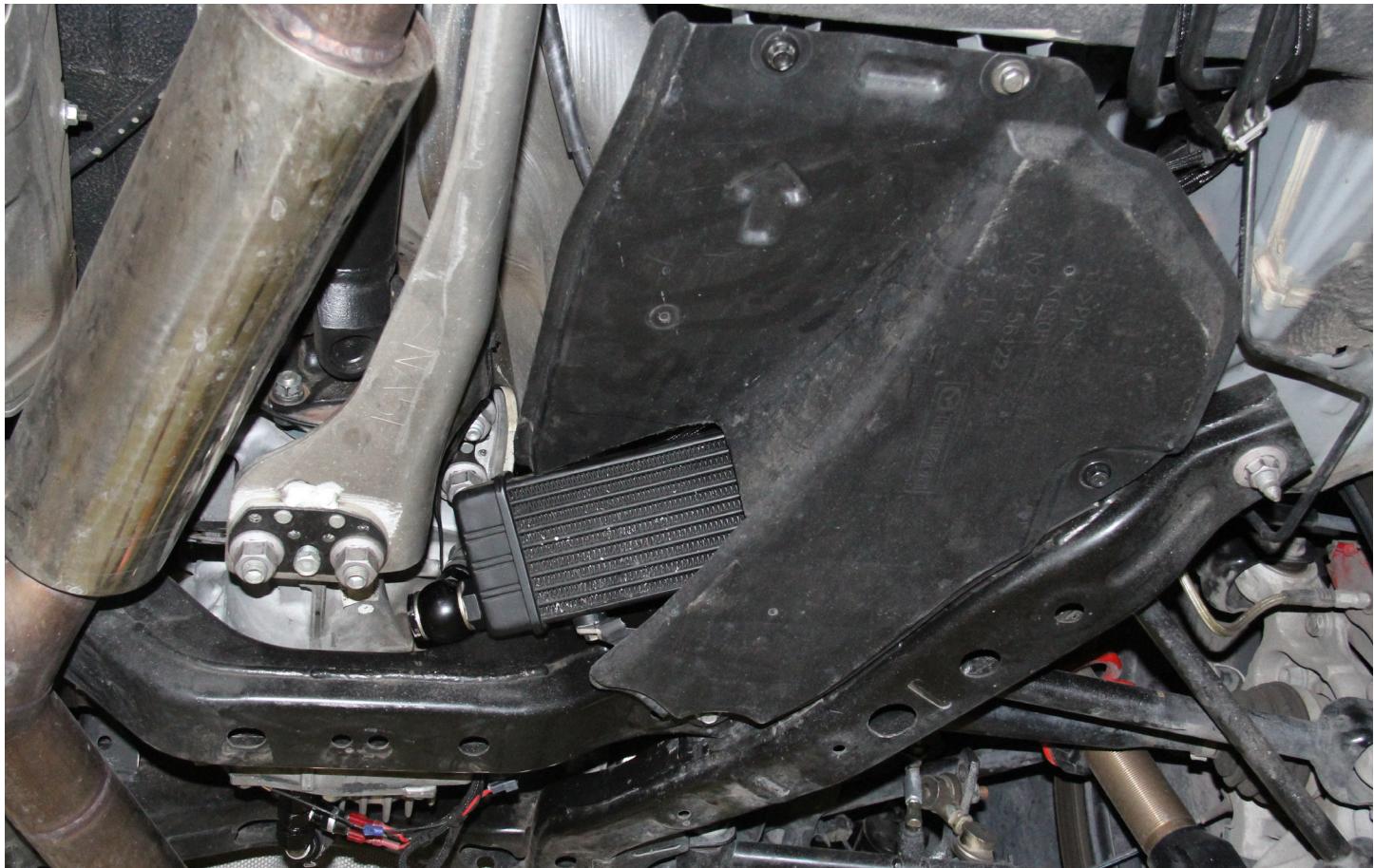


Flyin' Miata

ND Differential Fluid Cooler Kit 08-90320



Thanks for purchasing our ND differential fluid cooler kit. This kit installs cleanly and invisibly while thoroughly cooling the fluid as much as needed. It's perfectly suitable for street and track cars. The install is pretty straightforward, but please let us know if you have any suggestions for the product or instructions.

WARNING: Not everyone can perform every installation. It is critical that you be honest with yourself in regards to your ability. We're more than happy to help, but there are only so many things we can do from the other end of a phone / computer. If in doubt, discuss the install with us before you dive in. Improper installation could cause injury and / or death!

Required tools and supplies:

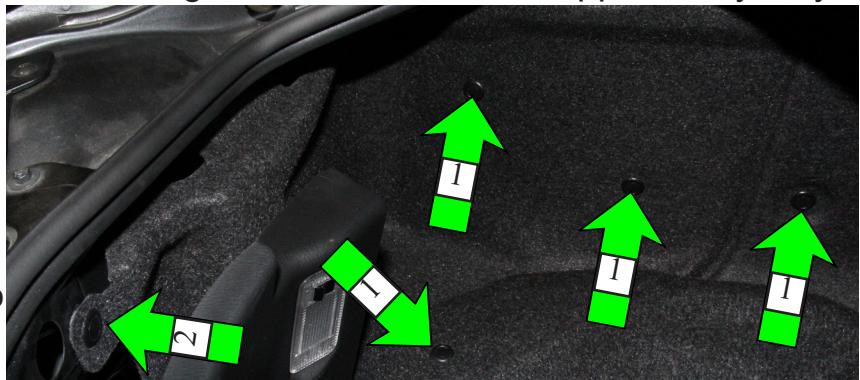
- Metric socket set and wrenches
- 7/8" and 1-5/16" open-end wrenches or (carefully used) Crescent wrench
- Drill with 1/4" drill bit
- "Mazda Long Life Hypoid Gear Oil SG1" or high-quality synthetic 75W90 differential fluid (now a ~2qt capacity)
- Silicone sealant
- Electrical tape
- Wire crimpers
- Wire strippers
- Heat gun (for heat-shrink tubing)
- Thread sealant
- Pinch hose clamp pliers
- Fine-tooth hacksaw, cable shears, PVC cutter, box knife, or a cut-off wheel
- Aluminum AN hose wrenches ("normal" wrenches can be used but will mar the fittings' anodizing)
- Vise
- Hot knife for wire loom (recommended, not required)

Torque specs

- Cooler fittings: 29 lb-ft max, support hex on cooler
- M8 bolts: 8.5 lb-ft
- M6 bolts: 3.5 lb-ft / 42 lb-in
- AN-8 fittings: hand tight + one turn, max of 29 lb-ft
- Drain and fill plugs: 35 lb-ft
- 1/8 NPT temp sensor: hand-tight + 3/4 - 1-3/4 turns, max of 12 lb-ft

Cooler and pump installation

1. Begin by getting the entire car in the air (not just the rear). Higher is generally better, but be sure you have sufficient room to get underneath the car and work. Jack-stands or ramps will work well, but NEVER get underneath a car supported by only a jack.
2. Open the trunk and remove the vertical panel on the left side. Remove the four obvious fasteners (1) and the hidden one (2). The hidden fastener can be accessed after removing the two fasteners on the top and bottom of the left side of the rear plastic panel then flexing the cover forward a bit. These fasteners are removed by pulling the center section out about a 1/4", then removing the entire fastener from the car.



3. The pump bracket will be installed as shown (prototype bracket shown).
BE ABSOLUTELY SURE YOU WON'T DRILL THROUGH ANYTHING IMPORTANT! Buffer using scrap as needed. You'll be drilling up from the bottom, so you won't be able to see what's going on in the trunk.



4. Pour a small amount of differential fluid into the inlet of the pump. This pump will self-prime if the gears are wet, with dry gears it won't be able to pull fluid out of the differential.

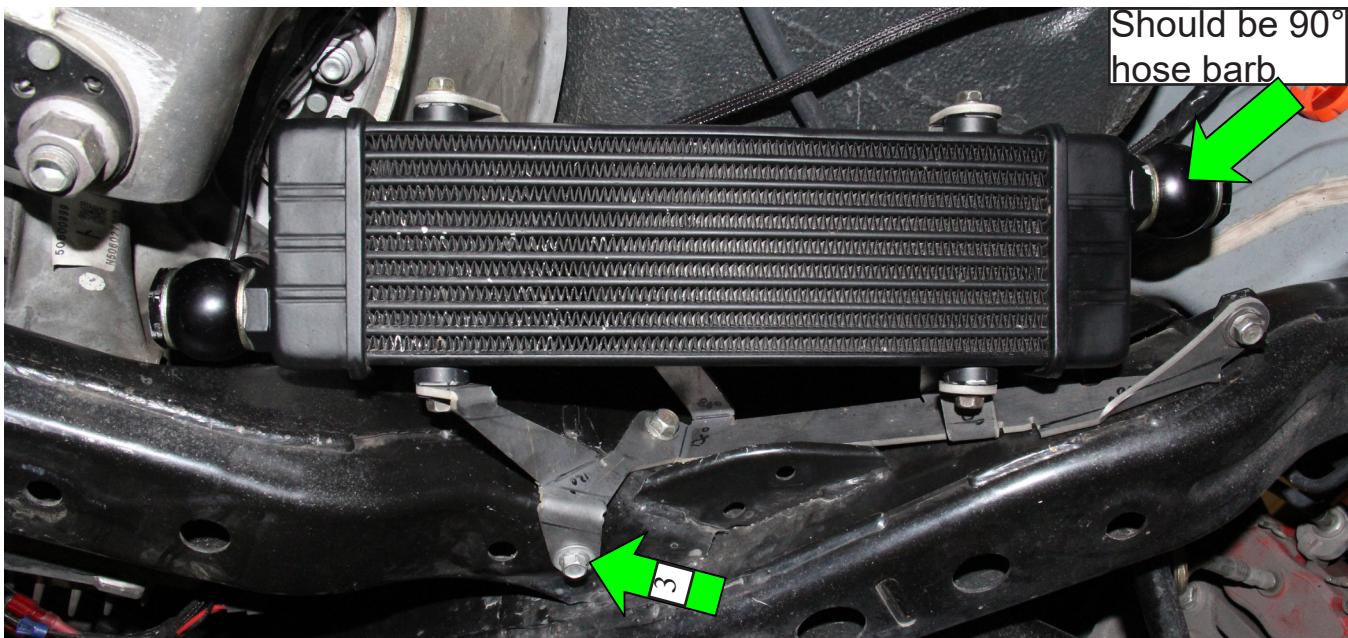
5. Assemble the pump and filter as shown, using one 90° female-to-female fitting (27-16982). Be sure the filter is located on the inlet side of the pump. Locate it as shown in the left rear corner of the car, above the reverse light (the exact location is up to the installer, but be sure to consider everything in the trunk as well as parts on the underside of the trunk). (Remember that all left/right references are from the driver's perspective, so the left side of the car is always the driver's side (in the US).) Carefully mark four of the hole locations if you're feeling confident or one if you're not.



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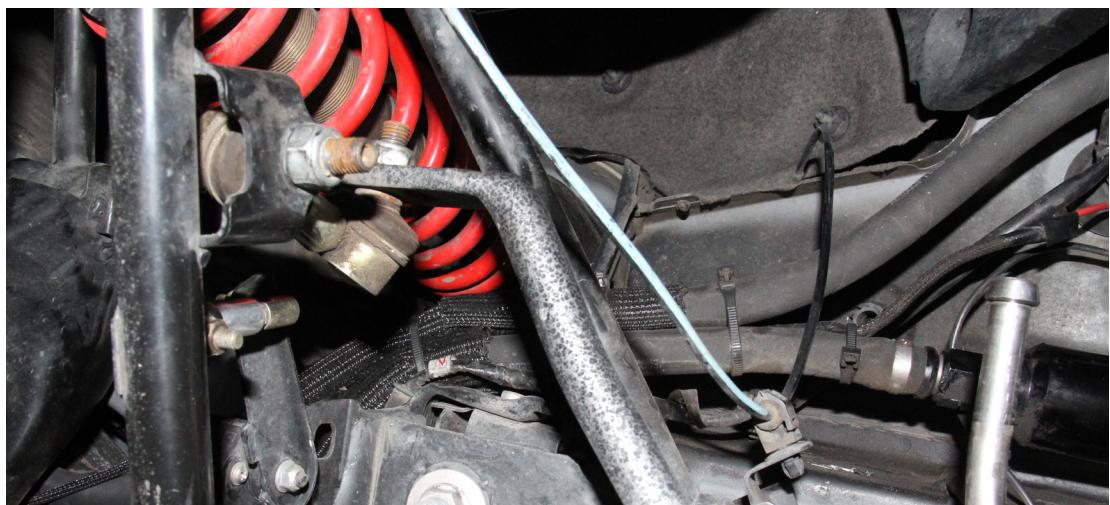
6. Depending on your confidence level, drill the 1-4 1/4" hole(s) now. If you choose to drill a single hole, use a nut and bolt to hold the pump in place. Mark the other holes now that the location of the pump is relatively fixed and drill the remaining holes. Finish the holes to remove any burrs.
7. Smear sealant on the holes, top and bottom, to both prevent rust and seal the trunk from moisture. Slip the studs of the diff pump mount through the drilled holes and install the pump, using the fender washers (36-30150) and nylock nuts (36-20137). Tighten these nuts enough to slightly squish the rubber grommets, don't overtighten them. We don't want the pump to be loose, but the rubber grommets should only be squished slightly so that they can do their job of damping vibrations.

- Carefully install one M22 -> male AN -8 fitting (27-16395) into one of the fittings on the cooler. Smear some oil on the O-ring opposite the AN (flare) side near the hex and tighten the fitting into place. **You must support the hex on the cooler**, otherwise you could destroy the cooler. Tighten to 29 lb-ft - overtightening could destroy the cooler.
- Remove the plastic duct from the front left of the differential and bolt the cooler bracket to the subframe. Use the M8x1.25x16mm bolt (36-10420) and M8 washer (36-30130) in the larger hole. Use the two M6x1.0x20mm bolts (36-10403) and 1/4" washers (36-30022, bigger OD than M6 washers) for the smaller bottom holes. Loosely install all three bolts, then tighten the M8 bolt to 8.5 lb-ft. Finally, tighten the M6 bolts to 3.5 lb-ft / 42 lb-in (snug is fine for these, the specific torque isn't critical).



- Orient the cooler such that the installed fitting is at the top of the left (driver's) side. The AN-8 male fitting should be on the right side of the photo above, the photo shows an incorrect banjo fitting but the orientation of the cooler is correct. Put another way, the AN-8 male fitting should be on the side close to the tire, at the top, the fitting-less hole should be closer to the differential and on the bottom. Bolt the cooler into its bracket, using four M6 x 1.0 x 10mm bolts (36-10401) with four 1/4" washer (36-30022) tightened to 42 lb-in. Be careful not to over-tighten these. It's possible that the arms of the bracket won't be exactly perfect, thanks to manufacturing tolerances. You may have to bend the arms slightly, but everything should match up nicely with some tweaking.
- Loosely thread a 90° AN-8 hose barb onto the outlet of the pump. Do the same with another 90° barb on the fitting you've installed in the cooler. Measure the length of hose necessary to connect the two fittings (we used 40"). **BE SURE TO MARK THE ORIENTATION OF THE TWO FITTINGS RELATIVE TO THE HOSE**. Since neither of these fittings is straight, the clocking is important. Refer to Appendix A for how to assemble the hose.

12. Permanently route and connect the hose. Think about how the suspension moves and be 100% sure that the hoses won't be damaged as the car drives. Zip-tie as needed. Be sure to

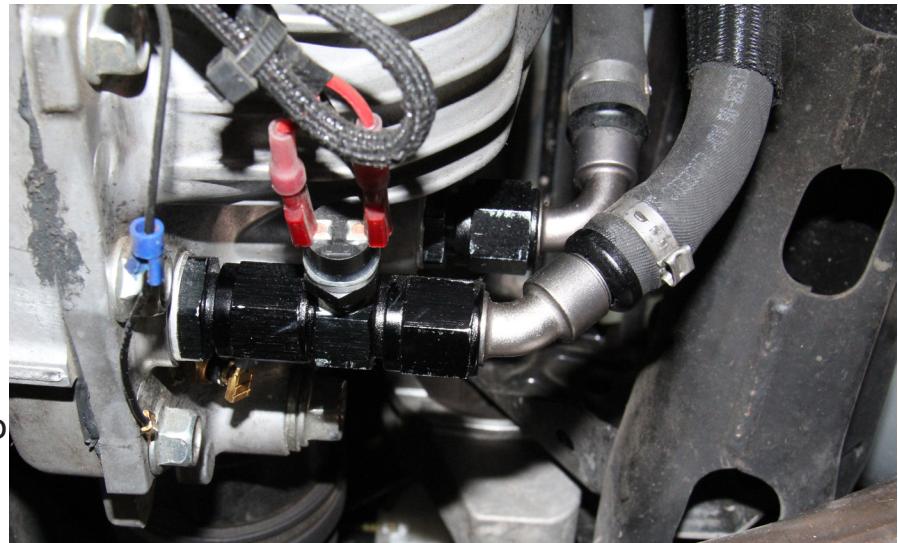


smear some oil on both the threads and the flare of each fitting before tightening down. Hand-tighten each fitting, then use a wrench to tighten it one more full turn. Do not tighten more than 29 lb-ft.

13. Drain the fluid from the differential. If you're going to reuse the fluid (bear in mind you'll need extra) be sure your drain pan is clean. Set aside both the fill plug and the drain plug, neither will be reused.

14. Grab both M18x1.5 -> AN -8 male fittings (27-16385) and both 18mm crush washers (04-37016). Fully tighten (35 lb-ft) both into the drain and fill holes.

15. Using the banjo fitting (27-16445), the banjo bolt (36-16322) and two 22mm bonded seal washers (36-31222, one on either side of the banjo fitting), create an assembly as shown and thread it into the inside port of the cooler. Point



the outlet towards the top of the differential, being careful to maximize the space between the hose and the differential. Tighten down the banjo bolt. **BE SURE TO SUPPORT THE HEX ON THE COOLER** and tighten to 29 lb-ft.

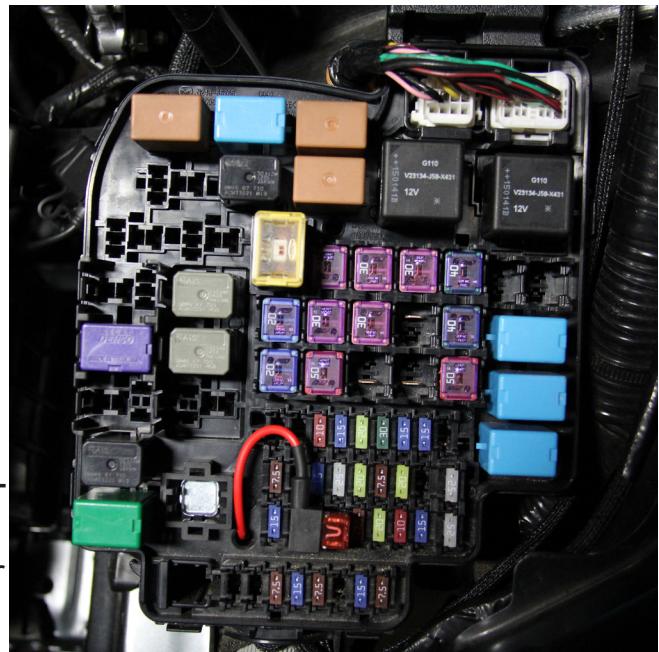
16. Loosely install a 0° AN -8 -> hose barb onto the banjo fitting and a 90° AN-8 -> hose barb onto the diff fill. Measure the length of hose (we used 22") and assemble. Permanently install the hose on the cooler end and loosely install it on the diff end. Follow the oil and torque rules.

17. Smear some oil on the threads and flare, then temporarily connect the AN-8 temp sensor fitting (27-16487) that we've been using for hose assembly to the fitting in the differential drain.

18. Loosely install the 60° female AN -8 → hose barb onto the assembly from step 17, pointing up. Loosely install a 0° AN -8 → hose barb onto the inlet of the filter from step 5.
19. Measure the length of hose needed to connect the two fittings from the previous step - we used 34". Assemble per Appendix A.
20. Using thread sealant, tighten the 1/8 NPT temp sensor (36-80605, with two metal terminals) into the AN-8 temp sensor fitting we've been using to assemble the hoses (27-16487). Tighten the temp sensor itself 3/4 - 1-3/4 turns past hand-tight, but don't exceed 12 lb-ft. Smear some oil on the fitting in the drain and install this assembly to the standard AN -8 torque. Install the remaining fittings and hose here. Be sure to oil the fittings and torque appropriately. We'll fill the system later, for now we need to wire the pump.

Wiring

1. Disconnect the negative terminal of the battery.
2. Crimp a blue female spade (36-80151) onto one end of the black 14ga wire (36-80215 BLACK). Heat-shrink the wire end of the terminal, then push it onto one of the male terminals on the temp sensor in the fitting coming out of the diff drain. It doesn't matter which terminal it's connected to. Be absolutely sure your crimps are solid, give them a slight tug to make sure they won't let go. You MUST heat-shrink the butt connector to seal the connection and (more importantly) provide strain relief.
3. Route the black wire from step 2 up to the pump appropriately to determine the correct length. Connect this wire to the black wire on the pump using a blue butt connector (36-80105).
4. Use a blue butt connector (36-80105) to connect the red pump wire to the red 14ga wire (36-80215 RED).
5. Slip this wire into the wire loom (36-88510) and route this wire all the way forward, zip-tying as needed. It's typically best to run it with the brake and fuel lines on the left side of the car. The wire should end up at the main fuse box.
6. Remove the fuse in the "Meter" location of the fuse box and install the fuse adapter (36-80555) in its place. The stock fuse won't be reused. Install the included 10-amp fuse (36-80515) in the lower location in the adapter, this is the new "Meter" fuse. Install the second 10-amp fuse in the upper location for the pump.



7. You can run the wires through the bottom of the fuse box if you'd like. It's a bit of a pain, so be prepared to problem-solve. You'll need to remove the M6 nut at the top corner, remove any zip-ties holding it down / together, and flex all of the tabs along the box's periphery back. If it doesn't release, don't force it - one of the tabs probably re-engaged. Be sure to properly support the bottom of the box when you reassemble it to ensure it clips together - it may be easier to remove the two nuts holding the bottom of the box down to get better access to squeeze it together.
8. If you don't run the wires out of the bottom of the fuse box, cut a groove in the lid to allow the wire to pass through.
9. Use a blue butt connector (36-80105) to connect the red wire from steps 4 and 5 to the fuse adapter. The pre-crimped butt connector isn't a heat-shrink connector, so we recommend replacing it.
10. Clean up the wiring using the remaining loom and electrical tape. Zip-tie in place as needed. If possible, cut the loom with a hot knife that will melt the ends together - it has a tendency to fray otherwise. Use 3" of the included heat-shrink tubing (36-80015) to secure each end of the loom.
11. Put the black wire from steps 2 and 3 in the existing wire loom over the red wire at the pump as far as is logical, then let it break out of the wire loom to head towards the differential. Slip the remaining wire loom over the wire at the bottom and feed it up the wire. If it's easier, unplug the female spade from step 2, pull the wire out from the subframe, install the loom, then reroute the wire and push the spade back onto the temp sensor. Zip-tie as needed. Use the smaller heat shrink tubing on both ends of wire loom.
12. Attach the blue ring terminal (36-80059) to the end of the 14ga black wire remaining from step 3.
13. Attach this ground to the closer M6 hole where the diff cooler bracket mounts (arrow 3 on p.5). The other end of this wire will attach to the remaining terminal on the temp switch from step 2. Cut it to length and attach a blue female spade (36-80151). Push it onto the remaining terminal.

Priming the system

1. Remove the hose connected to the differential inlet. Fill the differential with fluid. You can use stock fluid ("Mazda Long Life Hypoid Gear Oil SG1") or a high-quality synthetic 75W90. Leave the hose disconnected.
2. Disconnect the black wire running to the pump from the temp switch. Use some left-over wire to create a rudimentary jumper that will allow you to ground out this wire.
3. Turn the ignition on (our power wire is switched with the ignition) and cycle the pump briefly to pull fluid out of the differential to fill the lines and cooler. Be sure you don't pull all of the fluid out of the differential, check its level frequently and refill as needed. The fluid will come out in a rush if you leave the pump on too long, so be careful.

4. Once fluid comes out of the hose, top off the differential itself and connect the hose. Try to lose as little fluid as possible, but the pump won't let much (if any) fluid back-flow. Be sure there's some oil on the threads and taper (presumably not a problem) and tighten the fitting one turn beyond hand-tight (max of 29 lb-ft).
5. Once everything's tight, clean up any drips and trigger the pump to flow constantly. Watch it for a bit to make sure you don't have any drips anywhere. Address any drips that appear - you can probably snug fittings a bit more, but be careful about over-tightening.

Finishing details

1. Give a final once-over to all of the wiring and hoses. Be sure that nothing will chafe and fail, rearrange and secure as necessary.
2. Trim the plastic duct near the cooler as shown. The duct helps guide air to the cooler, so it's important that it's reinstalled.
3. The filter on the pump eliminates the need for the magnet in the drain plug, so it's okay that we're eliminating that magnet. The filter shouldn't need much attention, but it's a good idea to clean it every five years or so. As usual, the more severe the duty, the more frequently it will need to be cleaned.

Appendix A

In order to allow for adjustment of the hose lengths as needed, the installer will need to assemble the hoses. This is a bit of a pain, but it shouldn't be too bad if *all* of the steps are followed.

1. As you route the hose, mark where chafe protection (woven loom / protective sleeve) will need to be installed.
2. Once the appropriate length has been determined, cut the hose squarely using a fine-tooth hacksaw, cable shears, PVC cutter, box knife, or a cut-off wheel. If you'd like to ensure a square cut, wrap masking tape around the hose to establish a straight line to follow.
3. Cut the 1" heat shrink tube into 3" sections and slip the appropriate number of sections onto the hose before installing the ends. These will be used to secure the protective sleeve that goes over the hose once it's fully assembled.
4. This hose is easier to assemble if it's warm - leave it in warm sunlight for awhile, or warm up some water and put the end of the hose in it to soften.
5. Mount the male -> female AN -8 fitting with 1/8 NPT port (27-16487) gently but firmly in a vise, with the male end exposed. It can point horizontally or vertically, whichever is easiest in your situation, but be sure it won't rotate as you force the hose one. Clamp the body of the fitting, NOT the female nut. If necessary, shim to ensure you won't crush the female nut. Use a rag or aluminum jaws if you don't want to scratch the anodizing, failure to do so will ensure some aesthetic damage.
6. Thread the fitting that's being assembled onto the fitting in the vise. You don't have to fully torque it, but be sure that the barb end of the fitting can't wobble around.
7. Lubricate both the fitting's hose barb and the interior of the hose with clean motor oil. Slip a hose clamp (36-70650) over the hose (this must be done before the fitting is installed).
8. Push and twist the hose onto the barb. It's best if this is done in one continuous motion - in other words, try not to stop once it's moving. Remember to clock the second fitting installed in the hose as appropriate. Hoses with at least one straight fitting don't need to be clocked.
9. Once the hose is fully installed on the hose barb, move the hose clamp to between the two humps in the hose from the barb in the fitting. Pinch each ear equally with pinch hose clamp pliers.
10. Repeat for the other side (again, pay attention to clocking if need be).
11. Slip the abrasive sleeve over the hose, then slip the ends of the sleeve into the ends of the two heat shrink tubes (one at each end). Shrink the heat shrink tube using a heat gun and you're done.