

# How to Replace Bearings & Seals in a Supercharger

Cam Thai aka Stang94GT

## **DISCLAIMER:**

You do this at your own risk. The author of this document accepts no responsibility for any damage or injury that may occur as a result of reading this document or performing the repairs described herein. Note that doing this to your supercharger will void its warranty and may cause irreparable damage to your supercharger, engine, car, or anything else I can't think of right now.

I have performed what is described by this document and have only a few miles on my supercharger. It is possible that by the time you receive this document my supercharger may be in pieces and I am re-building my engine. **YOU DO THIS AT YOUR OWN RISK!**

If, during your own rebuild you come across snags, gotchas, or tips, please e-mail me with your details so that I may update this document for future readers. E-mail me at [cam\\_t\\_thai@yahoo.com](mailto:cam_t_thai@yahoo.com) or PM me on the Corral Forums.

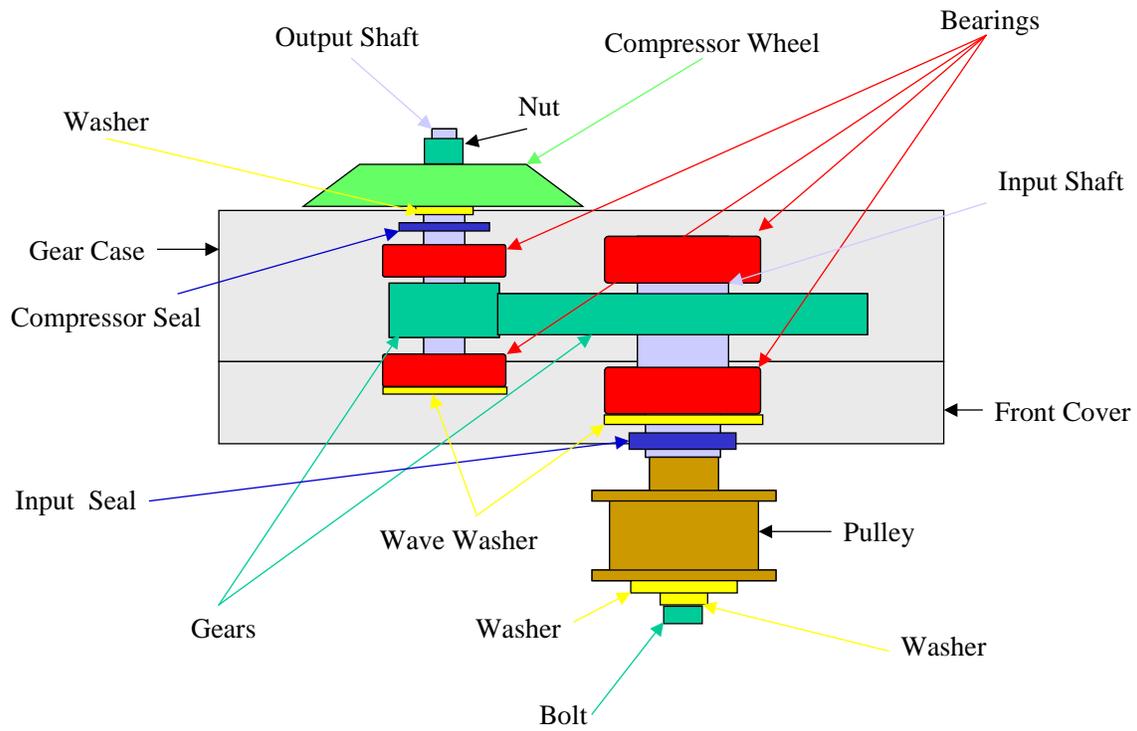
**IMPORTANT NOTE:** The high speed bearings shown in this write-up are standard roller bearings. The original bearings are thrust bearings. It is **HIGHLY** recommended that you use the proper thrust bearings to ensure blower life. Rather than revise the entire write-up I am including an appendix with additional information at the end of the original write-up.

**Read all instructions at least twice before attempting. Inspect all wear surfaces, use your judgment as to what is acceptable.**

## **List of Tools Required:**

- Impact gun
- Basic socket set
- 3/16" Allen key/wrench
- Press/brake to remove pulleys

## **Nomenclature:**



Side View of Supercharger Internals



Front cover, gear case, and compressor housing

**Disassembly:**

- Remove oil feed pipe. (Not necessary)
- Remove oil drain fitting. (Not necessary)
- Mark compressor housing relative to the gear case. Score the housings with a chisel or use a paint pen (sharpies may rub off when cleaning the housings).



- Remove the 6 bolts and e brackets which secure the compressor housing onto the gear case. Be extremely careful, the compressor wheel is very delicate and can easily be damaged. NEVER lay your supercharger with the compressor wheel down.



- Remove the compressor nut. Note that this is a LEFT-HAND THREADED NUT!! That means you spin it clockwise to loosen, opposite of normal. An impact gun is highly recommended for this operation. If you don't have access to an impact gun, do not bother attempting this rebuild on your own, you will only damage your supercharger. The nut can actually be removed while the housing is still on, but you get better access to the nut without the housing in the way.
- Mark the compressor wheel relative to the threads. A paint pen works best.
- Replace the compressor housing (re-install brackets or bolts if you wish) and lay supercharger compressor side down. Housing was replaced so that the wheel would not be damaged by these next steps.



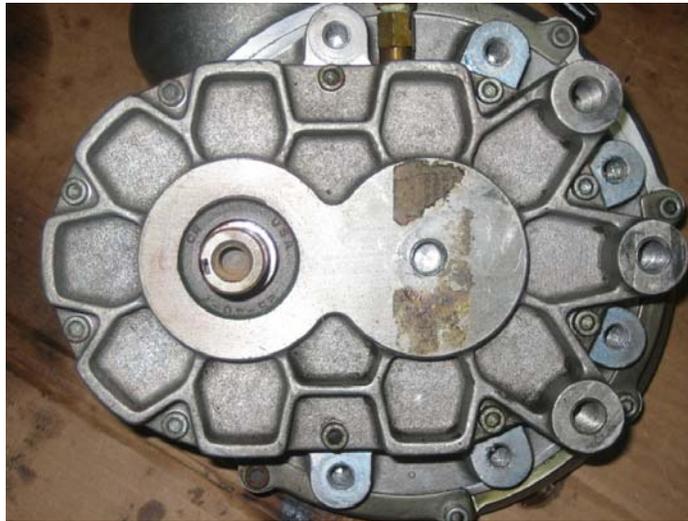
- Remove pulley. A strap wrench may be used if an impact gun cannot be found (but you needed one to remove the compressor nut so you've got one, right?). Using the strap wrench, hold the pulley secure while loosening the pulley bolt.



- Note pulley orientation, the long nose points TOWARD the compressor. Bolt is a standard right-hand thread.



- Be sure to remove key once pulley has been removed.



- Remove the 10 bolts which secure the front cover to the gear case.



- With care and patience, remove the front cover. There are two dowels which align the front cover to the gear case. Once these clear, the housing will have a tendency to rotate/tilt – do not let it tilt! Pull straight up on the housing, be sure you don't jerk it such that the compressor housing and gear case separate otherwise compressor wheel damage may occur.



- The large O-ring may come up with the front cover, be careful not to damage this seal as it may be re-used. Check ring for cracks or pinching. After re-installing my supercharger, I see that it is still leaking from the casing. I believe this o-ring is no longer providing an adequate seal for the housings. I plan to replace this o-ring in the near future.

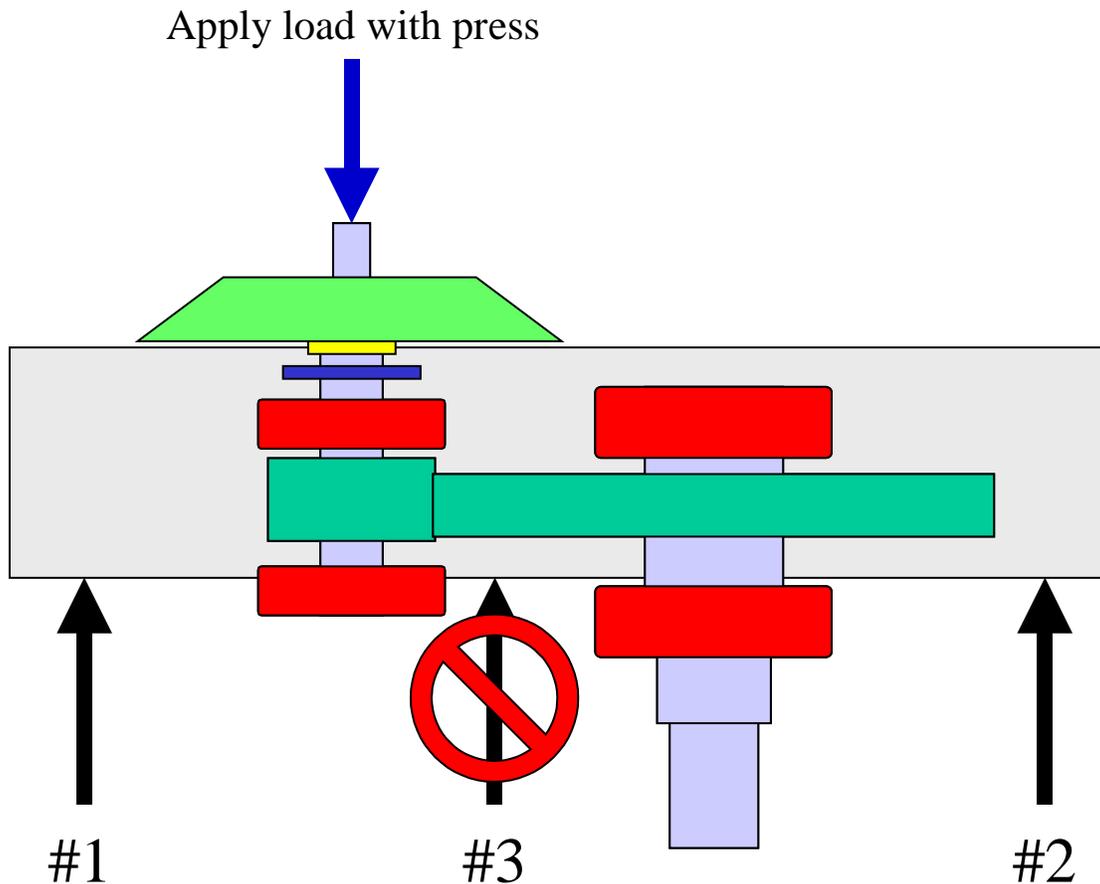


Wave washer for input shaft.



Wave washer for output shaft.

- There should be two wave washers which apply load to the input and output shafts, set these aside. Note orientation of smaller washer, it is critical that this washer be re-installed correctly.



- Take your assembly over to your press and support the supercharger at locations 1 & 2. Do NOT support at location #3 unless you are going to exercise EXTREME caution while pressing the output shaft out. Damage to bearings WILL occur if you are not careful. If you're replacing your bearings, this may not be a big deal but it's just not a good idea to support at location #3. See end of this document for more detailed information on why location #3 is a bad idea. Be sure to not damage the threads during disassembly.
- Place something soft under your supercharger. The input and output shafts will fall, you don't want it falling on the floor and breaking your gears.
- Slowly press down on the output shaft, be sure you do not apply any loading to the compressor wheel directly. A small dowel may be necessary to press the output shaft below the nose of the compressor wheel. After a certain point, you can carefully wiggle the input shaft and gear assembly out even before the output shaft is free.



- When both shafts are free from the gear case, place the compressor wheel in a safe place. Note that there should be a washer between the gear case and compressor wheel. This washer has a chamfer on the ID, note the orientation! The washer must be re-installed with the chamfer facing down, away from the compressor wheel.



Extremely tight clearance between output gear and bearing.



Extremely tight clearance between input gear and bearing.

- Take the shafts to a shop for them to remove and install your new bearings. If you have the ability to do this at home/work, be ready for a tough job. The clearance between two of the four bearings is extremely tight. Load must be applied on the inner race to remove the bearings. Finding something thin enough and stiff enough to fit between the gears and bearings was difficult.
- If you wish to do this yourself, the end bearings install until they're flush with the rear of each shaft. Be sure to lubricate the inner race with oil or assembly lube before pressing them onto the shaft. The other bearings are installed until they fully seat against the gears. Be sure that only the INNER RACES are loaded during assembly. Placing load on the outer race may cause damage to the bearing. Try to place all your support on the shaft itself and not on the end bearings during installation of the remaining 2 bearings which seat against their respective gears.



Input seal can be removed with a socket that fits between the ID and OD.



Compressor seal can be removed with a socket that is just larger than the black portion of the seal. The first “inner ring” of metal is actually part of the seal.

- Using an appropriately sized socket and hammer, remove the seals.
- Clean your housings.

### **Re-Assembly:**



- Input seal is installed so that it is flush with the front cover. Use a flat object to ensure that the seal is installed evenly and to the proper depth.



- Install compressor seal using an appropriately sized socket and hammer. Compressor seal should be installed so that it fully seats against the gear case.
- I'll assume that the 4 new bearings have been installed onto your input and output shafts.
- Lube your bearings and bearing housings with oil or assembly lube. Assembly lube worked best for me but is not required. The lube will stick to the bearing surfaces better than oil will.

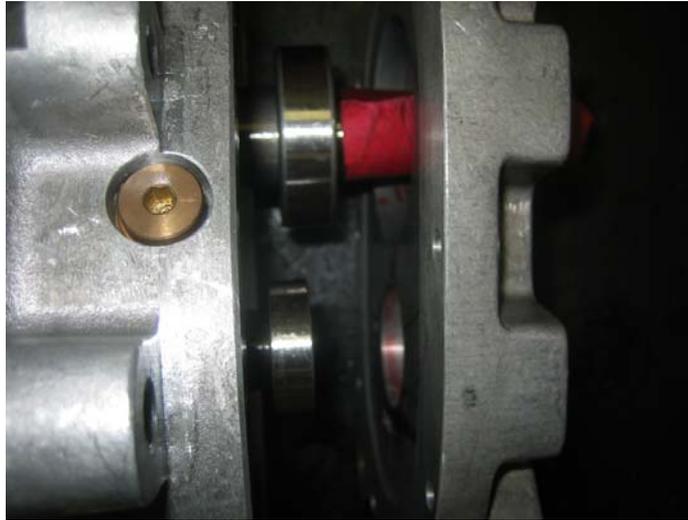


If installed without an expansion cone, the shaft OD is too large to fit through the new seal ID.



An expansion cone is necessary to insert the shaft without causing damage. I suggest using something flexible and sturdy such as manila, very thin cardboard, or card stock.

- Using something that is flexible and doesn't tear easily, create a "cone" to aid in installing your output shaft. The new seals have a smaller ID than your old seals and your shafts will damage the new seals unless they are guided through. The cone will expand the seal ID while the shaft is being installed. I tried a piece of paper at first but it tore when I tried to remove it. The cardboard your bearings came in or a manila folder work well. Cut a smaller square and roll it up into a cone. Stick this through the compressor seal with the larger end facing the front cover (and direction from which the shaft will be entering). Failure to do this will damage your oil seal!
- Guide the output shaft through the cone. **DO NOT FULLY INSTALL.** Once the output shaft has started, the input shaft will need to go in. Wiggle the large bearing into the appropriate bearing bore and push both shafts in at the same time. Remove cone once output shaft has been fully inserted. Lube gears up with assembly lube for start-up protection.



- Place gear case and shafts on side. Using your cone again, place the cone through your input seal, large end toward the input shaft. That red section is the cone I made from a manila folder.



- Before inserting the input shaft through the cone, place your two wave washers back into their appropriate cavities. Be sure the smaller wave washer goes back in the way it was removed! The ends which point up should face TOWARD the bearing. You can just barely see the washer tips in the above picture (circled in green).



- Joining the gear case and front cover while laying on their sides works best. Use caution and patience when joining the two as the bearings must be inserted into their cavities squarely. Failure to do so will score the cavities.
- Re-install 10 bolts. I didn't know what to torque these to so I replaced my bolts with a new set and used lock washers on each one. These plates are so stiff and the torques so low that a torquing pattern will not be necessary.



- Re-install the key and pulley. Use impact gun to secure bolt or secure using strap and socket wrench. Be sure pulley is installed with longer nose toward the compressor.



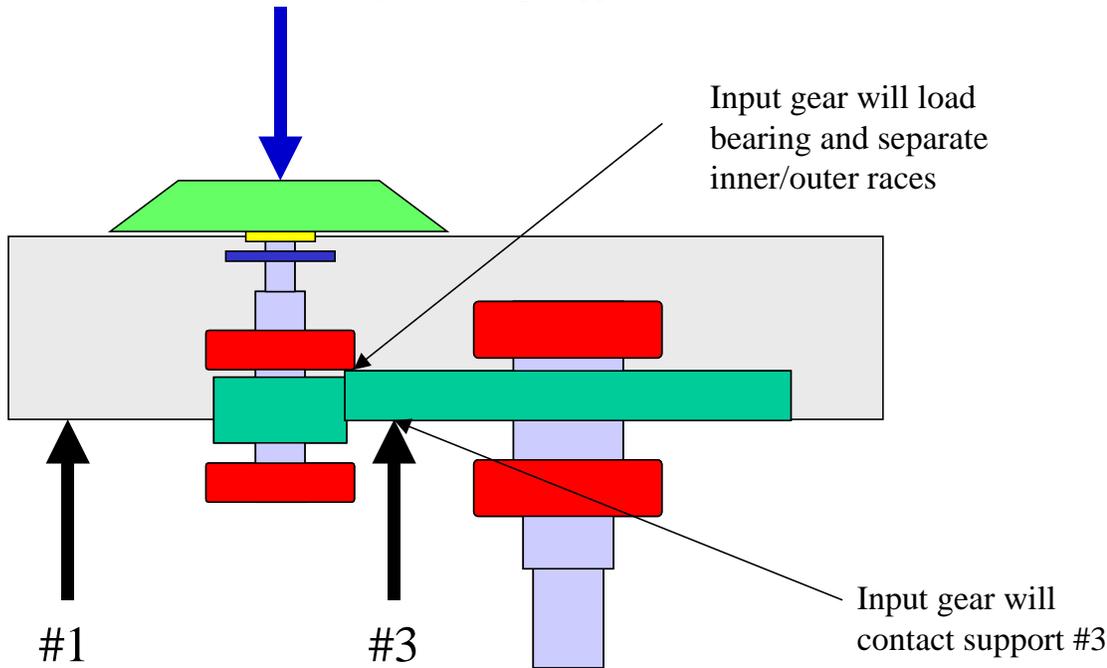
- Re-install washer with chamfer facing away from the compressor wheel.
- Re-install compressor wheel, be sure it is properly clocked relative to the shaft. A press will most likely be necessary for this step. The wave washer will apply upward force on the shaft while the wheel is being pressed. Secure compressor nut with impact gun. Remember, this is a left-hand threaded nut – counter-clockwise will tighten! Use the pulley to help you hold the shaft steady. Otherwise, carefully hold the compressor wheel at the OD (where it's strongest) while tightening.
- If you would prefer not to do it this way, the wheel can be re-installed prior to the front cover going back on. Direct load support can be applied to the back of the output shaft instead of the washer taking the load. My opinion is that any washer play between the shaft and wheel will be taken up when the compressor nut is tightened down. The compressor wheel will be pushed further down by the tightening of the nut.
- Re-install the compressor housing, secure with 6 bolts and 3 brackets. Again, I replaced my bolts and used lock washers. Be sure the housing is properly clocked.



**THAT'S IT!**

## Why supporting at location #3 is a bad idea ...

Guess how I disassembled my unit? Yup, supported it at locations 1 and 3.



As you can see from the above, I placed a lot of upward loading on the outer race of my upper bearing while pressing down on the output shaft. I ended up separating the upper bearing – lots of ball bearings everywhere!



Here's what you're left with if you're not careful, note the ball bearings everywhere! A busted bearing and an inner race that's still on the shaft. No big deal if you're going to replace the bearings.

To remove the inner race, I chucked the shaft to a lathe and carefully and quickly heated the inner race using a torch while turning the lathe with my hand. After a few seconds of heating, I was able to pry the inner race off with a flat head screwdriver. This procedure must be done quickly – if the output shaft begins to heat up, it's all over and your window of opportunity has closed. Let the assembly cool back down to room temperature and try locally heating the inner race again. **DO NOT** try to pry the inner race off if the shaft has gotten warm, you **WILL** cause damage to your output shaft. This method actually ended up working well for me because the clearance between the gear and bearing are so close, I didn't have anything available that would have been thin enough and stiff enough to use as a brace on my press. Best thing to do? Take this to a shop and have them press it off for you!

### Parts I Used:



Input Seal, Chicago Rawhide P/N 9725



Compressor Seal, Chicago Rawhide P/N 6248



Output Shaft Bearings, SKF P/N 6003 (Do not use)



Input Shaft Bearings, SKF P/N 6205

# Appendix

Additional information provided by Dedicated5.0 and NotoriousNotch

Updated: 22February 2008

I had intended to update this file years ago but never got around to it. There was some really good additional information posted by Dedicated5.0 and NotoriousNotch/jbj302 from the Corral Forums. I was hoping to take all their information and update this write-up so it was seamless but unfortunately time gets short and Life gets busy! I intended to go back and rebuild the blower using the correct thrust bearings but never got around to it before selling the car. The write-up you see in the pages prior to this worked flawlessly for me while I had the car. I sold the car about a year ago to SC306GT on the Corral Forums and included the appropriate thrust bearings with the car, I don't know if the blower was ever rebuilt with the correct thrust bearings. I've tried contacting him and will update this write-up if I get a response.

Again, I, or anyone involved in the creation of this write-up can in no way be held liable for the information included. You do this at your own risk!

So – on to the additional information that has been brought up since I did my initial rebuild. This information is being copied (with a few tweaks) from a post by NotoriousNotch available here:

<http://www.corral.net/forums/showthread.php?t=780865> (I hope the moderators don't mind, I'll remove this link if requested). Some additional information on rebuilding SQ blowers can also be found at that link thanks to 92rohcp.

Here's the tweak to the **original** instructions that Dedicated5.0 wanted to add (**my comments in red**):

- When he talks about removing the compressor nut he states that it is a Left Hand Thread. That is correct for the standard-rotation blowers on 5.0s. On the reverse blowers that are on the 4.6 cars it is a regular Right Hand Thread.
- When he talks about using a “cone” to guide the shaft into the seal. That is not a bad idea, but I don't think that it is really necessary. Using some assembly lube or oil to lube the seal and shaft should be the trick just fine. I've never seen a “cone” use to install oil seals before. → **I used the "cone" to install the seal because it is spring loaded. Using only lube may cause the seal to bend or fold during installation. In fact, that's what I did when I put my blower back together the first time. After discovering that I had screwed the ID of the seal, I re-used the original seal with the installation sleeve.**
- When he talks about installing the compressor wheel he says that using the impact will tighten the bolt and help push it down the rest of the way. I agree, but he should have added that you need to make sure that compressor wheel is seated flush with the case. If it's not, when you put the volute back on the compressor wheel could scrape against it.
- The seals he used are not the best for the application. They have an exposed metal case and one of them is a single-lip. Those are not the best features for sealing. The seals I used had a rubber covered case and both are a double-lip design. Much better features for sealing. → **Agreed, a better seal is a better seal. The seal I used was (visually) the same one that came out of my supercharger.**

Additional seal information: I don't like the seals you (Stang94GT) used for three reasons. First, they have an exposed metal case that can rust. The seals I used have a rubber-covered case that is sealed from the elements. Second, they put a green colored coating on the OD that is designed to scrape off when you install them to help seal against the housing. I wouldn't want any of the crap to flake off during installation and get into the blower. Third, one of the seals you used has only a single lip for sealing against the shaft. I much prefer the double lip designs that seal much better. → In response to the issues raised by Dedicated5.0; the rusty seal is a visual annoyance but I understand where he's coming from. The green colored coating is indeed there to aid in sealing; it will scratch and come off during installation. Just clean whatever may have come off before bolting it all back together. As for single versus multiple lip sealing on the shaft; I believe 2 seals are better than 1, I also believe there is so much parasitic drag that the blower won't care if it's being sealed by 1 or 2 seals. So – I say go for the seal recommended by Dedicated5.0.

- The bearings he used for the high-speed side are incorrect. They are standard radial ball bearings. He should have used the high-speed angular contact ABEC 7 bearings that I posted in my thread. → Agreed, the bearings should be high-speed angular contact as recommended by Dedicated5.0/NotoriousNotch. The pic below is the original high speed bearing from my blower before being taken apart. Note the side that THRUST is written.



Revised parts list as supplied by Dedicated5.0:

Low Speed Side:

1 seal – Chicago Rawhide 9776

2 bearings – SKF 6205JEM

Alternatives are:

- MRC 205S
- Fafner 205K
- F..A..G 6205.C3
- BCA 205NC3
- SNR 6205.J30
- KOYO 6205C3

High Speed Side:

1 seal – Chicago Rawhide 6428

1 matched set bearings – SKF 7003CD/P4ADGA

Alternatives are:

- MRC 103KRDS-BKE#7
- Fafner 2MM9103WI DUL
- F.A.G B7003CB.T.P4S.DUL
- SNR 7003.CV.DU.J74
- NTN 7003CT1GD2/GNP4
- NSK 7003CTYDULP4

Below stated by Dedicated5.0:

I did not replace the o-ring that seals the case. It was in good shape so I soaked it in tranny fluid to swell it a little. Any of the distributors above should be able to match it for you. I would recommend using a brown Viton o-ring instead of the Buna one [supercharger manufacturer] uses. Viton is a higher temp material that would most likely hold up better than the standard Buna.

# SQ Supercharger Rebuild Information

92rohcp from the Corral.net Forums

Additional details on an SQ blower rebuild can be found on the link from above. I took the liberty of pulling details about the SQ rebuild that 92rohcp did and I focused on aspects that differed from the V1 rebuild. Thanks to 92rohcp for the information here (I made some minor edits):

Helical gears from SQ supercharger. Note that the two gears will not slide up and down relative to each other the way the V1 gears do – this will make pressing the gears out more difficult and you will need to be extra careful!



It also appears there is a different style seal for the output shaft, it has a metal in ring that has a hard plastic outer seal that is spring loaded. The plastic part seems to make a seal with the spacer that is between the impeller and the outer gear case. This is not at all like the v-1 units.



Look how the output shaft seal is hard plastic and pivots. It's spring loaded, there is no soft rubber lip at all.



The spacer or washer on the SQ is different, it does not have a chamfer on it. However, it does have a groove in it that faces down toward the gear case.

Here is how the washer or spacer fits and makes contact with the hard plastic seal. You can tell by the worn area of the washer that it turns with the impeller and makes contact with the seal, which must be the sealing part. It was leaking on mine (92rohcp), but it doesn't look damaged, maybe just bad design (he said it, not me!).



Another noted difference in the SQ is the cover to the impeller has an orange gasket (seal) and a small lip for it to fit into, see below:



The output shaft seal (compressor seal) was hard to get out. I could not do it with the rubber hammer. I used the press and even that took a lot of force. Remember, this is a different seal than the others (for the V1) seen before.



Here is a pic of the seals as you can see they are not Chicago rawhide seals they are SKF. I gave the parts guy the Chicago rawhide part #'s 9776 and 6428 listed by NotoriousNotch. When they arrived they were SKF brand. I was told that Chicago rawhide is now SKF and most seal and packaging has the SKF logo and new parts numbers as you can see by the boxes.



This is the new double lipped SKF seal for the input shaft



92rohpc decided he did not want to replace his output shaft seal with the old carbon face design used by the original supercharger manufacturer. Here is the new output shaft seal take note of the new part #

The high speed bearings 92rohpc used, NSK 7003CTYNSULP4:



To orient the high speed bearing is very, very easy. The outer race on the thrust side of the bearing will be thicker, that side should face outward or away from the gear. So both bearings thrust sides outward. You will see this on your [supercharger manufacturer] bearings when you disassemble, they will say thrust on that side facing out. So another way to put it is the thicker side thrust side of the bearing will face down into the bearing cups on the gear case and the cover.

Note: 92rohpc had a lot of difficulties with pulling his bearings out. It's possible the manufacturer went to putting an interference fit on the OD of the bearings, meaning they will tend to stay in the housings instead of on the shaft when you separate everything. His is the only SQ rebuild I have read about so YMMV.

Lastly, some may ask why it is that I have chosen to distribute this information as a .pdf instead of in the raw Word format. I chose to do this because I didn't want the file to get hacked up and posted online without some type of control – call it ego, whatever. I would like my work to remain as I intended. I, Dedicated5.0, NotoriousNotch, and 92rohcp have worked to put this together and we want to ensure that the best information available is contained in this file. If updates are needed/requested I will be happy to make these updates for the community.

Best Regards and Happy Motoring,

Cam Thai / Stang94GT