

# Instructions for Use

The following document has been created to ensure the user is successful in their use of 2.7g/cc and 4.0g/cc GMASS™ High Density 3D Printer Filament.

## **Using GMASS™ for Radiation Attenuation**

The nominal radiation attenuation characteristics of GMASS™ is as follows (75kV x-ray source):

| GMASS™ Filament | Printed Thickness | Lead Equivalence |
|-----------------|-------------------|------------------|
| 2.7g/cc GMASS   | 1.0cm             | 1.9mm            |
| 4.0g/cc GMASS   | 1.0cm             | 2.8mm            |

Warning: If using GMASS™ for radiation attenuation, perform radiation inspections with the part in the "as used" condition to verify acceptability of attenuation. Defects in printing may result in regions of low attenuation and unanticipated levels of radiation exposure.

## **Storage**

As with any ABS based printer filament, GMASS™ works best when it is maintained in a low humidity environment. It is recommended that GMASS™ be stored at room temperature in a sealed bag with desiccant.

## **3D Printer Models**

GMASS™ is designed to work on any 3D printer that is capable of printing 1.75mm ABS filament and does not require proprietary filament.

## **Layer Height**

While best results are likely at a layer height of 0.20mm, GMASS™ has been printed in layer heights from 0.10mm to 0.30mm.



## **Print Bed Temperature**

A heated printer bed is recommended when using GMASS™. The recommended printer bed temperature is 100°C to 110°C.

## **Print Bed Preparation**

Several methods can be used to ensure the part adheres to the printer bed. A layer of polyimide tape can improve the adherence. A thin slurry of acetone and ABS printer filament may also be applied to the printer bed or tape covering using a paint brush. The acetone will evaporate leaving a thin layer of ABS film that provides an optimal surface for print adhesion.

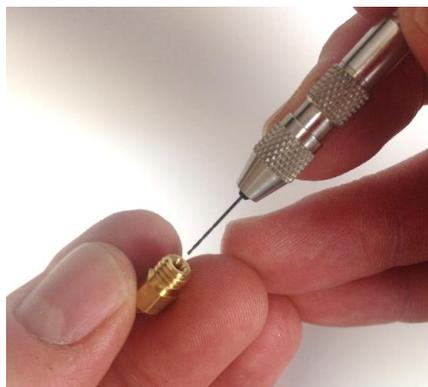
Warning: Acetone is flammable and can cause tissue irritation. Refer to the acetone Material Safety Data Sheet (MSDS) for appropriate handling of acetone.

Be sure that your bed has been leveled and that the nozzle is at the correct height according to your printer manufacturer's recommendations.

## **Print Nozzle**

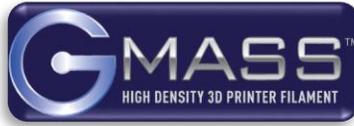
Users of GMASS™ will want to maintain a supply of replacement print nozzles.

GMASS™ can be printed using a common nozzle with a 0.4mm diameter throat. However, for more reliable printing, it is recommended that a nozzle with a 0.5mm to 0.6mm diameter throat be used. A 0.4mm nozzle can be enlarged using an appropriately sized drill bit mounted in a pin vice.



Pin vise with mounted drill bit

GMASS™ has abrasive properties. Extended use of GMASS™, particularly tungsten based GMASS™, will enlarge the nozzle throat and wear down the tip of the nozzle. The rate of



throat enlargement is dependent on printing parameters such as print head speed, layer height, temperature, and part geometry. It is recommended that the nozzle be inspected after every two hours of use.



3D print using nozzle with oversized throat

### Print Nozzle Temperature

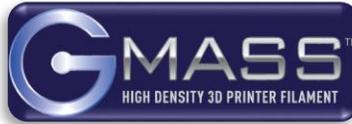
GMASS™ has been successfully printed at temperatures set between 200°C and 230°C. Print temperature will vary depending on printer model and other printing parameters such as print speed, layer height, and nozzle throat diameter.

### Overhang

Because of its high density composition GMASS™ may not be as capable as low density filament in achieving unsupported overhangs. In internal testing GMASS™ was capable of a 45° degree overhang. Significant distortion was observed when printing a 60° overhang. Performance will be affected by printer settings. It is recommended that the user determine performance using their printer and preferred settings.



Overhang demonstrator Blue: 2.7g/cc GMASS™. Dk Gray: 4.0g/cc GMASS™



**Infill**

The high density of GMASS™ means it will not bridge gaps as well as common ABS. It is recommended that a higher infill density is used than would be used with common ABS. Bridging performance will be affected by model and printer parameters. The user should determine the appropriate infill for their temperature and print rate settings.



Defects in surface resulting from sparse infill

**Troubleshooting**

| <b>Fault</b>                  | <b>Possible Cause</b>  | <b>See Section(s)</b>     |
|-------------------------------|--|---------------------------|
| Oozing                        | nozzle temperature that is too high or a nozzle throat that is too large | Print Nozzle<br>Print Bed |
| Irregularly stratified layers | nozzle throat is too large   | Print Nozzle              |
| Rough top surface             | sparse infill  | Infill                    |
| Not sticking to bed           | poor bed preparation or printer bed that is not level                    | Print Bed                 |

Turner MedTech is committed to your success with the use of GMASS™. If you have any questions please contact us through one of the following methods:

Web: [www.gmass.turnermedtech.com](http://www.gmass.turnermedtech.com)

Email: [sales@tmedtech.com](mailto:sales@tmedtech.com)

Phone: 1-801-796-2951 (8:00am – 5:00pm MT, Monday – Friday)

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