16TPI x 2in bolts to mount lower bracket (OEM compressor is specially threaded to accept metric fine-thread bolts for lower bracket, new compressor is standard coarse thread).
- York 206 front compressor seal kit from NAPA # 207243 $18.33 or CCI #488-25274.
- York compressor gasket kit (all gaskets except front seal – includes Teflon o-ringgs) #207120 $16.90
- Teflon compressor port Rotoloc o-rings (2) NAPA # 207165 $1.30/each.
- O-rings (specific for air conditioning applications) for any opened connections. Interestingly, all fittings were standard – not metric- sizes & threads; I purchased GM blue assortment kit 21-24657B ($7.52) from ACKits.com to ensure I had any & all required.
- Nylog O-ring sealant $5.50 from ACkits.com.
- Compressor oil (appropriate type for selected refrigerant: R-12/blend or R-134a) approx $5 per quart also from ACkits.com.
- Schrader valve cores for compressor fittings (most recommend replacing at every major service; I did not as mine were only 12 months old). Will need installation tool (Craftsman tire valve removal tool works perfectly).
- Plastic cap for compressor ports x2 (typically accompany new compressor).
- Blue Loctite (removable via hand-tools, not the forever type).
- M10 x1mm (fine) thread nuts x2 to remove compressor studs. If you need to replace any nyloc nuts my local hardware store had all the correct metric sizes, albeit silver nuts with white or blue (not yellow) nylon rings.

Original Schrader valve cores & removal tool:

References:

Printed
Haynes heating & air conditioning manual #1480
308/328 factory technical specifications manual

Internet
www.ccicompressor.com
www.napaonline.com
www.ackits.com
www.aircondition.com

Parts sources:
NAPA
Carquest
www.ackits.com
www.oem-performance-parts.com (cross-reference to Saab 80-86 8v filter-dryer)
www.4s.com (Four Seasons A/C products website)
Parker A/C Manufacturing (662) 728-3141 or www.parker.com

Simplistic Approach toLeak Testing

Most common reason for poor A/C performance is lack of refrigerant, either due to actual leak or slow loss over time. Clues to system charge are sight glass window (located on top of filter-dryer; clear if completely discharged, bubbly if partially charged, and oily if desiccant breaking down) and (with car off) briefly depressing high-side Schrader valve to see if system pressurized (realize venting refrigerant into atmosphere is technically illegal). If system appears completely discharged, next step is to verify integrity by evacuating system. Connect the gauge set with engine cold (challenging but possible with intake ducting and airbox in place) by reaching under the airbox to remove both black plastic schraeder valve caps. Connect the high-pressure hose to the upper (discharge) fitting and low-pressure hose to the lower (suction) fitting; if your system has been converted to R-134a hoses will snap onto adaptor fittings. I always put a drop of oil on each hose fitting gasket to enhance sealing. Connect the third hose to the vacuum pump, open both sides, and pull vacuum down to at least –25psi; if cannot accomplish this with vacuum pump in good working order you have a large leak somewhere & may actually be able to hear hissing (if so, proceed directly to specific component/hose repair). Unless extremely loose, fittings typically will not cause this magnitude of leakage. Close gauges, note reading, and wait 30 minutes. If vacuum remains unchanged, no leak is present & system can be recharged (or you can replace filter-dryer, re-test, then recharge). However should the pressure slowly return (increase to atmospheric), a leak is present somewhere in the system.

Finding this leak can be a challenge. Options include very sensitive electronic “sniffers” or my preference UV dye (much better than the old thick red dye) [some shops also pressurize with nitrogen or compressed air to 200-300psi and listen for leak]. System must be partially charged for dye or sniffer to work. Pull vacuum then close gauge set. Connect refrigerant to center hose and purge air from hose (open can then crack hose connector at gauges slightly until refrigerant comes out). Open both sides and allow pressures to equalize. Close off both sides and route hoses away from hot or rotating engine parts. Start car & allow to warm. Rotate A/C blower to high and thermostat to max cool. Open low-pressure side and add in remainder of refrigerant can to partially pressurize system – discharge pressures will typically be in 50psi range. Don’t be surprised if compressor clutch doesn’t engage until you add a bit of refrigerant – signifies low-pressure cutoff switch at filter-dryer is working properly. Turn car off, remove gauge set and connect UV dye cylinder with hose (purge dye hose per instructions) to suction fitting. Add in UV dye per instructions and remove connector hose; if adding to discharged system in vacuum I found easier to add about 5ml directly to hose connected to suction side (my hoses have inline shut-off valves), re-connect to gauge set, then push in with refrigerant charge. Wear gloves to prevent your hands from glowing. Restart car & run with A/C on for about 15 minutes. Shut off and start tracing lines & components with UV light and yellow goggles. Really

quite impressive how well this highlights, especially at night. Expect a slight amount of dye leakage from filling around suction input hose fitting.

If no obvious massive leak, proceed systematically from front of car. Look through the lower front spoiler grill to inspect the condenser (able to maneuver small UV light stalk through opening). Check over filter-dryer, along hoses, and all hose connections & crimpings. Remove the cowl covering (7-8 Philips screws around perimeter) to check around expansion valve. The evaporator core is not really very accessible but possibly able to remove blower resistor (in ducting above accelerator pedal) and be creative with inspection mirror. Some also recommend running car and checking if fluorescent dye leaks out of evaporator drain hose. The refrigerant lines run inside the frame rail along the passenger side & thus unless previous overcharge/rupture or accident typically well-protected from damage. Check lines attaching to compressor in engine compartment (need to remove airbox & ducting for thorough inspection). Compressor front seal is buried under magnetic clutch but UV dye around clutch or spray pattern on compressor body suggestive of failure. A problem I encountered was cleaning off dye after leak found – wipe it off immediately otherwise very stubborn to remove once dry. Scrubbing with isopropyl alcohol worked reasonably well.

My car had a loud hissing sound in engine compartment when pulling initial vacuum but I could not localize. Partially charged with UV dye and then obviously leaking around magnetic clutch from front compressor seal (impossible to see once clutch installed).

If you are unable to connect A/C gauges with airbox in place the steps for removal are:

First, block front wheels & loosen right rear while car is still on ground. I use an aluminum-lined socket and plastic freezer baggie to avoid damaging the lug bolt:

Jack the right rear up and support with stand/blocks under frame box tubing. Make certain car is very secure – not only are you going to be working underneath, but may want to run the car in neutral while supported.

Remove wheel. Inner fiberglass well liner is held on with 7 screws – 3 hex, 4 Phillips. Maneuver liner out by rotating forward and clearing fender lip:

Compressor is now visible. Remove the airbox top cover 5mm hex screws and set aside. Remove the airbox lower section (held to CIS airflow unit with large hose clamp accessed from below fender with ¼" socket on universal; fortunately mine was only snug & I was able to wiggle off) and two hoses below:


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The “s-shaped” fiberglass intake duct is held in place by one small bolt in wheel well and two 8mm hex screws in engine compartment below decklid support strut:


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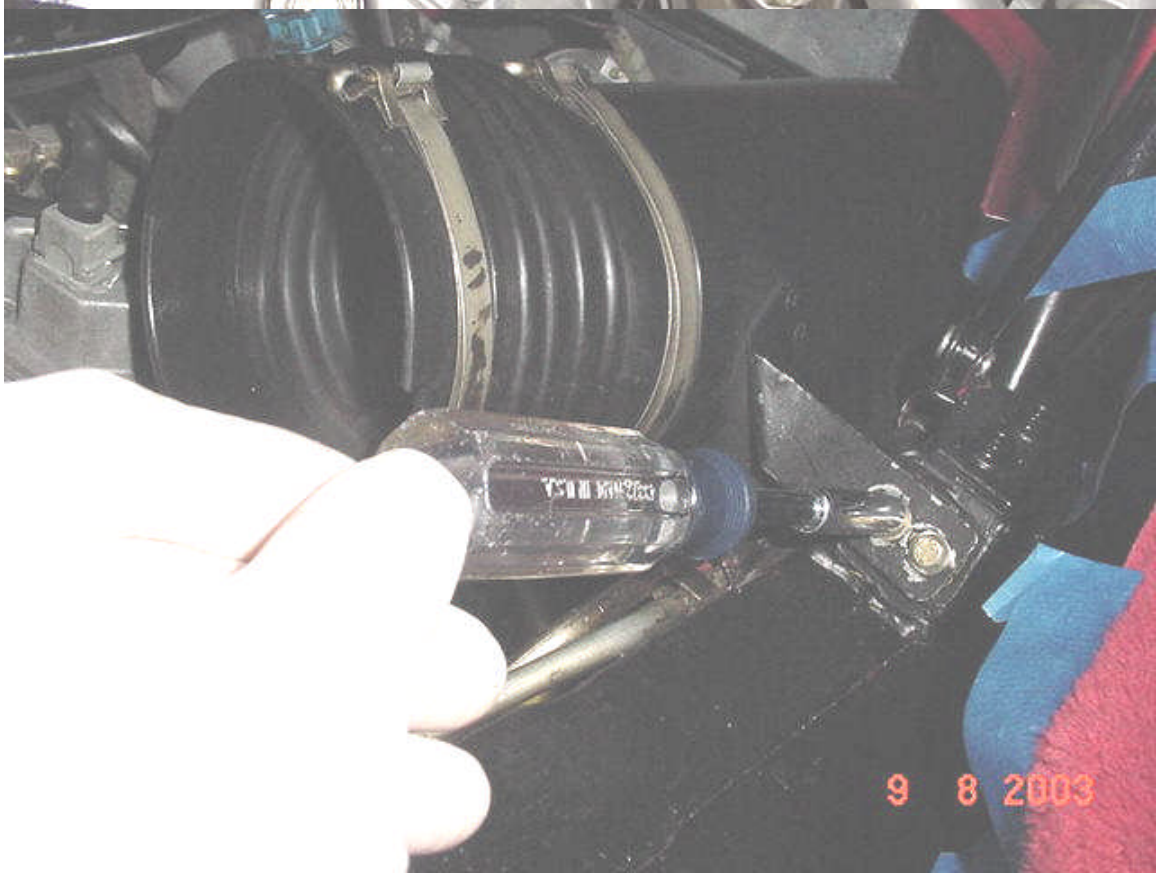
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Remove and maneuver out of engine compartment.

Now both high and low sides are accessible to connect gauge set. If you choose to add refrigerant/UV dye and need to start car ensure gearbox is in neutral & temporarily replace airbox with air filter.

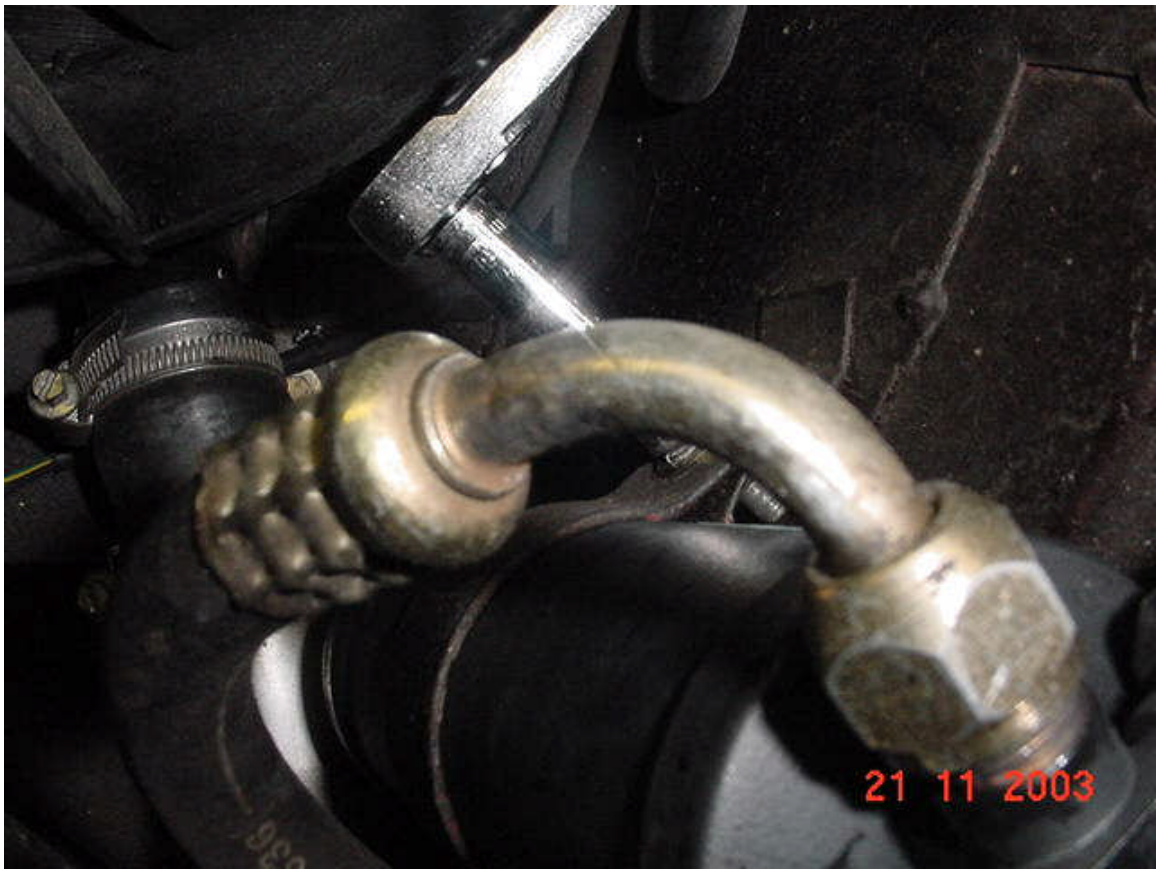
Replacing Filter-Dryer

Once you have confirmed system integrity I recommend changing filter-dryer. Alternatively, if you do find a leak, repair that component and change filter-dryer then recheck system integrity. Access to this section of the system is not terribly difficult. Open front hood and filter-dryer with pressure switch is visible in the right front with condenser below. Remove the perimeter screws and lift off the fiberglass cowl cover. Hoses run along the right fenderwell from the filter-dryer to the expansion valve and from the evaporator core returning to the compressor. Unfortunately no auxiliary service fittings are provided. The expansion valve-to-evaporator connection is covered in gooey black insulation. Evaporator core is buried under the middle aspect of the dash.

Considered good preventive maintenance to replace the filter dryer anytime the system is opened for service. With age some units have also been known to discharge their desiccant contents into the system and clog the downstream expansion valve/components.

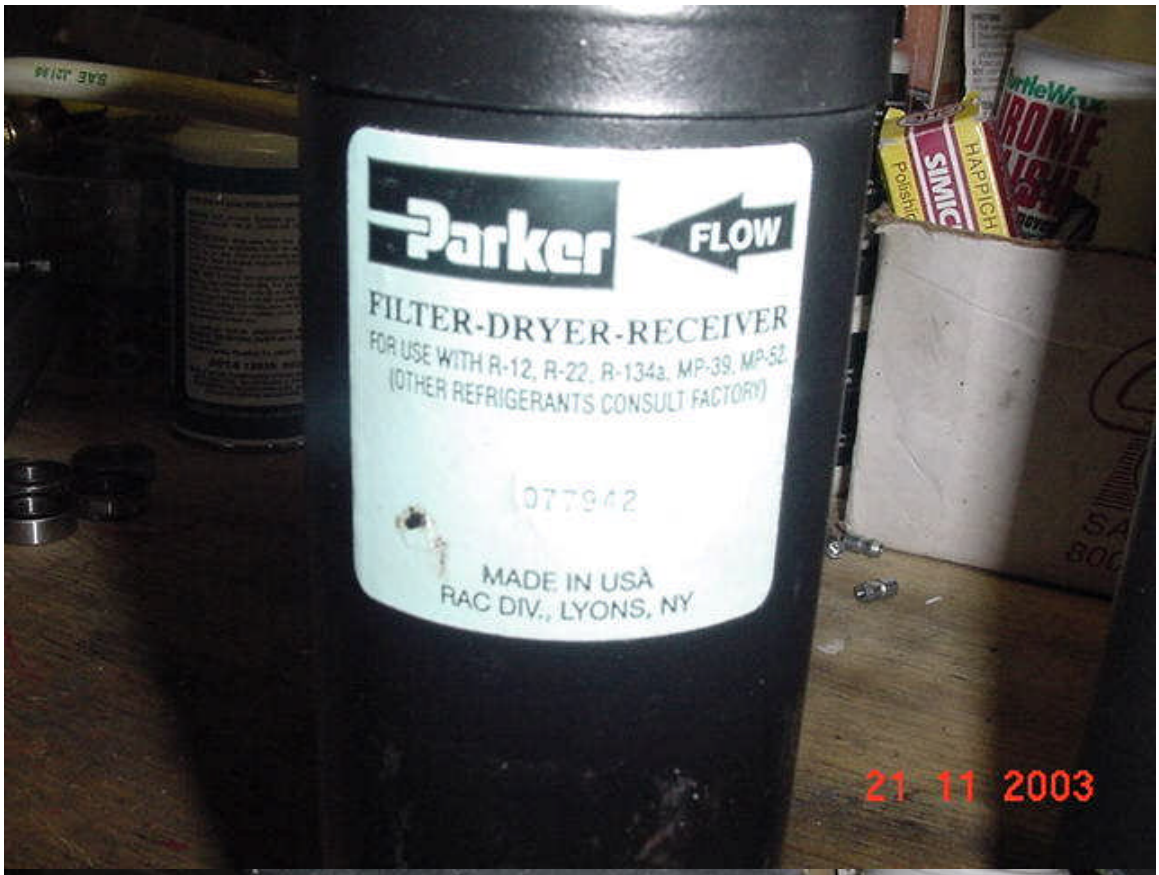
To remove, first confirm system is depressurized. Hold both fitting & top square part of filter-dryer and slowly loosen (normal RH threads):

Note the o-ring on either hose – remove & cover both lines to prevent dirt in system. Disconnect the pressure switch wiring harness. Small 10mm bolt holds circumferential cylinder clamp in place:



Remove and cap both input/discharge fittings on filter-dryer to prevent oil leaking out. The OEM unit on my car is a Parker #077942 that cross-references to Four Seasons #208625 available complete with canister & sensor from Carquest for $63/NAPA $58. Catalogs list as fitting 80-86 Saab with 8v engine; I have found online listings for $31. OEM (left) and replacement (right) filter-dryers:

Close-up photos of Parker labels: OEM first then replacement:


Parker
FLOW
FILTER-DRYER-RECEIVER
FOR USE WITH R-12, R-22, R-134a, MP-39, MP-52
(OTHER REFRIGERANTS CONSULT FACTORY)
077942
MADE IN USA
RAC DIV., LYONS, NY
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Parker
FLOW
110013
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(OTHER REFRIGERANTS CONSULT FACTORY)
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SAWYER, MI
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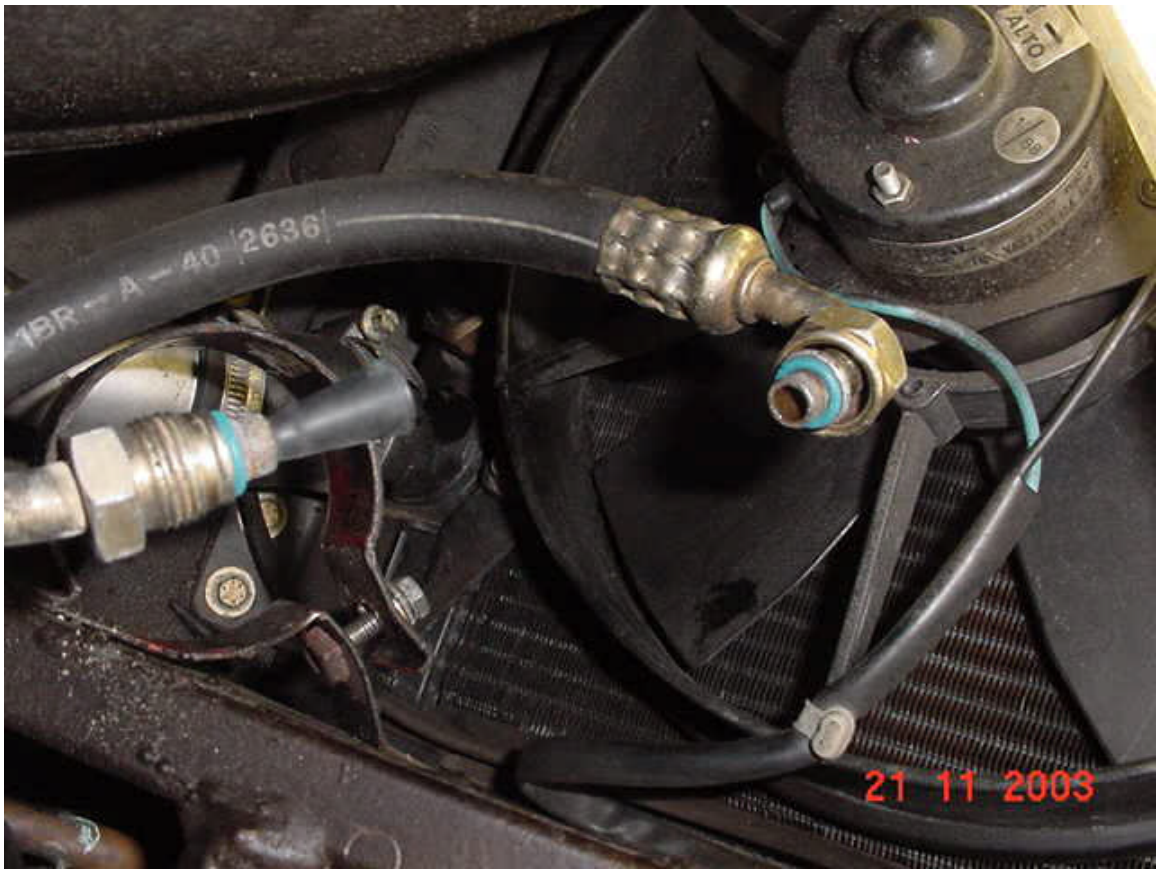
Remember to add 1oz of oil to the system (525 viscosity for R-12/HCFC blends or PAG for R-134a) when replacing. Can add either directly to new filter-dryer or into either line:

Fit new o-rings to each connection (blue GM #12):



I used Nylog sealant on both O-rings:

Lower new filter-dryer into circumferential clamp. “Seat” both lines to snug then install & tighten 10mm clamp bolt. Tighten both fittings securely now using 17 & 19mm wrenches, holding rectangular ridge on top of body of filter-dryer to prevent twisting. Re-connect low-pressure switch leads (connections are not specific, one lead to each terminal).

Removing Compressor

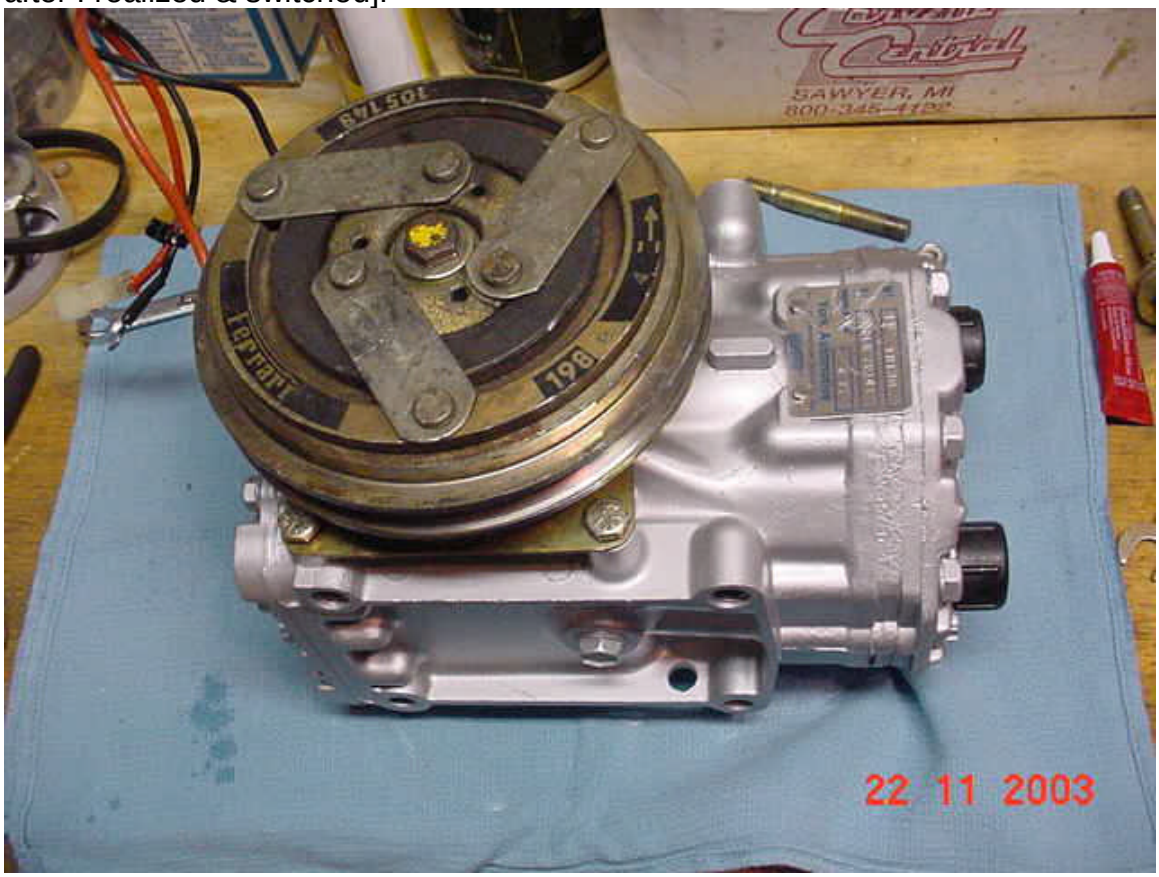
This is the most difficult aspect of the job. Remove wheel, fender well liner, airbox & ducting as described above. Depressurize system. Remove both fittings from compressor and cap open lines & compressor to prevent oil leakage. If you plan to replace the A/C belt, will need to remove both alternator & water pump belts [see my article on accessory belts for removing alternator belt; water pump belt requires loosening pivoting tensioner & removing]. Loosen the A/C belt tensioner – top nut is 17mm and bottom 13mm, both with washers underneath – and set tensioner aside. Lower compressor bract has a lower 17mm nut easy to access but compressor lower bracket mounting bolt obstructs upper. I was able to use a 17mm socket on 3/8”universal with extension to loosen then used box end of ratcheting combination wrench from above to remove. Removing ascending coolant pipe hose clamp to allow slight movement may help but is not necessary. Compressor mounting bolts are 17mm; do not need to remove inner

prior to bracket removal. Take care not to lose the large flat washers that fit between the gray bushings and the compressor. Maneuver bracket out.

Disconnect the magnetic clutch power lead. A small 10mm grounding bolt facing directly backwards at the top of the cambelt cover is best accessed with a small combination wrench (don't drop into engine compartment). Compressor is then held in with three 17mm nuts; I removed closest to firewall first followed by other two [17mm ratcheting combination wrench excellent for tight workspace]. Support the compressor from underneath then remove nuts. As the compressor drops down be careful not to lose large washers or "c-shaped" shims (one per stud). Remove all washers/bushings until top three studs exposed. I was unable to extricate the compressor from the engine compartment with these in place so using double-nut technique removed in-situ (not very tight). Rotate so magnetic clutch facing gas tank then lift & turn to maneuver out.

Compressor Front Seal Replacement

Set the compressor/clutch assembly on the workbench. Clean any major deposits of road debris. Note orientation of the magnetic clutch leads – ground wire attaches to top right magnetic coil bolt (with flat as opposed to star lock washer) and leads towards body of compressor [leads should run towards right in picture – I initially installed incorrectly but for some reason forgot to photograph after I realized & switched]:



Metal ID tag on compressor reads:

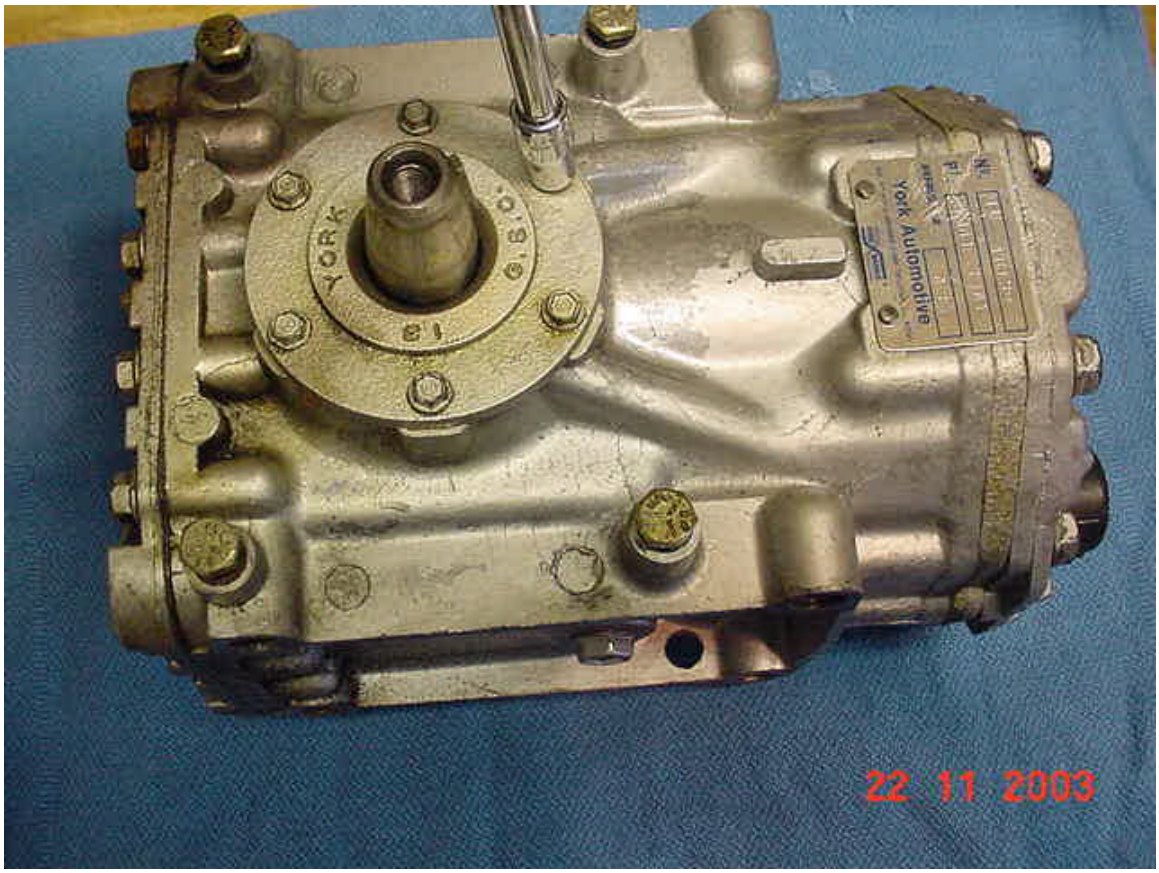
No 18130
Pt 206R 20141
Refrig 4 87

Main pulley nut (note yellow torque marking in photo) is 14mm; special tools to hold the clutch while loosening exist, but I ran power to the clutch leads from a battery tender to engage pulley.

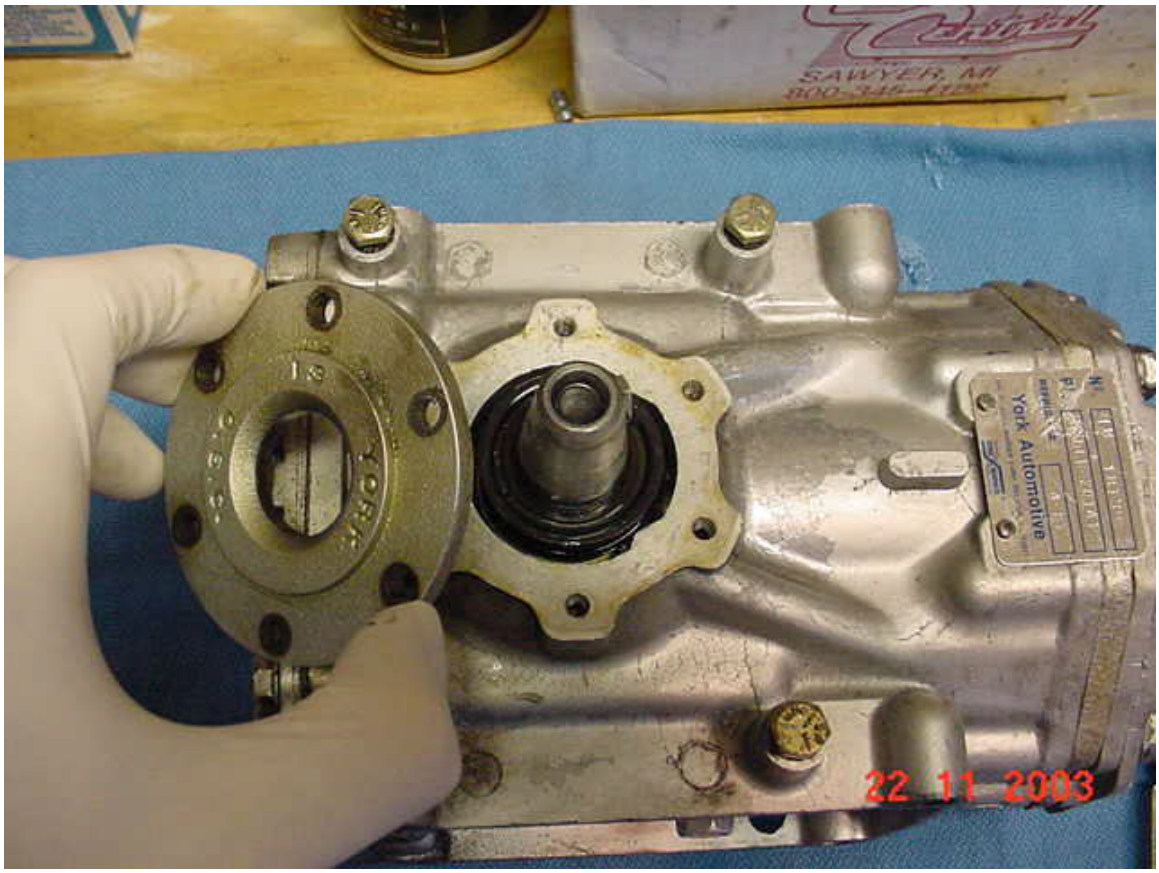
I then put a large elastic strap wrench around pulley and was able to loosen bolt (not very tight, perhaps 15 ft-lbs?). Unscrew almost to point of removal – I then turned compressor over and tapped around pulley with rubber mallet until clutch came loose – leaving bolt in place prevents from falling. If you have access to a clutch puller tool this job would be greatly simplified; the York uses a pliable rubber-esque seal but tapping on other compressors with ceramic seals potentially could fracture. Magnetic coil mount removes with four 11mm bolts.

Clean & set magnetic clutch components aside. Clutch appears to be proprietary part (stamped “Ferrari “) but unless magnetic aspect fails only working part is a bearing held in with snap rings that should be replaceable (could only discern “8148” marking on seal surface). Mine spun smoothly so did not disassemble further.

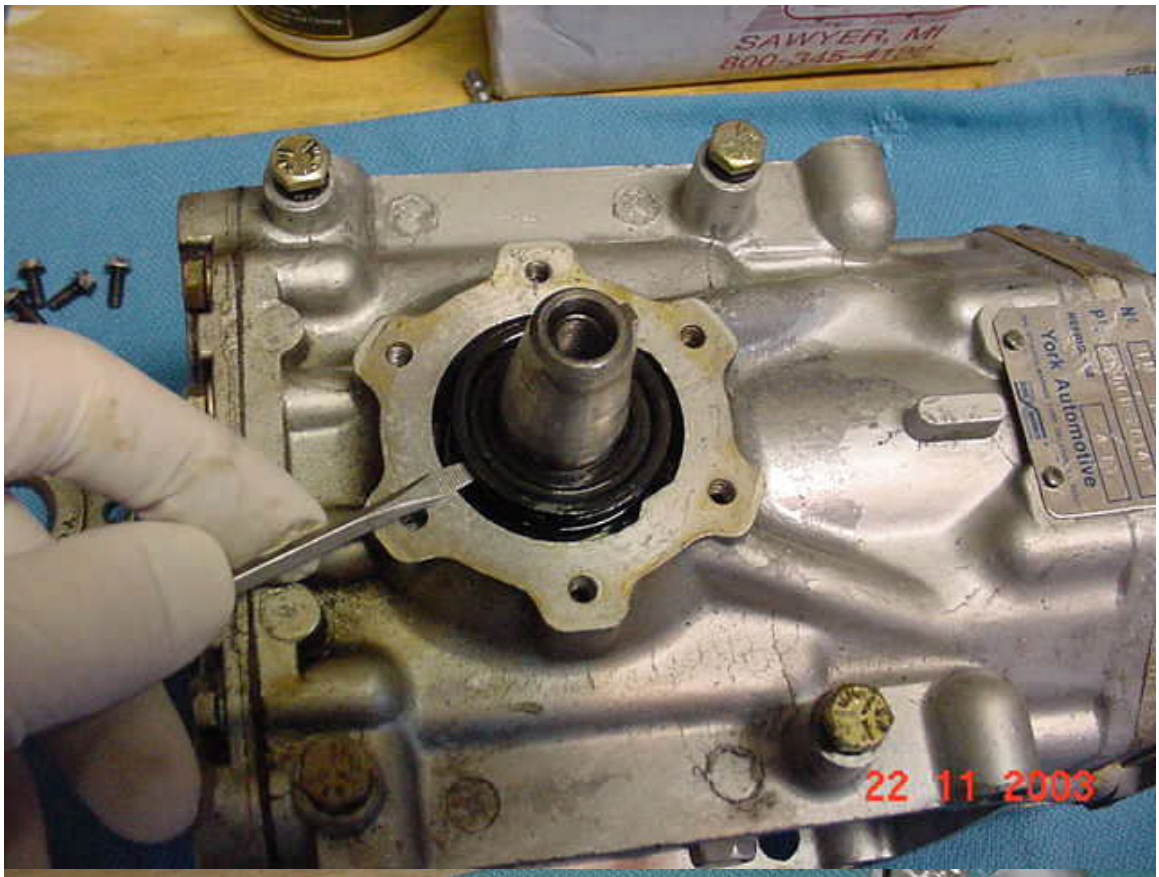
Compressor front seal was leaking. This is a York type 206 RH discharge compressor requiring seal kit for “6-bolt ¼” front plate” – NAPA part # 207243 or CCI # 488-25274. CCI kit is OEM with bolts & centering tool, NAPA kit has a few spare parts without bolts and unfortunately does not include instructions, so I installed new seal in manner old seal was removed (purchase CCI if you can find/order; both run about $15-20). Front seal is spring-loaded, so apply gentle pressure with 7/8 deep socket [not illustrated] and loosen six perimeter ¼” bolts:



Neither these bolts nor the clutch hub bolt penetrate the compressor cavity so thread sealant is not required. Remove the circular front plate & note the large o-ring seal on back:



Next, carefully pry the seal components off the main shaft without scratching the shaft sealing surface: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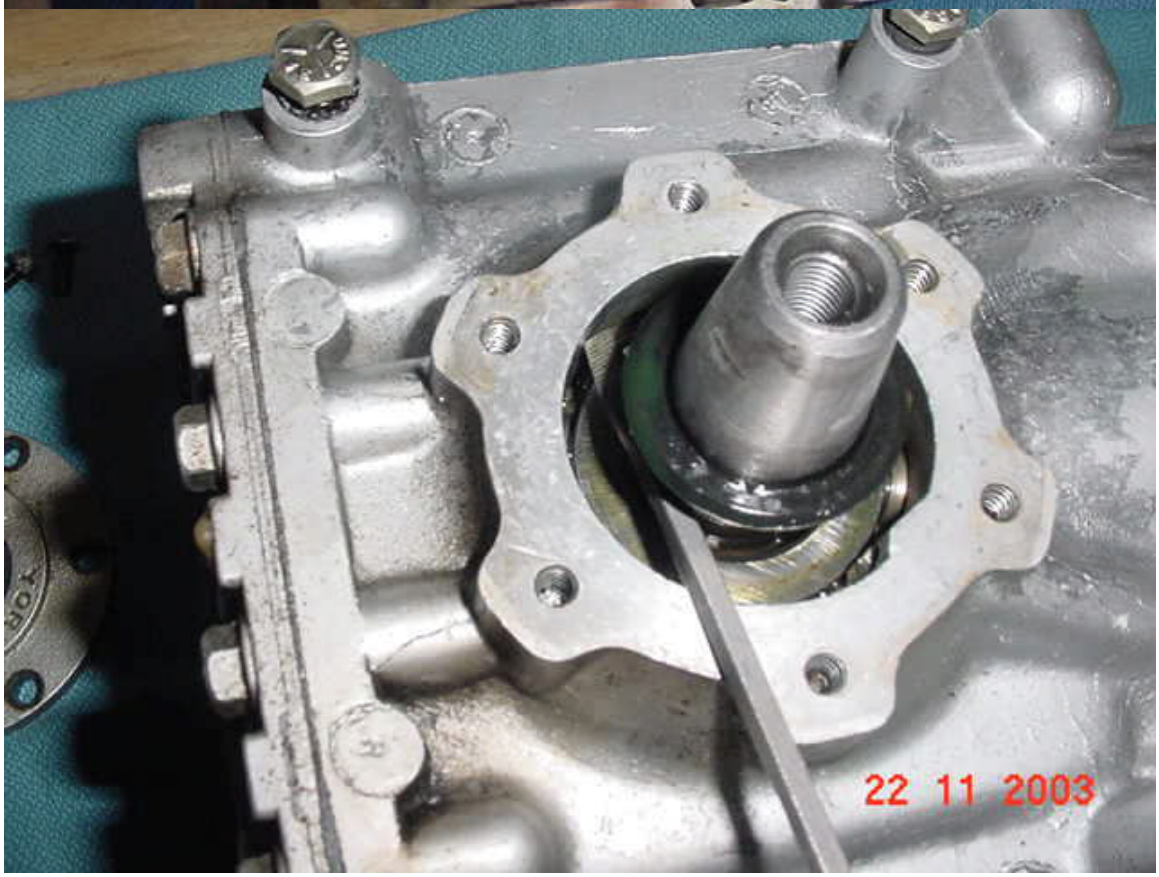
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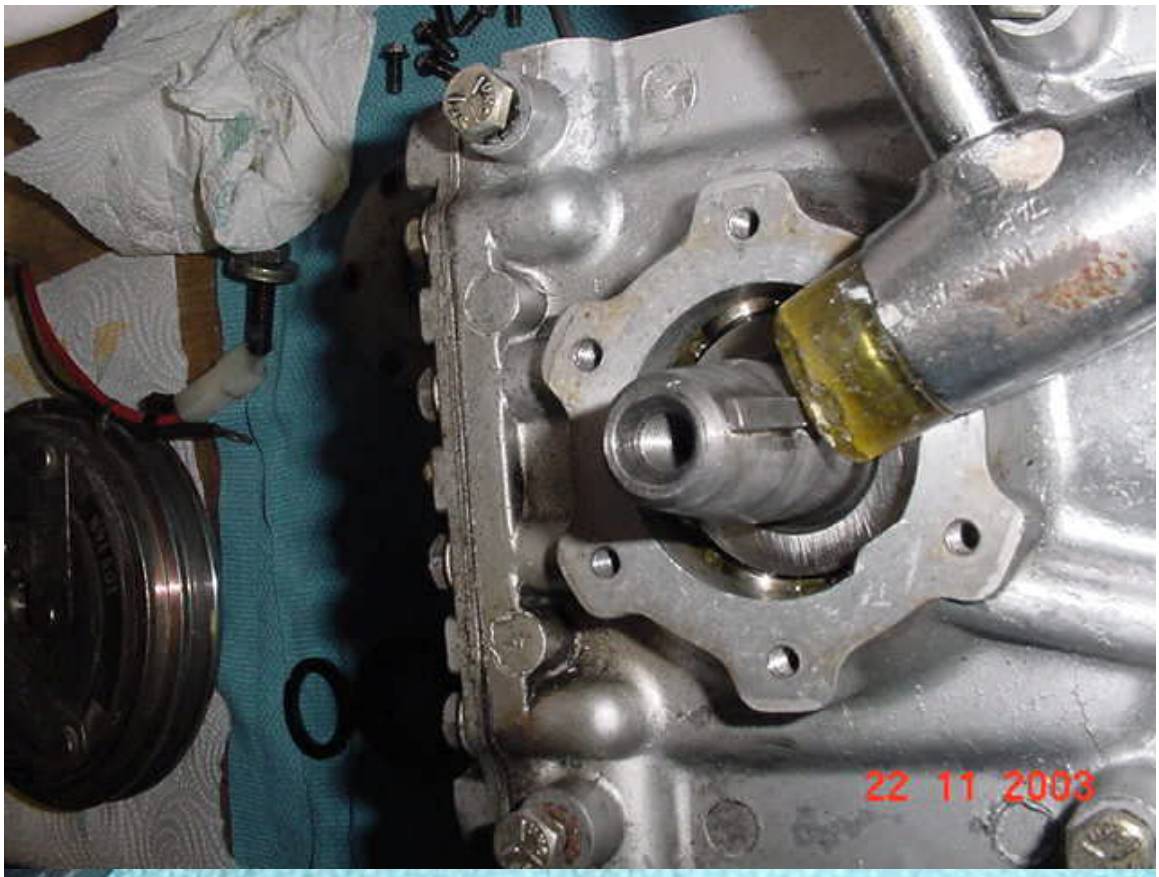
My old seal came off in three pieces: a carbon washer, spring-assembly, and lower “hat-shaped” seal with encompassing thin metal ring:

Clean the front plate sealing surface – endeavor not to let debris enter the compressor front bearing. I then turned the compressor over and briefly polished the shaft with 600-grit sandpaper (holding upside down prevents any filings from falling into front bearing).

Remove the woodruff key by tapping gently with hammer until front end tilts upwards: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Liberally wipe down the shaft with refrigerant oil (either 525v mineral oil or PAG depending on what type of refrigerant you're going to use). The kit seal was two pieces – carbon (black) washer fits on top with small "step" on face upwards and edges fit into "tangs" on spring-loaded seal:

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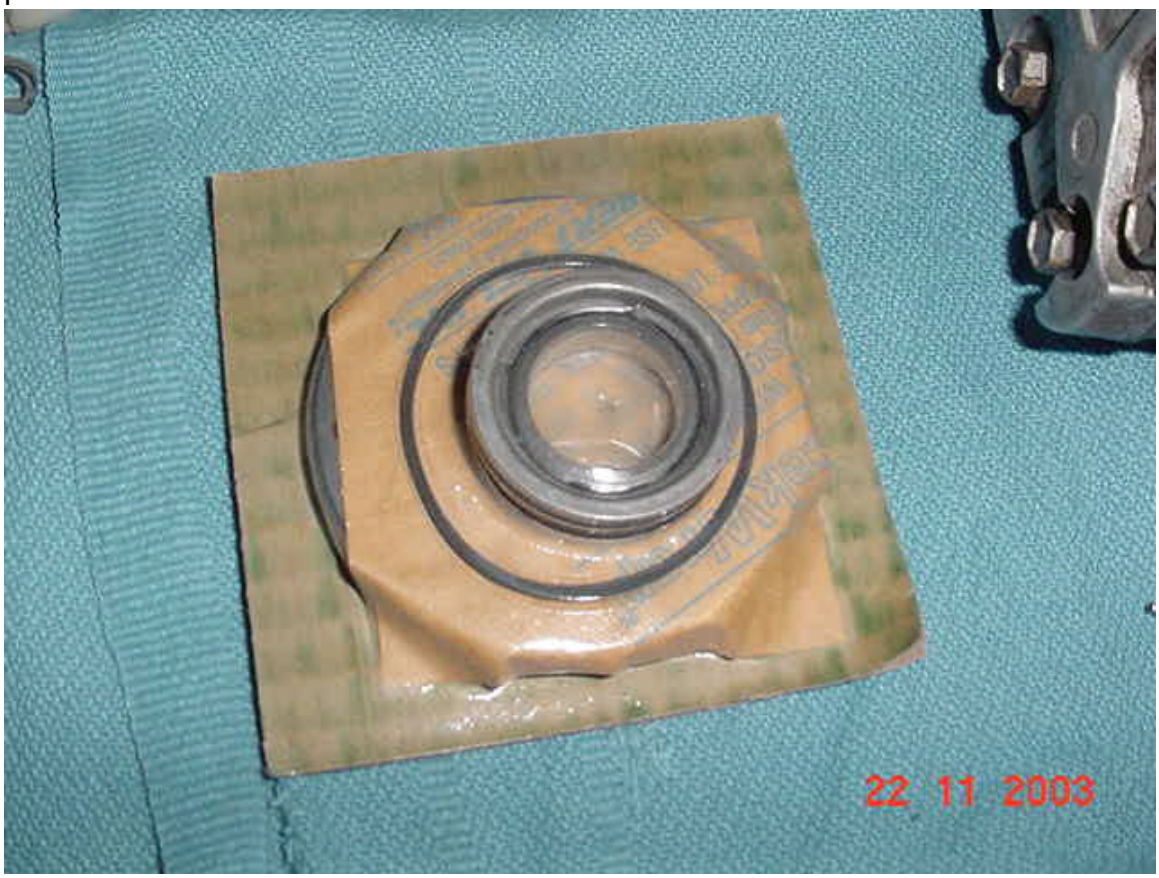
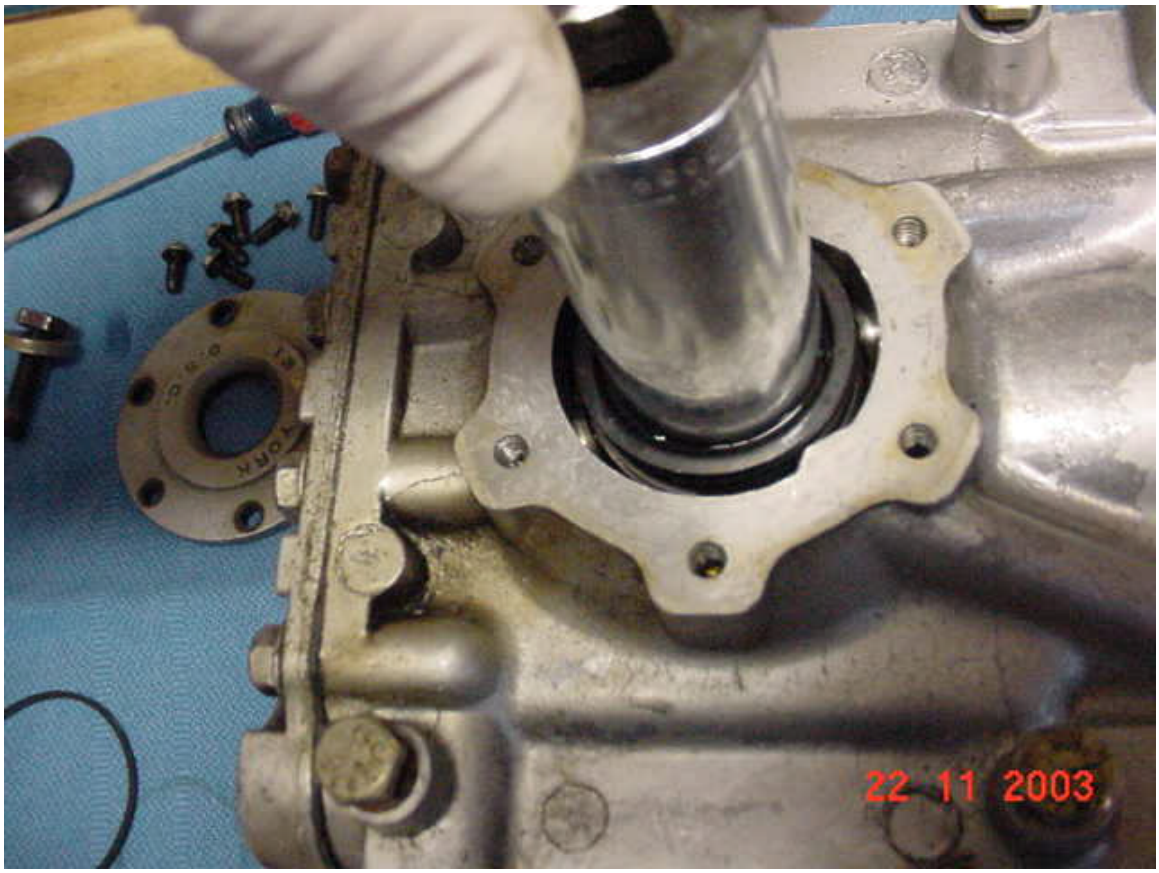
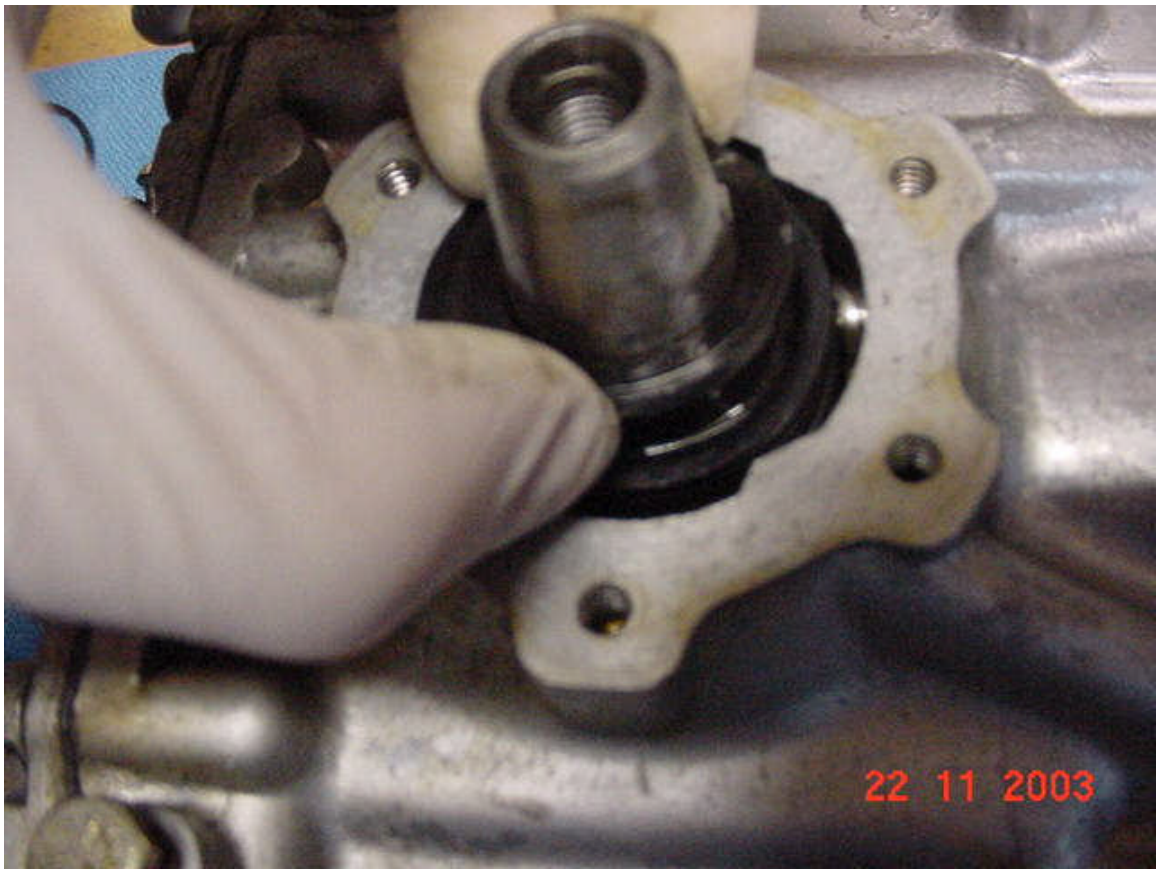


Coat the entire seal with refrigerant oil. Fit spring-loaded seal onto the shaft (with recess for carbon washer facing upwards) and press squarely downward with 7/8” deep socket to seat:

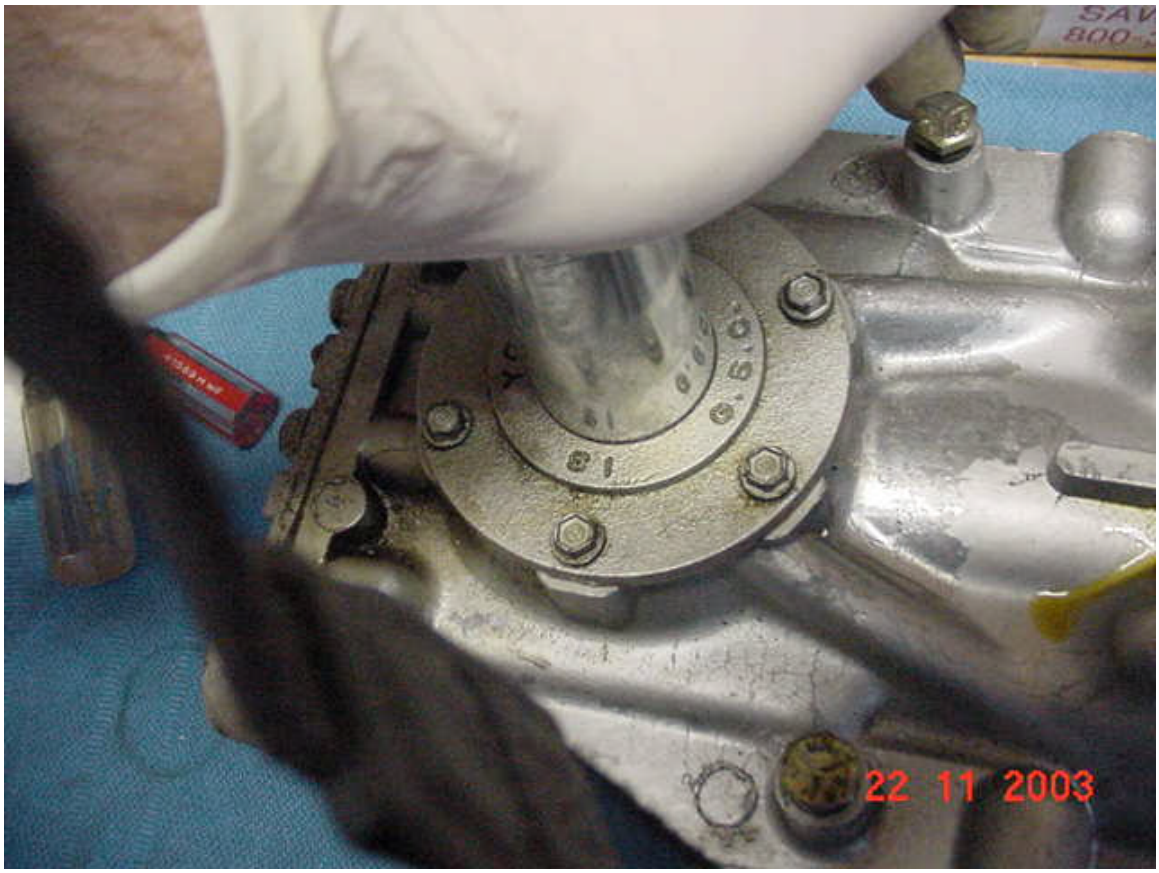


Carbon ring then fits on top, taking care to install with small “stepped” surface upward & edge detents aligned with seal:



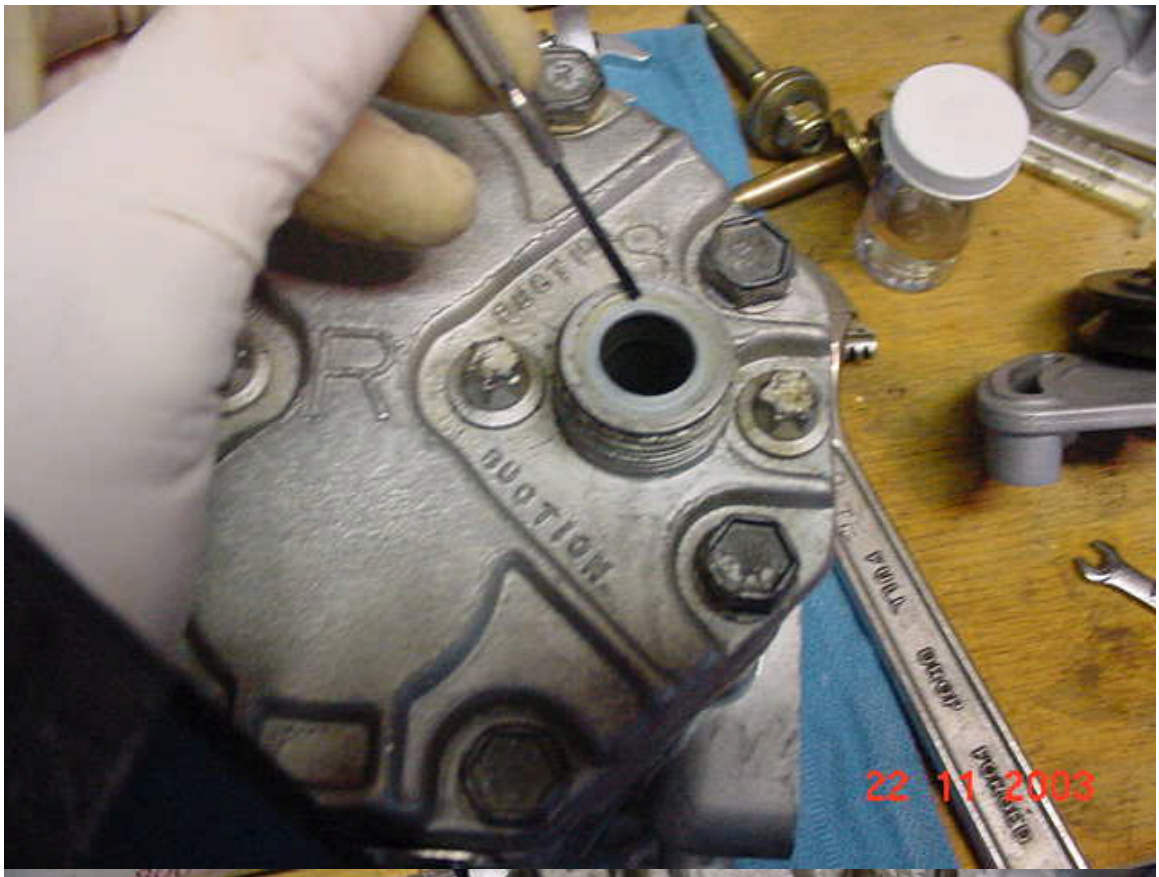
Fit a new o-ring to the circular front plate (I coated this ring with Nylog sealant) and set on top:

On my compressor the “G.S.C.” logo originally lined up with the body so I reinstalled in this orientation. Press the plate down gently with the 7/8” deep socket and install the perimeter ¼” bolts and tighten symmetrically (per CCI torque to 5-8 fl-lbs if you’re fortunate & own a microtorque wrench):



Rotate the compressor shaft a few times to lubricate the seal. Tap the woodruff key back into place:

Remove the suction & discharge port covers. Pry out both Rotoloc Teflon o-rings and replace with new NAPA parts #207165: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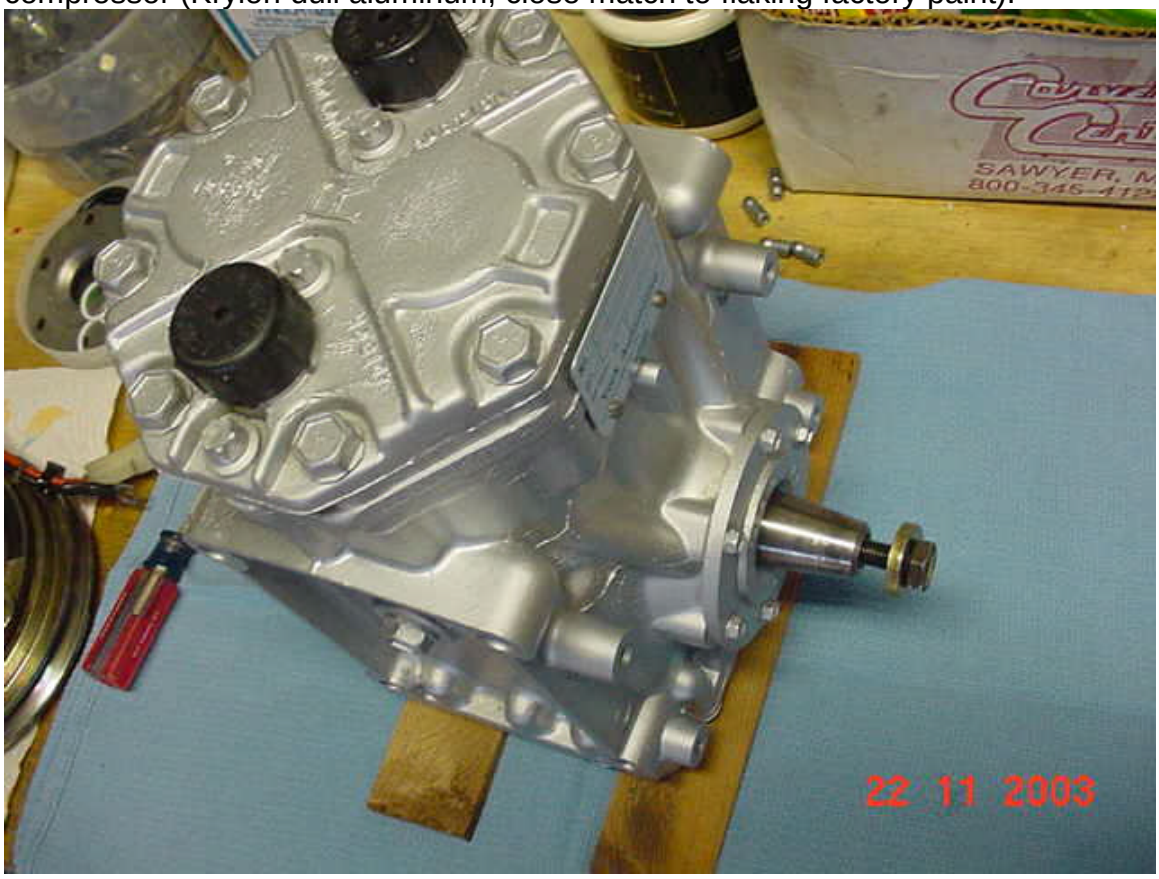
Note: I then assembled an apparatus to vacuum-test the new seal using vacuum pump, gauges, and two stem-type Ford service ports (from 1966 Mustang). At first air continued to leak around seal. After disassembling & reassembling several times suddenly was air-tight. I have no idea what I did differently – assembled as above x3 – perhaps the seal had to "seat"? Then pressurized with can of HCFC blend to 35psi without leakage.

Estimate amount of oil that dripped out of compressor during removal & add that amount back through the suction port (I guesstimated 1.5 ounces on floor). Recap suction & discharge ports. I then washed, dried & resprayed my compressor (Krylon dull aluminum, close match to flaking factory paint):



Compressor Replacement

NAPA sells the York 209/210 (206-style with larger displacement) compressor for the 308/328 under part #278108 (new)/#258108 (remanufactured). Both are painted black *[can respray to dull silver for OEM appearance]* & have the correct upper discharge/lower suction ports to fit original lines properly. The new unit that NAPA pulled for me had correct endplate with Rotoloc fittings & new Teflon o-rings but the rebuilt part had two adaptors to an o-ring endplate. I would prefer as

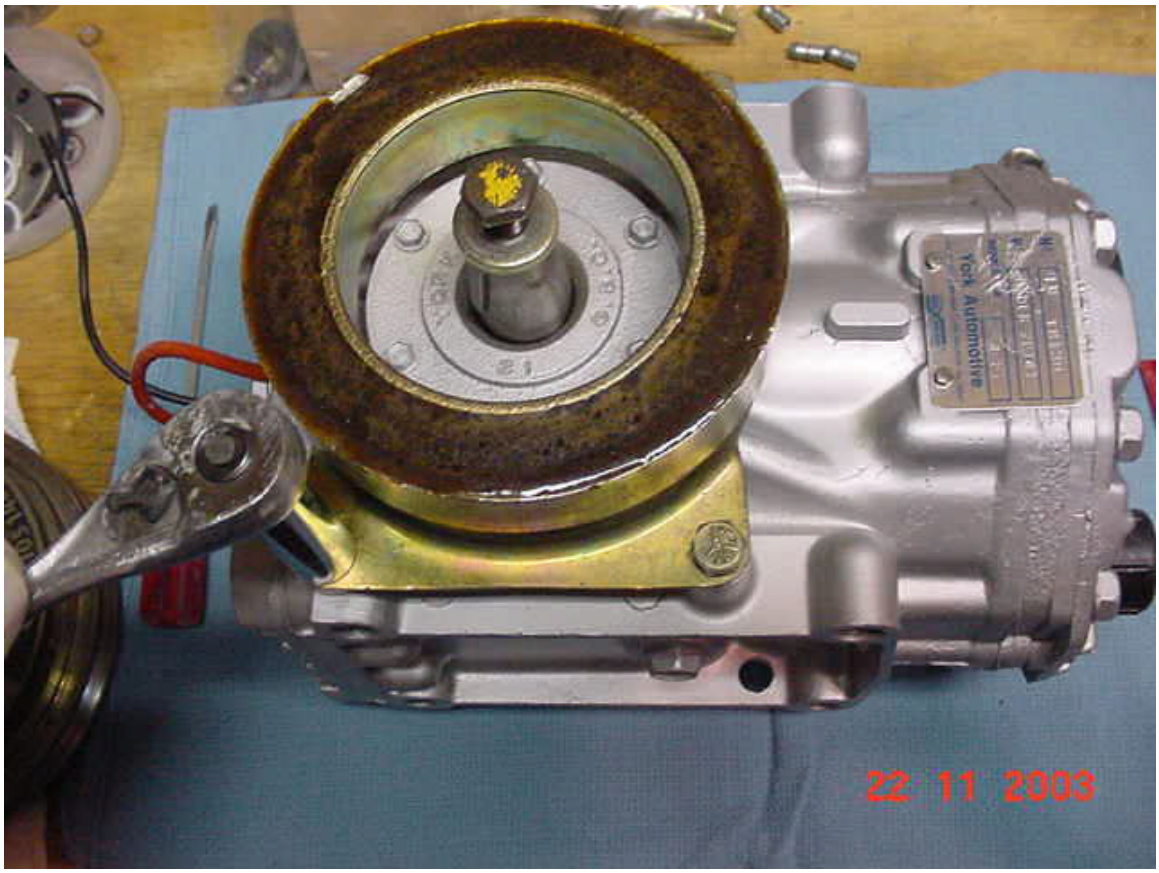
few fittings as possible to minimize potential sources for leaks. I was quoted $179 for remanufactured or $330 for new, both with 1-year warranty provided customer replaces both filter-dryer & expansion valve concurrently & can provide proof system flushed clean by certified HVAC mechanic. Unfortunately if one performs this at home and cannot provide documentation apparently warranty is void.

Addendum:

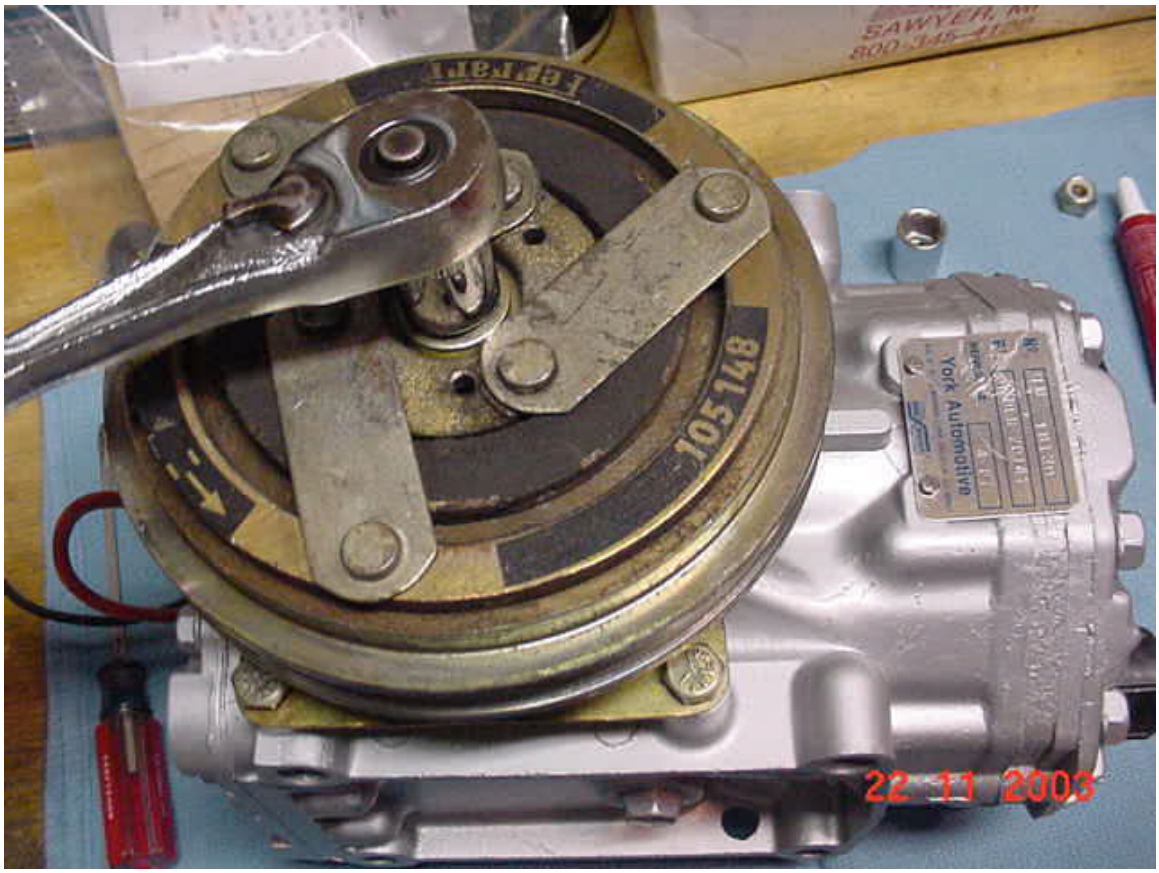
The above replacement of front compressor seal held for about 6 months. I then found oil dripping from rear compressor plate & elected to replace compressor. The first compressor (#258108) I purchased had similar fittings to Rotoloc but were not correct; a second compressor had proper endplate. I sprayed with Krylon dull aluminum to replicate factory finish. On reinstallation, I found that the lower mounting bracket fittings on the OEM compressor were threaded for metric bolts on the bottom while the replacement #258108 used 3/8 x16 TPI on all mounting points. I purchased two 3/8 x16 TPI x 2in long grade-8 (so gold cad color would match original hardware) to use on lower bracket. Realize if you ever need to disassemble these will require 9/16” wrench & all other fasteners are metric.

Reassembly

Replace the magnetic coil and tighten four 11mm bolts – I used blue loctite on these threads. [This photo is incorrect; leads should run off right of magnetic coil mount and along compressor body]:

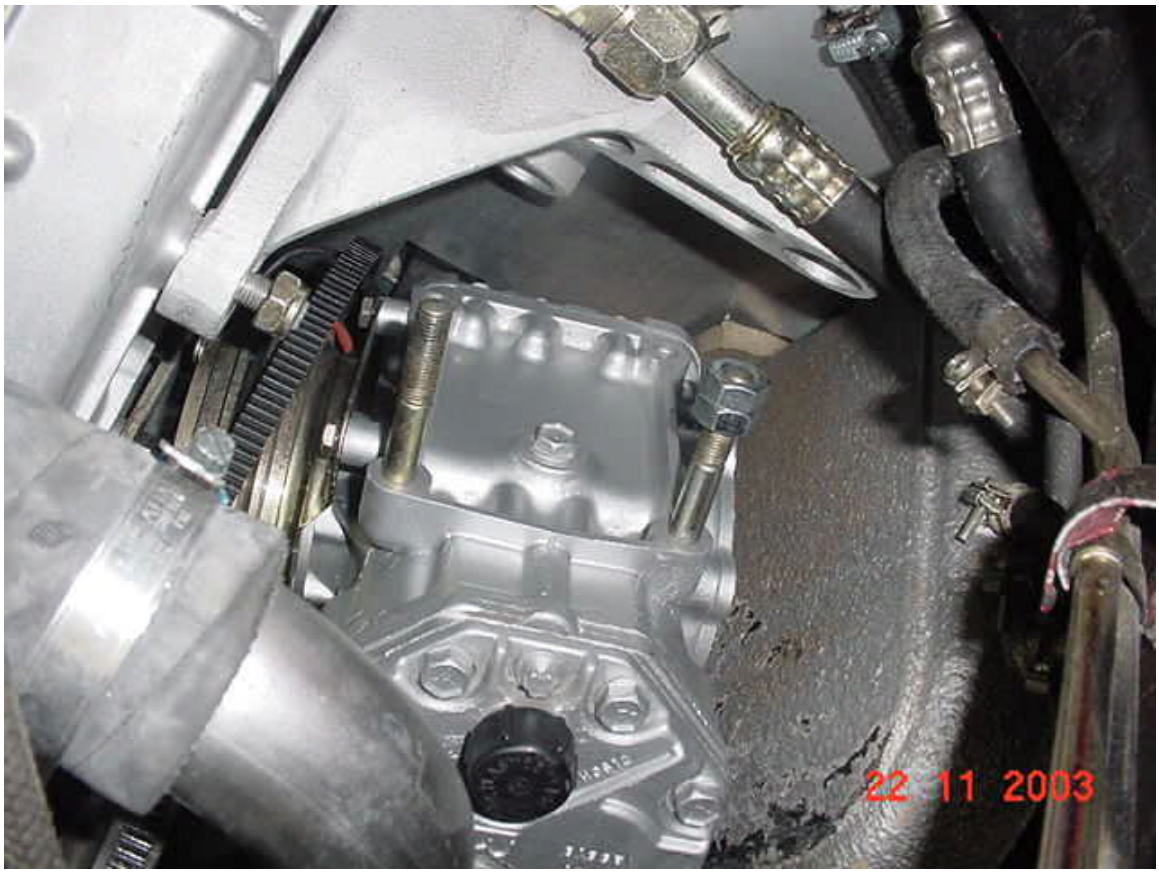


Fit the pulley assembly over keyway, re-energize clutch, hold with strap wrench & tighten 14mm center bolt. Could not find specific torque in factory manual but found one reference to 10-12ft-lbs, again with blue loctite on threads:

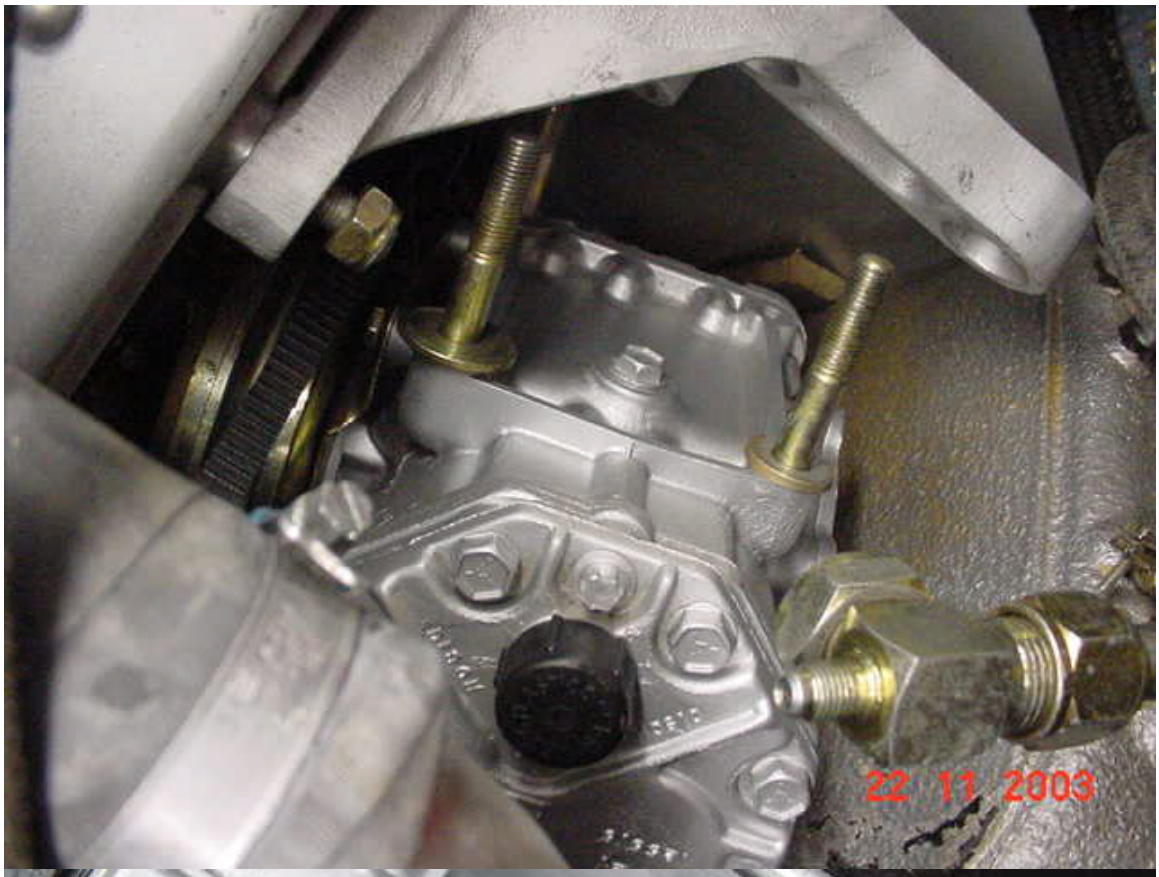


De-energize clutch. Spin the center section and outer pulley 360 degrees & ensure neither contacts magnetic coil.

Maneuver compressor back into engine bay. I found this was easiest by starting with clutch pulley facing away from cambelt covers then lowering into area beside gas tank. Once in vicinity, there is sufficient room to rotate into correct orientation. Using the same double-nut technique as for removal, install three studs into compressor body – I used blue loctite to mount studs to compressor:



Put fasteners in proper sequence: “c”-shaped washer - large washer – lower cushion with sleeve - onto each stud: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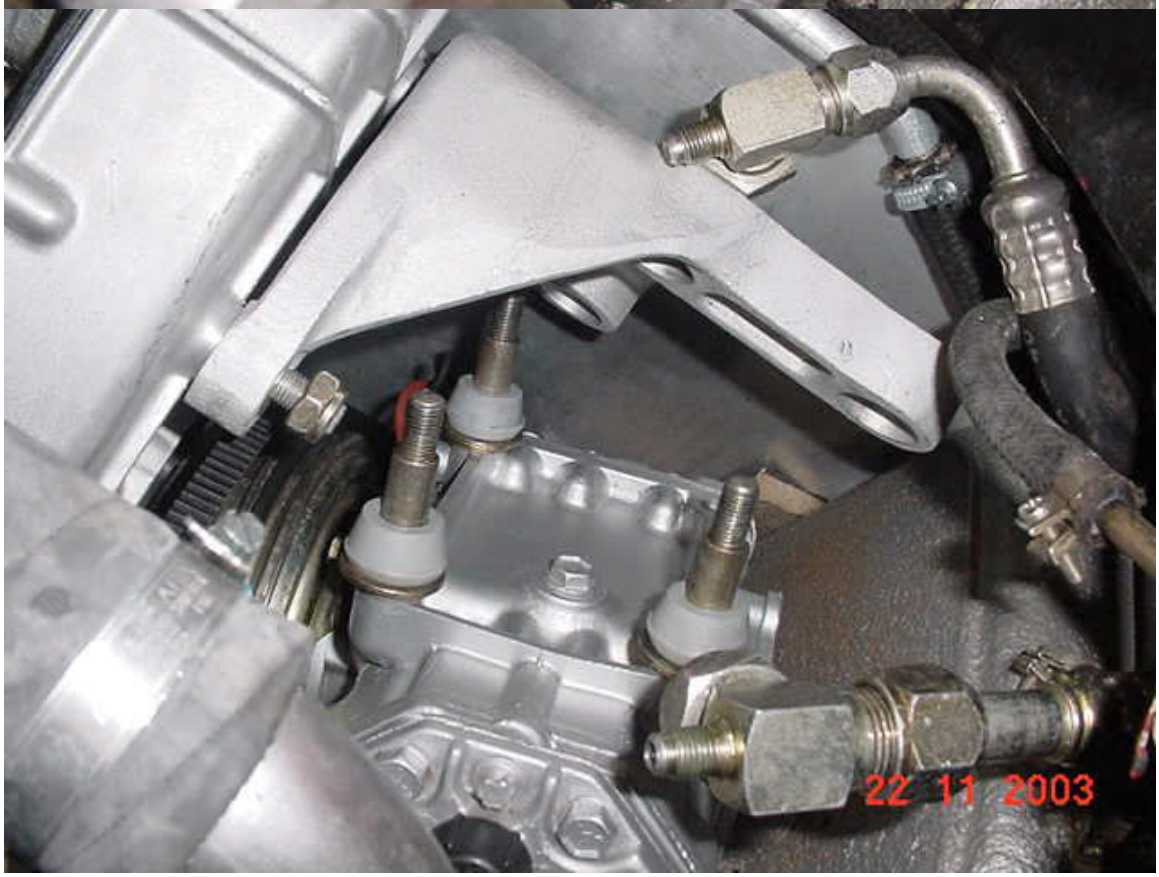
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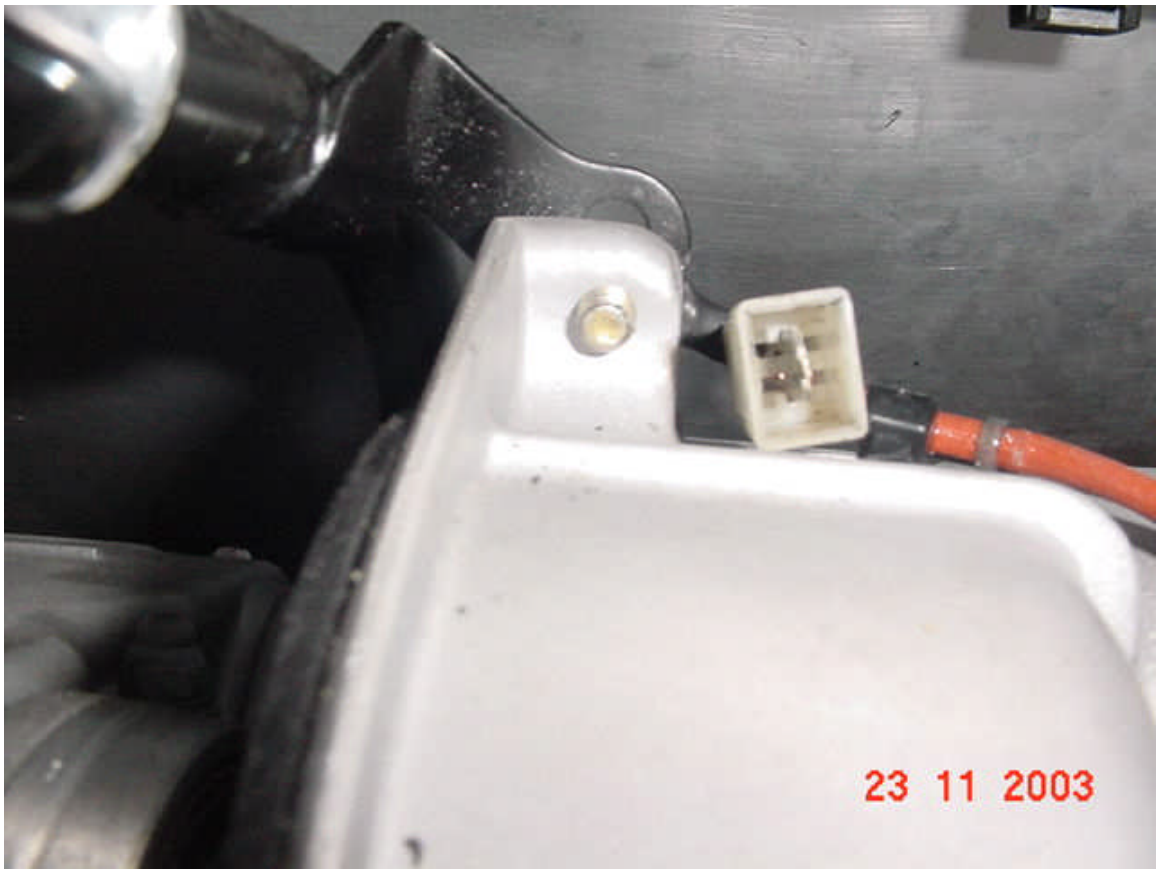
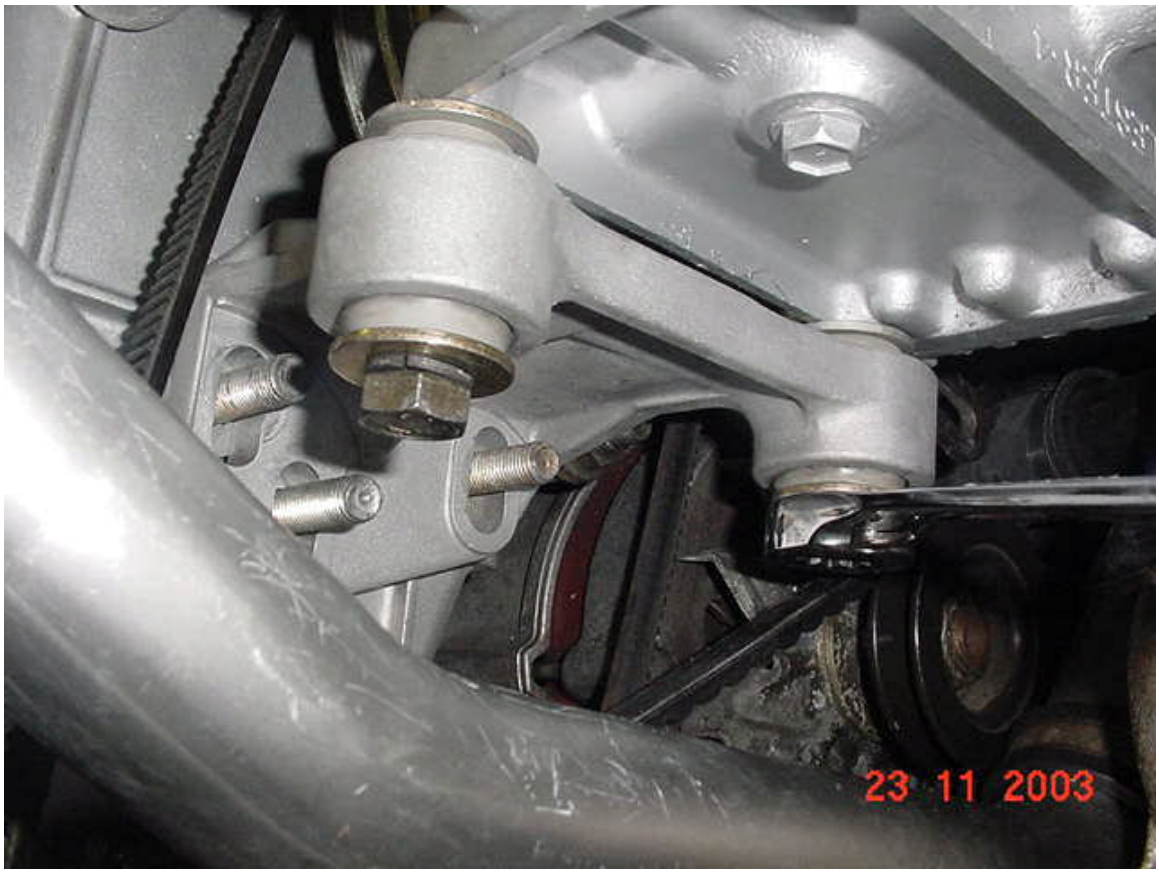
<u>Important: install the compressor belt loosely over pulley before affixing compressor in position</u> – there is insufficient slack in belt to do so after installed, in which case you have to loosen compressor once again (don't ask how I discovered this). Working by myself, I lifted the compressor into place and temporarily spun large washer and nut on the top to hold in place while installing others. From top side, install rubber bushing – large washer – 17mm nyloc nut on each stud. Rocking compressor slightly & lubricating with Armor-All facilitates sliding bushings over sleeves:

Torque spec for these nuts is 14 ft-lbs, but I was unable to get a torque wrench into tight space so tightened to "snug". Next, connect the clutch lead wiring and tighten ground onto cam cover; this same 10mm bolt holds the upper dipstick (again, take care not to drop this small bolt into the depths of the engine compartment):



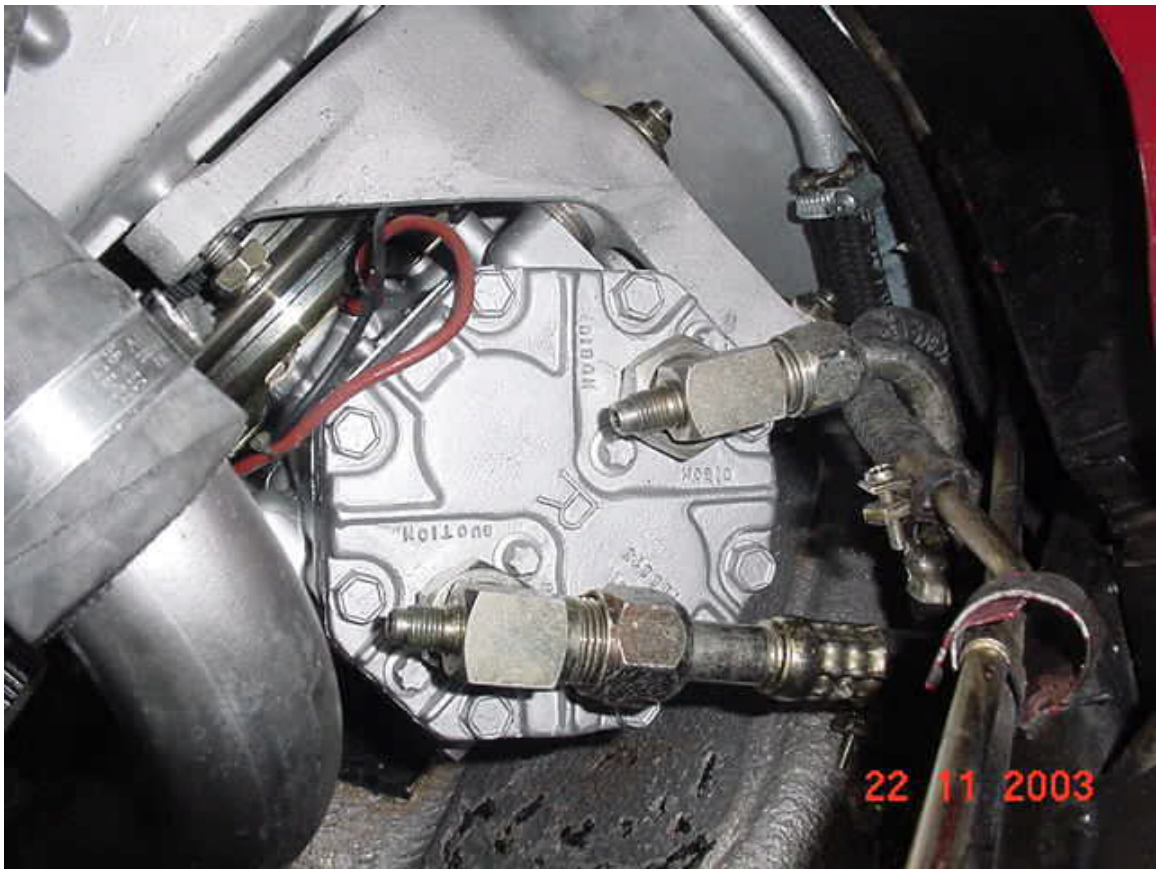
Put the two large bolts through the lower compressor bracket bushing prior to installation (difficult to clear ascending water pipe otherwise). My cambelt covers had a small washer on each stud between the cover & bracket:



Start both large bolts into compressor ears by hand to avoid cross-threading, then install washer – 17mm nyloc nut on upper & right bracket studs. Upper nut (top left in above photo) is particularly challenging, as compressor mounting bolt obstructs access:

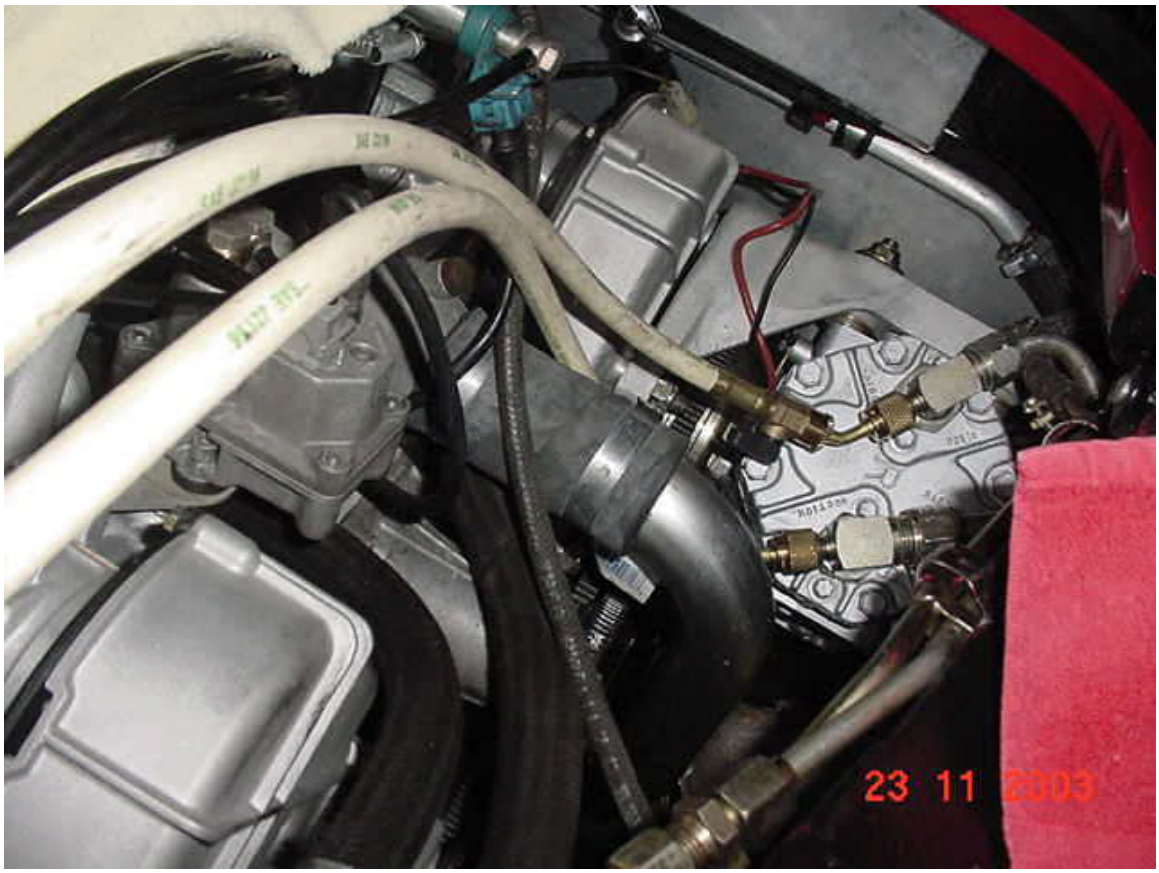
Tighten lower bracket-to-compressor 17mm bolts. A/C belt tensioner then pivots on left bracket stud (17mm) and lower cambelt cover stud (13mm) – center and right lower in above photo. Push upward until compressor belt tensions to 42 ft-lbs (used) or 48 ft-lbs (new) using Krikit belt tension gauge. Tighten pivot and locking nuts. Reinstall ascending coolant pipe hose clamp if previously removed:

Once compressor is secured, remove caps and re-install discharge (high-pressure) upper outflow hose and lower suction (low-pressure) hose. I used Nylog sealant on Teflon o-rings and tightened both fittings securely using 1 1/8” combination wrench:

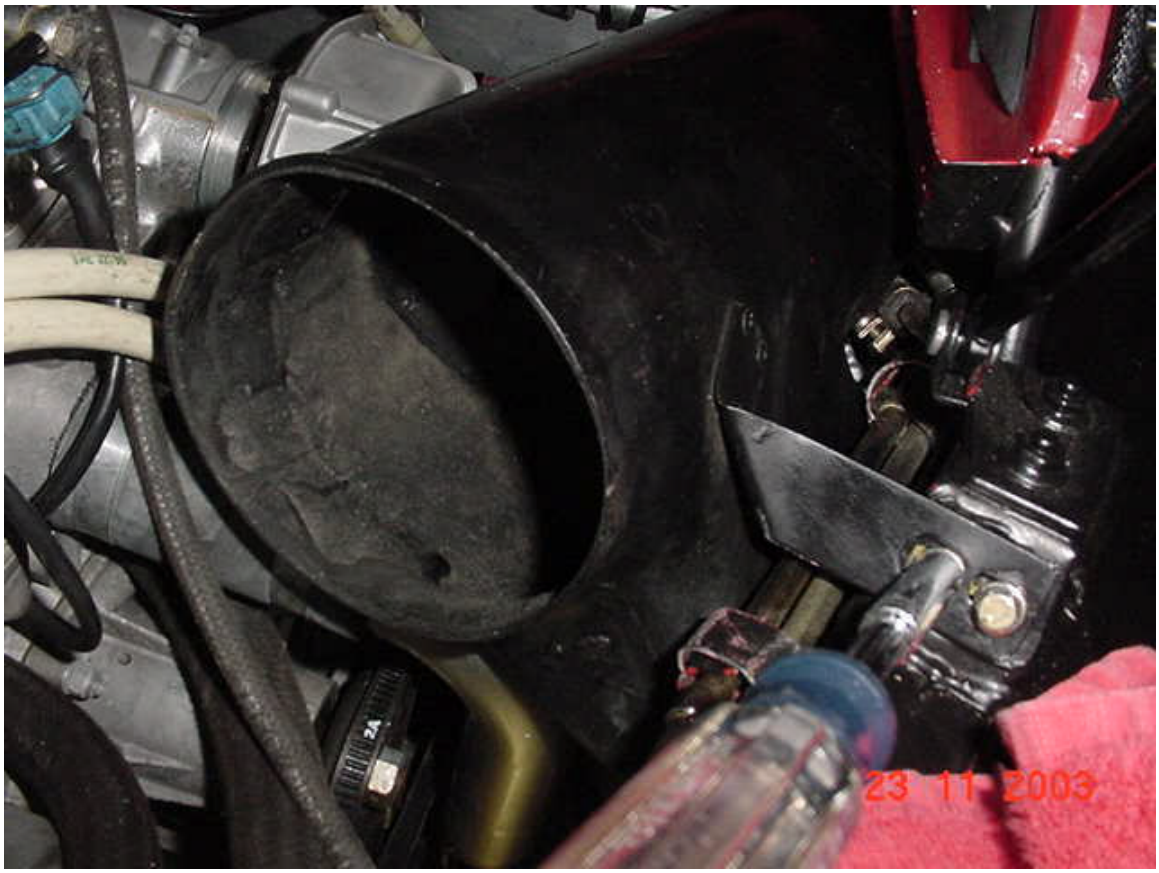


Ferrari issued a recall on the early 1986 cars due to interference between the upper hose crimping and fuel return hose, recommending the return hose metal line be bent downward to achieve ½" clearance. Mine were very close on 1988 car, so not certain if there was actually a production line change. Replace Schrader valves cores (if you choose to) at this point; valve unscrews counterclockwise with valve removal tool; reinstallation is reverse.

I then pre-installed gauge set & pulled vacuum to confirm system integrity prior to recharging:



Maneuver intake ducting into position and secure to fender underside with 10mm bolt and to engine compartment buttress with two 8mm hex screws:



Refit lower airbox & air filter, remembering to install both hoses on underside (large hose clamp nut is 6mm nut & smaller 7mm):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After liberally coating the inside with Armor-All, I was able to slide the rubber bellows hose back over the intake ducting and airbox top. Tighten four 5mm hex bolts to secure airbox top:

Replace fenderwell fiberglass shielding using the three 10mm and four Philips-head screws. Replace the wheel and seat bolts while on stand. Jack car slightly and remove stand. Torque wheel bolts to 72 ft-lbs:

Evacuating & Recharging A/C

Attach vacuum pump to input line on gauges and evacuate system to minimum -25psi. Close off both sides and allow to stand for 30 minutes. If readings remain unchanged, system is secure. Some recommend pulling a vacuum for a further 30 minutes to evacuate all moisture, others recommend introducing a partial charge to system & then re-evacuating. If vacuum does not hold, you'll need to identify source of secondary leak (as per UV dye kit, above). Repair this leak then evacuate & check system again.

As previous, attach refrigerant can to input line on gauges. Pierce can and purge line with refrigerant. Open both high & low sides to allow refrigerant into system. When pressure stabilizes, close off both sides. After checking nothing is near rotating/hot aspects of engine, start car & allow to warm to operating temperature. Some recommend putting a fan in front of the condenser (RH front bumper) when testing A/C. Open low side and add refrigerant until can is empty. Full charge for 328 is 2.2 lbs (1kg) R-12 or approximately 14oz R-134a or 12 ounces HCFC blend (DuraCool/HC-12a). Interestingly, after adding 2 cans of DuraCool my high-side pressures were only in 100-110psi range (typical R-12 system operates at 180-220psi). Sight glass showed bubbles (which I understand is common with HCFC blends even when fully charged) so I continued until high-

side pressure read in 175-200 range (required 5 cans DuraCool in total). Sight glass was then clear. Turn off engine. To spill the least refrigerant, remove the low-pressure line immediately, allow engine to cool & pressures to equalize, then remove high-pressure line. Reinstall both Schrader valve caps. Congratulations & hopefully your A/C will work properly for at least a few years.