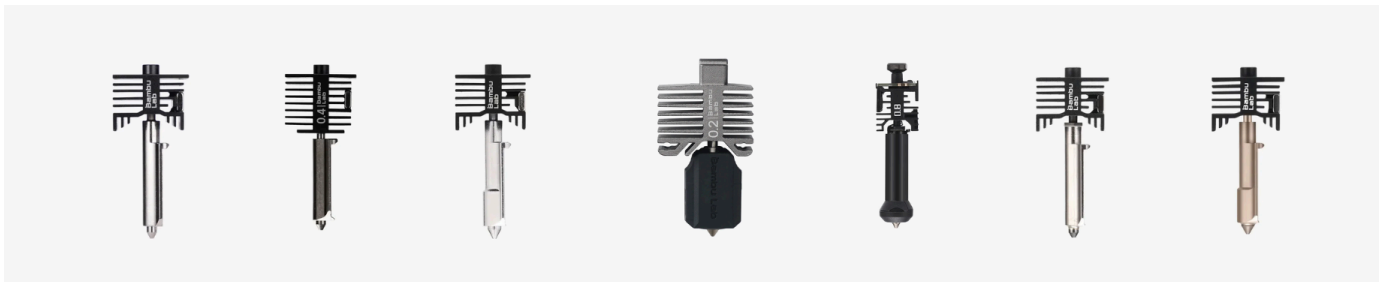


Introduction to Bambu Nozzles

This guide details the features, functions, dimensions, and materials of various nozzles, as well as basic information about silicone sock for hotend.

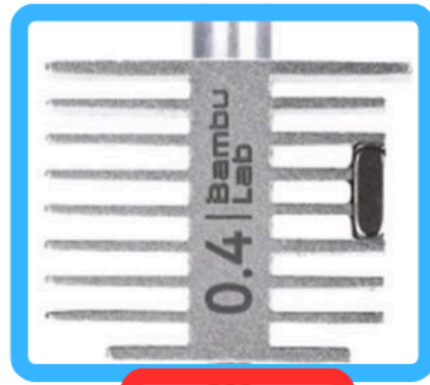
Nozzle

Nozzle, also called the **hotend**, is a core component located in the toolhead of a 3D printer. It heats the filament to a specified temperature, rapidly melting it into a fluid state. The molten filament is then deposited in thin layers to build your 3D model. Nozzle diameters are typically available in four sizes: **0.2 mm**, **0.4 mm**, **0.6 mm**, and **0.8 mm**. Nozzles are made of either **hardened steel** or **stainless steel**.



There are three important parts of the nozzle:

- ▶ **The Cold End:** Keeps the filament solid until it enters the melting zone. Prevents premature softening (heat creep). Supported by a dedicated cooling fan on its left to minimize clogging risks.
- ▶ **The Hot End:** Where the filament is heated and melted for extrusion.
- ▶ **The Thermal Break:** The hot and cold ends are isolated by a robust titanium alloy thermal break, ensuring heat stays concentrated in the melting zone and does not travel upward.



Cold end



Hot end

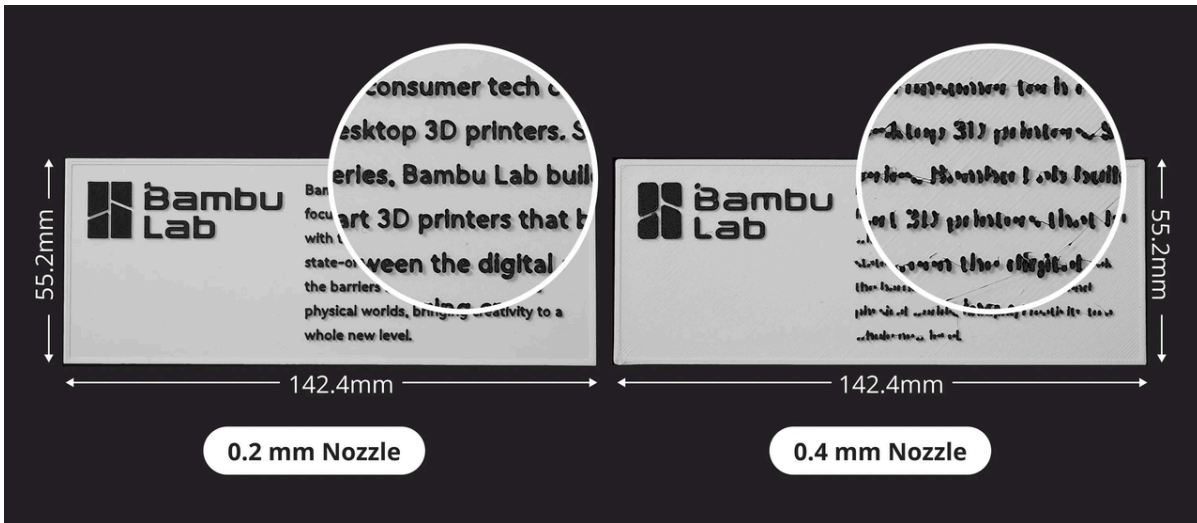
✦ Learn more about filament compatibility on [Filament guide](#).




Size

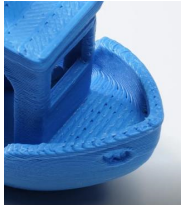
Nozzle size refers to the diameter of the exit orifice at the tip of the nozzle. This dimension dictates the width of the extruded filament and serves as a primary factor in determining the print accuracy, layer height, and speed.

A larger nozzle diameter results in a higher flow rate of molten filament extruded per second, leading to faster printing speeds and stronger parts.

Choosing the right nozzle is a trade-off between speed and precision. The image below shows the difference between a **0.2 mm and 0.4 mm nozzle**. The 0.2 mm nozzle produces clearer, more detailed text. The 0.4 mm nozzle is faster but loses fine detail on small features.





Nozzle diameter	Performance	Features	Primary applications	Layer heights	Potential Drawbacks
0.2 mm		Smallest diameter. Extreme detail and ultra-fine resolution. Superior surface finish. Supports lowest layer heights for maximum quality.	Ultra-fine detail printing, such as miniatures, jewelry, or intricate prototypes requiring high precision.	Typically 0.05 mm to 0.12 mm (25-60% of nozzle diameter for optimal results).	<ul style="list-style-type: none"> · Reduced strength. Fine lines lower interlayer adhesion. · Slow speeds. High layer count reduces efficiency. · High clog risk. Sensitive to filament impurities or diameter variance.
0.4 mm		Universal standard. Optimal balance of speed and detail. Highly versatile. Compatible with most market filaments.	General-purpose printing, including enclosures, brackets, consumer products, and prototypes.	0.1 mm to 0.3 mm (25-75% of nozzle diameter), with 0.2 mm being standard.	<ul style="list-style-type: none"> · Moderate clog risk with fiber-reinforced filaments. Larger diameters recommended to minimize blockages.
0.6 mm		High flow rate. Clog-resistant. Enhanced interlayer bonding/part	Rapid prototyping, large models, and functional parts like jigs,	0.15 mm to 0.45 mm (25-75% of nozzle diameter),	<ul style="list-style-type: none"> · Detail loss. Visible layer lines and softer edges. · Higher cost. Increased

Nozzle diameter	Performance	Features	Primary applications	Layer heights	Potential Drawbacks
		strength. Produces stronger parts.	fixtures, or automotive components.	with 0.3-0.4 mm being common.	material consumption. · Poorer bridging. Thick extrusions affect overhang performance.
0.8 mm		Ultra-high-speed. Maximum flow rate. Minimizes print time. Thickest layer heights for robust structures.	Large-scale prototypes, structural components, and vase-mode prints requiring speed and durability.	0.2 mm to 0.6 mm (25-75% of nozzle diameter), with 0.4-0.5 mm being typical.	· Low precision. High surface roughness and obvious textures. · Hard support removal. Robust supports leave heavy surface marks. · High production cost. Increased material usage.

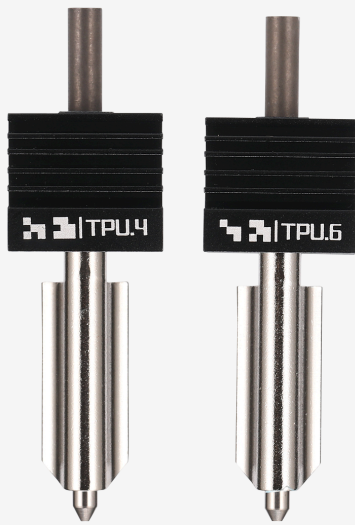
Materials

There are two common materials for nozzles:

Material	Image	Color	Key features	Best for	Applicable filaments
Hardened steel		Black heat dissipation fins	· Harder than stainless steel · Superior wear resistance	Any abrasive filaments with hard particles	PA-CF, PLA-CF, PETG-CF, Glow-in-the-Dark, Wood, etc.
Stainless steel		Gray heat dissipation fins	· High temperature resistance · Corrosion resistance · Cost-effective	Most non-abrasive general-purpose filaments (no fibers/particles)	PLA, ABS, ASA, PETG, TPU, PVA, etc.

Types

TPU Hotend



Purchase link: [H2D TPU High-Flow Kit](#)



Compatibility: H2D and H2D Pro (Right Hotend)

Size: 0.4mm/ 0.6mm

The TPU hotend is specifically designed to enhance the printing performance of **flexible filaments**, significantly improving **volumetric flow rate** and **reliability** during printing.

The TPU dedicated hotend differs structurally from the standard H2 series hotend and must be used in conjunction with the **TPU dedicated hotend cover**.

- ▶ **Limitations:** After installing the TPU Hotend, the cutter installation is not supported, so the cutter function cannot be used, and the right nozzle does not support automatic filament changing and automatic filament feeding and retracting.
- ▶ **Only flexible filaments are allowed:** The TPU hotend has a special inner coating, printing hard filaments is prohibited (such as PLA, PETG, TPU for AMS), otherwise it will cause the coat to wear and fail.
- ▶ **Position Limitation:** The TPU hotend can only be installed on the right nozzle. If it is installed on the left nozzle, it will cause the nozzle lifting mechanism to malfunction.

🔗 For more details about the TPU Hotend, please read: [TPU High Flow Kit for the H2D Series](#)

Tungsten Carbide Nozzle



Purchase link: [Tungsten Carbide Nozzle - Standard](#) & [High Flow](#)

Compatibility: H2D (both left and right hotend), H2S, H2C (left hotend), P2S, X2D

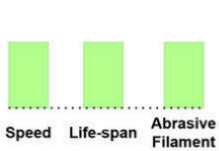
Max. Printing Temp: 350 °C

Size: 0.4mm/ 0.6mm/ 0.8mm

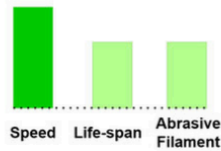
Tungsten carbide nozzle is highly durable and maintains its circular and accurate shape even after extended use. Compared with hardened steel, it shows significantly less wear, even after many kilograms of filament.

- ▶ **Perfect for Abrasive Filament**
- ▶ **HRA 90 Tougher nozzle, lower maintenance**
- ▶ **Save Up to 30% of Your Time**
- ▶ **High-Speed Precision**

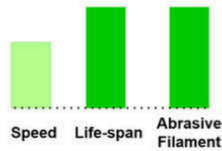
Harden steel



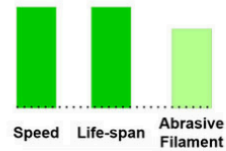
Harden steel HF



Tungsten Carbide



Tungsten Carbide HF



Vortek Induction Nozzle



Purchase link: [H2C Induction Hotend - Standard & High Flow](#) [↗](#)

Compatibility: H2C (right hotend)

Max. Printing Temp: 350 °C

Size: 0.2mm/ 0.4mm/ 0.6mm/ 0.8mm

Materials: Hardened steel / Stainless steel

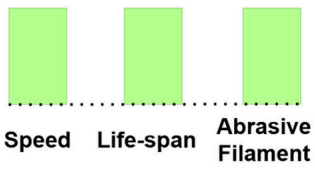
The Vortek Induction Hotend is designed for the right hotend of H2C printer, which can be automatically replaced by the printer with 6 right hotends to be installed for alternating use.

- ▶ **Ultra-Fast Heating:** Only about 8 seconds to reach printing temperature (e.g., 220°C) from room temperature, significantly reducing color change waiting time, reducing purge waste and improving multi-color printing efficiency.
- ▶ **Non-Contact Integration:** No physical cables or connectors required, eliminating failure points such as cable wear and poor contact caused by repeated plugging and unplugging, resulting in higher reliability.
- ▶ **High Efficiency and Energy Saving:** Heat is generated directly inside the heated metal, with thermal efficiency much higher than traditional heating elements, enabling faster temperature rise.
- ▶ **Safe and Reliable:** Hotend in-position detection ensures that only properly installed hotends can be activated.

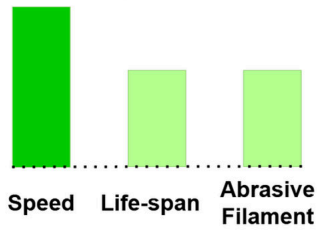
[🔗 For more details about the workflow of the Vortek Induction Hotend, please read: Introduction to the Workflow of the Vortek Induction Hotend](#)

The high flow hotend (as the name suggests) has a higher flow of filament during printing, as the different nozzle structure increases the contact area between the filament and the hotend. This design increases the print speed, which can help reduce overall print time.

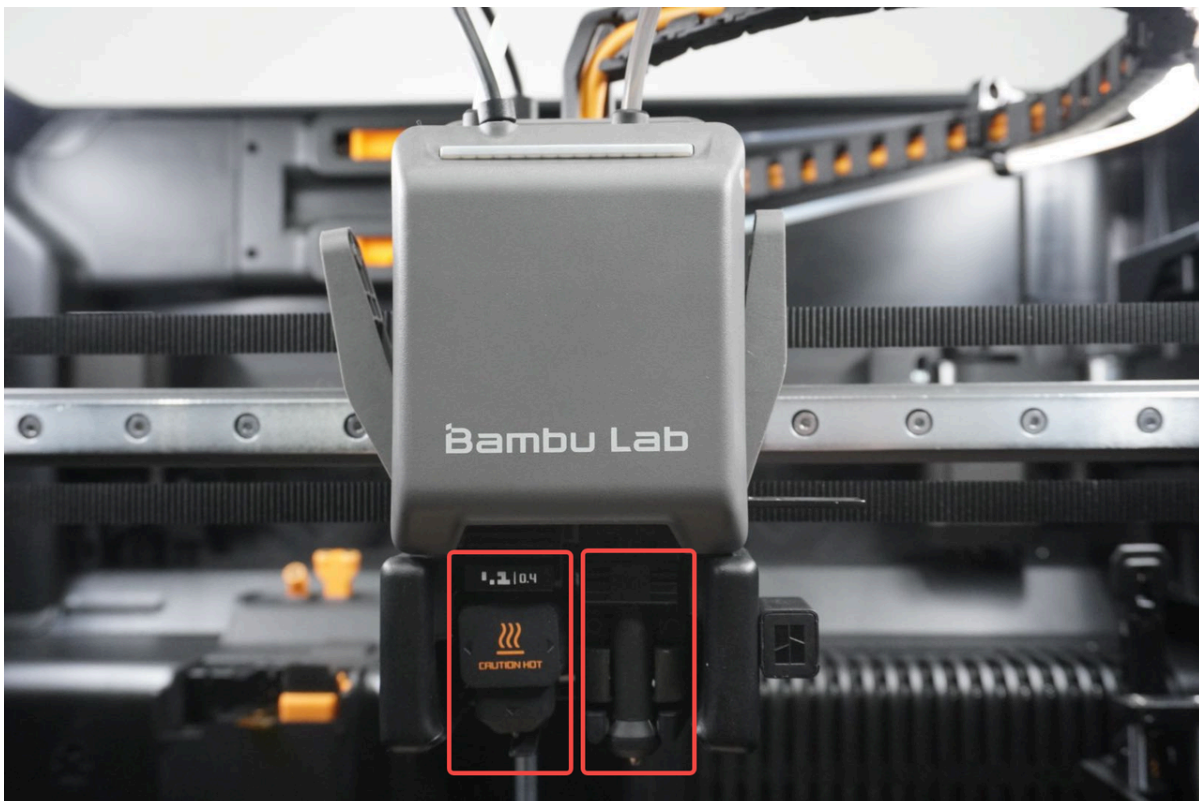
Harden steel



High flow




Similar to the H2D printer, the H2C printer also has two nozzle assemblies. The difference is that the right nozzle of the H2C is an induction nozzle, while the left one is a standard H2 Series nozzle.



- ▶ **Replacement instructions:** [Induction Hotend Replacement Guide for H2C](#)
- ▶ **Cold pull maintenance:** [H2C Nozzle Cold Pull Maintenance and Cleaning](#)
- ▶ **Unclogging procedure:** [H2C Nozzle / Hotend Clog Cleaning Guide](#)

H2 Series/P2S/X2D Nozzle

	Purchase link: Bambu Hotend - H2/P2S Standard & High Flow
	Compatibility: H2D (both left and right), H2S, H2C (left hotend), P2S, X2D
	Max. Printing Temp: 350 °C
	Size: 0.2mm/ 0.4mm/ 0.6mm/ 0.8mm
	Materials: Hardened steel / Stainless steel

This hotend features a quick swap design, which enables easy separation of the thermal and electronic components of the hotend. Simply unlock the latch for quick and easy hotend removal and installation.

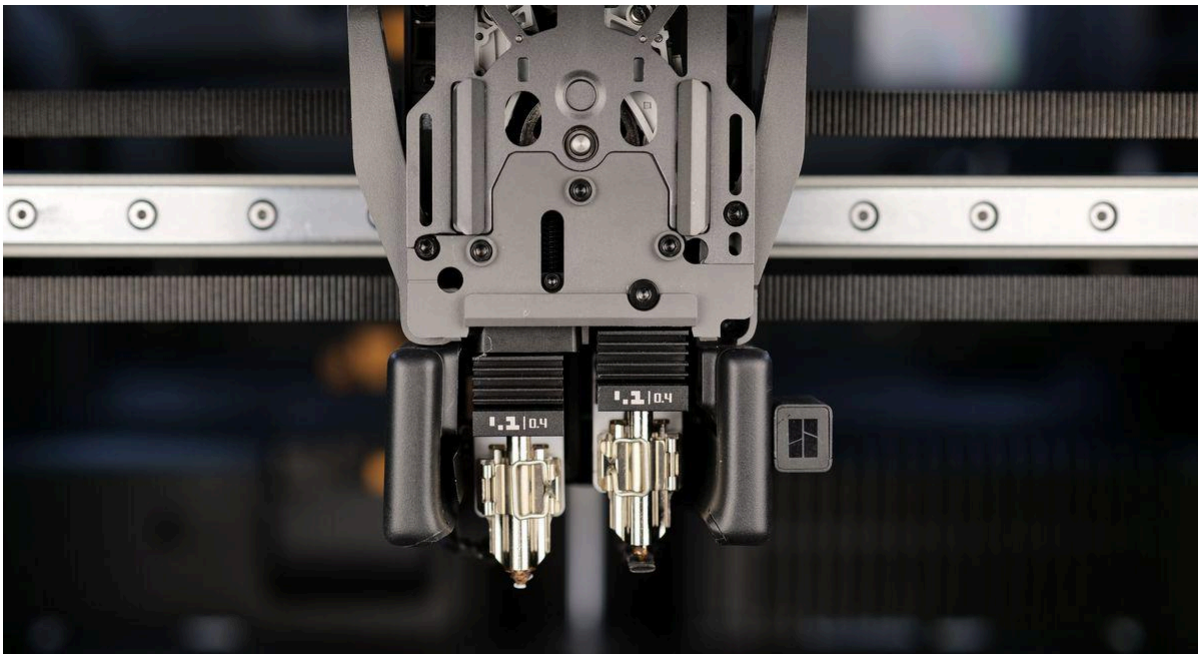
High flow nozzle is an upgraded version of the standard nozzle. Compared to the standard nozzle, the high-flow nozzle has a powerful nozzle heating capacity, and its optimized flame melting zone increases the maximum volume velocity by 62.5%, allowing extruded filaments to melt faster and more efficiently without loss of detail, reducing model printing time by up to 30%.



- ▶ **Replacement instructions:** [P2S](#); [H2D](#); [X2D](#)
- ▶ **Unclogging procedure:** [P2S](#); [H2D](#); [H2S](#); [X2D](#)
- ▶ **Cold pull maintenance:** [H2D](#); [H2S](#)

The H2D printer has two independent nozzles, using only one nozzle for each print. Prior to the H2D, all Bambu printers are single-nozzle printers. The dual-nozzle design significantly reduces filament waste while increasing printing speed.


For example, when printing with one type of general filament and one type of support filament, the general filament is loaded into one nozzle of the H2D, and the support filament is loaded into the other. This way, when switching between general and support filaments for each layer, the H2D only needs to switch nozzles, eliminating the need for filament clearing. This results in almost no filament waste and significantly reduces filament switching time, which is particularly noticeable in printing using only two types of filaments.



- ▶ **H2D Grouping strategy:** [Introduction to Filament Grouping Strategy for Dual Nozzle Printers](#)
- ▶ **H2D Printable range:** [Introduction to the printable range of H2D dual nozzles](#)

E3D High Flow ObXidian™ Hotend



Purchase link: [E3D High Flow ObXidian™ Hotend](#) 

Compatibility: X1C / P1 Seires

Max. Printing Temp: 300 °C

Size: 0.4mm/ 0.6mm

The E3D High Flow ObXidian™ Hotend is a jointly developed product shared by Bambu Lab and E3D. This hotend can provide 60% more flow rate, features the signature ObXidian™ hardened nozzle, and E3DLC™ coating for excellent durability.

This hotend is the result of seamless cooperation between E3D and Bambu Lab. Both teams shared precious know-how on the hotend, the printer, and the thermal process of the materials. The end product is thoroughly tested by both teams and will be officially integrated into all the software ecosystems of Bambu Lab.

- ▶ **High-flow, high-speed**
- ▶ **Uncompromised layer bonding at high speeds**
- ▶ **Non-stick coating, reduce the risk of nozzle blobing**
- ▶ **Official-tuned printer presets**

Find more details about official-tuned printer presets in this wiki: [Manually Adjust System to E3D HF ObXidian™ 0.4/0.6mm Preset](#)

A1 Series Nozzle



Purchase link: [A1 Series Nozzle](#) 

Compatibility: A1 / A1 mini

Max. Printing Temp: 300 °C

Size: 0.2mm/0.4mm/0.6mm/0.8mm

Materials: Hardened steel / Stainless steel

The A1 nozzle is easily detached from the heating assembly (which heats the nozzle to melt the filament). This makes replacing the nozzle as hassle-free as possible.

A1 comes standard with a 0.4mm stainless steel nozzle, and a hardened steel nozzle can be upgraded to an optional upgrade.

- ▶ **Replacement instructions:** [A1 Series](#).
- ▶ **Unclogging procedure:** [A1/A1 mini Nozzle/Hotend Unclogging Procedure](#); [How to clean the A1 series hotend assembly](#).

X1/P1 Series Nozzle



Purchase link: [Bambu Hotend - X1C](#) & [Bambu Hotend - P1 Series](#)

Compatibility: X1C, P1P, P1S

Max. Printing Temp: 320 °C

Size: 0.2mm/ 0.4mm/ 0.6mm/ 0.8mm

Materials: Hardened steel / Stainless steel

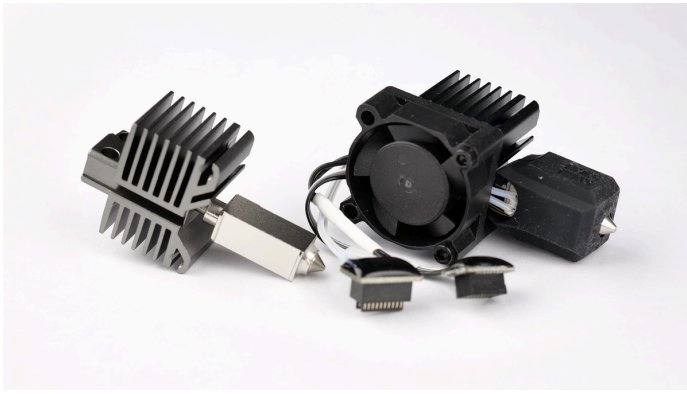
The X1C / P1 Series features an all-in-one design for the hotend. This means that the nozzle is integrated into the heatblock and connected to the heatsink via a thin metal tube for best performance. Having this design allows the hotend to heat up much faster than a regular hotend, and the all-in-one design minimizes issues that might come up when swapping nozzles.

P1S comes standard with a 0.4mm stainless steel nozzle, X1C comes standard with a 0.4mm hardened steel nozzle, and an upgrade to a hardened steel nozzle is also available as an option.

- ▶ **Replacement instructions:** [P1 Series](#); [X1 Series](#).
- ▶ **Unclogging procedure:** [X1/P1 Series](#).
- ▶ **Cold pull maintenance:** [X1 Series](#); [P1 Series](#).

The X1/P1 series printer nozzles come in two types:






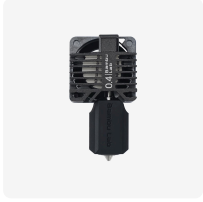

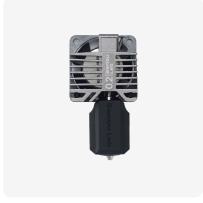

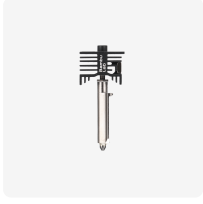

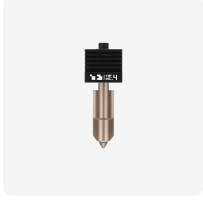

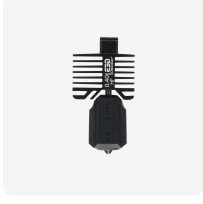
- ▶ **Nozzle only** – just the metal part, without electronics, ideal for basic replacements where the electronics can still be used and can be migrated to the new nozzle. Cheaper to replace, as the electronics can be re-used.
- ▶ **Complete hotend** – includes the nozzle, heater, thermistor, silicone sock and fan, allowing quick and easy swaps without extra assembly. This version is a bit more expensive, but it brings the quick replacement benefits.



(The left side shows a single nozzle assembly, and the right side shows the complete hotend assembly)

★ Nozzle-Printer Compatibility

Nozzle type	Image	Compatibility
TPU Hotend		H2D and H2D Pro (Right Hotend)
H2 Series/P2S Hotend		H2D, H2S, H2C, P2S, X2D
H2C Induction Hotend		H2C
X1C Hotend		X1C
P1 Series Hotend		P1P, P1S

Nozzle type	Image	Compatibility
A1 Series Hotend 		A1 mini, A1
H2 Series/P2S High Flow Hotend 		H2D, H2S, H2C, P2S, X2D
X1C Complete Hotend Assembly 		X1C
P1 Series Complete Hotend Assembly 		P1P, P1S
Tungsten Carbide Nozzle 		H2D, H2S, H2C, P2S, X2D
High Flow Tungsten Carbide Nozzle 		H2D, H2S, H2C, P2S, X2D
E3D High Flow ObXidian™ Hotend 		X1C, P1P, P1S

Silicone Sock for Hotend

The silicone sock for hotend is black protective cover wrapped around the nozzle.

Made of high-quality silicone, it boasts superior temperature resistance (rated high temperature up to 300°C), providing optimal thermal insulation to maintain a stable nozzle temperature during printing and minimizes heat loss.

It also offers durable protection against filaments adhering to the nozzle surface.

Without the silicone sock, the part cooling fan would lower the nozzle temperature, causing temperature fluctuations that can degrade print quality.



H2 Series Hotend Silicone Sock

Made of high-quality silicone, it offers superior temperature resistance (rated temperatures up to 300°C). It provides optimal thermal insulation for the hotend, maintaining a stable temperature during printing, while also offering long-lasting protection against filament sticking to the hotend.

Compatibility: H2D / H2D Pro / H2C / H2S

Purchase link: [H2 Series Hotend Silicone Sock](#) 



X1/P1 Series Hotend Silicone Sock

Made of high-quality silicone, it offers superior temperature resistance (rated temperatures up to 300°C). It provides optimal thermal insulation for the hotend, maintaining a stable temperature during printing, while also offering long-lasting protection against filament sticking to the hotend.

Compatibility: X1C / P1P / P1S

Purchase link: [X1/P1 Series Hotend Silicone Sock](#) [↗](#)



P2S/X2D Hotend Silicone Sock

Unlike previous printers' silicone socks, P2S/X2D silicone sock has three orange marker dots, a unique design of the P2S, used for AI recognition to detect whether the nozzle has a silicone sock installed. If a silicone sock with markers is not installed, the system will automatically display an error message prompting you to install the silicone sock; using an older version of the silicone sock will also result in an error message.

X2D and P2S share the same type of silicone sock, but X2D does not support the AI recognition function.

Compatibility: P2S/X2D

Purchase link: [P2S/X2D Hotend Silicone Sock](#) [↗](#)

Note: P2S hotend silicone sock are not compatible with silicone sock for other series.



A1/A1 mini Hotend Silicone Sock

Made of high-quality silicone, it offers superior temperature resistance (rated temperatures up to 300°C). It provides optimal thermal insulation for the hotend, maintaining a stable temperature during printing, while also offering long-lasting protection against filament sticking to the hotend.

Compatibility: A1 / A1 mini

Purchase link: [A1/A1 mini Hotend Silicone Sock](#) 



Useful links

[Filament guide - Printer, Nozzle, AMS, Build Plate, Glue Compatibility and Required Parameters](#)

[Printing with 0.2mm nozzles - Frequently Asked Questions](#)

[How to Avoid Nozzle Clogs](#)

End Notes

We hope the detailed guide provided has been helpful and informative.

If this guide does not solve your problem, *please submit a [technical ticket](#)* [↗](#), we will answer your questions and provide assistance.

If you have any suggestions or feedback on this Wiki, please leave a message in the comment area.

Thank you for your support and attention!