MASTER ALLOY:
Argentium 960 Silver - Millform

Instructions for Alloying & Graining

Product code: MA-A960-MILL

ARGENTIUM® THE FINEST SILVER

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Document explains sequence for producing Argentium 960 Silver from Master Alloy. The process is designed to minimise gas contamination and oxidation. **FINE SILVER MUST BE FULLY DE-GASSED BEFORE THE MASTER ALLOY IS ADDED - failure to remove the oxygen will result in a reduction in performance of the final alloy.**

Master Alloys – Applications & Mixing Ratios

Product code	Applications for finished alloy	Fine silver : Master Alloy
MA-A960-MILL	Sheet & wire applications	96.2% : 3.8%

Equipment & Materials

- Clean induction furnace suitable for melting silver
- Clean, dedicated crucible and melting tools
- Certified fine silver
- Argentium Silver Master Alloy
- High-purity argon
- Calibrated temperature measurement equipment
- Suitable weighing equipment
- Suitable casting or graining equipment (over-pressure graining equipment preferred)

Important: All materials, tools, crucibles and casting/graining equipment must be clean. Avoid contamination from other alloys, solder, polishing compounds, steel or other metals.

Alloying Process

1 Furnace preparation

- Ensure the induction furnace, crucible and tools are clean.
- Check the vacuum system and argon supply before beginning the melt.
- Where the furnace permits, evacuate and purge the chamber with high-purity argon to minimise atmospheric oxygen and moisture.
- Charge **fine silver only** into the crucible.

DO NOT add the Argentium Master Alloy at this stage.

2 Melt the fine silver

- Begin induction heating and melt the fine silver under controlled conditions. Fine silver melts at approx. **962°C / 1763°F**.
- Once fully molten, hold at a temperature sufficient to keep the silver fully liquid without unnecessary overheating.
- Avoid excessive temperature and prolonged holding times (as these can increase oxidation and gas absorption).

3 De-gas (critical stage)

The fine silver MUST be de-gassed before the Master Alloy is added - failure to remove the oxygen will result in a reduction in performance of the final alloy.

Vacuum furnace:

- Once completely molten, apply the furnace's **validated vacuum de-gassing cycle**.
- Maintain the molten fine silver under vacuum and at a controlled temperature to remove dissolved gases (particularly oxygen).
- Do not introduce the Master Alloy during vacuum de-gassing.

NB. Vacuum level, temperature and de-gassing time should be established and validated for the specific induction furnace and batch size.

Open casting system:

- Use a clean graphite crucible and protect the molten silver continuously with argon.
- Once fully molten, immerse a clean graphite rod and gently move it through the melt. The carbon reacts with dissolved oxygen, forming gaseous carbon oxides that leave the melt. Avoid vigorous stirring.
- Remove the rod, allow the melt to settle briefly under argon, then add the Master Alloy.

4 **Establish argon protection**	Following completion of the vacuum de-gassing cycle: • Discontinue the vacuum and introduce **high-purity argon** into the furnace. • Establish and maintain the specified protective argon atmosphere over the molten fine silver. • Avoid unnecessary exposure of the molten silver to atmospheric air. **NB.** The argon atmosphere protects the de-gassed silver from reabsorbing oxygen and limits oxidation during alloying.
5 **Add the Master Alloy**	**Only after** the fine silver has been de-gassed and the argon protective atmosphere established: • Add the specified quantity of Argentium Master Alloy to the molten fine silver, carefully, to minimise splashing and turbulence. • Maintain the protective argon atmosphere throughout the addition. • Introduce the Master Alloy **as soon as reasonably practical** after de-gassing, to minimise exposure of the alloying constituents to excessive temperature and oxidation.
6 **Homogenise**	• Allow the Master Alloy to dissolve completely. • Use the furnace's electromagnetic stirring to assist mixing - avoid unnecessary mechanical stirring. • Maintain the required temperature for the minimum time needed to achieve a homogeneous composition - avoid excessive overheating or prolonged holding. **DO NOT** repeat the vacuum de-gassing cycle after the Master Alloy has been added.
7 **Pour the melt**	Molten alloy can be made into grain *(see step 8),* poured into bars, or used directly for investment casting. • For further information, follow the **Technical Information & Instructions** documentation available for each Argentium Silver alloy *(available as downloadable pdfs from www.argentiumsilver.com/user-guides-downloads)*. **RECYCLING:** Any recycling of sprues and scrap MUST be processed using the same equipment, with inert gas (argon) protection.
8 **Graining (over-pressure system)**	Fully homogenised molten alloy should be granulated using a **controlled over-pressure granulation system**. **Preparation** • Ensure the granulation system, crucible, nozzle and equipment are clean and dry and fill the granulation vessel with clean water. • Check the over-pressure system, inert gas supply (argon), pressure controls and safety devices. • Confirm the nozzle and outlet are clean and suitable for producing the required grain size. **Granulation** • Once fully homogenised, maintain the granulation temperature (approx. **1065°C / 1949°F**) and protective argon atmosphere. • Transfer the molten alloy to the over-pressure granulation chamber (follow the equipment manufacturer's procedure). • Apply the **inert-gas over-pressure** to force the molten alloy through the nozzle - keep pressure and flow rate consistent for uniform grain size and shape. • Allow the granulated alloy to cool completely in the water before recovery. **IMPORTANT:** Maintain a controlled inert-gas atmosphere and consistent over-pressure throughout granulation. **Recovery & drying** • Recover the grain and rinse with clean water (if required). • **Dry the grain thoroughly** before weighing, packaging or storage - it is important that there is no moisture within the grain or packaging. • Inspect the finished quality of the grain. **NB.** Grain sold commercially must be pickled and barrel polished to a bright finish before thorough rinsing and drying. **SAFETY:** Always follow the induction furnace manufacturer's operating instructions and appropriate molten-metal safety procedures. Never introduce wet or contaminated materials, tools or moulds into contact with molten metal.