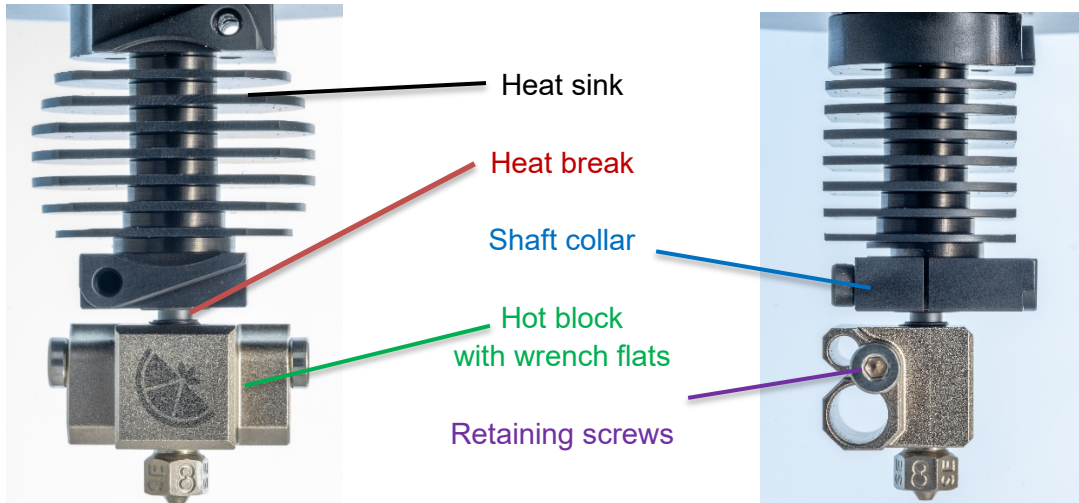


# Copperhead™ Installation Instructions



## Copperhead™ Performance Advantages

Eliminate heat creep with the Slice Engineering® Copperhead™ all-metal hotend. The open source (CC-BY-SA 4.0) Copperhead™ design utilizes the Bimetallic Heat Break™ technology from the best-selling Mosquito™ hotend, plus a myriad of other features to improve printing performance and ease of use.

Copperhead™ is rated for operation up to 450°C, meaning it can print all printable thermoplastics, including PEEK, Ultem (PEI), ASA, polycarbonate, Nylon, and others.

For a complete list of Copperhead™ performance benefits, check out our [website](#).

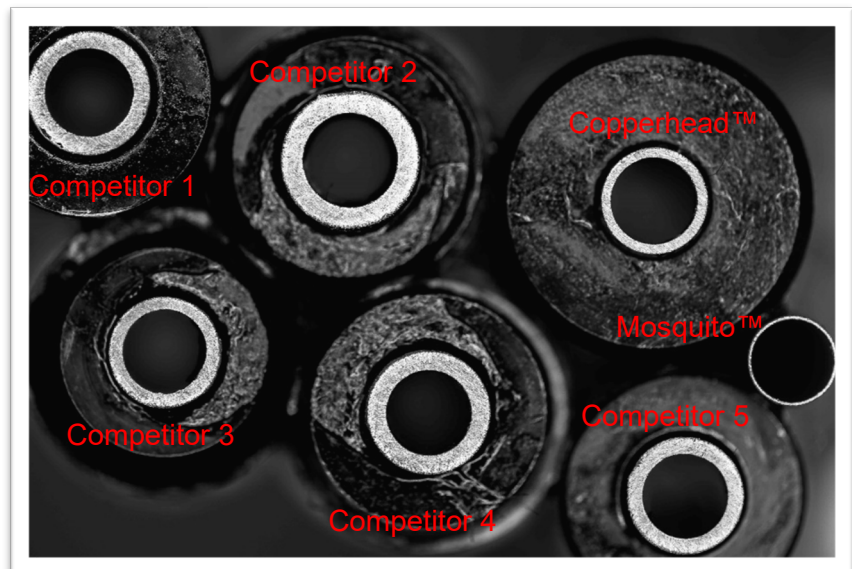



Figure 1. Heat Break comparison – cross sectioned to show area of heat transmission

## How to Install a Copperhead™ on Your Printer:

### 1. Choose the Correct Variant

The Copperhead™ is available in numerous variants to allow for maximum adaptability to a variety of 3D printers. Certain 3D printers have been pre-vetted by Slice Engineering® and are shown in the Compatibility Chart below. But the chart is by no means exhaustive – if your 3D printer is not listed, please [reach out to us](#) and we can help you find the right solution. Printable adapters are also available for certain common 3D printers.



| w/ Heat Sink (Screw Mount)                              | w/ Heat Sink (Groove Mount)  | Standard (Ø6, length 10) | RepRap 1.75   | RepRap 2.85   | Mk 8   | Mk 10  |
|---|--|--------------------------|---|---|--|--|
| Uses the same screw mounting interface as the Mosquito™ | Bondtech BMG<br>Bondtech QR<br>D-Bot Core XY<br>Formbot Raptor 1<br>Formbot Raptor 2<br>Formbot Troodon<br>RailCore II<br>Zesty Nimble<br>Creality CR-10*<br>Any free-standing groovemount hotend<br>*with printable mount | Raise3D Pro2             | E3D V6<br>E3D Titan<br>E3D Volcano<br>Prusa Mk2<br>Prusa Mk2s<br>Prusa Mk3<br>Prusa Mk3s<br>Artillery Sidewinder*<br>* requires modified fan shroud | Lulzbot Mini<br>Lulzbot Taz Workhorse<br>Lulzbot Aerostruder head | MakerBot Replicator 1<br>MakerBot Replicator 2<br>Lulzbot Taz 6 Hexagon<br>MK8 Hotends | Cocoon Create 3D Print<br>Dremel Idea Builder<br>FlashForge Creator Pro<br>FlashForge Creator X<br>FlashForge Dreamer<br>MakerGear M2 Series<br>MakerGear M3 Series<br>Monoprice Maker<br>Select 3D Printer v2<br>PowerSpec 3D Pro<br>PowerSpec 3D X<br>PowerSpec Ultra 3D Printer<br>QIDI TECH I<br>Wanhao Duplicator 4S<br>Wanhao Duplicator 4X<br>Wanhao i3 |

Figure 2. Compatibility Chart

Once you have reviewed the Compatibility Chart, select the appropriate version of the heat sink (Groove mount, Screw mount (see Fig. 4), or none) and heat break (Standard, Rep Rap 1.75, Rep Rap 2.85, Mk 8, or Mk10) to fit your 3D printer. The hot block is the same in all configurations.



Figure 3. Copperhead™ Configurations

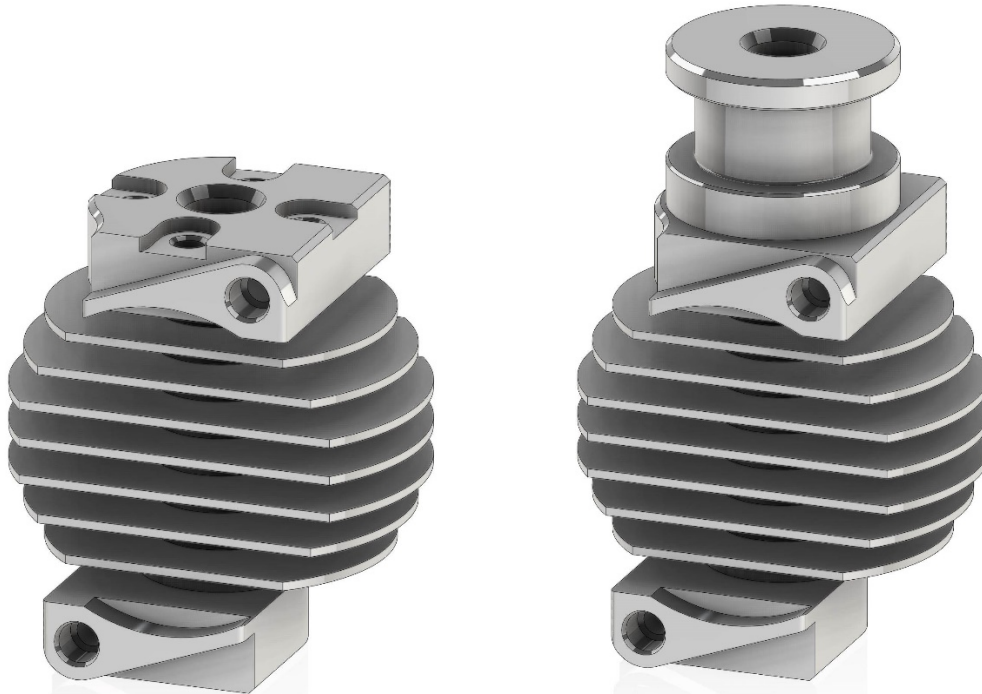


Figure 4. Copperhead™ Heat Sink Variants

The Copperhead™ heat sink is made of black-anodized aircraft grade aluminum and is optimized to reduce fan noise. There is a groove mount variant that is common to many 3D printers, as well as a screw mount variant that features a quartet of M2.5x0.45 tapped holes 12 mm apart (similar to the Mosquito™ mounting interface\*). Both include a coupler designed to accept PTFE tubing with a 4 mm outer diameter (not shown). Slice Engineering® recommends [Capricorn XS](#) tubing since its 1.9 mm inner diameter will prevent dramatically oversized filament from entering the heat break where it could become lodged.

\*NOTE: The Mosquito™ mounting interface also includes two counterbored holes to facilitate mounting to the Bondtech BMG-M. The Copperhead™ DOES NOT include these holes.

## 2. Install the Heat Break on the Hot Block

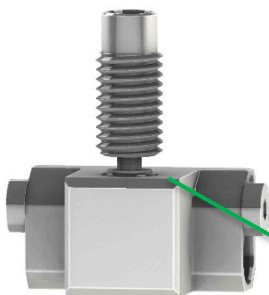


Figure 5. Copperhead™ Hot Block with Bimetallic Heat Break™ Installed

Locate your Copperhead™ Hot Block. Thread the selected variant of Bimetallic Heat Break™ into the Copperhead™ Hot Block until the last thread of the distal section of the heat break is approximately aligned with the top surface of the hot block.

Distal thread aligned

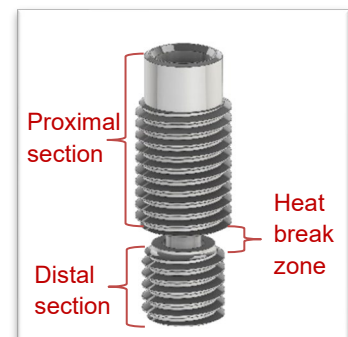


Figure 6. Anatomy of a Heat Break

### 3. Install the Nozzle on the Hot Block

If the threads of the nozzle and the hot block are clean of thermoplastic residue, there is no need to “pre-heat” Copperhead™ to change nozzles. If thermoplastic residue exists, a traditional hot nozzle change is required as with other hot ends. With proper tightening and use of high-quality nozzles, threads will stay clean. Use of Boron Nitride Paste (see Step 4) on the threads and sealing surfaces of the nozzle and heat break improve sealing and boost conduction of heat.



Figure 7. Copperhead™ Hot Block with Vanadium™ Nozzle installed

Locate your nozzle (keep it PG for the kids, please). Thread it into the Copperhead™ Hot Block from the bottom by hand. Grasp the Hot Block wrench flats (see Fig. 7) with a wrench, and then tighten the nozzle. Slice Engineering recommends the use of a [1.5 Nm torque wrench](#) for tightening nozzles to prevent plastic leakage.



Figure 8. Slice Engineering® Nozzle Torque Wrench™

**NOTE:** Not all nozzles are manufactured to withstand 1.5 Nm of torque. Low-quality nozzles may snap under these loads. Do not use the [Nozzle Torque Wrench™](#) on low quality nozzles.

### 4. Use Boron Nitride Paste



Figure 9. Boron Nitride Paste

Slice Engineering® recommends Boron Nitride Paste for use in hotends of any brand. For decades it has been used as a “heat transfer and release coating” for industrial cartridge heaters. Use it to improve heat transfer:

- From the cartridge heater to the hot block, to extend the life of the cartridge heater
- From the hot block to the temperature sensor, to shorten response time and improve accuracy of temperature measurements
- From the hot block to the heat break to improve high flow rate performance when printing with large diameter nozzles
- To improve the seal between nozzle and heat break

Boron Nitride Paste may be used generally, in assemblies operating in temperatures up to 1000°C, as an electrically insulative heat transfer and anti-seize compound.

The paste is aqueous, so the water carrier must evaporate before the compound becomes an electrical insulator. Paste bridging a temperature sensor’s lead wires will affect the sensor’s measurements while the paste remains wet. Dry the paste by allowing it to set overnight, or to save time, heat it to a temperature below 100 °C by activating the cartridge heater in short bursts. The paste will dry completely, and temperature measurements will return to normal upon first use of the hotend.

*Note: Avoid exceeding 100 °C while drying, to keep the water from boiling and ejecting the paste with steam.*

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THE NEXT STEP VARIES DEPENDING ON THE CONFIGURATION OF COPPERHEAD™ SELECTED. IF USING THE COPPERHEAD™ HEAT SINK, PROCEED TO STEP 5. IF USING THE COPPERHEAD™ HOT BLOCK AND HEAT BREAK ON A DIFFERENT TYPE OF HEAT SINK, SKIP TO STEP 7 BEFORE RETURNING TO STEPS 5 AND 6.

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## 5. Install the Temperature Sensor

Copperhead™ works with all temperature sensor types commonly found in 3d printers:

Cartridge sensors of 3mm diameter such as those from Slice Engineering™:

1. Remove either retaining screw (M3 low head socket cap) from the hot block.
2. Apply Boron Nitride Paste inside the hot block’s sensor slot with the provided applicator swab and onto the surface of the cartridge.
3. Insert the sensor into the sensor slot.
4. Reinstall the removed retaining screw.

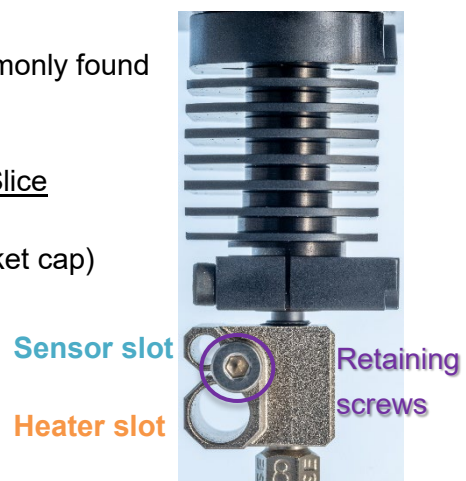


Figure 10. Copperhead™ heater and sensor slots



5. Wipe away any excess Boron Nitride Paste using a cotton swab, then allow it to dry as described in the preceding section.

Threaded stud sensors with M3 threads:

1. Remove either retaining screw from the hot block.
2. Apply Boron Nitride Paste onto the threads and shoulder of the sensor.
3. Install the sensor into the threaded hole previously occupied by the retaining screw
4. Wipe away any excess Boron Nitride Paste using a cotton swab, then allow it to dry as described in the preceding section.

Glass bead sensors:

To achieve accurate temperature measurements with this sensor type, Boron Nitride Paste must fill the space between the glass bead and the wall of the sensor hole. This is achieved by potting the sensor into the hole.

1. Fill the sensor slot with Paste and insert the glass bead deeply into the wet paste
2. Anchor the sensor's leads to the Copperhead™ heatsink using the included Panduit zip tie for cable control and strain relief.
3. Wipe away excess Boron Nitride Paste using a cotton swab or sponge and allow it to dry as described in the preceding section.

## 6. Install the Cartridge Heater

Any cartridge heater that has a 6 mm outer diameter and a cartridge length less than 22.5 mm may be used with Copperhead™.

*Note: A low-quality cartridge heater may have a substantially oversize (out of specification) outer diameter and not fit Copperhead™. If the heater inserts easily, use it, otherwise replace it. Do not force an oversize heater into the cartridge heater slot in the Copperhead™.*

1. Remove either retaining screw from the hot block.
2. Apply Boron Nitride Paste inside the hot block's heater cartridge slot with the provided applicator swab and onto the surface of the cartridge.
3. Insert the heater into the slot.
4. Reinstall the removed retaining screw.
5. Wipe away any excess Boron Nitride Paste using a cotton swab and allow it to dry as described in the preceding section.

## 7. Install the Heat Break into the Heat Sink

Certain variants of the Copperhead™ Heat Break are intended to work with non-Copperhead™ heat sinks. For example, the Rep Rap 1.75 variant installs onto an E3D V6 heat sink, whereas the Mk 10 variant slots directly into the MakerGear M3 heat sink shaft collar. Depending on the variant selected, installation steps will vary.

*NOTE: The Copperhead™ Bimetallic Heat Break™ is very thin and is not designed to resist a torque. Please DO NOT torque the heat break during installation into the heat sink. This will likely damage the heat break.*

The Copperhead™ Heat Sink features a shaft collar that allows for both height adjustability of the Standard heat break and provides rotational mobility. Simply slot the Standard heat break into the Copperhead™ Heat Sink, and tighten the shaft collar with the provided hex wrenches.

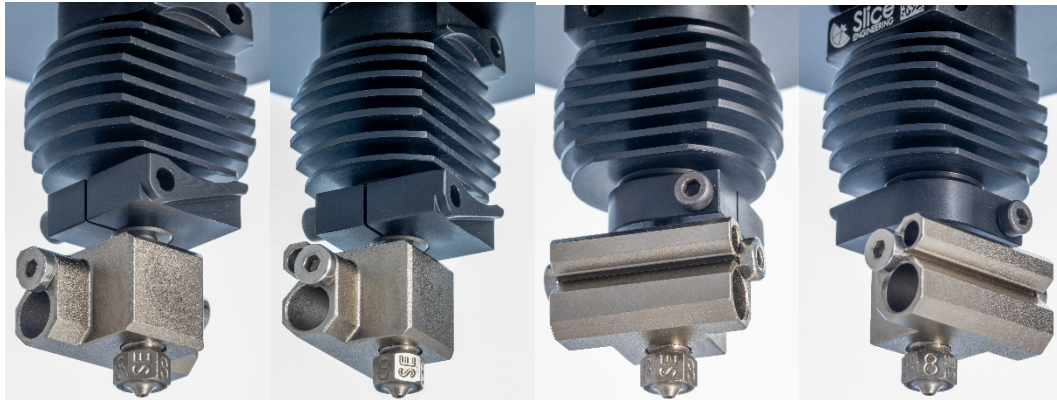


Figure 11. Copperhead™ Hot Block installed at various angles of rotation

## 8. Install the Cooling Fan

The Copperhead™ can utilize a variety of cooling fans. The Copperhead™ Heat Sink fits the Slice Engineering® 25 mm fans natively. Other variants of the Copperhead™ can fit the OEM cooling fan configuration already preinstalled on your 3D printer.

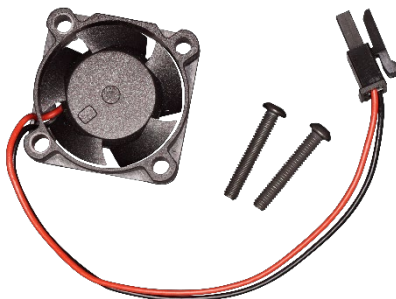


Figure 12. Slice Engineering® fan with included hardware

## 9. Provide Strain Relief and Cable Management

Use the included Panduit zip tie to capture and contain the heater cartridge, temperature sensor, and fan cables as shown in Figure 13.



*Figure 13. Copperhead™ with temperature sensor, heater cartridge, fan, and nozzle installed with strain relief.*