Arctic Silver®

Thermal Compound Application Method

• Surface Spread •

Contents

Introduction

Thank you for purchasing an Arctic Silver thermal compound. Please read all instructions carefully before applying your new compound. While these instructions were tested using the following Arctic Silver products (Arctic Silver 5, Céramique, Arctic Alumina and Matrix) the surface spread method is applicable with any thermal compound used with the following CPU:

- Any AMD® Mobile or Notebook CPU (K6 through K10)
- Any AMD® CPU without a Metal Cap (heatspreader)

A note about heatsinks:

If the base of your heatsink is not flat due to exposed heat-pipes or ridges, please read the Heat-Pipe Heatsink Method first:

http://www.arcticsilver.com/pdf/hp/hphs_method.pdf

Precautions

Arctic Silver Thermal Compound Precautions:

1) Don't put it in your mouth.

2) Keep away from children or where children can get a hold of it.

3) Keep it away from pets.

4) Arctic Silver 5 ONLY: While much safer than silver greases engineered for high electrical conductivity, Arctic Silver 5 thermal compound should be kept away from electrical traces, pins, and leads. Arctic Silver 5 is slightly capacitive and could cause problems if it bridged two close-proximity electrical paths.

5) Never turn on a computer without a heatsink properly mounted on the CPU and thermal compound between the CPU core and the heatsink. A modern high-performance CPU can be permanently damaged in less than 10 seconds without proper cooling.

6) Arctic Silver 5, Céramique, Arctic Alumina and Matrix thermal compounds are greases and have no adhesive qualities. They will never dry or set and cannot be used to glue a heatsink to a CPU core.

Application Instructions

Heatsink Preparation:

If your heatsink has thermal material or a thermal pad on it, the existing material or pad must be removed prior to applying the new thermal compound. Only the new thermal compound should be between the heatsink and the metal cap of the CPU.

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

Thermal pad removal: Most thermal pads are made with paraffin wax that melts once it gets hot. As it melts, the wax fills the microscopic valleys in the heatsink and metal cap of the CPU. To minimize permanent contamination of the heatsink and metal cap, the thermal pad should be removed from the heatsink prior to turning on the computer. Never use heat or hot water to remove the pad, as the heat will melt the wax into the heatsink.

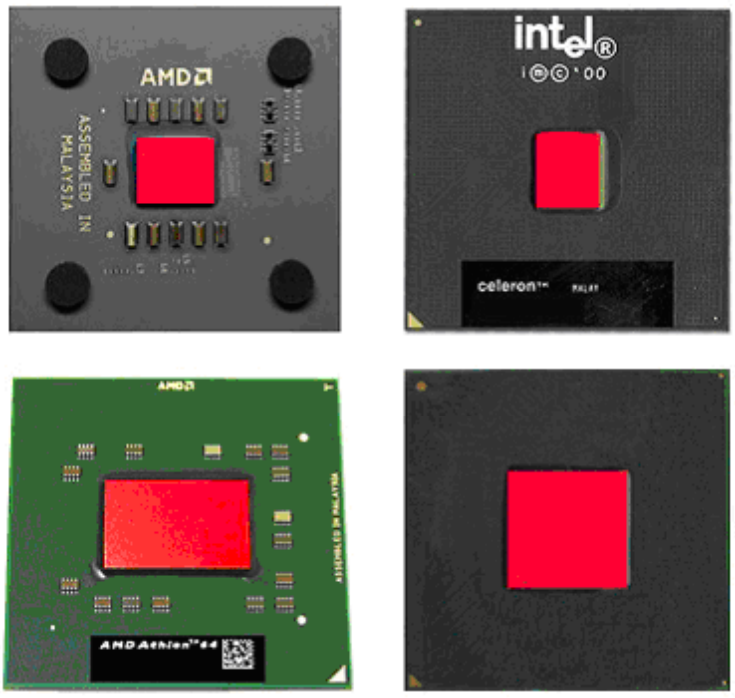
Take care not to scratch the surface of the heatsink when removing the pad. A plastic tool will scrape off the thermal pad without scratching the metal surface. You can then remove the remnants of the wax with ArctiClean 1 and 2, a xylene based cleaner (Goof Off and some carburetor cleaners), or high-purity isopropyl alcohol and a LINT FREE cloth (a lens cleaning cloth or a coffee filter). If you use Goof Off or another xylene based cleaner always follow up with a cleaning of high-purity isopropyl alcohol.

Thermal material removal: Remove existing thermal material with ArctiClean 1 and 2, a xylene based cleaner (Goof Off and some carburetor cleaners), or high-purity isopropyl alcohol and a LINT FREE cloth (a lens cleaning cloth or coffee filter). If you use Goof Off or another xylene based cleaner always follow up with a cleaning of high-purity isopropyl alcohol.

Important: Keep the surface free of foreign materials and do NOT touch the surface after it has been cleaned. A hair, piece of lint, and even dead skin cells can significantly affect the thermal interface's performance. Oils from you fingers can adversely affect the performance by preventing the micronized silver or ceramic fill from directly contacting the metal surfaces. (Fingerprints can be as thick as 0.005")

CPU Preparation:

The surfaces highlighted in red are the CPU core in picture QP1. If the core is new, cleaning is not required, but is highly recommended. If any existing thermal material is on the core, the surface must be cleaned prior to applying your new thermal compound.



QP1

Thermal material removal: Remove existing thermal material with ArctiClean 1 and 2, a xylene based cleaner (Goof Off and some carburetor cleaners), or high-purity isopropyl alcohol and a LINT FREE cloth (a lens cleaning cloth or coffee filter). If you use Goof Off or another xylene based cleaner always follow up with a cleaning of high-purity isopropyl alcohol.

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Tinting the Heatsink:

Why tint the heatsink? Simply put, it will lessen the break-in period. If the break-in period is reduced you will achieve maximum performance in less time (To learn more about the break-in period for your Arctic Silver's product please see page 7).

Here is the list of things you will need to tint your heatsink:

- Your new thermal compound
- An old credit card or a piece of hard plastic with a straight edge
- Coffee filter or lens cleaning cloth.

Photo HS1 shows Céramique being used however, the method of tinting a heatsink is the same for Arctic Silver 5, Arctic Alumina and Matrix Thermal Compounds. Determine what area on the base of the heatsink will contact the core once the heatsink is mounted.

HS1

Squeeze enough thermal compound onto the center of this area to create a small mound. By working the plastic tool (old credit card) back and forth in all directions (See the green symbol in photo HS1) you will smooth out the compound and work it into heatsink. This will ensure optimum filling of the microscopic valleys in the metal where the core will contact the heatsink.

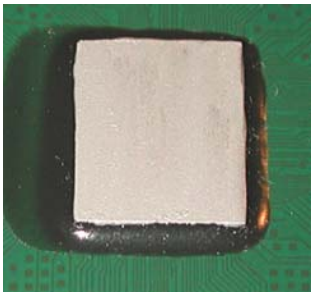
Important! DO NOT smooth or apply the compound with your bare finger, you will contaminate the surface (skin cells, and body oil again). After you have thoroughly worked the thermal compound into the surface of the heatsink, remove the excess compound by wiping it away with a coffee filter or a LINT FREE cloth. DO NOT use any solvent or fluid to clean the surface or you will reverse what you just accomplished. Notice that the base of the heatsink is slightly discolored even after the entire compound would seem to have been removed. The discoloring you see is the thermal compound inside the microscopic valleys of the heatsink.

Applying Thermal Compound:

Apply some thermal compound and nothing else to the corner of the die as shown in photo QP2. The amount of thermal compound to apply depends on the surface area of your die. For a small single core CPU use about 1-2 cubic millimeters (1/4 of a bb or 1/2 uncooked grain of white rice) of thermal compound. For a large single or multiple core CPU, use 4-5 cubic millimeters (2/3 of a bb or 1 uncooked grain of white rice) of thermal compound. Spread the thermal compound over the die as shown in photo QP3 and QP4. The small amount of thermal compound has been carefully spread over the top of the die using a single edge razor blade. A razor blade or the clean edge of a credit card can be used as an application tool. You may use whatever tool is available as long as it is CLEAN and allows you to control the application area and thickness. The flatter the mating surface of a die and heatsink, the thinner the layer of thermal compound 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.

QP2

QP3



QP4

Attaching the Heatsink:

Use your manufacturer's heatsink instructions in combination with the following suggestions: RECHECK to make sure no foreign contaminants are present on either the bottom of the heatsink or the top of the core. Be sure to lower the heatsink straight down onto the core. Once the heatsink is properly mounted, grasp the heatsink and very gently twist it slightly clockwise and counterclockwise one time each if possible (Just one or two degrees or so if possible). Please note that some heatsinks cannot be twisted once mounted. Once mounted properly you should have an optimum bond line between the two surfaces.

Once you are finished applying thermal compound and mounting your heatsink properly, turn on your computer. Your computer should function normally. For more information on the break-in period, please see below.

If you have unusually high temperatures, please refer to the trouble shooting list on page 9 of these instructions.

Break-In Period Explained:

Due to the unique carrier fluid used and the shapes and sizes of the thermally conductive particles in Arctic Silver's thermal compounds it will take multiple thermal cycles to achieve maximum particle to particle thermal conduction and for the heatsink to metal cap 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 often drop slightly to significantly over this "break-in" period. This break-in will occur during the normal use of the computer as long as the computer is turned off from time to time and the interface is allowed to cool.

Break-In Period by Thermal Compound:

Arctic Silver 5:
Break-in period: 200 hours (Break-in period will occur during normal use.)
Temps will drop several degrees over the break-in period measured with a thermal diode in the hottest part of the CPU core.

Céramique:
Break-in period: 25 hours (Break-in period will occur during normal use.)
Temps will drop several degrees over the break-in period measured with a thermal diode in the hottest part of the CPU core.

Arctic Alumina:
Break-in period: 36 hours (Break-in period will occur during normal use.)
Temps will drop several degrees over the break-in period measured with a thermal diode in the hottest part of the CPU core.

Matrix:
Break-in period: 300 hours (Break-in period will occur during normal use.)
Temps will drop several degrees over the break-in period measured with a thermal diode in the hottest part of the CPU core.

Storage And Clean-Up

To keep your new thermal 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 between the particles and suspension fluid will be at the back end of the syringe. Like any mix of particles that are many times heavier than the suspension fluid, there may be some separation in the compound over time when stored in the original syringe. Storing in a cool place like a refrigerator will minimize the possibility of separation over time. This does not affect the performance of the un-separated or remixed compound.

Removal From Hardware:

Thermal compound 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. Again, use ArctiClean 1 and 2 or high-purity isopropyl alcohol.

CPU Core: Remove thermal material with ArctiClean 1 and 2, a xylene based cleaner, (Goof Off and some carburetor cleaners) or high-purity isopropyl alcohol and a LINT FREE cloth (a lens cleaning cloth or coffee filter). If you use Goof Off or another xylene based cleaner always follow up with a cleaning of high-purity isopropyl alcohol.

Heatsink: Remove thermal material with ArctiClean 1 and 2, a xylene based cleaner, (Goof Off and some carburetor cleaners) or high-purity isopropyl alcohol and a LINT FREE cloth (a lens cleaning cloth or coffee filter). If you use Goof Off or another xylene based cleaner always follow up with a cleaning of high-purity isopropyl alcohol.

CPU Ceramic Package: Remove thermal compound with ArctiClean 1 and 2, a liquid dish soap (not dishwasher detergent), WD-40, Citrus based cleaners, xylene based products (Goof Off, some carburetor cleaners and many brake cleaners.) or mineral spirits. Once the majority of the compound has been removed from the ceramic, small patches remaining on the ceramic package can be 'erased' with a soft eraser.

Removal From Self:

Wash your hands with any liquid soap (Dawn, Lux, Palmolive, Etc.) rather than hand soap. (Do not use detergent for an automatic dishwasher.)

Troubleshooting

When someone gets temperature results that are the opposite of the results achieved by hundreds of thousands of other users, the problem can usually be traced to one of 12 things listed below:

1. The heatsink was cleaned with an oil based cleaner which filled the microscopic gaps and contaminated the interface.

2. The existing thermal interface material was not completely removed. The compound should be the only material between the heatsink and the CPU.

3. The heatsink was not installed properly.

4. The thermal compound was applied too thick.

5. The measurement is being taken on the cold side of the thermal junction or on the side of the core where thermal compound squeezed from the junction contaminates the probe. (Better compound then transfers more heat to the probe so the temperature reads higher.)

6. The measurement probe moved when the chip was removed to clean off the previous compound.

7. The compound was not allowed to go through its break-in period. (Minimum 25 hours. Can be 400+ hours.) Temperatures will drop 1C to 5C over this time.

8. The application was contaminated with an eyelash, a bit of dirt, fingerprint or something else that spaced the heatsink away from the metal cap.

9. An unbalanced heatsink fan is causing excessive vibration and damaging the interface layer.

10. An improperly manufactured or bent shim is interfering with proper contact between the CPU core and the heatsink.

11. The heatsink fan was not plugged back in after the compound was changed.

12. The ambient temperature where the computer is located has changed. If the room temperature changes, the CPU temperature will also change. It is important to remember that cooling solutions keep the CPU X number of degrees above ambient. So if the ambient temperature increases 3 degrees, the CPU temperature will also increase 3 degrees.