

Arctic Silver Thermal Compound Instructions

Cautions

- While much safer than greases engineered for high electrical conductivity, Arctic Silver thermal compounds should be kept away from electrical traces, pins, and leads.
- The compound is slightly capacitive and can cause problems if it bridges two close-proximity electrical paths. Never turn on a computer without a heatsink properly mounted on the CPU with a thermal interface material between the CPU core and the heatsink.
- A modern high-performance CPU can be permanently damaged in less than 10 seconds without proper cooling.
- Arctic Silver compounds are a grease and do not have any adhesive qualities. It will never dry or set and cannot be used to glue a heatsink to a chip.
- To *permanently* glue a heatsink to a chip that does not have any other attachment method, please use Arctic Silver Adhesive.

Reminder

Due to the unique shape and sizes of the silver particles in Arctic Silver thermal compound, it will take up to 72 hours to achieve maximum particle to particle thermal conduction and for the heatsink to CPU interface to reach maximum conductivity. (This period will be longer in a system without a fan on the heatsink.) On systems measuring actual internal core temperatures via the CPU's internal diode, the measured temperature will drop as much as 2C to 4C over this "break-in" period.

Before You Begin

Even though Arctic Silver thermal compounds are specifically engineered for high electrical resistance, you should keep the compound away from processor, memory, and motherboard traces and pins. Arctic Silver thermal compounds are slightly capacitive and there is a possibility that dust or metal particles and/or shavings carried by the airflow inside the computer case could contaminate the compound and increase its electrical conductivity. **ONLY Arctic Silver thermal compound should be between the processor core and the heatsink.**

Remove any thermal pads or other interface material from the heatsink before applying the Arctic Silver thermal compound. Thermal pads are made with paraffin wax that melts once it gets hot. When it melts, it will fill in the microscopic valleys in the heatsink with wax. To minimize the permanent contamination of the mounting surface with wax, the thermal pad should be removed before it is used and melted. Never use heat or hot water to remove the pad, the heat will melt the wax into the heatsink. Thermal pads can be scraped off with a plastic tool that will not scratch the heatsink then the remnants can be removed with a xylene based cleaner, (Goof Off and some carburetor cleaners) acetone, MEK, mineral spirits, or 99% isopropyl alcohol.

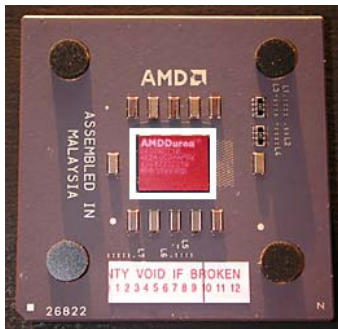
Never use any oil or petroleum based cleaners (WD-40, citrus based cleaners and many automotive degreasers) on the base of a heatsink. The oil, which is engineered to not evaporate, will fill in the microscopic valleys in the metal and significantly reduce the effectiveness of any subsequently applied thermal compound.

Important Precautions

**Don't put it in your mouth.
Keep it away from children and pets.**

Application Instructions

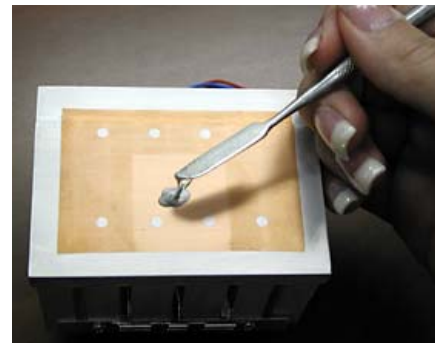
On the CPU, Arctic Silver thermal compound should only be applied to the top of the core. The core is the raised rectangle in the center of the CPU and is colored red and boxed in white in the photos below of AMD and Intel CPUs.



Note that on the Intel P4, the compound is applied to the integral heat spreader. (The metal cap that covers the actual CPU core.)

Clean the mating surfaces completely with a low residual solvent (High-purity isopropyl alcohol or acetone) and a LINT FREE cloth. (i.e. lens cleaning cloth) If another thermal compound has previously been applied, the mounting surface should be thoroughly scrubbed and cleaned with a xylene based cleaner, (Goof Off and some carburetor cleaners) acetone, MEK, mineral spirits, or 99% pure isopropyl alcohol. Keep the surfaces free of foreign materials and DO NOT touch the surfaces. (A hair, piece of lint, or even dead skin cells can significantly affect the thermal interfaces performance.) In addition, oils from your fingers can adversely affect the performance by preventing the micronized silver from directly contacting the metal surface. (Fingerprints can be as thick as 0.005")

Determine what area on the base of the heatsink will contact the CPU core once the heatsink is mounted. Twist the plunger in the syringe barrel at least 1/2 turn to insure that it is free. Squeeze enough Arctic Silver thermal compound onto the center of this area to create a small mound as shown in the photo below on the left. Do not apply the Arctic Silver thermal compound directly to the CPU.



Using a clean razor, the clean edge of a credit card, a clean knife, or some other appropriate clean tool, pick up a small dab of the Arctic Silver compound from the mound you put on the heatsink as shown in the photo above on the right.



Put the dab of Arctic Silver thermal compound you removed from the heatsink base onto one corner of the CPU core as shown in the photo to the right. Only apply the thermal compound to the top of the actual CPU core. (Also known as the slug or die.) In the photo to the left it is the small raised blue rectangle in the middle of the Celeron II processor. On an AMD Duron or T-bird, it is the small raised rectangle in the center of the AMD processor.

Only a very small amount of Arctic Silver thermal compound is needed on modern CPU cores, about 1/2 the size of an uncooked grain of short-grain white rice or 1/4 of a BB.



Tint (stain) the bottom of the heatsink in the area where the CPU core will contact it. Put a finger into a plastic bag and thoroughly rub the compound into the base of the heatsink using both clockwise and counter-clockwise circular motion as shown in the photo to the left. This will insure optimum filling of the microscopic valleys in the metal.

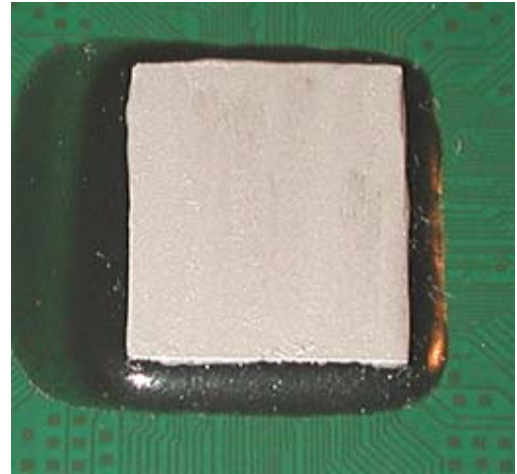
DO NOT use your bare finger to apply or smooth the compound (skin cells, and oils again)

Re-clean the heatsink surface with a LINT FREE cloth as shown in the picture to the right. Do not use any solvent or fluid. On copper or anodized aluminum heatsinks, you may notice that the base of the heatsink is slightly discolored even after all the compound seems to have been removed. That is the Arctic Silver thermal compound filling the microscopic valleys.



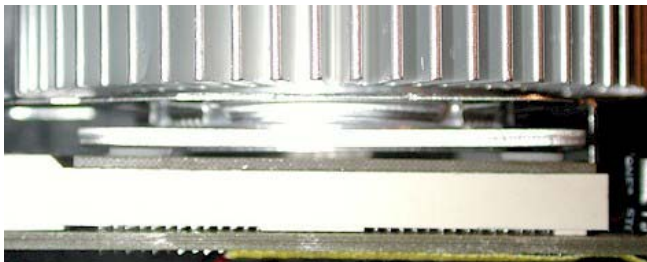
Spread the Arctic Silver thermal compound over the CPU core as shown in the photo to the left. The small amount transferred from the heatsink in the step at the top of the previous page has been carefully spread over the top of the core using a single edge razor blade. A razor blade or the clean edge of a credit card can be used as the application tool. You may use whatever tool you choose as long as it is CLEAN and allows you to control the application area and thickness. The flatter the mating surfaces, the thinner the layer that is required. Stock processors and/or heatsinks with normal surface irregularities will require a layer 0.003" to 0.005 thick as shown below to fill the resultant gaps. (Equal to the thickness of about 1 sheet of standard weight paper.) Properly lapped heatsinks with mirror finishes will only require a translucent haze.

To the right is a close up of the top of the CPU core with a fairly thick layer of Arctic Silver thermal compound applied. Lapped heatsinks would probably require a thinner layer while heatsinks with very rough bases could require a slightly thicker layer. In almost all instances, the proper layer thickness will be equal to or less than the thickness of a sheet of paper.



RE-CHECK to make sure no foreign contaminants are present on either the bottom of the heatsink or the top of the CPU core. Mount the heatsink on the CPU in the proper orientation per the heatsink's instructions. Verify that the pressure point on the clip is directly above the CPU core.

PRESS the two surfaces together ONLY. Minimize any "twisting" or lateral "sliding" in either plane in an attempt to mate the "peaks" of the surfaces together. When you twist or slide one surface against the other, "peaks" on one or both surfaces will travel over areas where two "valleys" should come to rest. The peaks will scrape away compound that is needed to fill the void between the valleys that will oppose each other when the surfaces are in their final position and cause small voids (air gaps). ANY air gap will significantly increase thermal resistance in an otherwise GOOD interface. If the thermal compound is properly made and of the proper consistency, direct non-sliding pressure vertical to the mating plane will be more than enough to insure that the surfaces "bottom out". Additionally, "sliding" the surfaces together may cause one surface to scratch/gouge the other possibly opening up a larger inter-surface gap which will increase thermal resistance.



Secure the heatsink with the supplied clips or other hardware. Carefully check from all four sides that the heatsink is sitting flush on the CPU core. It is possible for some heatsinks to sit at an angle on the CPU core even when they are properly oriented and the clip is properly engaged as shown in the photo to the left. Notice how there is more space between the right side of the heatsink base and the CPU ceramic than between the left side of the heatsink base and the CPU ceramic. This heatsink is tilting to the left and is not making proper contact with the CPU core.

Storage

Like any mix of particles that are many times heavier than the suspension fluid, there will be some separation in the compound over time when stored in the original syringe. (All thermal compounds eventually experience some separation in storage.) This does not affect the performance of the unseparated or remixed compound.

To keep the compound fresh for future applications, always replace the cap on the syringe after each use. The syringe should be stored tip down so that any separation that occurs will be at the back end of the syringe with fully suspended particles below that. Storing in a cool place like a refrigerator will also lessen the separation over time.

Removal Instructions

Arctic Silver thermal compounds can easily be removed from hardware using the proper cleaners and tools. For general clean up, a cloth or paper towel will work well. Intricate cleaning can be accomplished with Q-tip swabs. An old toothbrush can often get the compound out of crevices that other tools cannot reach.

The recommended cleaners are:

CPU Core:

Use isopropyl alcohol or acetone and a bit of careful rubbing.
(If you use acetone, do a final cleaning with high-purity isopropyl alcohol.)

Heatsink:

Use xylene based products (Goof Off, some carburetor cleaners and many brake cleaners.) acetone, or mineral spirits.

Once you have applied thermal grease or melted a thermal pad onto a heatsink, it is impossible to remove all of the grease or pad from the microscopic valleys in the heatsink using standard cleaning chemicals and paper or fabric towels. Any subsequent thermal material will be applied over the remnants of the original material.

Never use any oil or petroleum based cleaners (WD-40, citrus based grease removers and many automotive degreasers) on the base of a heatsink. The oil, which is engineered to not evaporate, will fill in the microscopic valleys in the metal and significantly reduce the effectiveness of any subsequently applied thermal compound.

CPU Ceramic:

Use any of the following cleaners.
Any dish detergent (Dawn, Lux, Palmolive, Etc.) Do not use soap for an automatic dishwasher to clean a CPU.
WD-40, citrus based grease removers (Goo Gone, Etc.)
Xylene based products (Goof Off, some carburetor cleaners and brake cleaners.)
Mineral spirits. (Be careful to keep the mineral spirits away from the core.)
Once the majority of the compound has been removed from the ceramic, small patches remaining on the ceramic can be 'erased' with a soft eraser.

If you use any of the suggested products to remove Arctic Silver thermal compound from the CPU ceramic or heatsink base, always do a final cleaning with high-purity isopropyl alcohol to remove any residue from the cleaner.

Yourself:

To remove Arctic Silver thermal compound from your skin, Wash your hands with any dish washing detergent (Dawn, Lux, Palmolive, Etc.) rather than hand soap. (Do not use soap for an automatic dishwasher.)