

THERMACAST™

3D Resin for Direct Casting Moulds

Technical Data Sheet

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Quick Start Guide

For a quick overview, follow these streamlined steps to create and use your ThermaCAST™ resin mould for metal casting:

1. **Design Your Mould:** Create a 3D model with at least 5mm for Pewter and 8mm for Zinc Alloys around your intended cast part and include draft angles.
2. **Prepare the Environment:** Ensure the printing area is heated to at least 25°C (77°F).
3. **3D Print the Mould:** Use a standard MSLA resin printer with ThermaCAST™ resin, adjusting print settings as recommended.
4. **Post-Process the Mould:** Clean with ResinAway or IPA, rinse thoroughly, scrub, dry completely, and post-cure in a 405nm unit for 1 hour.
5. **Prepare for Casting:** Make sure that your mould is completely dry. This can be done by using a dehydrator or by gently “torching”. Brush in 100% pure talc or graphite powder inside the mould as a release agent, blowing off any excess or loose release agent. Secure with clamps if using a two-part mould, and ensure the mould is dry and cool prior to pouring.
6. **Cast Your Metal:** Pour the molten metal (under 550°C or 1022°F) into the prepared mould following all safety protocols, allow it to cool, and then remove the cast part.
7. **Finish Your Part:** Trim sprue, smooth edges, and perform any necessary finishing touches.

Detailed How-To Guide

1. Introduction

Welcome to the ThermaCAST™ - The future of Metal Casting! This guide provides comprehensive instructions for creating high-quality metal castings using ThermaCAST™ resin. Whether you're a hobbyist, engineer, or artist, this guide will help you achieve precise and reliable results.

2. Materials and Tools Needed

Before you begin, gather the following materials and tools.



- ThermaCAST™ Resin
- MSLA Resin 3D Printer
- 3D Modelling Software (e.g., Blender, Fusion 360)* (optional)
- M3D ResinAway® or Isopropyl Alcohol (IPA) for cleaning
- 405nm Post Cure Unit* (optional)
- Furnace* (optional for lower temp alloys)
- Dehydrator or Low-Temperature Oven (40-50°C)* (optional)
- 100% Pure Talc Powder or Graphite Powder ($\leq 30\mu\text{m}$)
- Heat-Resistant Gloves
- Full-Face Shield
- Heat-Proof Apron
- Closed Leather Shoes
- Metal Pouring Tools (e.g. tongs, pouring pot)
- Clamps or Clips for mould assembly
- Vibration Device or Tray* (optional)
- Powder-Based Fire Extinguisher
- Thermocouple for temperature measurement* (optional)

PROTIP: Furnaces: Look on Amazon or eBay under “electric metal melting furnace.” **Safety Gear:** Check your local hardware store in the welding section for gloves, face shields, and aprons. **Metals:** Use Google to search for “casting metals for sale” or visit local metal suppliers for pewter, zinc, or white metal alloys.

3. Preparing the Environment

Creating an optimal environment is crucial for successful 3D printing and casting.

i) Temperature Control

- Ensure the printing room or resin vat is heated to at least 25°C (77°F). This temperature accommodates the thick ThermaCAST™ resin, ensuring consistent flow and curing during printing.

ii) Ventilation

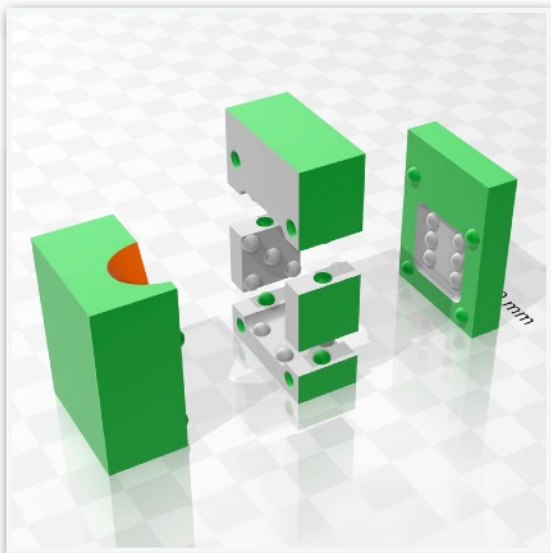
- Operate in a well-ventilated area to minimise inhalation of resin fumes. Use overhead ducting or a purpose-built fume cupboard.

iii) Workspace Setup

- Organise your workspace to keep all tools and materials within easy reach. Ensure surfaces are heat-resistant and non-flammable.

4. Designing the Mould

Proper mould design is essential for successful casting.



i) Wall Thickness

Ensure all mould walls are at least 5mm for Pewter and 8mm for Zinc Alloys. This enhances durability and heat resistance.

ii) Draft Angles

Incorporate draft angles (typically 5 degrees) into your design. Drafts facilitate the easy release of the cast part that can cause mould breakage.

iii) Avoid Undercuts

Design your mould without undercuts unless absolutely necessary. If undercuts are required, consider using multi-part moulds to allow for easier part removal.

iv) Detail Consideration

Simplify intricate details where possible to reduce the risk of mould damage during casting and part removal.

5. 3D Printing the Mould

Follow these steps to print your mould using ThermaCAST™ resin.

i) Prepare the 3D Model

- Import your designed mould into your slicer software. Orient the model to minimise support structures and ensure optimal print quality.

ii) Printer Settings

Layer Height

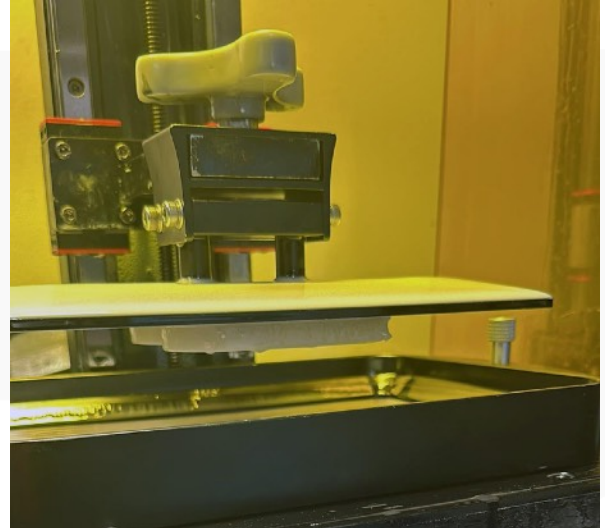
- 0.05mm (50µm) for high-detail areas.
- 0.1mm (100µm) for less detailed sections.

Exposure Time

- **Bottom Layer:** Approximately 40 seconds.
- **Normal Layers:** Around 3 seconds

Model Position & Supports

Moulds should be orientated flat on the build plate so supports are not usually required. If supports are used, ensure they are heavy and dense structures to maintain mould integrity during printing.



Lift Heights

Increase lift heights for both bottom and normal layers to allow resin to flow back under the model as it prints. Incorporate a 1 second pause after each lift to give the material time to reposition.

iii) Fill the Vat

Top up the resin vat to ensure enough resin flows back under the model during printing, preventing print failures.

iv) Start the Print

Begin printing on your standard MSLA resin printer. Monitor the print process to ensure there are no issues such as layer shifting or incomplete curing.



6. Post-Processing the Mould

After printing, follow these steps to prepare your mould for casting.

i) Cleaning

- **Remove the Mould:** Carefully detach the mould from the printer.
- **Rinse Thoroughly:** Use ResinAway or IPA to eliminate uncured resin.
- **Scrub:** Use a brush, such as a paintbrush or toothbrush, to remove excess uncured material from the mould's edges and casting areas.
- **Rinse with Water:** Remove any solvents, as residues can ignite during casting.

ii) Drying

- The mould must be **free of moisture** and cleaning solution residue.

Drying Methods

- **Dehydrator** or Low-Temperature Oven: Gently dry the mould at 40-50°C for 30 minutes or longer, depending on mould size.
- **Compressed Air or Hairdryer:** Use to remove any remaining moisture.

iii) Post-Curing

- **Cure Time:** Post-cure the mould for at least 60 minutes using a 405nm LED UV light to fully harden the resin and enhance thermal properties.



7. Preparing the Mould for Casting

Proper preparation ensures successful metal casting.

i) Apply Release Powder

- **Recommended Powders:** Lightly brush the inside of the mould with 100% pure talc powder or 30-micron graphite powder.
- **Application Method:** Use a soft makeup brush and gently tap the moulds to remove excess powder.
- **Avoid Baby Powder:** Most baby powders are cornstarch-based and can burn upon contact with molten metal, making them unsuitable.

ii) Mould Assembly (If Using a Two-Part Mould)

- **Coating:** Coat both mould surfaces with real talc or graphite powder to protect the surface and enhance mould longevity.
- **Securing the Mould:** Use metal G-clamps or similar to secure the mould, ensuring the left, right, and bottom sides are clamped to prevent metal from flowing out.
- **Clamping Tightness:** Ensure clamps are not overly tight; a small gap can assist dispersing trapped air during pouring. Use additional clamps to prevent mould warping at higher temperatures.



PROTIP: Use a Vibration Device attached to the mould or tray to help metal flow into finer cavities. Prime the mould with a lower-temperature metal, such as pewter, or gently “flame polish” the surface as this can help prepare the mould for higher temperature alloys such as ZA2/3/12.

8. The Casting Process

Follow these steps to cast your metal part safely and effectively.



i) Safety First

- **Personal Protective Equipment (PPE):** Wear heat-resistant gloves, a full-face mask, a heat-proof apron, and closed leather shoes.
- **Ventilation:** Ensure your workspace is well-ventilated with overhead ducting or a fume cupboard.

ii) Furnace Preparation

- **Set Temperature:** Ensure the furnace reaches the optimal pouring temperature for your specific Alloy. Refer to the Recommended Pouring Temperatures table on the website.
- **Temperature Verification:** Use a reliable thermocouple to accurately measure metal temperatures, as furnace gauges can be inaccurate.



iii) Pouring the Metal

- **Controlled Pouring:** Slowly pour the molten metal into the prepared mould to prevent splashing and ensure even flow.
- **Pouring Technique:** For larger moulds, consider pouring in stages (e.g., 1/3 at a time) to ensure even distribution.
- **Pouring Angle:** Pour at an angle between 30-45 degrees to help release air and create a smoother finish without defects.

iv) Post-Pour Handling

- **Scraping Excess Metal:** Use appropriate tools to scrape away excess metal from the top of the mould while the metal is still liquid.
- **Cooling:** Allow the metal to solidify completely before opening the mould. Larger volume sections will require more time to cool. Attempting to open the mould too early before the metal has cooled beyond the “snow” stage—may result in the metal part breaking during removal.

Note: Water purging is not advised, as it may generate steam, which poses a potential safety hazard.

9. Post-Casting Procedures

Once the metal has cooled, follow these steps to complete your casting.

i) Opening the Mould

- **Remove Clamps:** Carefully remove the clamps and open the mould once the metal has cooled enough to remain intact but is still warm.
- **Release the Cast Part:** Gently extract the hot metal part using heat-resistant gloves. Do not allow the metal to stay in the mould for too long to prevent mould warping or cracking.



ii) Allow to Cool

- **Complete Cooling:** Allow the cast part to cool completely before performing any post-processing to ensure safety and ease of handling.

iii) Finishing

- **Trim Sprue and Excess Metal:** Use metal snips, a band saw, or a hack saw to remove sprue and any excess metal.
- **Smooth Edges:** Use a belt sander, disc sander, or file to smooth edges and remove imperfections.
- **Detailed Cleaning:** For intricate cleaning, use a Dremel tool or an electric buffing wheel.
- **Polishing:** Achieve a high-polish, mirror-like finish with wet and dry sandpaper or buffing wheels.



iv) Protecting the Metal

Apply coatings such as electroplating, specialty waxes, or paints to prevent corrosion, especially for metals like zinc.

10. Maintenance and Reuse of Moulds

To ensure longevity, reuse and consistent results with your moulds.

i) Cleaning After Use

- **Remove Residue:** Remove any remaining powder and residue from the mould after each casting using a soft brush or compressed air to clean intricate details without damaging the mould.

ii) Storage

- **Cool, Dry Place:** Store moulds in a cool, dry place away from direct sunlight and sources of heat.
- **Sealed Containers:** Keep moulds in sealed containers to prevent contamination and moisture absorption.

iii) Inspection

- **Regular Checks:** Regularly inspect moulds for signs of wear, warping, or damage.
- **Replacement:** Replace moulds that show significant wear to maintain casting quality.



iv) Reapplying Powder

- **Before Each Use:** Reapply a light layer of 100% pure talc or graphite powder before each use to ensure easy part release and prevent sticking.



Frequently Asked Questions (FAQs)

Q1. What metals are compatible with ThermaCAST™ resin?

ThermaCAST™ is compatible with a variety of low-melting-point metal Alloys (under 550°C), including:

- Pewter
- Zinc and Zinc Alloys (such as ZA2 / 3 / 12)
- White Metals (e.g., Tin Alloys, Bismuth Alloys)
- Bismuth Alloys
- Lead-Free Solder Alloys
- Indium Alloys

NB: Always ensure the materials pouring temperature does not exceed 550°C.

Q2. Can I use ThermaCAST™ resin for high-volume production?

While ThermaCAST™ is durable and suitable for repeated use, high-volume production may require multiple moulds or considering other materials designed for mass manufacturing. ThermaCAST™ is ideal for small to medium-scale projects, prototyping, and bespoke applications.

Q3. How do I ensure my mould is completely dry before casting?

After post-curing, allow the mould to air dry thoroughly. For added assurance, use a dehydrator or low-temperature oven (40-50°C) for at least 30 minutes, adjusting the time based on mould size. Ensure no moisture or cleaning residue remains by using compressed air or a hairdryer.

Q4. Why is my cast part sticking to the mould?

Possible reasons include:

- **Check the design of the mould:** Ensure it has adequate draft angle and is free from any undercuts.
- **Insufficient Application of Release Powder:** Ensure a light, even layer of talc or graphite powder.
- **Overly Tight Clamps:** Prevent proper release by adjusting clamp tightness.
- **Mould Warping:** Excessive heat can warp the mould, affecting release.
- **Inadequate Cooling:** Allow sufficient cooling time before attempting to remove the part.

(FAQ Continued)

Q5. Can I reuse the same mould multiple times?

Yes, ThermaCAST™ moulds are designed for multiple uses. Proper maintenance, cleaning, and careful handling will extend the lifespan of your moulds. Reapply release powder before each use to ensure easy part release.



Q6. What should I do if my mould warps or cracks?

If your mould shows signs of warping or cracking:

- Assess Usage:** Ensure you are not exceeding the recommended temperature limits.
- Wall Thickness:** Verify that mould walls are sufficiently thick.
- Cooling:** Allow adequate cooling between pours to prevent thermal stress.
- Storage:** Store moulds properly to avoid deformation.

NB: Replace damaged moulds to maintain casting quality and safety.

Q7. Is ThermaCAST™ resin safe to handle?

When used according to guidelines and with appropriate PPE, ThermaCAST™ is safe for handling. Always follow safety instructions to minimise exposure to uncured resin and molten metals.

Q8. How do I dispose of excess ThermaCAST™ resin?

Dispose of excess resin and cleaning solvents in accordance with local regulations. Do not pour resin down drains or dispose of it in regular trash. Refer to your local waste management guidelines for proper disposal methods.

Q9. Where can I get casting equipment and materials?

Search on Amazon or eBay for “electric metal melting furnace”. For Safety Gear, check your local hardware store in the welding section for gloves, face shields, and aprons. Metal Alloys can be found on ebay or Google search, try “casting metals for sale” or visit local metal suppliers for pewter, zinc, or white metal alloys.

Safety Guide

Safety First: Comprehensive Guidelines for Using ThermaCAST™ Resin

At Monocure3D, your safety is our utmost priority. Working with ThermaCAST™ resin and metal casting involves handling high temperatures and molten materials, which can pose significant risks. Adhering to the following safety guidelines will help ensure a secure and successful casting experience.

1. Personal Protective Equipment (PPE)

Always wear appropriate PPE to protect against burns, fumes, and other hazards.

- **Heat-Resistant Gloves:** Essential for handling hot moulds and molten metal. Ensure gloves are rated for temperatures exceeding your casting needs.
- **Full-Face Mask:** Protect your eyes and face from splashes, fumes, and debris.
- **Heat-Proof Apron:** Shields your torso and arms from heat and accidental spills.
- **Closed Leather Shoes:** Prevent foot injuries and provide protection against heat.
- **Protective Clothing:** Wear long sleeves and pants made of flame-resistant materials to minimise skin exposure.

2. Workspace Preparation

Creating a safe and efficient workspace is crucial.

i) Ventilation

- **Proper Ventilation Systems:** Use overhead ducting or a purpose-built fume cupboard to remove harmful fumes and ensure fresh air circulation.
- **Avoid Enclosed Spaces:** Do not perform casting in confined areas without adequate ventilation to prevent the buildup of toxic fumes.

ii) Fire Safety

- **Fire Extinguishers:** Keep a powder-based fire extinguisher within arm's reach. Ensure it is fully charged, easily accessible, and regularly inspected as per local regulations.
- **Fire-Resistant Surfaces:** Conduct casting on surfaces that can withstand high temperatures and are non-flammable.
- **No Flammable Materials Nearby:** Keep flammable liquids, gases, and materials away from the casting area to reduce fire risk.
- **Clear Work Area:** Remove Clutter: Ensure the workspace is free from unnecessary items that could cause tripping hazards or interfere with casting operations.
- **Secure Cables and Tools:** Keep electrical cables organised and tools properly stored to prevent accidents.

3. Handling Molten Metals

Proper handling of molten metals is critical to prevent severe burns and accidents.

i) Use Appropriate Tools

- **Metal Pouring Tools:** Utilise tools designed for high temperatures, such as pouring pots with sturdy handles.
- **Mould Handling Equipment:** Use clamps, tongs, and other specialised tools to manage hot moulds safely.

ii) Pouring Techniques

- **Controlled Pouring:** Pour molten metal slowly and steadily to prevent splashing and spills.
- **Stable Positioning:** Ensure the furnace and moulds are on a stable, level surface to avoid tipping during pouring.

iii) Temperature Monitoring

- **Thermocouples:** Always use a reliable thermocouple to accurately measure metal temperatures, as furnace gauges can be inaccurate.
- **Avoid Overheating:** Do not exceed the recommended temperatures (under 550°C or 1022°F) for your specific metal to maintain mould integrity and prevent accidents.

4. Equipment Safety

- Ensuring that all equipment is in good working condition is vital.

i) Furnace Maintenance

- **Regular Inspections:** Check the furnace for any signs of wear, damage, or malfunction before each use.
- **Proper Operation:** Follow manufacturer instructions for operating the furnace safely and efficiently.

ii) Post-Cure Units

- **Safe Curing Practices:** Use standard 405nm post-cure units as directed, ensuring they are placed on stable surfaces away from flammable materials.

iii) Dehydrators and Ovens

- **Temperature Control:** Set dehydrators or low-temperature ovens (40-50°C) accurately to prevent overheating moulds during the drying process.
- **Supervision:** Never leave heating equipment unattended while in use.

(Safety Guide Continued)

5. Chemical Safety

- Handling resin and powders requires careful attention to prevent over exposure.

i) Resin Handling (refer to SDS on our website for complete information)

- **Ventilated Areas:** Use ResinAway or IPA in well-ventilated spaces to minimise inhalation of fumes.
- **Skin Protection:** Avoid direct contact with uncured resin by wearing gloves and protective clothing.

ii) Powder Application

- **Avoid Inhalation:** When brushing talc or graphite powder into moulds, wear a mask to prevent inhaling fine particles.
- **Use Pure Powders:** Ensure the use of 100% pure talc powder to avoid fire hazards associated with contaminated powders like baby powder.

6. Emergency Preparedness

Being prepared for emergencies can significantly reduce the severity of accidents.

- **First Aid Kit:** Keep a well-stocked first aid kit nearby, including burn treatments and eye wash solutions.
- **Training:** Ensure all users are trained in basic first aid procedures relevant to casting accidents.
- **Emergency Contacts:** Have contact information for local emergency services readily available.
- **Incident Reporting:** Establish a protocol for reporting and documenting accidents or near-misses.

7. Operational Best Practices

Adhering to best practices ensures consistent safety and quality.

- **Avoid Working Alone:** Whenever possible, have another person present to assist in case of emergencies.
- **Stay Alert:** Do not perform casting operations if you are tired, medicated, or under the influence of substances that could impair your judgement or reflexes.
- **Proper Training:** Ensure that everyone involved in the casting process is adequately trained and familiar with safety protocols.

(Safety Guide Continued)

8. Storage and Handling of Materials

Proper storage and handling of materials reduce the risk of accidents and material degradation.

Resin Storage: Cool, Dry Place: Store ThermaCAST™ resin in a cool, dry area away from direct sunlight and sources of heat.

Sealed Containers: Keep resin containers tightly sealed to prevent contamination and moisture absorption.

Powder Storage

- **Dry Environment:** Store talc and graphite powders in airtight containers to maintain their quality and prevent clumping.
- **Labelling:** Clearly label all containers to avoid confusion and ensure the correct powder is used for each application.
- **Metal Storage:** Dry Environment: Store metal ingots and scraps in a dry, moisture-free area to prevent oxidation or corrosion, which can impact casting quality.
- **Organisation:** Keep metals separated by type and clearly labelled. Use an engraver to mark crucibles for specific metals to avoid accidental mixing during melts.
- **Crucible Care:** Always use separate crucibles for different metals and avoid leaving melted metal in the crucible after use. Reheating residual metal can cause the crucible to crack or weaken over time.

9. Environmental Considerations

Minimising environmental impact is part of maintaining a safe and responsible casting practice.

Proper Disposal

- **Resin Waste:** Dispose of excess resin and cleaning solvents according to local regulations to prevent environmental contamination.
- **Powder Waste:** Collect and dispose of used powders safely, avoiding release into the environment.
- **Equipment Usage:** Use energy-efficient equipment and turn off devices when not in use to reduce energy consumption and prevent overheating.
- **Reusing Scraps:** Trimmed sprues, gates, runners, and any miscast parts can be safely added back into the melt, provided they are completely dry. Never introduce materials containing moisture into molten metal, as this can cause a dangerous steam explosion.
- **Handling Dross:** Any dross skimmed from the surface of the melt before casting should be discarded and must not be reintroduced into the melt, as it may contain impurities that compromise casting quality.

Metal Melting and Pouring Temperatures Guide

The table below outlines the temperature ranges for various low-melting-point metals, ideal for use with ThermaCAST™ Resin moulds. For optimal results, the recommended casting temperature is typically 50–100°C (122–212°F) above the metal’s melting point, depending on the mould’s size, level of detail, and shape. These metals are widely used in casting applications such as jewellery, custom components, and small-scale manufacturing projects.

Metal	Melting Temperature (°C)	Melting Temperature (°F)	Optimal Pouring Temperature (°C)	Optimal Pouring Temperature (°F)
Pewter	170–230	338–446	280–300	536–572
Tin	232	449.6	280–300	536–572
Bismuth	271	519.8	300–320	572–608
Lead-Free Solder	217–227	423–440	250–270	482–518
White Metal	200–250	392–482	280–300	536–572
Zinc	420	788	480–510	896–950
Zinc Alloy (ZA12)	432	810	480–500	896–932
Zinc Alloy (ZA 3/5)	386	727	430–450	806–842
Indium Alloy	156–200	313–392	220–240	428–464

- **Melting Temperature (°C/°F):** Indicates the range at which the metal transitions from solid to liquid. This is the minimum temperature required for melting.
- **Optimal Pouring Temperature (°C/°F):** Slightly higher than the melting point, this ensures the metal flows smoothly into the mould and fills intricate details effectively.

Why Optimal Pouring Temperature Matters

Casting at the optimal pouring temperature is crucial for achieving high-quality results. It ensures the molten metal flows smoothly into all parts of the mould, filling even the finest details. Proper temperature control reduces common defects such as air pockets, pits, shrinkage, and uneven surfaces, while also protecting the mould from unnecessary stress or damage caused by overheating.

Using the Temperature Guide

To ensure success, select a metal suitable for your project, use a reliable thermocouple to accurately monitor the metal’s temperature, and always preheat and thoroughly dry the mould to avoid steam-related defects or other casting issues.

Disclaimer

Important Safety Information

The information provided in this user guide is intended to ensure safe and effective use of ThermaCAST™ resin for metal casting applications. While every effort has been made to ensure the accuracy and reliability of the information, Monocure3D does not accept any liability for errors, omissions, or any damages arising from the use or inability to use ThermaCAST™ resin as described in this guide.

User Responsibility

- It is the user's responsibility to understand and adhere to all safety guidelines and instructions provided.
- Users must comply with local laws and regulations regarding metal casting and resin use.
- Monocure3D® recommends seeking professional advice if unsure about any aspect of the casting process.

Product Use

- ThermaCAST™ resin is intended for use with compatible low-melting-point metals only.
- Do not exceed the **maximum temperature rating of 550°C (1022°F)** to avoid mould damage and safety hazards.
- Always perform a test cast to ensure compatibility and functionality before proceeding with larger projects.

Health and Safety

- Prolonged exposure to resin fumes and powders can be harmful. Always use in a well-ventilated area and wear appropriate PPE.
- In case of accidental contact with skin or eyes, seek immediate medical attention and follow first aid procedures.

Warranty

ThermaCAST™ resin is covered by Monocure3D's standard warranty policy, and has a 12 month shelf life. Please refer to our Warranty Terms for more information.

By using ThermaCAST™ resin, you acknowledge that you have read, understood, and agree to comply with the terms and conditions outlined in this user guide.

For further assistance or to report any issues, please contact our support team at **support@monocure3d.com** or call **+61(0) 29738 5340**

Thank you for choosing Monocure3D® and ThermaCAST™ resin. We wish you successful and safe casting projects!