

Argentium User Guide

Argentium Original (935)



ARGENTIUM[®]
THE FINEST SILVER

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Argentium Original (935)

A superior sterling silver alloy suitable for items produced from sheet, wire and tubing. It has excellent machining properties and can be used for smaller scale casting applications.



Look for this sign for useful/important information to remember about Argentium silver.

Heating, quenching and pickling

Heating applications and heat/colour recognition



Argentium silver displays a paler colour glow than traditional sterling silver at red-hot temperatures.

Torch and furnace annealing do's

- Carry out torch annealing and soldering procedures in a shaded area to prevent overheating.
- Make sure your Argentium silver is securely supported whilst heating.
- Wait until the red glow has disappeared from your Argentium silver before touching or moving.
- Recommended furnace annealing temperature: 600-650°C/1112-1202°F for 20-45 minutes (dependent on the thickness of the material being annealed).
- When furnace annealing using a protective atmosphere, it is important that the furnace gas does not deplete the germanium oxide surface layer as this will diminish tarnish and firestain resistance. Use inert furnace atmospheres (i.e. nitrogen or argon) or an atmosphere containing maximum 5-10% hydrogen in nitrogen.

Don'ts

- Do not touch, move or manipulate Argentium silver while it is at red heat, as this may cause cracking.
- Be careful not to overheat.
- Furnace atmospheres containing more than 10% hydrogen are not recommended.

Quenching



Argentium silver retains its heat for longer than traditional sterling.

Do's

- After annealing, wait for the red glow to disappear before quenching (best judged in a shaded area).
- Always quench in water.

Don'ts

- Do not quench Argentium silver too quickly as cracking may occur.
- It is hazardous to quench metals in pickle solutions.

Pickling

Recommended pickling solutions

- Sodium bisulphate
- Weak Sparex
- Phosphoric acid
- Sulphuric acid

Do's

- Dilute pickle solution as advised by the supplier.
- Heat pickle solution to recommended working temperature.
- Use pickling solution that is not over-used.

Don'ts

- **Do not use hydrofluoric acid with Argentium silver** - hydrofluoric acid dissolves the protective germanium oxide and diminishes tarnish resistance.
- Do not use old or over-used pickle as the strength of any pickling solution will reduce with use and saturated solutions can leave unwanted deposits on immersed items.

Forming and decorative techniques

Forming

Ductility is an important property in any alloy that is required to be shaped and formed by operations including spinning, stamping, raising, drawing and hammering.

Argentium Original has greater ductility than traditional sterling silver - this means that the metal can be worked longer and further between each annealing, thus decreasing manufacturing time and labour.

Hardness and durability are not compromised by the ductile properties.

Machining and engraving

Argentium Original has very good machining and engraving properties. Unlike traditional sterling, Argentium is not 'sticky' and will cut cleanly with a bright, sharp finish.

Mokumé Gane

Argentium Original's firestain resistance means that Mokumé Gane does not have the dark halo surrounding the Argentium silver sections (as seen with traditional sterling Mokumé). Argentium Mokumé Gane is available to purchase from Rio Grande (riogrande.com).

Granulation and Keum-Boo

Argentium Original's fusing properties enable techniques such as granulation and Keum-Boo to be applied.

Instruction DVDs by Ronda Coryell are available to purchase. Each DVD beautifully demonstrates how to carry out different processes with Argentium, including fusing and granulation techniques. Please visit rondacoryell.com or riogrande.com for further information.

Patination

Ronda Coryell's earrings (right), beautifully demonstrate how a dark, rich patina can be achieved using patinating agents such as liver of sulphur. The process can take a little longer than with traditional sterling silver due to the tarnish resistant properties of Argentium.



Heat-hardening treatments



Argentium silver can be formed into complex shapes in its fully soft condition and by means of heat treatments have its hardness and durability increased.

Method 1 - air-cooling

Step 1

After annealing or soldering allow Argentium silver to air-cool to room temperature.

Step 2 (This step increases the hardness of Argentium Original by 20-30HV/DPH)

Heat Argentium silver in a furnace or oven at 300°C/572°F for 120 minutes, then air-cool to room temperature.

Method 2 - quenching

Step 1

Torch annealing method: Heat Argentium silver to a pale-red annealing temperature, wait until the red glow has disappeared then quench in water.

Furnace annealing method: The recommended temperature is 650°C/1202°F under inert atmosphere (nitrogen or argon) or slightly reducing atmosphere (maximum 5-10% hydrogen) for 10-20 minutes, wait until the red glow has disappeared then quench in water.

Step 2 (This step increases hardness of Argentium Original by 55-65HV/DPH)

Heat Argentium silver in a furnace or oven at 300°C/572°F for approximately 120 minutes, then air-cool to room temperature.

Important information

- Hardness will differ between wrought and cast material.
- Lower temperatures can be used for Step 2 (minimum temperature of 220°C/428°F), with a corresponding increase in time.
- Preheat the oven/furnace and supports to the required temperature before commencing the heat-hardening treatments.
- Make sure that the oven is clean and free from chemicals and substances that may be detrimental to the heat treatment process.
- Slight discolouration may occur during the heating processes - this can easily be removed using pickle.
- Remember that Argentium silver glows a paler colour than traditional sterling silver at red-hot temperatures - it is recommended to carry out heating applications in a shaded area to facilitate temperature/colour recognition and prevent overheating.

Joining techniques

Soldering



Argentium solders have been developed to give a good colour match with Argentium silver - (Argentium solders are available from Rio Grande - riogrande.com).

Do's

- Always make sure that surfaces are clean and degreased before soldering.
- Remember that Argentium silver glows a paler colour than traditional sterling silver at soldering temperatures - it is recommended that soldering applications should be carried out in a shaded area to avoid overheating.
- To minimise distortion of Argentium Original during soldering operations, it is recommended to carry out a pre-annealing step - simply heat the sheet to a pale-red annealing temperature and allow to air-cool to room temperature.
- Argentium silver can be brittle at red-hot temperatures - make sure that the silver is well supported during soldering applications and simply wait a few seconds for the red glow to disappear before touching or moving.

Don'ts

- Don't quench soldered pieces as this can cause the solder joint to fracture.
- Be careful not to touch or move your Argentium silver piece too quickly after soldering as this can cause brittleness - wait until the red glow has completely disappeared.

Flux

Argentium Original is highly resistant to firestain, it is therefore only necessary to flux the seam to be soldered rather than applying flux to the whole piece. The following fluxes are recommended (use as directed by the manufacturer):

- My-T-Flux (supplied by Rio Grande, USA)
- Battern's Flux
- Prip's Flux

N.B. 'Handy' or 'Easy Flow' type fluxes can cause staining with Argentium silver.



Kristina Niedderer

Joining techniques

Fusing



Unlike traditional sterling silver, Argentium Original can be easily fused - producing strong, clean joints with the added benefit of not having to remove excess solder or having visible solder seams on finished articles. Instruction DVDs by Ronda Coryell are available to purchase - please visit rondacoryell.com or riogrande.com for further information.

Argentium Original will fuse with: Argentium silver, pure silver, gold and platinum.

Do's

- Thoroughly clean/degrease sections being fused.
- It is recommended to apply a diluted flux to the sections being fused.
- Heat the piece with a gas/air flame and work in a shaded area (this makes it easier to visualise the temperature by the colour/glow of the metal).
- Argentium silver will glow brighter as the temperature rises - look for a 'wet' surface appearance as an indication of the correct fusing temperature.
- Allow the red glow to disappear before touching or moving the fused piece.

Don'ts

- Be careful not to touch or move your Argentium piece too quickly after fusing as this can cause brittleness - wait until the red glow has disappeared.

Welding



The high conductivity and reflectivity of traditional sterling silver makes the alloy difficult to weld. The small amount of germanium in Argentium Original increases the thermal and electrical resistance, making the silver suitable for welding processes.

Advantages of welding

Welding applications offer efficient production methods, using localised heat for joining materials. Welding technologies provide excellent alternatives to the use of solders.

The weldability of Argentium Original opens new avenues for the design and production of silverware and jewellery items.

Measuring conductivity

The International Annealed Copper Scale (IACS) is a measure of conductivity in metals and alloys (lower IACS values = increased weldability).

The chart below shows the IACS values for various metals and alloys.

Metal or alloy	IACS value (%)
Copper	100
Pure silver	108
Traditional sterling	96
Argentium Original (935)	68
Mild steel	25

Investment casting Argentium Original 935



Argentium Original 935 is suitable for smaller scale casting. 'Argentium Professional Casting' alloys (935 and 960 grades) are available for small scale to high volume casting requirements.

Flask burn-out

- Allow the flask to stand for 2 hours before the burn-out cycle.
- Do not overload the burn-out furnace - this ensures that the centre of all the flasks will reach the required temperature for complete burn-out and that there is sufficient air-flow to remove moisture from the cured investment powder.

Flask and metal temperatures

The following temperatures are for general guidance. Personal experience and knowledge of casting equipment will enable judgement of the suitable flask and casting temperatures to use.

Size of object	Metal casting temperature (thinner object = hotter temp.)	Flask temperature (thinner object = hotter temp.)
Thin: 0.2 - 0.5mm	1000-990°C / 1832-1814°F	600-560°C / 1112-1040°F
Medium: 0.5 - 1.2mm	990-980°C / 1814-1796°F	560-520°C / 1040-968°F
Thick: >1.2mm	980-960°C / 1796-1760°F	520-480°C / 968-896°F

Crucibles

- Use separate crucibles to avoid contamination from other alloys.
- Clay graphite or pure graphite crucibles are recommended.
- Silicon carbide crucibles are not recommended.

Accurate temperature control

- Argentium silver displays a paler colour glow than traditional sterling silver when heated or molten.
- Accurate temperature readings are important to prevent overheating.

Protective gas cover

- Use an inert gas cover (i.e. argon or nitrogen).
- The cast flask should be held under the inert gas protection for 1 minute before removal from the casting chamber.

N.B. If a protective atmosphere is not available, flux can be used (boric acid is recommended). Skim any oxides off the surface before stirring.

Removing flask from the casting chamber

After pouring the metal, remove the flask from the casting chamber within 1 minute.

Wet investment removal (suitable for castings without stones)

- After pouring the metal, remove from the casting chamber within 1 minute and leave flask to stand for 20 minutes before quenching in water.
- Castings can then be hardened by heat treatments (see page 5).

Dry investment removal (suitable for stone in place castings)

- After pouring the metal, remove from the casting chamber within 1 minute and leave flask to cool for a minimum time of 90 minutes before quenching in water.
- Remove investment residues by jet washing in water, followed by pickling, then rinse with water (do not rinse in deionised water).

N.B. Leaving flasks to air-cool to room temperature before removing castings from the investment, will give a hardness of 90+ HV/DPH.

Finishing processes

Optimising tarnish resistance

Optimum tarnish resistance of Argentium silver relies upon applying good practice for finishing procedures. The aim of these finishing procedures is to optimise the formation of the protective germanium oxide that gives Argentium silver its tarnish resistance.

Certain practices used in the trade with traditional sterling silver may harm Argentium's protective germanium oxide and care must be taken not to contaminate the surface of Argentium silver with other metals/materials during polishing processes.

The following recommendations are a guide to achieving a beautiful lustrous finish with optimum tarnish resistance.

Degreasing and rinsing

Argentium pieces should be ultrasonically cleaned, rinsed with tap water and thoroughly dried:

- 1) Between each polishing stage.
- 2) Before the final surface passivation heat treatment.

Ultrasonic cleaning process recommended for smaller scale operations

- 1) Immerse pieces in an ultrasonic bath at 40-60°C / 104-140°F for 2-3 minutes using a detergent solution (dishwashing detergents including Joy and Fairy are recommended). Ensure the pH of the cleaning solution is between 7-9.
- 2) Rinse with tap water and dry thoroughly.



Important information

Do not rinse Argentium silver alloys with deionised/reverse osmosis water - the high purity of this water can remove some of the protective germanium from the surface of Argentium, therefore reducing tarnish resistance.

Steam cleaning and electrolytic cleaning should not be used with Argentium silver as these processes can diminish tarnish resistance.



Finishing processes



Helpful tip

After purchasing Argentium silver semi-finished products such as wire, chain and jump rings - even though these items may look clean and bright it is advisable to refinish them (using either manual or mechanical methods) to ensure optimum tarnish resistance.

Manual polishing



Important information

It is important to use separate polishing wheels, mops and compounds for Argentium silver to avoid contaminating the surface with residues from other metals or materials - surface contamination can diminish the tarnish resistance of Argentium items. If this is absolutely not possible, then polishing wheels and mops must be thoroughly cleaned/raked before use.

The cutting (or dressing) stage requires the use of separate abrasive papers or wheels.

Mechanical finishing (3 stage process)

Stage 1 (optional)

Surface burnishing operation - to brighten 'hard to reach' areas of items using magnetic pins in a near-neutral aqueous and soap solution (pH 7-9). Minimum time = 20 minutes.

Stage 2

Cutting and dressing operation - to smooth the surface using either one or a combination of the following processes:

- A ceramic or plastic media in a near-neutral aqueous solution (pH 7-9) - use as recommended by the manufacturer.
- Manual techniques using abrasive wheels and papers.

Stage 3

Polishing operation - to give a lustrous finish using either one or a combination of the following processes:

- A dry polishing media such as crushed walnut shell (use as recommended by the manufacturer).
- Manual polishing using polishing compounds with polishing mops/wheels/felts.

Do's

- Use separate polishing media for Argentium silver to prevent cross contamination with other metals/materials.
- Maintain clean polishing media and solutions.
- Clean and rinse items between each polishing stage.
- Thoroughly dry items after degreasing and rinsing.

Don'ts

- Do not use polishing media and solutions that have been used with other metals/materials - this can contaminate the surface of Argentium items and will diminish tarnish resistance.
- Do not rinse with deionised water as this can damage the protective germanium oxide and diminish tarnish resistance.

Finishing processes

Surface passivation

Argentium silver's tarnish resistance relies upon a protective germanium oxide surface layer. It is possible to assist the formation of this layer by applying a simple heat treatment to finished pieces.

After pieces have received their final polishing and degreasing/cleaning operations, heat them in an oven in an air atmosphere at 100°C/212°F for 3-16 hours. No further polishing should be required provided that the oven is clean.



Important information

- *Ensure that the Argentium silver finished items are thoroughly clean before heat treating.*
- *Preheat the oven to the required temperature before carrying out the heat treatment.*
- *Make sure that the oven is clean and free from chemicals and substances that may be detrimental to the heat treatment process.*

Long term care

Argentium silver is low maintenance, easy to care for and simple to keep clean. Simply wipe away any dust or finger marks with a soft cloth or, for more intricate pieces, wash them in warm soapy water, rinse and dry immediately to avoid water marks.

An occasional wipe with a clean silver polishing cloth will help to maintain Argentium silver's beautiful shine and lustre (Goddard's Long Term Silver Cloths and Tiffany & Co. Cloths are recommended). Avoid using coarse, contaminated or old cloths as they may impair the surface lustre of Argentium silver.

Please do not use 'dip' polishes or electrolytic cleaning processes with Argentium silver.



Important care advice

As recommended for other precious metals, it is advisable to remove Argentium silver jewellery before entering chlorinated or salt-water swimming pools/jacuzzis and before carrying out activities where Argentium could come into contact with chemicals.



Eva Martin - photography by Rio Grande

For sales and technical enquiries please email
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argentiumsilver.com