

# THE METALS BOOK

VOLUME 76



STULLER

The beauty of it all.™



YOUR  
PRIME  
MANUFACTURING  
SOURCE

# A Message to Our Valued Customers

Dear Valued Customer,

We are proud to introduce our newest edition of the metals catalog, The Metals Book, Vol. 76.

With a new and improved user-friendly look, this catalog has been expanded to include:

- New products in several categories including yellow-gold filled items, expanded laser wire selections and Preform sizing stock options
- Helpful tips and tricks to enhance your efficiencies
- All-inclusive product detailed charts
- Technical data designed to make your job easier
- Improved selection of X1 white gold



Throughout this new metals book, you will notice our new Refined Karats logo. This logo symbolizes our continuing commitment to conducting all phases of our operations in the most ethically, environmentally and socially responsible manner possible. You have our assurance that products showing the Refined Karats logo contain recycled precious metals.

We've also made requested enhancements to other popular programs such as:

- Metals Club, known throughout the industry for offering numerous benefits for core metal product
- Clean Scrap Program, which now allows you to send us your platinum and palladium clean scrap, as well as, gold and silver
- Introduction of stullerbench.com, a bench jeweler-friendly community that allows jewelers from around the world to connect and discuss important issues

As a prime manufacturer, it is our hope this catalog proves to become one more way we offer the beauty of it all.

Sincerely,

Matthew G. Stuller  
Founder, President and Chief Executive Officer



**YOUR  
PRIME  
MANUFACTURING  
SOURCE**



## Sample pricing is based on the following markets

Gold = \$1,000/oz      Palladium = \$225/oz  
 Platinum = \$1,100/oz      Ruthenium = \$80/oz  
 Silver = \$12/oz      Iridium = \$425/oz

**For current pricing, please contact your friendly sales consultant at 800-877-7700. When ordering, pricing will be based on current market on that day.**

## Lead Times

- >Standard qualities (14KY, 14KW, 10KY, 10KW, 18KY and 18KW) will ship same day in most cases.
- >Backorders will ship following day.
- >All other qualities will ship following day, in most cases.
- >Same day shipping is subject to order specifications and inventory on hand at time of order.

## Quality Abbreviations

<b>KY</b>	Karat Yellow	<b>AGPD</b>	Stulladium (Silver/Palladium)
<b>KW</b>	Karat White	<b>PW</b>	Palladium White
<b>RY</b>	Royal Yellow	<b>PALL</b>	.950 Super Palladium
<b>KR</b>	Karat Red	<b>PT58</b>	.585 Platinum
<b>KG</b>	Karat Green	<b>PLRU</b>	.950 Platinum/.05 Ruthenium
<b>X1</b>	Extreme White	<b>PLIR</b>	.900 Platinum/.10 Iridium
<b>STER</b>	Sterling Silver	<b>PLCO</b>	.950 Platinum/.05 Colbalt
<b>FS</b>	Fine Silver	<b>YGF</b>	Yellow Gold Filled
<b>ARSS</b>	Argentium™ Sterling Silver	<b>PGF</b>	Precious Gold Filled

## Order Minimums

Karat Gold & Platinum		Silver	
Grain	1 dwt	Grain	10 dwt
Alloy	10 dwt	Sheet 6" Wide	1 inch
Sheet	1 square inch	Sheet 12" Wide	1 inch
Strip (depends on size)	1.5 - 4 inches	Flat Sizing Stock	12 inches
Wire 6 -12ga	1 inch	Half-Round Sizing Stock	12 inches
Wire 13 - 24ga	3 inches	Wire 4 - 14 ga	12 inches
Wire 25 - 30+ga	36 inches	Wire 16 -21 ga	24 inches
Flat Sizing Stock	1 and 3 inches	Wire 22 - 24 ga	36 inches
Half-Round	1 and 3 inches	Wire 26 - 30ga	100 dwt spools
Square	1 and 3 inches	Wire Half-Round 2 - 8 ga	12inches Comfort
Fit & Triangle	1 inch	Wire Half-Round	10 - 12 ga 24 inches
PREFORM	1 inch	Wire Low-Dome	6 inches
Bezel 2mm	12 inches	Wire Flat (depends on size)	12 - 60inches
Bezel 3mm - 6mm	6 inches	Wire Square 4 -10 ga	6 inches
Bezel Step	3 inches	Wire Square 12 -14 ga	12 inches
Tubing Round	1 and 3 inches	Wire Square 16 -18 ga	24 inches
Tubing Square & Oval	3 inches	Wire Square 20 ga	36 inches
Solder Sheet	1 dwt	Wire Square 21 - 24 ga	60 inches
Solder Chip	1 dwt	Pattern Wire	12 inches

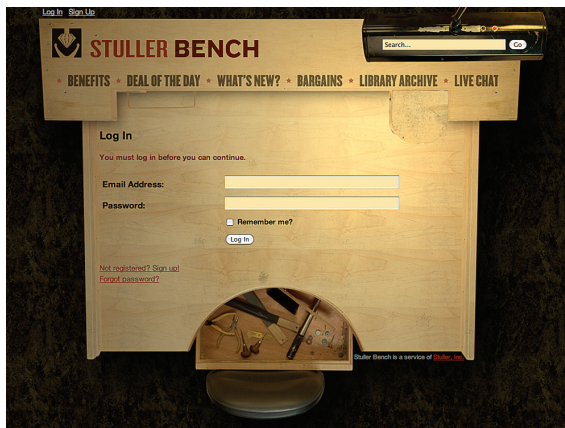
• All sizing stock and wire has a 1/10 mm tolerance  
 • See appropriate product section for more specific order minimums per product profile and/or size

# Welcome to StullerBench.com

## The Place to Go for Everything a Bench Jeweler Needs

Get connected to the largest community of bench jewelers in the country and receive a variety of FREE added benefits.

**Designed with you in mind**, we provide: special "deals-of-the-day," members-only discounts, opportunity to purchase used tools, early notification of hot, new products, access to technical articles and reference libraries and much more! Chat live with our technical experts and receive real-time answers!



### Visit often because the benefits will change daily.

Sign up today and let us provide you with even more ways to say "Yes" to your customers.

#### Benefits:

- Become connected with the largest community of bench jewelers in the country.
- Receive a unique member log in and password.
- As the program grows, Stuller Bench will continue to provide value-added benefits to the jeweler.
- Receive special "deals-of-the-day".
- Receive early notification of new products.
- Receive exclusive member-only discounts.
- Get access to reference libraries of technical and educational materials and videos.
- Access the used tools liquidation inventory.
- Chat with technical experts regarding products or procedures.
- Coming Soon! Receive shop layout advice and tips from design experts.
- Brush up on industry practices with weekly-featured articles or techniques.
- Set up your own Stuller Shop account.

## We Are Your Prime Manufacturing Source!



With one of the largest mill product offerings in the industry, we have what you need. Our prime manufacturing provides more than 50 grain options and at least 20 different mill products.

#### Get it all from Stuller:

- master alloys
- grain
- sheet
- wire
- laser wire
- sizing stock - preform™, flat, half round, triangle, comfort fit and square
- solder - including Colormatch™
- tubing
- stampings
- bezel stock

Order through the website at [www.stuller.com](http://www.stuller.com), or by calling 800.877.7777.





Get the best price possible on  
your Metals purchases!

Start saving today!

The Metals Club is a price break program that is designed to give you the total quantity price break on every order that is equal to your average monthly combined purchases of casting grain, mill products, and solders.

**Here are some Frequently Asked Questions about the Metals Club:**

**What is the Metals Club? How does it work?**

Example - If you tell us that you buy an average of 60 dwts of karat gold products (including grain, sheet, wire, stock, solder, tubing, etc...) per month, 5 dwts of platinum per month, and no silver at all, Stuller will set you up at the 50-99 dwt Club Level on gold, platinum, and silver. You will receive your quantity pricing on each and every order, even on small orders for a pennyweight of solder. This allows you to purchase small quantities as needed, yet receive your total quantity price. Also, as long as you meet the quota for one metal quality (gold in this case), you get the quantity pricing for gold, platinum, and silver products! After a period of time (usually 6 months), Stuller will review your metals purchases and advise if you have met, exceeded, or have not met your original purchasing estimates. If you used 105 dwts per month in gold, Stuller will offer to move you to the 100-199 dwt level. If you purchased 25 dwts of gold on average per month, Stuller would ask if you want to move down to the 20-49 dwt level, or if you would prefer to place an order to make up the difference to maintain the 50-99 dwt price level.

Basically, the Metals Club enables you to buy only what you need, when you need it, and receive the price benefits of your average monthly combined purchase totals.

**What is the minimum purchasing requirement to Join the Metals Club?**

The minimum requirement is one of the following:

- 20 dwts average monthly purchases of gold grain/mill product/solders...or
- 20 dwts average monthly purchases of platinum grain/mill product/solders...or
- 400 dwts (20 oz) average monthly purchases of silver grain/mill product/solders.

There is also a 50 dwt, 100 dwt, 200 dwt, and 500 dwt Club level.

**Can Stuller go back and find out what my average orders have been over the last 6 months?**

Stuller does not review your previous purchases to determine your level. We ask that you estimate your average monthly pennyweight purchases for the next six months. There is not a penalty or charge back if you do not meet your forecast totals, but there is an initial order requirement of 50 % of your estimated average monthly purchases to "Join the Metals Club"

**What is the actual discount or savings at each level?**

The pricing for mill products is based on the intrinsic value of the metal (spot markets x karat content) plus a fabrication charge per dwt, which varies by quantity price break and product type. The easiest way to determine your savings at the various club levels is to refer to the pricing of products at the specific price breaks in the Metals Book. Regardless of what the gold market is today, tomorrow, or next month, your savings per dwt will always be the same. In other words, the 50 dwt price will always be \$ X.XX less than the 1 dwt price for each product category.

**How do I join?**

Call the Stuller Club Member Hotline toll free at 1-877-619-2173 or email us at clubinfo@stuller.com and one of our friendly Club specialist will walk you through the set up process and answer any questions concerning the Metals Price Club program.

**Remember, if you are not already a Club Member, you may be paying too much!**



## In just 3 working days:

- Get fresh styles to stock your showcase
- Fill your bench with tools, supplies & findings
- Set custom designs with new mountings & gemstones
- Or, pay on your Stuller account, and So Much More!

For more information visit [stuller.com/cleanscrap](http://stuller.com/cleanscrap).

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### Refining Checklists

#### Do

- Send clean Karat Gold and silver scrap
- Send Platinum group metals
- Keep PGM's separate
- Fill out our Clean Scrap Packing Slip
- Include the weight of scrap
- Remove anything that is not Karat Gold, Silver scrap, or PGM
- Package your shipment adequately
- Insure your shipment
- Ship to Stuller (*see shipping info to your right*)
- Enjoy the credit to your Stuller account

#### Don't

- Put scrap in reclosable poly bags (gets caught in lip of bag)
- Use adhesive tape (adhesive residue will adhere to scrap)
- Send bench sweeps and filings
- Send crucibles, emery paper, buffs, brushes, or saw blades
- Send computer parts, electronic parts, or electrical parts
- Send plating solutions

### Terms & Settlement

Type of Material	Gold (Au)	Silver (Ag) Purity>80%	Palladium	Platinum
Metal Accountability	98%	96%	85%	90%
Min Refining Charge	\$100	\$100	\$125	\$125
Max Refining Charge	\$1.00 per oz	\$1.00 per oz	\$1.25 per oz	\$1.25 per oz
Turn Time	3 working days	3 working days	5 working days	5 working days

You asked even more,  
We listened even better.

Now accepting Platinum & Palladium

### Turn Your Clean Scrap into New Product

You've come to trust Stuller when purchasing mill products, findings, grain, castings, finished jewelry and thousands of other products. Discover today how you can earn credits toward your Stuller account by allowing us to refine your clean scrap through our unique clean scrap program.

We will always handle your scrap shipment with the same honesty and integrity that you've come to expect from us. When your scrap shipment arrives, we will weigh it and verify the integrity of the metal. Next, we will melt your clean scrap and fire assay a sample. We will then proceed to refine your clean scrap. All settlements will be credited to your Stuller account based on after-melt weight at second London Fix on day of settlement.

### Preparing Your Shipment

The method of shipping is up to you. However, we suggest that you insure your shipment with the carrier you choose. Stuller is not responsible for lost product by carrier or inadequate packaging prior to arrival at Stuller. It is important that your karat gold, silver, and platinum group metals be kept separate this will assure that your platinum group metals are properly identified and processed. Platinum group metals, karat gold, and silver will be analyzed separately. Refining charges will apply accordingly.

Please be sure to use the refining checklists on the left and include a completed packing slip with your clean scrap shipment. Send your shipment to Stuller, Inc, ATTN Materials Management-3616, 302 Rue Louis XIV, Lafayette, LA 70508. *The packing slip is available upon request from your friendly sales consultant or at [stuller.com](http://stuller.com).*





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# Clean Scrap Packing Slip

Please enclose this completed packing slip and send to address below.  
If you have any questions, contact Materials Management at 1.800.877.7777.

Account # _____	Date _____
Company name _____	Contact Person _____
Street address _____	City person _____
Phone number _____	City, State, Zip _____
Email Address _____	Fax number _____

Please indicate the material type and quality of clean scrap enclosed. Do not include sweeps. All settlements will be credited to the Stuller account listed above based on after melt weight at second London Fix on day of settlement. Please be sure to separate your karat gold, silver and platinum group metals to assure proper identification and analysis.

Material	Quality	Weight <i>Indicate dwt, t/oz, lbs, grams</i>	Weight received <i>(For Stuller Use Only)</i>
_____	10K	_____	_____
_____	12K	_____	_____
_____	14K	_____	_____
_____	18K	_____	_____
_____	22K	_____	_____
_____	Platinum	_____	_____
_____	Palladium	_____	_____
_____	Mixed KT <small>WITH SILVER</small>	_____	_____
_____	Mixed KT <small>WITH PGM</small>	_____	_____
_____	Silver	_____	_____

All credits to account will be made at second London Fix on day of settlement. Final settlement is 3 to 5 days from date of receipt.  
**Note:** Stuller will fire assay for fine silver content in gold lots at no additional charge. Platinum group metals, karat gold, and silver will be processed and analyzed separately. Refining charges will apply accordingly.

Type of Material	Gold (Au)	Silver (Ag) <small>Purity&gt;80%</small>	Palladium (Pd)	Platinum (Pt)
Metal Accountability	98%	96%	85%	90%
Min Refining Charge	\$100	\$100	\$125	\$125
Max Refining Charge	\$1.00 per oz	\$1.00 per oz	\$1.25per oz	\$1.25 per oz
Turn Time	3 working days	3 working days	5 working days	5 working days

**Stuller, Inc**  
**ATTN Materials Management-3616**  
**302 Rue Louis XIV**  
**Lafayette, LA 70508**

For Stuller Use only			
Received by _____	Date _____	Tracking ID _____	_____
Verified by _____	Date _____	Tracking ID _____	_____

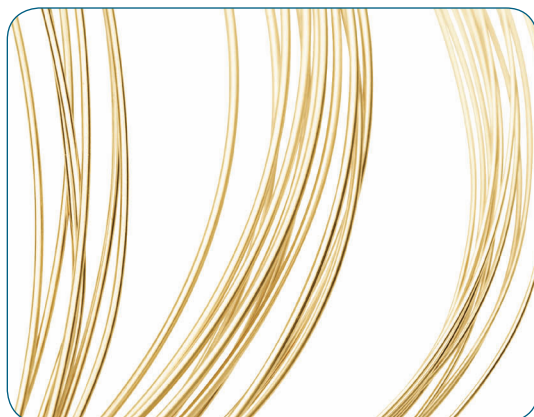
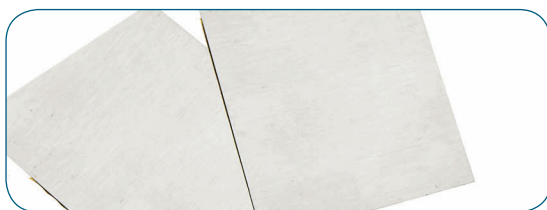
# NEW PRODUCT HIGHLIGHTS

NEW LASER WIRE SPOOL LENGTHS & QUALITIES

PRECUT PREFORM SIZING STOCK

COLOR-MATCH CHIP CADMIUM FREE SOLDER

PRECIOUS FILLED — 14KT GOLD ON STERLING





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# In a sense, we've been *refined* in our processes for a while...



Dear Customer,

This letter is in response to your questions regarding Stuller's sourcing of gold used in its production of gold jewelry products. We understand your concerns related to the potential environmental and cultural impact of certain mining activities.

Stuller, Inc. and its affiliated companies have always been, and continue to be, committed to conducting all phases of its operations in the most ethically, environmentally, and socially responsible manner possible. The companies from which we purchase our gold maintain policies and procedures, which require social and environmental responsibility on the part of their suppliers. Stuller would reconsider its relationship with said companies if we became aware that they were violating any social or environmental laws.

Only specific branded gold bars or grain are acceptable in Stuller, Inc production operations and raw material used in production is recycled internally.

Purchased products are sourced from companies who also have a policy in regard to environmental standards. Stuller requests all suppliers to sign a supplier agreement that state that they follow environmentally friendly practices.

Sincerely,


Matt Stuller  
Founder, CEO  
Stuller, Inc.

Throughout the Metals Book you will notice the new Refined karats logo. This is to assure you that Stuller maintains its commitment to conducting all phases of its operations in the most ethically, environmentally and socially responsible manner possible.



*refined* Karats

Stuller, Inc. is proud to say that we've always been and always will be true to our environment, practices and to you, our customer.

  
STULLER  
P.O. Box 87777  
LAFAYETTE, LA  
70598-7777

The refined Karats symbol indicates which product lines are manufactured by Stuller, using recycled and refined metals.

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## Forever White . . . See the Difference

- premium white color
- no need to Rhodium plate
- excellent casting characteristics
- meets European specification
- look of platinum with the cost of 14kt
- maintains a bright white finish
- brilliant surface finish

### Metal categories available in X1 white gold:

- 10kt, 14kt, and 18kt casting grain
- 14kt sheet and round wire
- 14kt sizing stock in comfort fit, flat, half-round, square and Preform shapes
- Matching 10kt, 14kt, and 18kt cadmium-free solders

### Other product categories available in X1 white gold

- die-struck settings
- shanks
- mountings
- solitaire rings
- wedding bands
- findings



### X1™ 14kt Service Kit

The 14kt X1 white gold service kit includes the most popular items needed to size rings, do general repair tasks, and assemble 14kt X1 white gold components and jewelry, all without the need to rhodium plate. All supplied in a convenient, durable plastic utility case.

The 14kt X1 service kit includes:

#### 14kt X1 white sizing stock

- 3 inches 1.5 x 1mm flat
- 3 inches 2 x 1.5mm flat
- 3 inches 2 x 1mm flat
- 3 inches 3 x 1.5mm flat
- 1 inch 4 x 1.5mm flat

#### 14kt X1 white round wire

- 3 inches 18 ga (1.02 mm)
- \*3 inches 21 ga (.72 mm)

#### 14kt X1 white cad-free plumb solder

- 1 dwt Easy Flow
- 1 dwt Medium Flow

\*Standard earwire diameter

Finally, white gold  
*the way you want it.*

No Rhodium Plating Required



  
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The beauty of it all.™



## **X<sub>1</sub>** **WHITE** **GOLD** F.A.Q's

***Q. What is X<sub>1</sub> white gold?***

A. X<sub>1</sub> is a new family of karat white gold casting grain that is formulated to achieve a very good white color, without the need for rhodium plating.

***Q. What does X<sub>1</sub> mean?***

A. X<sub>1</sub> has a level 1 color rating which stands for extreme white. According to the World Gold Councils White Gold Task Force's guide, level 1 color rated white gold does not need rhodium plating to achieve a good white color.

***Q. Is X<sub>1</sub> white gold as white as Rhodium or Platinum?***

A. X<sub>1</sub> does have an excellent white color with high reflectivity compared to other white gold alloys, but no white gold alloy is as white as rhodium plate, due to the yellow color of the pure gold in the alloy. 14kt X<sub>1</sub> white gold is close to the whiteness of .950 Platinum alloys.

***Q. Can I rhodium plate X<sub>1</sub> white gold?***

A. X<sub>1</sub> white gold may be rhodium plated just like other white gold alloys. However, rhodium plating is not required to achieve an excellent white surface finish. One advantage to using X<sub>1</sub> white gold is that when the rhodium plate inevitably wears off, the underlying metal is nice, platinum like color instead of the yellowish/off-white color of most karat white gold alloys.

---

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

***Q. Is the high nickel content a problem?***

**A.** Previous generations of high nickel gold alloys have historically displayed problem such as porosity in castings, brittleness, fire cracking, and susceptibility to stress corrosion cracking (predominately in prongs). Stuller has formulated X<sub>1</sub> with additives that help to reduce some of the problems associated with high nickel content, compared to high nickel white gold alloys without these additives. Under certain conditions, ALL nickel white gold alloys including X<sub>1</sub>, are susceptible to stress corrosion cracking.

Stuller offers an impressive selection of nickel white gold casting grain and mill products, ranging from 7% nickel and up, X<sub>1</sub> is one alternative option, which will provide a good white color.

***Q. Is X<sub>1</sub> white gold hard and brittle?***

**A.** X<sub>1</sub> is harder, but is not necessarily more brittle than lower-nickel content alloys. Stuller has formulated X<sub>1</sub> with trace elements that provide grain structure control that has proven to improve mechanical characteristics such as prong bending and ring stretching, compared to high-nickel white gold alloys without these additives.

***Q. Does X<sub>1</sub> meet the European requirements for nickel release rates and fineness?***

**A.** Test samples submitted by Stuller, have met the current EU requirements for nickel release rates. However, Stuller does not guarantee that all products manufactured in X<sub>1</sub> white gold will achieve the same results, as condition of sample can affect test results.

**IMPORTANT:** Even though the X<sub>1</sub> samples submitted for testing have passed the International tests for nickel release, X<sub>1</sub> does contain nickel. Some persons that are highly sensitive to nickel could potentially experience a nickel allergic skin reaction. All karats offered in X<sub>1</sub> white gold are alloyed to EU specifications for gold fineness. 14kt X<sub>1</sub> is alloyed at .585 gold content.

***Q. Does X<sub>1</sub> white gold cost more than standard white gold?***

**A.** X<sub>1</sub> white gold casting grain and mill products cost approximately 10 cents per pennyweight (\$2.00 per oz) more than standard nickel white gold. It is important to realize that X<sub>1</sub> white gold is alloyed with a higher gold content to meet ALL International requirements for gold fineness.

***Q. Can I order other products lines, like mountings, wedding bands, and findings made with X<sub>1</sub>?***

**A.** Yes! We currently offer selections of 14kt X<sub>1</sub> die struck settings, shanks, mountings, and wedding bands, as well as color matched solders, sizing stock, wire, sheet, and casting grain in 10k, 14k, and 18k. MASTER alloy is available for 14k only.

***Q. Can I reuse X<sub>1</sub> for casting?***

**A.** Yes. Stuller recommends using a 75% fresh mix when re-melting X<sub>1</sub> white gold. White gold alloys are typically not as reusable as yellow alloys. If there are any dark inclusions or foreign particles visible in X<sub>1</sub> scrap, it has become contaminated or depleted, and should be submitted for refining.

***Q. Do I need to do anything different when casting X<sub>1</sub> white gold?***

**A.** Pay particular attention to the recommended quenching instructions. It is important to quench within 2 to 4 minutes. As a general rule, quench just prior to the red glow leaving the button. In most cases, X<sub>1</sub> may be annealed to recover from improper quench cycle. All other casting techniques are the same. Stuller does not recommend torch melting when casting X<sub>1</sub> white gold, due to the narrow temperature range of these alloys.

***Q. Does X<sub>1</sub> white gold have a significantly higher melting temperature? Do I need to use investment for platinum casting?***

**A.** X<sub>1</sub> melting temperatures are comparable to standard nickel white gold alloy temperatures. Standard investment for gold casting will provide good results.

***Q. What about polishing and finishing X<sub>1</sub> white gold pieces?***

**A.** Use the same procedures and compounds that you normally would use on white gold.

***Q. What type of solders should be used for X<sub>1</sub> white gold ?***

**A.** Stuller's Metals Technology division has developed X<sub>1</sub> white gold cadmium-free solders that are color-matched to the X<sub>1</sub> white gold alloys. Traditional solders may be used on X<sub>1</sub> white gold pieces, but may leave a visible yellowish/white solder joint or seam. Stuller recommends using only X<sub>1</sub> white gold components, sizing stock, and solders for sizing and assembly of bright-white, rhodium-free X<sub>1</sub> jewelry.

## Technical Data and Information

X1™ white gold casting grain produces a white finish with a Grade 1 white color (YID<19). These casting grain formulas are deoxidized, grain refined, and are desinged for casting applications only. X1™ white gold sheet, wire, sizing stock and solder are also available in 14kt. Color matched cadmium-free solders are available in 10kt, 14kt, and 18kt.

KARAT	10K	14K	18K
Gold Content (minimum)	0.417	0.585	0.750

### PHYSICAL & MECHANICAL PROPERTIES

Density (gm/cc)	11.17	12.58	14.69
Hardness- As Cast (VHN)	158	204	231
Yield Strength (psi)	26950	32100	31600
Ultimate Tensile Strength (psi)	78590	83553	93745
Elongation (%)	52	38	42

### MELTING TEMPERATURE DATA

Solidus (°F)	1754	1682	1662
Liquidus (°F)	1850	1730	1702
Casting (°F)	150 F to 225 F above Liquidus Temperature		
Flask Range (°F)	1050-1200	1050-1150	1050-1150
Quench Time (range in minutes)*	2-4	2-4	2-4

Remelting We recommend a 75% fresh mix when reusing

Optimal temperatures may vary according to type of equipment used.

Melting Equipment: Induction melting is recommended. If torch melting, use a reducing flame and melt as quickly as possible. Investment: Most standard investment powders will provide good results.

### NICKEL RELEASE DATA

** Test Results (mg/cm <sup>2</sup> Ni released per week)	<.1	0.1	<.1
EN 1811:1999 Requirements	≤.5	≤.5	≤.5

### IMPORTANT

\* Quenching: As a general rule, quench just prior to the red glow leaving the button. If the optimal quench is missed, Ductility may be recovered by annealing the casting(s).

Annealing: Heat in an oven set to 1350-1400 °F for 10 to 20 minutes, depending on size of castings. Quench immediately. Do not allow to air cool.

\*\*Stuller does not guarantee that all products manufactured with X1™ white gold will achieve the same test results for nickel-release rates, as condition of samples can affect results.

Under certain conditions, all nickel-white gold alloys are susceptible to stress corrosion (cracking). Stuller cannot guarantee the X1™ white gold family to be completely immune to stress corrosion.

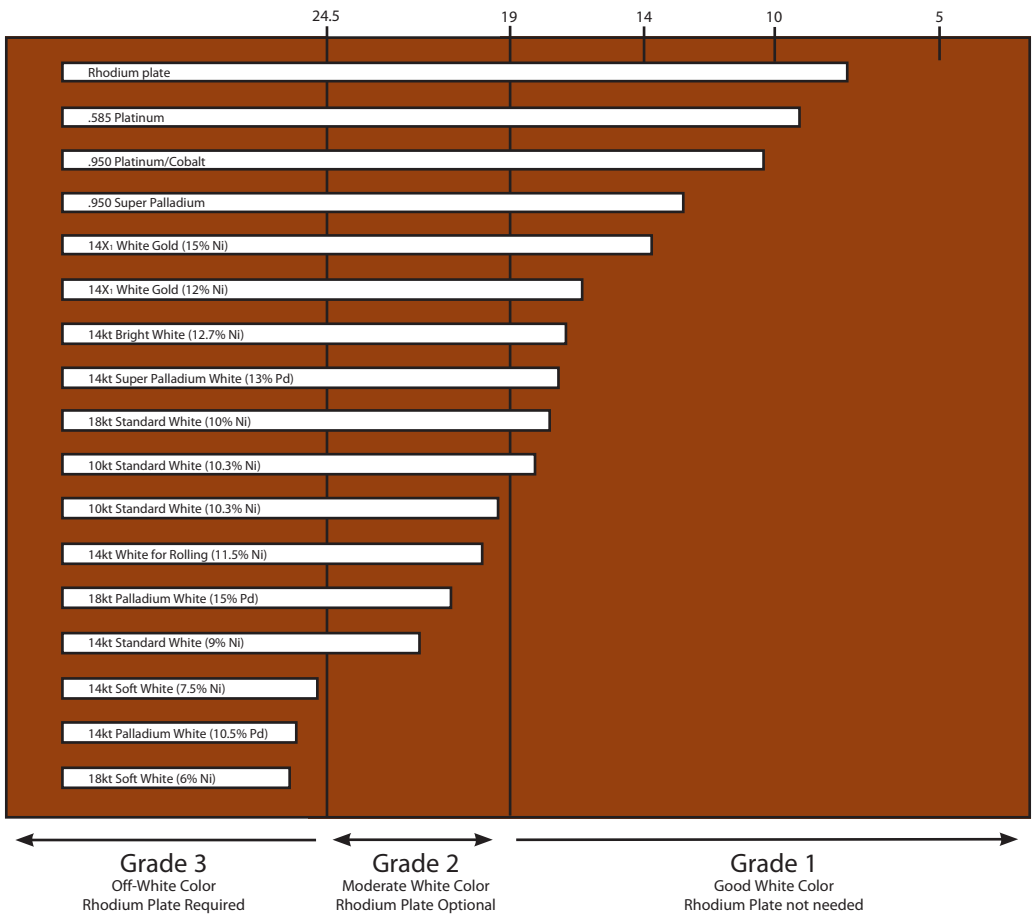


## How WHITE IS WHITE?

All color ratings presented below are based on the YI D1925 (yellowness index) as specified by the World Gold Council / M.J.S.A. White Gold Task Force guidelines for grading the color of white gold alloys. The rating system divides white gold alloys into three categories using the alloy's YI or yellowness index.

YID<19	Grade 1 – Premium White Color – Rhodium Plating not required
YID 19-24.5	Grade 2 – Moderate White Color – Rhodium Plating optional
YID 24.5-32	Grade 3 – Off-White Color – Rhodium Plating required
YID>32	Not considered to be a white gold alloy.

### Stuller White Gold & Platinum Group Metals ASTM YI D1925 Color Ratings



Here are some exceptional benefits of X<sub>1</sub> white gold:

- Premium white color that stays white, and compares to the elegance and color of platinum
- Excellent stone setting characteristics (dead set with very little prong spring back)
- X<sub>1</sub> white gold have met all of the European nickel release tests
- Alloyed at .585 gold content to meet all international fineness requirements
- May be used in conjunction with other precious metals



14K standard white gold



14K X1 white gold



.950 Platinum/Cobalt



Rhodium plated

# A WEALTH OF COLOR



*Stuller's wealth of  
color includes:*

STANDARD  
BRIGHT  
RICH  
ROLLING  
EURO  
RED  
GREEN  
CLEAN CAST  
LEMON  
SOFT



# GRAIN

Stuller karat gold casting grains are produced using only high purity raw materials. All metals used in Stuller alloys are certified to exceed 0.999+ in metallic purity. Each melt is analyzed by traditional fire assay and x-ray fluorescence techniques to ensure quality and consistency. Our karat gold casting alloys contain special additives that enhance casting characteristics, provide for less rejects and finishing work, and increase reusability factors. Grain for rolling is formulated specifically for sheet production and wire drawing applications.

Stuller's Metals division is continuously evaluating new precious metal alloys that provide superior results for jewelry manufacturing applications. Our white gold alloys include 10kt, 14kt, 18kt and X1™ white gold casting grain, which provide an exceptional white color and finish. Our 14kt clean-cast white is enhanced with elements to control grain structure and provide for clean, bright white castings and excellent surface finish. Platinum group metal casting alloys include 585 platinum (formulated with 100% platinum group metals) and 950 super palladium. Stuller offers one of the most comprehensive selections of white precious metals for jewelry casting in the industry.

• **Minimum order quantity for grain is ONE pennyweight.**

## APPROX PRICING PER PENNYWEIGHT for grain

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200 dwt
10kt	\$25.17	\$24.53	\$23.56	\$22.96	\$22.57	\$22.36	\$22.06
10kt X1 white	\$25.27	\$24.63	\$23.66	\$33.06	\$22.67	\$22.46	\$22.16
14kt	\$33.86	\$33.25	\$32.56	\$31.88	\$31.44	\$31.00	\$30.56
14kt X1 white	\$34.01	\$33.40	\$32.51	\$32.03	\$31.59	\$31.15	\$30.71
14kt palladium white	\$35.03	\$34.02	\$33.53	\$33.05	\$32.61	\$32.17	\$31.73
14kt super palladium white	\$36.36	\$35.02	\$34.13	\$33.65	\$33.21	\$32.77	\$32.33
18kt	\$42.64	\$42.11	\$41.13	\$40.56	\$40.14	\$39.34	\$39.17
18kt X1 white	\$42.74	\$42.21	\$41.23	\$40.66	\$40.24	\$39.44	\$39.27
18kt palladium white	\$44.33	\$43.80	\$42.82	\$42.25	\$41.83	\$41.03	\$40.86
22kt	\$53.14	\$52.31	\$51.15	\$50.29	\$49.66	\$49.04	\$48.98
24kt	\$52.96	\$52.30	\$81.87	\$51.38	\$51.13	\$51.02	\$50.97
.585 platinum	\$46.15	\$46.05	\$45.95	\$45.60	\$45.52	\$45.40	\$45.09
.900 platinum/iridium	\$58.74	\$58.64	\$58.54	\$58.19	\$58.11	\$59.99	\$57.68
.950 platinum/ruthenium	\$59.66	\$59.56	\$59.46	\$59.11	\$59.03	\$58.91	\$58.60
.950 platinum/cobalt	\$59.36	\$29.26	\$59.16	\$58.51	\$59.73	\$58.61	\$58.30
.950 super palladium	\$15.07	\$14.97	\$14.87	\$14.52	\$14.44	\$14.32	\$14.01

# GRAIN

## GRAIN karat gold, platinum, and palladium

Quality	Nominal Composition %					Master Alloy Used	Density <sup>1</sup> (grams/cubic cm)
	Copper	Silver	Zinc	Nickel	Palladium		
10kt yellow standard	44.30	7.00	6.90			*	11.32
10kt yellow bright	40.50	11.20	6.6			CA03	11.47
10kt yellow rich	41.90	9.80	6.50			*	11.42
10kt yellow for rolling	39.80	9.40	9.40			RA03	11.37
10kt red	55.00	3.00	0.50			CA15	11.52
10kt green	11.70	44.00	3.00			CA16	12.42
14k yellow euro (.585)	22.70	11.40	7.60			*	12.91
14kt yellow standard	31.60	5.00	1.90			*	12.84
14kt yellow clean cast	28.50	6.70	6.70			*	12.89
14kt yellow bright	29.00	8.00	4.70			CA03	12.99
14kt yellow rich	28.00	9.80	3.80			*	13.05
14kt yellow lemon	25.00	8.60	8.00			CA04	12.84
14kt yellow for rolling	28.40	6.70	6.70			RA03	12.89
14kt red	39.20	2.00	0.40			CA15	13.03
14kt green	2.00	39.00	0.60			CA16	14.17
18kt yellow rich	11.30	12.50	.80			CA21	15.39
18kt yellow royal	6.70	16.50	1.50			CA23	15.53
18kt yellow for rolling	9.30	15.00	0.60			RA08	15.54
18kt red	23.30	1.20	0.20			CA15	15.02
18kt green	1.20	23.20	0.40			CA16	15.89
18k yellow euro	5.90	18.20	0.60			*	15.64
22kt yellow	3.50	4.90	*			*	17.86
24kt fine gold	*	*	*			*	19.30
10kt white	35.70		12.30	10.30		CA06	10.99
10kt white for rolling	33.80		9.00	16.00		RA13	11.17
10kt X1™ white	33.20		9.00	16.00		*	11.17
14kt white soft (low nickel)	25.50		8.80	7.50		CA06	12.53
14kt white standard	23.80		8.80	9.00		CA02	12.57
14kt white bright	21.00		7.84	12.73		*	12.61
14kt X1™ white (.585)	17.50		8.95	15.00		*	12.58
14kt white clean-cast (.585)	21.50		9.00	11.00		*	12.57
14kt white palladium	4.60	26.30	0.50		10.40	CA17	14.37
14kt white super palladium (.585)	7.20	20.00	.75		13.50	*	14.60
14kt white for rolling	24.20		6.40	11.10		RA13	12.71
18kt white soft (low nickel)	13.10		5.00	6.20		*	14.62
18kt white	9.80		5.20	9.80		CA18	14.68
18kt X1™ white	8.75		4.10	12.00		*	14.69
18kt white palladium <sup>2</sup>	8.30				13.00	*	15.66
18kt white for rolling	9.70		5.00	9.70		RA12	14.68
.585 platinum (U.S. patent 6,048,492)	*				31.5	*	17.27
.900 platinum/iridium	*					*	21.56
.950 platinum/cobalt	*					*	20.10
.950 platinum/ruthenium	*					*	20.66
.950 super palladium	*				95.00	*	11.79

\* Not applicable

<sup>1</sup>To determine the amount of metal needed for casting, multiply the wax weight (including sprue) by the corresponding Density (specific gravity). Allow extra for the button

<sup>2</sup>18k Palladium white is supplied in small sheet squares



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Vickers Hardness	Melt Temp Range (°F)	Casting Temp Range (°F)	Flask Temp (°F) <sup>3</sup>	Description	Quality
128	1525-1645	1770-1855	850-950	popular medium yellow color	10kt yellow standard
135	1480-1610	1735-1820	900-1000	our original bright yellow	10kt yellow bright
131	1490-1615	1740-1825	850-950	exceptional yellow luster	10kt yellow rich
131	1505-1605	1730-1815	850-950	sheet/wire fabrication	10kt yellow for rolling
122	1740-1780	1905-1990	950-1050	rose/pink gold in color	10kt red
137	1455-1480	1605-1690	900-1000	light green color	10kt green
134	1520-1615	1740-1825	900-1000	rich green /yellow (.585)	14k yellow euro (.585)
138	1545-1600	1725-1810	950-1100	standard medium yellow	14kt yellow standard
155	1510-1590	1715-1800	950-1100	grain refined; deoxidized	14kt yellow clean cast
162	1480-1580	1705-1790	900-1000	bright color highlights diamonds	14kt yellow bright
165	1450-1535	1660-1745	900-1000	premium yellow luster	14kt yellow rich
138	1545-1600	1725-1810	850-950	light/pale yellow color	14kt yellow lemon
136	1675-1720	1845-1930	950-1050	sheet/wire fabrication	14kt yellow for rolling
88	1710-1800	1925-2010	900-1000	rose/pink gold in color	14kt red
145	1410-1495	1620-1705	900-1000	medium green color	14kt green
160	1585-1630	1755-1840	900-1050	classic 18kt yellow color	18kt yellow rich
126	1615-1655	1780-1865	900-1050	rich italian green tint; popular in Europe	18kt yellow royal
141	1620-1665	1790-1875	900-1050	sheet/wire fabrication	18kt yellow for rolling
257	1670-1685	1810-1895	950-1050	rose/pink gold in color	18kt red
95	1800-1860	1985-2070	950-1050	rich green color	18kt green
115	1645-1720	1845-1930	900-1050	rich green yellow color	18k yellow euro
74	1810-1845	1970-2055	1000-1100	deep yellow color	22kt yellow
30	1945	2070-2155	1000-1100	.9995+ pure gold	24kt fine gold
165	1715-1750	1875-1960	1000-1100	standard nickel white	10kt white
178	1780-1850	1975-2060	1000-1100	sheet/wire fabrication	10kt white for rolling
158	1754-1850	2000-2075	1000-1100	grade 1 bright white	10kt X1™ white
172	1655-1710	1835-1920	1000-1100	low nickel-off white color	14kt white soft (low nickel)
179	1670-1710	1835-1920	1000-1100	our original 14kt white	14kt white standard
204	1715-1740	1865-1950	1000-1100	bright nickel white color	14kt white bright
204	1682-1730	1880-1955	1000-1100	exceptional grade 1 white color	14kt X1™ white (.585)
174	1676-1719	1875-1990	1000-1100	grain refined; deoxidized	14kt white clean-cast (.585)
125	1865-1920	2045-2130	1050-1200	low palladium-off white color	14kt white palladium
150	2030-2165	2280-2380	1050-1200	high pall, grade 1 white color (.585)	14kt white super palladium (.585)
183	1710-1760	1885-1970	950-1100	sheet/wire fabrication	14kt white for rolling
203	1625-1665	1790-1875	950-1100	low nickel-off white color	18kt white soft (low nickel)
228	1645-1685	1810-1895	950-1100	good nickel white color	18kt white
231	1662-1925	1852-1925	950-1100	grade 1 bright white color	18kt X1™ white
158	1895-2040	2155-2255	1000-1150	excellent castability, good color	18kt white palladium <sup>2</sup>
228	1645-1685	1810-1895	950-1100	sheet/wire fabrication	18kt white for rolling
145	3140-3180	3275-3450	1350-1500	100% PGM alloy	.585 platinum (U.S. patent 6,048,492)
110	3236-3254	3360-3400	1500-1650	good casting characteristics	.900 platinum/iridium
135	3182-3209	3015-3050	1400-1550	best color and castability	.950 platinum/cobalt
130	3236-3263	3266-3295	1500-1650	95% platinum	.950 platinum/ruthenium
138	2610-2640	2732-2768	1300-1500	enhanced 95% palladium alloy	.950 super palladium

For technical tips on casting refer to pages 126 – 133.

<sup>3</sup>Optimal flask temperature will vary according to tree size and type of equipment used. See Melting and Investment Casting on pages 000-000 for tips and more technical information

NOTE: 14k Euro-Yellow, 14k, X1, 14k Palladium white, and all 18K casting grains meet the European specifications for all gold fineness.

# Custom Wax Casting



If you have a custom wax that you need to cast, Stuller's Special Projects department will be happy to evaluate it. Based on your wax design and metal specifications, Stuller may be able to do the casting for you in our state-of-the-art factory!

We offer casting in Clip & Ship (raw castings) or machine tumbled (semi-finish). We use our high quality gold and platinum casting grain to cast your waxes. Stuller can cast your custom wax in most metal qualities listed on the grain page.

Consultation, wax evaluation, and estimates are free! Just call 1.800.877.7777 ext. 3402 for special project desk. Our Special Projects department will contact you for more information on your request.

Stuller, Inc. is not liable for copyright infringements. You are responsible for and maintain ownership of the designs that you submit for custom casting.

Package your waxes securely to avoid damage during transit. Stuller, Inc. does not assume responsibility for damage or lost merchandise during shipment. Send your waxes to the following address:

Stuller, Inc.  
Attn: Department 5  
302 Rue Louis XIV  
Lafayette, Louisiana 70508

We will contact you when your waxes are received. Estimated costs and completion date will be reviewed at the time of receipt. If there are any problems casting your wax or unforeseen delays, we will notify you immediately.



The quality of your castings will only be as good as the quality of your waxes. Be sure to check your waxes for the following potential problems:



- Small gaps in design
- Prongs incomplete or not sealed
- Cracks in the wax
- Air bubbles
- Bearing and bezels not complete
- Flashing or pin holes
- Tool or file marks
- Wax contamination (dust, shavings, foreign particles)
- Wax flaking

As always, we want you to be successful, and no one gives you more ways to succeed than Stuller!



## You do the **CAD** We'll do the **CAM**

**CAM Production Services**  
are now available from Stuller.

The full power of Stuller's awesome manufacturing capabilities is now at your fingertips! 40 years of industry-shaping innovation and know-how can be behind every CAD creation of yours in a timely and cost-effective manner.

Spend your time designing rather than worrying about the manufacturing process. We have partnered with jewelers for 40 years and worked hard to gain your trust and confidence. This same trust and confidence extends to your designs. They will be held in utmost confidentiality and security. Your designs will be produced with high precision, quality, and with speedy results.

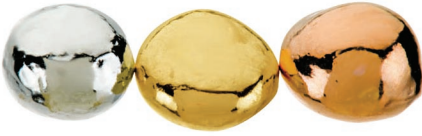
### Here's How:

- **Log on to Stuller.com**
- **Go to Stuller Studio Tab**
- **Scroll down to CAM Services**
- **Choose "New Request"**
- **Insert your CAD File.**
- **Add your instructions, such as ring size, quality of metal to cast the piece in, semi-polished or fully polished, set with your stones or any from our inventory, etc.**
- **Click "Save Request"**

Shortly after you click "Save Request", one of our CAM Consultants will call you back with all the confirmations, giving price and issuing delivery dates.

Visit <http://www.stuller.com/cadcamservices>  
or call 800·877·7777 ext. 3804 for more information.

# CASTING ALLOY



Stuller master alloys are produced with only the purest metals available. Our Master alloys for casting grain are formulated to produce brighter castings, with reduced porosity and uniform grain structure and are non-oxidizing.

• **Minimum order is 10 pennyweights.**

## ALLOY-casting master alloy

Used for	item	color	silver content	melting point 10kt	melting point 14kt	melting point 18kt
10/14w	CA02	nickel white		1840°F	1710°F	
10/14y	CA03	bright yellow	19.20	1617°F	1610°F	
10/14y	CA04	lemon yellow	20.80	1530°F	1535°F	
18y	CA05	bright yellow	60.00			1705°F
10/14w	CA06	soft nickel white		1710°F	1734°F	
10/14y	CA08	deep yellow	12.00	1590°F	1580°F	
10/14y	CA09	yellow	13.20	1580°F	1575°F	
10/14y	CA10	reddish yellow	14.80	1646°F	1606°F	
10/14y	CA11	rich yellow	17.25	1610°F	1620°F	
10/14y	CA12	bright yellow	19.75	1560°F	1550°F	
10/14y	CA13	rich lemon yellow	27.50	1620°F	1610°F	
10/14y	CA14	rich yellow	33.33	1580°F	1560°F	
10/14r	CA15	red	5.00	1780°F	1720°F	
14/18g	CA16	green	93.60		1800°F	1860°F
14w	CA17	palladium white	63.00		1920°F	
18w	CA18	nickel white	40.00			1685°F
18w	CA19	palladium white	39.60			2040°F
18y	CA20	reddish yellow	38.25			1660°F
18y	CA21	rich yellow	50.50			1630°F
18y	CA23	royal yellow	66.40			1755°F
18/22y	CA24	deep yellow	58.00			1835°F

Note: Casting master alloys do not contain gold.

## ALLOY Tech Tip

Here is a list of alloys that closely match our gold alloys used for casting production at Stuller.

Karat	Color Match Gold Alloy	Color Match Master Alloy
10kt yellow	10kt Bright Yellow	CA03
10kt white	10kt White	CA06
14kt yellow	14kt Clean Cast Yellow	RA03 ( no bright cast addition in this master but is a color match )
14kt white	14kt Clean Cast White	CA06 ( no grain refiner in this master but is a color match )
18kt yellow	18kt Rich Yellow	CA21
18kt white	18kt White	CA18 or RA12

Here is a list of alloys that closely match our gold alloys used for sheet and wire production or Stuller.

Karat	Color Match Gold Alloy	Color Match Master Alloy
10kt yellow	10kt Yellow for rolling	CA03
10kt white	10kt White for rolling	CA06
14kt yellow	14kt Yellow for rolling	RA03 ( no bright cast addition in this master but is a color match )
14kt white	14kt White for rolling	CA06 ( no grain refiner in this master but is a color match )
18kt yellow	18kt Yellow for rolling	CA21
18kt white	18kt White for rolling	CA18 or RA12

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



# ROLLING ALLOY

Stuller master alloys for rolling are specifically formulated for rolling and wire drawing applications.

- Minimum order is 10 pennyweights.



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See page 2 for details.

## ALLOY-rolling master alloy

Used for	item	color	silver content	melting point		
				10kt	14kt	18kt
10/14w	RA02	soft nickel white		1860°F	1810°F	
10/14y	RA03	rich yellow	16.00	1605°F	1600°F	
10/14y	RA05	yellow	9.20	1600°F	1580°F	
18/22y	RA06	deep yellow	58.00			1835°F
18y	RA08	bright yellow	60.00			1665°F
10/14r	RA09	red	5.00	1776°F	1707°F	
10/14y	RA11	deep yellow	11.80	1550°F	1540°F	
18w	RA12	nickel white				1685°F
10/14w	RA13	nickel white		1850°F	1760°F	
10/14y	RA14	bright yellow	20.00	1635°F	1625°F	
18y	RA15	royal yellow	66.40			1765°F
10/14y	RA16	rich yellow	33.33	1580°F	1560°F	
14w	RA17	palladium white	63.00		1920°F	
18w	RA18	palladium white	39.60			2006°F

Note: Rolling master alloys do not contain gold.

## GOLD COLOR REFERENCE CHART

	RED			YELLOW						GREEN	
	1	2	3	4	5	6	7	8	9	10	
ALLOY 10K	804 CA15	801 RA10		102 CA03	101 CA10	300 RA03		803 CA16			
ALLOY 14K	804 CA15	801 RA10		102 CA03	101 CA10	300 RA03	108 CA04		800 RA09		
ALLOY 18K	804 CA15	801 RA10			112 CA21	308 RA08	115 CA23 RA15			800 RA09	

# KARAT CONVERSION CHART FOR CHANGING 1 UNIT WEIGHT

Instructions: Determine starting karat by moving down in Starting Karat column. Move across Desired Karat columns to find multiplier value. Multiply customer's weight by found value. This will be the amount of metal needed to change to the desired karat. If they are lowering the karat - alloy is added. If they are raising the karat - gold is added.

Examples: Customer has 20 dwt. of 18kt gold they want to convert to 14kt. Move down to 18 then across to 14 and the value is .286 x 20 = 5.72 dwt of alloy needed. Customer has 20 dwt of 14kt gold they want to convert to 18kt. Move down to 14 then across to 18 and the value is .667 x 20 = 13.34 dwt of gold needed.

STARTING KARAT	DESIRED KARAT													
	10	11	12	13	14	15	16	17	18	19	20	21		22
8	0.143	0.231	0.333	0.455	0.600	0.778	1.000	1.286	1.667	2.200	3.000	4.333	7.000	G O L D  T O  A L L Y T O  A D D
9	0.071	0.154	0.250	0.364	0.500	0.667	0.875	1.143	1.500	2.000	2.750	4.000	6.500	
10	0.000	0.077	0.167	0.273	0.400	0.556	0.750	1.000	1.333	1.800	2.500	3.667	6.000	
11	0.100	0.000	0.083	0.182	0.300	0.444	0.625	0.857	1.167	1.600	2.250	3.333	5.500	
12	0.200	0.091	0.000	0.091	0.200	0.333	0.500	0.714	1.000	1.400	2.000	3.000	5.000	
13	0.300	0.182	0.083	0.000	0.100	0.222	0.375	0.571	0.833	1.200	1.750	2.667	4.500	
14	0.400	0.273	0.167	0.077	0.000	0.111	0.250	0.429	0.667	1.000	1.500	2.333	4.000	
15	0.500	0.364	0.250	0.154	0.071	0.000	0.125	0.286	0.500	0.800	1.250	2.000	3.500	
16	0.600	0.455	0.333	0.231	0.143	0.067	0.000	0.143	0.333	0.600	1.000	1.667	3.000	
17	0.700	0.545	0.417	0.308	0.214	0.133	0.063	0.000	0.167	0.400	0.750	1.333	2.500	
18	0.800	0.636	0.500	0.385	0.286	0.200	0.125	0.059	0.000	0.200	0.500	1.000	2.000	
19	0.900	0.727	0.583	0.462	0.357	0.267	0.188	0.118	0.056	0.000	0.250	0.667	1.500	
20	1.000	0.818	0.667	0.538	0.429	0.333	0.250	0.176	0.111	0.053	0.000	0.333	1.000	
21	1.100	0.909	0.750	0.615	0.500	0.400	0.313	0.235	0.167	0.105	0.050	0.000	0.500	
22	1.200	1.000	0.833	0.692	0.571	0.467	0.375	0.294	0.222	0.158	0.100	0.048	0.000	
23	1.300	1.091	0.917	0.769	0.643	0.533	0.438	0.353	0.278	0.211	0.150	0.095	0.045	
24	1.400	1.182	1.000	0.846	0.714	0.600	0.500	0.412	0.333	0.263	0.200	0.143	0.091	

## ALLOY TO ADD

KARAT GOLD FINENESS	
karat	percentage
1kt	4.17%
2kt	8.33%
3kt	12.50%
4kt	16.67%
5kt	20.83%
6kt	25.00%
7kt	29.17%
8kt	33.33%
9kt	37.50%
10kt	41.67%
11kt	45.83%
12kt	50.00%
13kt	54.17%
14kt	58.33%
15kt	62.50%
16kt	66.67%
17kt	70.83%
18kt	75.00%
19kt	79.17%
20kt	83.33%
21kt	87.50%
22kt	91.67%
23kt	95.83%
24kt	99.95% +

### Raising the Karat of a Quantity of Gold

$$\text{Amount of 24kt gold needed} = \frac{(\text{final karat} - \text{beginning karat}) \times \text{beginning weight}}{24 - \text{final karat}}$$

Example 1:

How much 24kt gold must be added to 15 grams of 12kt gold to raise it to 14kt gold?

$$\text{Amount of 24kt gold needed} = \frac{(14 - 12) \times 15}{24 - 14} = 3 \text{ grams}$$

Example 2:

How much gold is required to raise 10 grams of 14kt gold to 18kt gold?

$$\text{Amount of fine gold needed} = \frac{(18 - 14) \times 10}{24 - 18} = 6.6 \text{ grams}$$

### Lowering the Karat of a quantity of gold

$$\text{Amount of alloy needed} = \frac{(\text{beginning karat} - \text{final karat}) \times \text{beginning weight}}{\text{final karat}}$$

Example:

We want to change 7 dwt of 18kt to 14kt.

$$\text{Amount of alloy needed} = \frac{(18 - 14) \times 7}{14} = \frac{(4)(7)}{14} = 2 \text{ dwt}$$

# NATIONAL GOLD AND SILVER MARKING ACT

On October 1, 1981, revised Section 295 of Volume 15 of the United States Code, the law governing requirements for gold and silver marking, which is commonly known as the National Gold and Silver Marking Act, went into effect. Originally enacted in 1906, this law never required one to indicate quality. However, if quality was affirmatively disclosed, it had to be accurate within 1/2 karat (without solder) or 1 karat (with solder, article assayed in its entirety) from the disclosed mark. Criminal sanctions could be imposed for violations.

In 1961, this Act was amended to require the additional disclosures of the name or registered trademark of the firm responsible for the quality guaranty. This law was amended in 1970 to provide for civil penalties via private legal action.

Now, the fineness tolerances for gold articles are considerably tightened. Signed into law in 1976 and effective on October 1, 1981, Section 295 was revised to further regulate precious metal standards by more stringently specifying the proportion of gold with and without solder, making gold as good as gold.

Since October 1 has passed, the following stricter requirements apply. In the case of gold or any of its alloys imported, exported, or transported through interstate commerce, actual fineness shall not be less by more than 3/1000ths parts (without solder) or 7/1000ths parts (with solder taken into account).

While the law requires that gold and silver jewelry carrying a quality mark also carry the registered trademark of the person or organization responsible for the guarantee of quality, there is no United States law requiring that gold or silver be quality marked in the first place. If a quality mark appears, so must the trademark. Whereas a quality mark alone is meaningless, the appearance of a trademark serves to assign the responsibility for fraudulent quality marks.

A quality mark represents the stated standard. The presence of the manufacturer's trademark is an important assurance that the ratio of gold to alloy as represented by a stamp on the article is accurate, thus making it conform with the law. On a pragmatic level, such a measure is valuable primarily to distributors and retailers who can hold the manufacturer responsible in case a quality mark is found to be an exaggeration, thereby relieving themselves from responsibility in the chain of distribution. If, however, a quality mark is unaccompanied by a manufacturer's trademark, it is the distributor and/or retailer who will be held accountable for having passed fraudulently marked goods onto the public.

A trademark is an assurance of quality. It is a permanent record of origin and an assumption of responsibility. It is clearly for the benefit of both distributors and retailers to make certain that each and every gold or silver item purchased is inscribed with a quality mark and is inscribed with a trademark, in accordance with the law. Important: The application of this mark is required to be identical to the means used in applying the quality mark, and must be at least as large as and positioned as close as possible to the quality mark.

Requiring that manufacturers remain wholly accountable for the quality of their gold and silver items, this law offers distributors and retailers a degree of assurance in the value of their products. Since tolerance standards are much higher than before, there may be a particular urge on the part of some members of our industry to bypass the requirements of signature presence on their gold and silver goods. Anyone who wants to keep his own standards high should remain alert, demanding that others do not try to side-step the law.

The Federal Trade Commission's Guides for the Jewelry Industry contain additional prohibitions of which industry members should be aware. JVC members have copies of the National Gold and Silver Marking Act, as well as our recommendations for revision of the current Guides, which we submitted on January 8, 1981. Reference to these Guides and the Stamping Act is advised for full understanding of the law.

—Jewelers Vigilance Committee

## JVC'S HOW TO OBTAIN A TRADEMARK KIT PREPARED EXCLUSIVELY FOR THE USE OF JVC

Cecilia L. Gardner, Esq., Executive Director and General Counsel  
Jewelers Vigilance Committee, Inc.

25 West 45th Street, Suite 400 • New York, NY 10036  
(212) 997-2002 • 800-JOIN JVC • Fax: (212) 997-9148 • [www.jvclegal.org](http://www.jvclegal.org)

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# SHEET

Karat Gold, Platinum, and Palladium sheets are supplied flat and 3/4-hard temper unless otherwise requested. Other metal qualities include our 14kt X1™ white and .950 Super Pd, both of which have a premium white color.

- **Minimum order is one square inch per size.**
- **Maximum sheet size is 4"x14" for same or next day shipping. Longer lengths are available with additional lead time. Annealing available upon request.**



For the best pricing

## APPROX PRICING PER PENNYWEIGHT for sheet sizing stock

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200dwt
10kt	\$25.32	\$24.38	\$23.76	\$23.51	\$23.04	\$22.98	\$22.76
14kt	\$34.06	\$33.29	\$32.73	\$32.20	\$31.72	\$31.50	\$31.28
14kt X1 white	\$34.21	\$33.44	\$32.88	\$32.35	\$31.87	\$31.65	\$31.43
14kt palladium white	\$35.23	\$34.46	\$33.90	\$33.37	\$32.89	\$32.67	\$32.45
18kt	\$42.85	\$42.26	\$41.48	\$40.96	\$40.51	\$40.24	\$39.92
18kt palladium white	\$44.54	\$43.95	\$43.17	\$42.65	\$42.20	\$41.93	\$41.61
22kt	\$53.39	\$52.32	\$51.36	\$50.65	\$49.90	\$49.63	\$49.36
24kt	\$54.13	\$53.60	\$52.92	\$52.43	\$52.21	\$52.09	\$52.03
.950 platinum/ruthenium	\$64.22	\$64.12	\$63.72	\$63.21	\$62.96	\$62.62	\$62.30
.950 super palladium	\$18.24	\$18.14	\$17.74	\$17.25	\$16.99	\$16.65	\$16.34

## SHEET karat gold, platinum, and palladium

gauge	thickness		10kt	14kt	18kt	plat/ru	.950pd
	mm	inch	dwt/in	dwt/in	dwt/in	dwt/in	dwt/in
32	0.20	0.008	0.959	1.086	1.307	1.745	1.477
31	0.23	0.009	1.067	1.209	1.455	1.942	1.643
30	0.26	0.010	1.199	1.358	1.634	2.1811	1.846
29	0.29	0.011	1.355	1.535	1.847	2.465	2.086
28	0.32	0.013	1.151	1.711	2.059	2.748	2.326
27	0.36	0.014	1.702	1.928	2.320	3.097	2.621
26	0.41	0.016	1.906	2.159	2.598	3.468	2.935
25	0.46	0.018	2.147	2.431	2.926	3.905	3.305
24	0.51	0.020	2.410	2.730	3.285	4.385	3.711
23	0.57	0.023	2.710	3.069	3.693	4.929	4.172
22	0.64	0.025	3.034	3.436	4.135	5.518	4.670
21	0.72	0.028	3.417	3.871	4.658	6.216	5.261
20	0.81	0.032	3.837	4.346	5.230	6.980	5.907
19	0.91	0.036	4.305	4.876	5.867	7.831	6.628
18	1.02	0.040	4.834	5.476	6.589	8.793	7.442
17	1.15	0.045	5.429	6.149	7.399	9.875	8.358
16	1.29	0.051	6.095	6.903	8.307	11.086	9.383
15	1.45	0.057	6.845	7.754	9.330	12.451	10.539
14	1.63	0.064	7.686	8.705	10.475	13.980	11.832
13	1.83	0.072	8.635	9.780	11.768	15.706	13.293
12	2.05	0.081	9.687	10.973	13.203	17.621	14.914
11	2.31	0.091	10.877	12.320	14.824	19.785	16.746
10	2.59	0.102	12.218	13.839	16.652	22.224	18.810
9	2.91	0.114	13.719	15.539	18.698	24.954	21.121
8	3.26	0.128	15.409	17.454	21.001	28.029	23.723

Order minimum areas: 6-23 ga=max 4" width, 24ga through 32ga=max 6"width. For gold and platinum gauges: all 14" max length.

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

# STRIP

Karat gold strip is supplied flat with a 3/4 hard-temper unless otherwise requested. Minimum order varies according to width of strip. Approximate dwts per inch (14kt) and corresponding minimum order length are listed below. Karat gold strip is available in lengths up to 14 inches. Annealing available upon request.

- For 1 strip with less than 7mm widths – see Flat Bezel on page 44.



refined Karats



For the best pricing

## APPROX PRICING PER PENNYWEIGHT for strip sizing stock

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200dwt
10kt	\$25.32	\$24.38	\$23.76	\$23.51	\$23.04	\$22.98	\$22.76
14kt	\$34.06	\$33.29	\$32.73	\$32.20	\$31.72	\$31.50	\$31.28
14kt palladium white	\$35.23	\$34.46	\$33.90	\$33.37	\$32.89	\$32.67	\$32.45
18kt	\$42.85	\$42.26	\$41.48	\$40.96	\$40.51	\$40.24	\$39.92
18kt palladium white	\$44.54	\$43.95	\$43.17	\$42.65	\$42.20	\$41.93	\$41.61

## STRIP karat gold, platinum, and palladium

width mm	min order length (in)	14kt/ft thickness 15ga 0.057"	14kt/ft thickness 17ga 0.045"	14kt/ft thickness 20ga 0.032"	14kt/ft thickness 24ga 0.020"	14kt/ft thickness 26ga 0.016"	14kt/ft thickness 28ga 0.013"	14kt/ft thickness 30ga 0.010"
24	1.5	7.326	5.810	4.107	2.580	2.040	1.617	1.283
22	1.5	6.716	5.326	3.765	2.365	1.870	1.482	1.176
20	1.5	6.105	4.842	3.422	2.150	1.700	1.347	1.070
18	1.5	5.495	4.358	3.080	1.935	1.530	1.213	0.963
16	2	4.884	3.874	2.738	1.720	1.360	1.078	0.856
15	2	4.579	3.632	2.567	1.162	1.275	1.011	0.802
14	2	4.274	3.389	2.396	1.505	1.190	0.943	0.749
13	2.5	3.968	3.147	2.224	1.397	1.105	0.876	0.695
12	3	3.663	2.905	2.053	1.290	1.020	0.808	0.642
11	3	3.358	2.663	1.882	1.182	0.935	0.741	0.588
10	3	3.053	2.421	1.711	1.075	0.850	0.674	0.535
9	3	2.747	2.179	1.540	0.967	0.765	0.606	0.481
8	3.5	2.442	1.937	1.369	0.860	0.680	0.539	0.428
7	4	2.137	1.695	1.198	0.753	0.595	0.472	0.374

Note: See Flat Bezel Strip for widths less than 7mm.

# WIRE

Round wire is supplied in continuous coils with a medium-hard temper unless otherwise requested. Other metal qualities include 14kt X1™ white, .585 platinum, and .950 super palladium, all of which have a premium white color. Straight Wire is also available in 14ga through 24ga in 14kt yellow, 14kt white, and 18kt yellow in lengths up to 12 inches. Annealing available upon request.



refined Karats



## APPROX PRICING PER PENNYWEIGHT for Round wire

For the best pricing

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200 dwt
10kt	\$25.27	\$24.73	\$23.61	\$23.46	\$23.09	\$22.82	\$22.61
14kt	\$33.95	\$33.39	\$32.63	\$32.10	\$31.67	\$31.40	\$31.13
14kt X1 white	\$34.10	\$33.54	\$32.78	\$32.25	\$31.82	\$31.55	\$31.28
14kt palladium white	\$35.12	\$34.56	\$33.80	\$33.27	\$32.84	\$32.57	\$32.30
18kt	\$42.74	\$42.09	\$41.36	\$40.79	\$40.45	\$40.07	\$39.81
18kt palladium white	\$44.43	\$43.78	\$43.05	\$42.48	\$42.14	\$41.76	\$41.50
22kt	\$53.26	\$52.50	\$51.34	\$50.58	\$49.88	\$49.50	\$49.22
24kt	\$54.04	\$53.52	\$52.84	\$52.34	\$52.11	\$52.00	\$51.94
.585 platinum	\$50.71	\$50.61	\$50.21	\$49.70	\$49.45	\$49.11	\$48.79
.950 platinum/ruthenium	\$64.22	\$64.12	\$63.72	\$63.21	\$62.96	\$62.62	\$62.30
.950 platinum/cobalt	\$63.92	\$63.82	\$63.42	\$62.91	\$62.66	\$62.32	\$62.00
.950 super palladium	\$18.24	\$18.14	\$17.74	\$17.25	\$16.99	\$16.65	\$16.34

## WIRE karat gold, platinum, and palladium round

	diameter		10kt	14kt	18kt	pt/ru	pt/co	.585 pt	.950
gauge	mm	inch	dwt/in	dwt/in	dwt/in	dwt/in	dwt/in	dwt/in	super pd dwt/in
30	0.26	0.010	.0094	.0107	.0128	.0171	.0172	.0145	.0096
29	0.29	0.011	.0120	.0136	.0164	.0219	.0220	.0185	.0122
28	0.32	0.013	.0150	.0169	.0204	.0272	.0273	.0230	.0152
27	0.36	0.014	.0190	.0215	.0259	.0345	.0347	.0292	.0193
26	0.41	0.016	.0238	.0270	.0324	.0433	.0435	.0366	.0242
25	0.46	0.018	.0302	.0342	.0411	.0549	0.552	.0465	.0307
*24	0.51	0.020	.0381	.0431	.0519	.0692	.0696	.0586	.0387
*23	0.57	0.023	.0481	.0545	.0656	.0875	.0879	.0741	.0489
*22	0.64	0.025	.0603	.0683	.0822	.1097	.1102	.0982	.0613
*21	0.72	0.028	.0765	.0867	.1043	.1391	.1398	.1178	.0778
*20	0.81	0.032	.0964	.1092	.1314	.1754	.1763	.1485	.0981
*19	0.91	0.036	.1214	.1375	.1654	.2208	.2219	.1869	.1235
*18	1.02	0.040	.1531	.1734	.2086	.2784	.2798	.2357	.1558
*17	1.15	0.045	.1931	.2187	.2631	.3511	.3529	.2972	.1965
*16	1.29	0.051	.2433	.2756	.3316	.4426	.4447	.3746	.2476
*15	1.45	0.057	.3069	.3476	.4183	.5583	.5610	.4725	.3123
*14	1.63	0.064	.3869	.4382	.5273	.7037	.7072	.5956	.3937
13	1.83	0.072	.4883	.5531	.6656	.8883	.8925	.7518	.4969
12	2.00	0.081	.6147	.6962	.8377	1.1181	1.1235	.9463	.6255
11	2.31	0.091	.7749	.8777	1.0561	1.4095	1.4163	1.1930	.7885
10	2.60	0.102	.9777	1.1074	1.3325	1.7784	1.7870	1.5052	.9949
9	2.91	0.114	1.2327	1.3963	1.6801	2.2423	2.2532	1.8979	1.2544
8	3.26	0.128	1.5551	1.7615	2.1196	2.8288	2.8425	2.3943	1.5825
7	3.67	0.144	1.9608	2.2210	2.6724	3.5666	3.5839	3.0187	1.9952
6	4.12	0.162	2.4718	2.7998	3.3689	4.4962	4.5180	3.8055	2.5153

Minimum orders: 6-12 ga-1" per size and quality, 13-24 ga-3" per size and quality, 25-30 ga-36" per size and quality.  
 \*Straight lengths are available in 14kt yellow, 14kt white, and 18kt yellow (12" maximum lengths) in 14ga thru 24ga.

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## StarWeld Jewelry Microwelder

The StarWeld microwelders are easy-to-use, low-maintenance laser welders for manual spot and seam welding, currently used in such industries as jewelry manufacturing and repair, dental and medical, electronics, tooling and repair.

The StarWeld Performance system, boasts improved ergonomics for operator comfort and technical features setting a new standard for the industry. Built by the most experienced company in such machines, with more than 25 years in laser technology and 3,000 installations worldwide.

### Standard Features:

- Manual spot / seam microwelding system with max energy ranging from 40 joule to 100 joule
- Ideal for spot and seam welding of gold, silver, platinum, titanium, copper, aluminum and high-grade steel alloys
- Time-saving technique – Welding even in the direct vicinity of heat sensitive parts, such as precious stones, without removing them from their settings
- The unique Sweet Spot Resonator improves laser beam quality and increases the ease of use for the operator
- Flexible Pulse Shaping for designed and controlled laser energy
- New LCD view shutter allows the laser to fire at 20 shots per second
- Variable-size workspace (removable bottom plate)
- Easy-to-use programming and real text information on graphic display
- Improved ergonomic design
- Noise reduction for all moving parts; allows operation in a quiet environment
- Very low maintenance costs
- TRUEVIEW™ optical path alignment ensures on target focusing 100% of the time.

### Basic Configuration:

- Mobile unit with front lockable wheel
- 10x Leica Microscope (15x total magnification in working chamber)
- Pulse shaping
- LCD View shutter
- Two halogen lights for illumination of working chamber
- Two shielding gas nozzles (fixed and flexible)
- Flexible nozzle for cooling work piece
- Removable base plate for large parts
- Integrated exhaust unit with the filter (99.997% grade of separation)
- Self-Diagnostic Programming

description	order no.	
Performance StarWelder 80 Joule DX Model	<b>14-0110</b>	<b>1+</b>
Performance StarWelder 100 Joule LX Model	<b>14-0110</b>	\$26,500.00
		\$27,500.00

Call Extension 4300 for pricing and leasing options.

### Specifications:

#### Laser

Type Pulsed Nd: YAG laser, wavelength 1064µm  
 Series StarWeld Performance Microwelder 6002

Model	DX	LX
Nominal output power max.	50W	50W
Pulse energy max.	80 Joule	100 Joule
Pulse peak power max.	6.0kW	9.0kW
Pulse width	<b>0.5-50ms</b>	<b>0.5-50ms</b>
Pulse frequency	<b>Single Shot-20Hz</b>	<b>Single Shot-20Hz</b>
<b>Motorized beam expansion-in 42 incremental steps</b>	<b>0.25-2.0mm</b>	<b>0.25-2.0m</b>

#### Utilities

Electrical 208-240V, 16A, 50/60Hz, single phase  
 Power consumption max. 1.3-1.7kW  
 Cooling unit Internal, water-air heat exchanger  
 Shielding gas Connection for shielding gas and cooling air

#### Dimensions and Weight

Dimensions 580mm W x 1230mm H x 900mm D (23" W x 48" H x 35" D)  
 Weight 286 lbs. (130 kg.)



Visit the Stuller Tools Booth at all the major Tradeshows to test-drive a Rofin Laser.

Visit [Stuller.com](http://Stuller.com) for all metals needs  
or laser wire tech tips.



## LASER WIRE KITS

Laser Wire Kits are supplied in handy plastic compartment boxes and feature an assortment of different qualities of metal individually spooled in 3ft lengths for ease of use with laser welders. All laser wires are annealed dead soft.



### 28 GA LASER WIRE KIT

**\$337.95**

metal quality	gauge	length
10kt yellow	28ga	3ft spool
14kt yellow	28ga	3ft spool
14kt palladium white	28ga	3ft spool
18kt yellow	28ga	3ft spool
18kt white	28ga	3ft spool
18kt palladium white	28ga	3ft spool
platinum/iridium	28ga	3ft spool
platinum/cobalt	28ga	3ft spool
stainless steel	28ga	3ft spool
titanium	30ga	3ft spool
eye-glass frame wire	30ga	3ft spool
silver weld-hard	28ga	3ft spool

### 30 GA LASER WIRE KIT

**\$219.95**

metal quality	gauge	length
10kt yellow	30ga	3ft spool
14kt yellow	30ga	3ft spool
14kt palladium white	30ga	3ft spool
18kt yellow	30ga	3ft spool
18kt white	30ga	3ft spool
18kt palladium white	30ga	3ft spool
platinum/iridium	30ga	3ft spool
stainless steel	30ga	3ft spool
titanium	30ga	3ft spool
eye-glass frame wire	30ga	3ft spool
silver weld-hard	30ga	3ft spool
silver braze-easy	30ga	3ft spool

Prices subject to change without notice.  
Priced at \$1000 gold market.



## LASER WIRE KITS

Stuller offers one of the most comprehensive wire selections for laser welding in the jewelry industry. We have added new qualities including 14 kt X1 white gold, Argentium™ sterling silver, .585 platinum, .950 super palladium, silver braze, silver weld, eye-glass frame wire, 14ky zinc free and silver/palladium. Laser wires are annealed dead soft to provide the best weld possible. They come packaged in convenient reusable plastic spools and is available in lengths, ranging from 3 ft. all the way to 20 ft.



### LASER WIRE Individual spooled laser wire

metal quality	gauge	3ft	dwt per spool			price/dwt
			5ft	10ft	20 ft	
10kt yellow	28ga		.900	1.800	3.600	\$28.65
10kt yellow	30ga		.594	1.188	2.270	\$29.14
10kt yellow	36ga		.140	.280	.565	\$33.13
14kt yellow	28ga		1.100	2.028	4.000	\$37.28
14kt yellow	30ga		.620	1.280	2.500	\$37.73
14kt yellow	36ga		.140	.410	.650	\$41.13
14kt yellow (zinc free)	30ga				2.765	\$37.62
14kt X1™ white	30ga		.630	1.290	2.540	\$37.81
14kt palladium white	28ga		1.134	2.268	4.536	\$38.37
14kt palladium white	30ga		.750	1.500	3.000	\$38.70
14kt palladium white	36ga		.159	.318	.710	\$41.92
14kt red	30ga		.650	1.250	2.500	\$37.98
18kt yellow	28ga		1.224	2.448	4.896	\$45.96
18kt yellow	30ga		.810	1.620	3.240	\$46.27
18kt yellow	36ga		.160	.400	.696	\$49.66
18kt white	28ga		1.158	2.316	4.632	\$45.99
18kt white	30ga		.762	1.524	2.900	\$46.38
18kt white	36ga		.162	.400	.760	\$49.28
18kt palladium white	28ga		1.278	2.556	5.150	\$46.96
18kt palladium white	30ga		.846	1.692	3.384	\$47.92
18kt palladium white	36ga		.180	.360	.750	\$51.04
22kt yellow	30ga			1.860		\$57.65
eye-glass frame wire	30ga				2.070	\$8.74
eye-glass frame wire	35ga				.710	\$15.52
silver weld-hard	30ga				2.060	\$8.75
silver weld-hard	35ga				.700	\$15.57
silver braze-easy	30ga				1.900	\$8.87
silver braze-easy	35ga				1.900	\$12.87
silver weld/braze-medium	30ga				1.986	\$8.80
silver weld/braze-medium	35ga				.660	\$15.83
stainless steel	28ga				2.110	\$7.95 ea
stainless steel	30ga				1.700	\$7.95 ea
titanium	30ga				.896	\$9.95 ea
argentium sterling silver	30ga				1.975	\$9.81
silver/palladium (AGPD)	30ga				1.813	\$17.19
.585 platinum (pt58)	30ga	.522				\$58.70
.900 platinum/iridium	28ga	1.019				\$69.41
.900 platinum/iridium	30ga	.621				\$71.00
.900 platinum/iridium	36ga			.530		\$72.13
.950 platinum/cobalt	28ga	.983				\$69.22
.900 platinum/ruthenium	28ga	.979				\$70.95
.950 super palladium	30ga				2.410	\$24.91

# Size Up a Ring in 2 Minutes

with the Award-winning

## Preform SIZING SYSTEM

- no waste
- strong joints
- seamless fit
- hands-free soldering



No waste —  
buy only what you need.

Order individual pieces in widths from 1mm to 5mm, precut to size a ring up from ½ to 3½ sizes. No minimum order. Also available in kits and bulk stock.



Watch the Preform Video at [www.stuller.com/preform](http://www.stuller.com/preform)

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Diamonds



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Findings



Metals



Tools



Packaging  
& Display

# Preform SIZING SYSTEM

## BENEFITS & ADVANTAGES:

- SEAMLESS FIT
- LESS PITTING
- STRONG JOINTS
- HANDS-FREE SOLDERING
- SAVES TIME
- EASY TO USE
- HIGH-QUALITY CONSTRUCTION
- LESS WASTED METAL



## Preform<sup>TM</sup> Mill Bits

48-1046	Drill Set (4 pc.)	\$59.95
48-1043	1.5mm stock	\$15.95
48-1044	1.75mm stock	\$15.95
48-1045	2.0mm stock	\$15.95
48-1047	1.2mm stock	\$15.95



## Preform<sup>TM</sup> Precut Sizing Kit

The kits are available in 4 thickness options; 1.2, 1.5, 1.75, & 2.0 mm in 14KY, 14KW, 10KY, 10KW, 18KY and 18KW. Each kit contains 120 possible sizings with 2, 3, and 4mm precut pieces.

Approximately based on \$900 gold.

Note: Charging an average of \$25 for each sizing, the kit has the potential to generate more than \$2,300 in profit for you.



## Manual Mill Guide

The manual mill guide is used to center and guide the drill bit when preparing the mounting to accept the Preform Stock. The vise includes a built-in ring clamp, a metal drill guide, and 2 clear tops with 6 selectable positions each for various shank thicknesses. Designed to work with all four sizes of mill bits.

48-1036 Preform Mill Guide \$49.95

# THE PREFORM METHOD

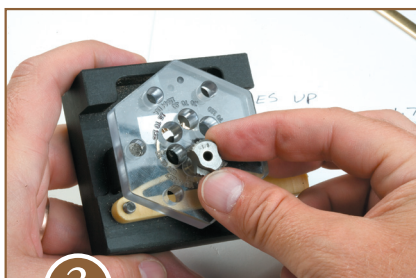
PT # 7520053



**1** Measure the width and thickness of the shank where the sizing joint will be.



**2** Place the mounting on the mandrel with the shank oriented on the top towards the locking mechanism. Then snap locking mechanism into place, holding tension on the mounting shank.



**3** Find the hole that represents your range and align with the bottom of the shank towards the locking mechanism. Using guide pins, clear top should snap into place. Now, place metal drill guide into selected hole.



**4** Choose the one of four end mill bits (1.2, 1.5, 1.75, and 2.0mm) ofered by Stuller, which matches your already-determined Preform stock thickness to drill through the shank.



**5** Using a chuck-style hand piece and flex shaft, insert end mill bit into the metal drill guide. The metal drill guide will keep the end mill perfectly straight as you drill through the shank.



**6** Use caution as you are drilling by using very light pressure. Let the end mill do the cutting for you. Do not let the bit bottom out at the end of the cut, which could over-cut the half-moon piercing.



7 Remove the clear 6-hole top and unclamp the mounting from the vise. You should have pierced through the shank, creating the half-moon effect on each end which will match the ends of the Preform stock.



8 Open the mounting on your mandrel  $\frac{1}{4}$  size from size needed.



9 Set your dividers a little wider than your shank width and mark the Preform stock for cutting. Then, saw out the Preform piece needed for your sizing.



10 Snap the Preform piece into place.



11 Finally, solder together using your traditional soldering methods.

## A No Brainer...

*"There is only one word to describe this new type of sizing technique.*

*"A no brainer." Its simple, fast and accurate with minimal effort...*

*It's really amazing how short the learning curve is. A person can learn to size a ring in approximately 5 minutes with this system. In my opinion this is a god-send."*

Billy Beadle  
Technical Trainer  
Stuller, Inc.



# SIZING STOCK BULK-PREFORM

Karat gold preform sizing stock is supplied in straight lengths with a medium hard temper unless otherwise requested.

- **Minimum order is 1 inch.**
- **Maximum straight length is 36 inch.**

Annealing is available upon request. Preform Sizing Stock is available in the following: 10KY, 10KW, 14KY, 14KW, 14K X1™, 18KY, and 18 KW.



For the best pricing

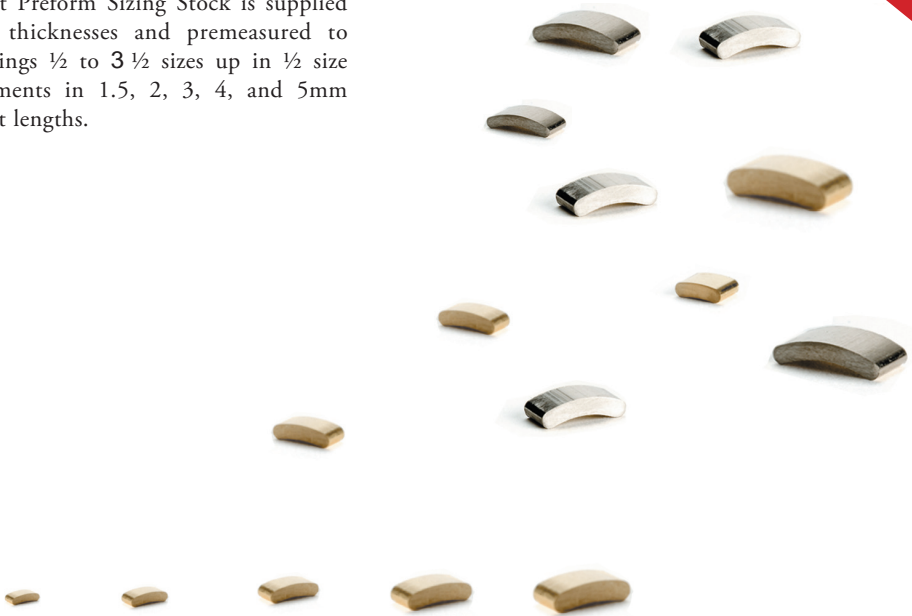
	thickness (mm) x width (ring size)	shank thickness	10kt dwt/in	14kt dwt/in	18kt dwt/in
	1.2mm x 1/2 size	.7mm–1.08mm	.496	.557	.663
	1.2mm x 1 size	.7mm–1.08mm	.774	.870	1.035
	1.2mm x 1.5 sizes	.7mm–1.08mm	1.052	1.182	1.407
	1.2mm x 2 sizes	.7mm–1.08mm	1.343	1.508	1.794
	1.2mm x 2.5 sizes	.7mm–1.08mm	1.621	1.821	2.167
	1.2mm x 3 sizes	.7mm–1.08mm	1.911	2.147	2.555
	1.2mm x 3.5 sizes	.7mm–1.08mm	2.164	2.432	2.894
	1.5mm x 1/2 size	1.09mm–1.36mm	.691	.770	.916
	1.5mm x 1 size	1.09mm–1.36mm	1.030	1.160	1.380
	1.5mm x 1.5 sizes	1.09mm–1.36mm	1.390	1.560	1.856
	1.5mm x 2 sizes	1.09mm–1.36mm	2.003	2.250	2.678
	1.5mm x 2.5 sizes	1.09mm–1.36mm	2.140	2.400	2.856
	1.5mm x 3 sizes	1.09mm–1.36mm	2.550	3.200	3.320
	1.5mm x 3.5 sizes	1.09mm–1.36mm	2.850	3.500	3.808
	1.75mm x 1/2 size	1.37mm–1.61mm	.846	.950	1.131
	1.75mm x 1 size	1.37mm–1.61mm	1.250	1.400	1.666
	1.75mm x 1.5 sizes	1.37mm–1.61mm	1.710	1.920	2.285
	1.75mm x 2 sizes	1.37mm–1.61mm	2.003	2.250	2.678
	1.75mm x 2.5 sizes	1.37mm–1.61mm	2.599	2.920	3.475
	1.75mm x 3 sizes	1.37mm–1.61mm	2.866	3.220	3.832
	1.75mm x 3.5 sizes	1.37mm–1.61mm	3.400	3.820	4.546
	2.0mm x 1/2 size	1.62mm–1.86mm	1.041	1.170	1.392
	2.0mm x 1 size	1.62mm–1.86mm	1.522	1.710	2.035
	2.0mm x 1.5 sizes	1.62mm–1.86mm	2.004	2.250	2.678
	2.0mm x 2 sizes	1.62mm–1.86mm	2.492	2.800	3.332
	2.0mm x 2.5 sizes	1.62mm–1.86mm	2.964	3.330	3.963
	2.0mm x 3 sizes	1.62mm–1.86mm	3.816	3.950	4.701
	2.0mm x 3.5 sizes	1.62mm–1.86mm	3.961	4.450	5.296

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

# SIZING STOCK PRE-CUT-PREFORM

Buy only what  
YOU NEED!

Precut Preform Sizing Stock is supplied in 4 thicknesses and premeasured to size rings ½ to 3 ½ sizes up in ½ size increments in 1.5, 2, 3, 4, and 5mm precut lengths.



1.5mm dwt/in	2mm dwt/in	3mm dwt/in	4mm dwt/in	5mm dwt/in
\$1.15	\$1.52	\$2.29	\$3.05	\$3.81
\$1.79	\$2.39	\$3.58	\$4.78	\$5.97
\$2.43	\$3.24	\$4.86	\$6.47	\$8.09
\$3.10	\$4.13	\$6.19	\$8.26	\$10.32
\$3.75	\$4.99	\$7.49	\$9.98	\$12.48
\$4.41	\$5.88	\$8.82	\$11.77	\$14.71
\$5.00	\$6.66	\$9.99	\$13.33	\$16.66
\$1.58	\$2.11	\$3.16	\$4.22	\$5.28
\$2.38	\$3.18	\$4.77	\$6.36	\$7.95
\$3.21	\$4.27	\$6.42	\$8.55	\$10.69
\$4.63	\$6.17	\$9.25	\$12.33	\$15.42
\$4.93	\$6.58	\$9.87	\$13.16	\$16.44
\$5.74	\$7.65	\$11.47	\$15.30	\$19.12
\$6.58	\$8.77	\$13.16	\$17.54	\$21.93
\$1.95	\$2.60	\$3.91	\$5.21	\$6.51
\$2.88	\$3.84	\$5.75	\$7.67	\$9.59
\$3.95	\$5.26	\$7.89	\$10.53	\$13.16
\$4.63	\$6.17	\$9.25	\$12.34	\$15.42
\$6.00	\$8.01	\$12.01	\$16.01	\$20.02
\$6.62	\$8.83	\$13.24	\$17.66	\$22.07
\$7.85	\$10.47	\$15.71	\$20.94	\$26.18
\$2.41	\$3.21	\$4.81	\$6.42	\$8.02
\$3.52	\$4.69	\$7.03	\$9.37	\$11.71
\$4.63	\$6.17	\$9.25	\$12.34	\$15.42
\$5.75	\$7.67	\$11.51	\$15.34	\$19.18
\$6.85	\$9.13	\$13.69	\$18.25	\$22.82
\$8.12	\$10.83	\$16.24	\$21.65	\$27.06

**COMING  
SOON!**

**NEW  
PREFORM  
SIZING  
DRILL  
PRESS**

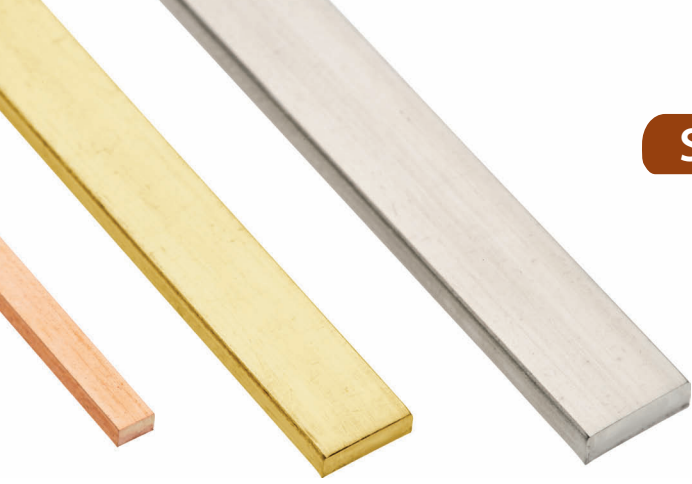


\* Approximate price per piece. Prices are based on 14ky at \$1000 gold market.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

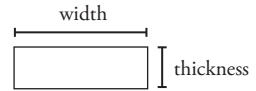
Palladium Market: \$225  
Silver \$12



# SIZING STOCK-FLAT

Karat gold, platinum, palladium, 14kt X1, .585 platinum, and .950 super palladium flat sizing stock are offered in straight lengths with 1/2 hard temper unless otherwise requested. Coiled sizing stock can be made to order with additional lead times. Annealing is available upon request.

- Maximum straight length is 36 inches



In order to determine what size best fits your needs, you must first measure the width, then the thickness.



For the best pricing

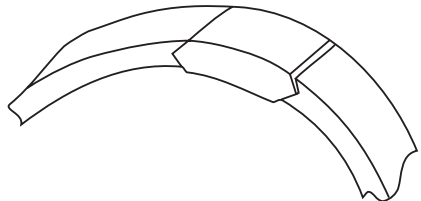
## APPROX PRICING PER PENNYWEIGHT for flat sizing stock

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200dwt
10kt	\$25.32	\$24.38	\$23.76	\$23.51	\$23.04	\$22.98	\$22.76
14kt	\$34.06	\$33.29	\$32.73	\$32.20	\$31.72	\$31.50	\$31.28
14kt X <sub>1</sub> white	\$34.21	\$33.44	\$32.88	\$32.35	\$31.87	\$31.65	\$31.43
14kt palladium white	\$35.23	\$34.46	\$33.90	\$33.37	\$32.89	\$32.67	\$32.45
18kt	\$42.85	\$42.26	\$41.48	\$40.96	\$40.51	\$40.24	\$39.92
18kt palladium white	\$44.54	\$43.95	\$43.17	\$42.65	\$42.20	\$41.93	\$41.61
22kt	\$53.39	\$52.32	\$51.36	\$50.65	\$49.90	\$49.63	\$49.36
.585 platinum	\$50.71	\$50.61	\$50.21	\$49.70	\$49.45	\$49.11	\$48.79
.950 platinum/ruthenium	\$64.22	\$64.12	\$63.72	\$63.21	\$62.96	\$62.62	\$62.30
.950 platinum/cobalt	\$63.92	\$63.82	\$63.42	\$62.91	\$62.66	\$62.32	\$62.00
.950 super palladium	\$18.24	\$18.14	\$17.74	\$17.25	\$16.99	\$16.65	\$16.34

## SIZING Tech Tip

### WORKING WITH SIZING STOCK

- To straighten our stocks and wire: first, anneal and quench to soften; then, fasten one end and pull on the opposite end with tongs or draw bench until you feel a slight movement. Release pressure, and the piece should be straight.
- To help prevent pits when sizing, you need an absolute flush fit at the joint which should also be as clean as possible. Paste solder is not designed for sizing work and should not be used.
- You can request tempers other than what we stock when you place your order. Allow three extra working days for us to ship.
- Remember — Stress relieving product will greatly reduce the likelihood of stress corrosion cracking.



### LEAD TIMES

10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order.



**SIZING STOCK-FLAT** karat gold, platinum, and palladium

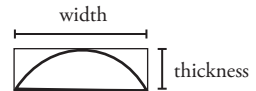
		Min	10kt	14kt	18kt	Pt/Ru	.950 Pd
MM size		dwt/inch	dwt/inch	dwt/inch	dwt/inch	dwt/inch	dwt/inch
1.5 x	1.5 x .75	3"	0.209	0.237	0.285	0.380	0.213
	1.5 x 1	3"	0.279	0.316	0.380	0.507	0.284
2 x	2 x .75	3"	0.279	0.316	0.380	0.507	0.284
	2 x 1	3"	0.372	0.421	0.507	0.676	0.378
	2 x 1.25	3"	0.465	0.526	0.633	0.845	0.473
2.5 x	2 x 1.5	3"	0.558	0.632	0.760	1.014	0.567
	2.5 x .75	3"	0.348	0.395	0.475	0.634	0.355
	2.5 x 1	3"	0.465	0.526	0.633	0.845	0.473
	2.5 x 1.25	1"	0.581	0.658	0.792	1.506	0.591
	2.5 x 1.5	1"	0.697	0.789	0.950	1.268	0.709
3 x	2.5 x 2	1"	0.929	1.053	1.267	1.690	0.946
	3 x .75	1"	0.418	0.474	0.570	0.761	0.426
	3 x 1	1"	0.558	0.632	0.760	1.014	0.567
	3 x 1.25	1"	0.697	0.789	0.950	1.268	0.709
	3 x 1.5	1"	0.836	0.947	1.140	1.521	0.851
	3 x 2	1"	1.115	1.263	1.520	2.028	1.135
3.5 x	3 x 2.5	1"	1.394	1.579	1.900	2.536	1.418
	3.5 x 1	1"	0.651	0.737	0.887	1.183	0.662
	3.5 x 1.5	1"	0.976	1.105	1.330	1.775	0.993
	3.5 x 2	1"	1.301	1.474	1.773	2.367	1.324
4 x	3.5 x 2.5	1"	1.626	1.842	2.216	2.958	1.655
	4 x .75	1"	0.558	0.632	0.760	1.014	0.567
	4 x 1	1"	0.743	0.842	1.013	1.352	0.757
	4 x 1.25	1"	0.929	1.053	1.267	1.690	0.946
	4 x 1.5	1"	1.115	1.263	1.520	2.028	1.135
	4 x 2	1"	1.487	1.684	2.027	2.705	1.513
	4 x 2.25	1"	1.673	1.895	2.280	3.043	1.702
4.5 x	4 x 3	1"	2.230	2.526	3.040	4.057	2.270
	4.5 x 1	1"	0.836	0.947	1.140	1.521	0.851
	4.5 x 1.5	1"	1.255	1.421	1.710	2.282	1.277
5 x	4.5 x 2	1"	1.673	1.895	2.280	3.043	1.702
	5 x .75	1"	0.697	0.789	0.950	1.268	0.709
	5 x 1	1"	0.929	1.053	1.267	1.690	0.946
	5 x 1.25	1"	1.162	1.316	1.583	2.113	1.182
	5 x 1.5	1"	1.394	1.579	1.900	2.536	1.418
	5 x 2	1"	1.859	2.105	2.533	3.381	1.891
6 x	5 x 2.5	1"	2.323	2.632	3.166	4.226	2.364
	6 x 1	1"	1.115	1.263	1.520	2.028	1.135
	6 x 1.5	1"	1.673	1.895	2.280	3.043	1.702
	6 x 2	1"	2.230	2.526	3.040	4.057	2.270
7 x	6 x 2.5	1"	2.788	3.158	3.800	5.071	2.837
	7 x 1	1"	1.301	1.474	1.773	2.367	1.324
	7 x 1.5	1"	1.952	2.210	2.660	3.550	1.986
	7 x 2	1"	2.602	2.947	3.546	4.733	2.648
8 x	7 x 2.5	1"	3.253	3.684	4.433	5.916	3.310
	8 x 1	1"	1.487	1.684	2.027	2.705	1.513
	8 x 1.5	1"	2.230	2.526	3.040	4.057	2.270
	8 x 2	1"	2.974	3.368	4.053	5.409	3.026
10 x	8 x 2.5	1"	3.717	4.210	5.066	6.762	3.783
	10 x 1	1"	1.859	2.105	2.533	3.381	1.891
	10 x 1.5	1"	2.788	3.158	3.800	5.071	2.837



# SIZING STOCK-HALF ROUND

Karat gold, platinum, palladium, 14kt X1 and .950 super palladium half round sizing stock are supplied in straight lengths with a ½ hard temper, unless otherwise requested. Coil sizing stock can be made to order with additional lead times. Annealing available on request.

- Maximum straight length is 36 inches.



In order to determine what size best fits your needs, you must first measure the width, then the thickness.



## APPROX PRICING PER PENNYWEIGHT for half round sizing stock

For the best pricing

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200dwt
10kt	\$25.32	\$24.38	\$23.76	\$23.51	\$23.04	\$22.98	\$22.76
14kt	\$34.06	\$33.29	\$32.73	\$32.20	\$31.72	\$31.50	\$31.28
14kt X1 white	\$34.21	\$33.44	\$32.88	\$32.35	\$31.87	\$31.65	\$31.43
14kt palladium white	\$35.23	\$34.46	\$33.90	\$33.37	\$32.89	\$32.67	\$32.45
18kt	\$42.85	\$42.26	\$41.48	\$40.96	\$40.51	\$40.24	\$39.92
18kt palladium white	\$44.54	\$43.95	\$43.17	\$42.65	\$42.20	\$41.93	\$41.61
22kt	\$53.39	\$52.32	\$51.36	\$50.65	\$49.90	\$49.63	\$49.36
.585 platinum	\$50.71	\$50.61	\$50.21	\$49.70	\$49.45	\$49.11	\$48.79
.950 platinum/ruthenium	\$64.22	\$64.12	\$63.72	\$63.21	\$62.96	\$62.62	\$62.30
.950 platinum/cobalt	\$63.92	\$63.82	\$63.42	\$62.91	\$62.66	\$62.32	\$62.00
.950 super palladium	\$18.24	\$18.14	\$17.74	\$17.25	\$16.99	\$16.65	\$16.34















































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LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

**SIZING STOCK-FLAT** karat gold, platinum, and palladium

		profile	Min	10kt	14kt	18kt	Pt/Ru	.950 Pd
		cross section		MM size	dwt/inch	dwt/inch	dwt/inch	dwt/inch
1 x		1 x .5	3"	.100	.110	.130	.180	.088
1.5 x		1.5 x .75	3"	.241	.233	.267	.330	.270
		1.5 x 1	3"	0.249	0.282	0.339	0.453	0.253
1.75 x		1.75 x 1	3"	0.290	0.329	0.396	0.528	0.295
2 x		2 x 1	3"	0.332	0.376	0.452	0.604	0.338
		2 x 1.5	3"	0.486	0.550	0.662	0.884	0.494
2.25 x		2.25 x 1.5	3"	0.547	0.619	0.745	0.994	0.556
		2.5 x 1.25	3"	0.511	0.579	0.696	0.930	0.520
2.5 x		2.5 x 1.5	1"	0.607	0.688	0.828	1.105	0.618
		2.5 x 2	1"	0.815	0.923	1.110	1.482	0.829
3 x		3 x 1	1"	0.498	0.564	0.678	0.905	0.507
		3 x 1.5	1"	0.729	0.825	0.993	1.325	0.741
3.5 x		3 x 2	1"	0.978	1.107	1.332	1.778	0.995
		3.5 x 1.5	1"	0.850	0.963	1.159	1.546	0.865
4 x		3.5 x 2	1"	1.140	1.292	1.554	2.075	1.161
		4 x 1	1"	0.664	0.752	0.905	1.207	0.675
4.5 x		4 x 1.5	1"	0.972	1.100	1.324	1.767	0.989
		4 x 2	1"	1.303	1.476	1.776	2.371	1.326
5 x		4.5 x 1.5	1"	1.093	1.238	1.490	1.988	1.112
		4.5 x 2	1"	1.466	1.661	1.999	2.667	1.492
5.5 x		5 x 1	1"	0.830	0.940	1.131	1.509	0.844
		5 x 1.5	1"	1.214	1.376	1.655	2.209	1.236
6 x		5 x 2	1"	1.629	1.845	2.221	2.964	1.658
		5 x 2.5	1"	2.024	2.293	2.759	3.682	2.060
6.5 x		5 x 3	1"	2.419	2.740	3.297	4.400	2.461
		6 x 1	1"	0.996	1.128	1.357	1.811	1.013
7 x		6 x 1.25	1"	1.226	1.389	1.672	2.231	1.248
		6 x 1.5	1"	1.457	1.651	1.986	2.651	1.483
7.5 x		6 x 2	1"	1.955	2.215	2.665	3.556	1.989
		6 x 2.5	1"	2.429	2.751	3.310	4.418	2.472
8 x		6 x 3	1"	2.903	3.288	3.956	5.280	2.954
		7 x 1	1"	1.161	1.316	1.583	2.113	1.182
8.5 x		7 x 1.5	1"	1.700	1.926	2.317	3.093	1.730
		7 x 2	1"	2.281	2.584	3.109	4.149	2.321
9 x		7 x 2.5	1"	1.431	1.621	1.950	2.603	1.456
		8 x 1.25	1"	1.635	1.852	2.229	2.974	1.664
9.5 x		8 x 1.5	1"	1.943	2.201	2.648	3.535	1.977
		8 x 1.7	1"	2.193	2.484	2.988	3.988	2.231
10 x		8 x 2	1"	2.607	2.953	3.553	4.742	2.653
		10 x 1.25	1"	2.044	2.315	2.786	3.718	2.080
11 x		12 x 1.5	1"	2.915	3.301	3.973	5.302	2.966
		12 x 1.7	1"	3.289	3.725	4.483	5.983	3.347
12 x		15 x 1.7	1"	4.111	4.657	5.603	7.478	4.148
15 x		18 x 1.7	1"	4.934	5.588	6.724	8.974	5.020



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## SIZING STOCK-SQUARE

Karat gold, platinum, 14kt X1, .585 Platinum, .950 Platinum/Cobalt, and .950 Super Palladium are supplied in straight lengths with ½ hard temper unless otherwise requested. Coiled sizing stock can be made to order with additional lead times. Annealing is available upon request.

• Maximum length is 36 inches.



refined Karats



For the best pricing

### APPROX PRICING PER PENNYWEIGHT for square sizing stock

	1 dwt	5 dwt	10 dwt	20 dt	50 dwt	100 dwt	200 dwt
10kt	\$25.32	\$24.38	\$23.76	\$23.51	\$23.04	\$22.98	\$22.76
14kt	\$34.06	\$33.29	\$32.73	\$32.20	\$31.72	\$31.50	\$31.28
14kt X1 white	\$34.21	\$33.44	\$32.88	\$32.35	\$31.87	\$31.65	\$31.43
14kt palladium white	\$35.23	\$34.46	\$33.90	\$33.37	\$32.89	\$32.67	\$32.45
18kt	\$42.85	\$42.26	\$41.48	\$40.96	\$40.51	\$40.24	\$39.92
18kt palladium white	\$44.54	\$43.95	\$43.17	\$42.65	\$42.20	\$41.93	\$41.61
22kt	\$53.39	\$52.32	\$51.36	\$50.65	\$49.90	\$49.63	\$49.36
.585 platinum	\$50.71	\$50.61	\$50.21	\$49.70	\$49.45	\$49.11	\$48.79
.950 platinum/ruthenium	\$64.22	\$64.12	\$63.72	\$63.21	\$62.96	\$62.62	\$62.30
.950 platinum/cobalt	\$63.92	\$63.82	\$63.42	\$62.91	\$62.66	\$62.32	\$62.00
.950 super palladium	\$18.24	\$18.14	\$17.74	\$17.25	\$16.99	\$16.65	\$16.34

### SIZING STOCK-SQUARE karat gold, platinum, and palladium

profile	10kt	14kt	18kt	Pt/Ru	.950 Pd		
cross section	MM size	min.	dwt/inch	dwt/inch	dwt/inch	dwt/inch	dwt/inch
■	.75 x .75	3"	0.105	0.118	0.142	0.190	0.106
■	1 x 1	3"	0.186	0.211	0.253	0.338	0.189
■	1.25 x 1.25	3"	0.290	0.329	0.396	0.528	0.296
■	1.5 x 1.5	3"	0.418	0.474	0.570	0.761	0.426
■	1.75 x 1.75	1"	0.569	0.645	0.776	1.035	0.579
■	2 x 2	1"	0.743	0.842	1.013	1.352	0.757
■	2.25 x 2.25	1"	0.941	1.066	1.282	1.712	0.957
■	2.5 x 2.5	1"	1.162	1.316	1.583	2.113	1.182
■	3 x 3	1"	1.673	1.895	2.280	3.043	1.702
■	3.5 x 3.5	1"	2.277	2.579	3.103	4.141	2.317
■	4 x 4	1"	2.974	3.368	4.053	5.409	3.026
■	5 x 5	1"	4.647	5.263	6.333	8.452	4.728
■	6 x 6	1"	6.691	7.579	9.119	12.171	6.809

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## SIZING STOCK-COMFORT FIT

Comfort fit sizing stock is great for fabricating comfort fit rings and sizing comfort fit bands. Karat gold, platinum, 14K X1, and .950 Platinum/Ruthenium comfort fit sizing stock are supplied in straight lengths with ½ hard temper unless otherwise requested. Coiled sizing stock can be made to order with additional lead times. Annealing is available upon request.

- Minimum order is 1 inch per size.
- Maximum straight length is 36 inches.







In order to determine what size best fits your needs, you must first measure the width, then the thickness.



*refined* Karats

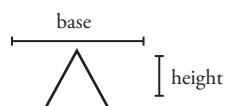
### SIZING STOCK-COMFORT FIT karat gold, platinum, and palladium

profile		10kt	14kt	18kt	pt/ru	.950 pd
cross section	MM	dwt/inch	dwt/inch	dwt/inch	dwt/inch	dwt/inch
	3 x 2	0.876	0.992	1.194	1.593	0.891
	4 x 2	1.168	1.323	1.592	2.124	1.188
	5 x 2	1.460	1.653	1.990	2.655	1.485
	6 x 2	1.752	1.984	2.387	3.186	1.782

## SIZING STOCK-TRIANGLE

Triangle sizing stock is stocked in 14kt yellow and white. Additional leadtime is required for other karats and colors. Supplied in straight lengths with medium hard temper, unless otherwise requested.

- Maximum straight length is 36 inches.







In order to determine what size best fits your needs, you must first measure the base, then the height.



*refined* Karats

### SIZING STOCK-TRIANGLE karat gold, platinum, and palladium

profile		10kt	14kt	18kt	pt/ru
cross section	MM	min.	dwt/inch	dwt/inch	dwt/inch
	2 x 1.75	1"	.325	0.368	.445
	4 x 3.5	1"	1.305	1.474	1.708
	6 x 5.5	1"	3.075	3.474	3.875
	8 x 7	1"	5.291	5.895	6.875

# BEZEL-FLAT STRIP

Flat bezel strips are supplied with a  $\frac{3}{4}$  hard temper in lengths up to 14 inches. Annealing is available upon request.



For the best pricing

## APPROX PRICING PER PENNYWEIGHT for bezel flat strip

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200 dwt
10kt	\$26.24	\$25.90	\$25.18	\$24.78	\$24.28	\$23.96	\$23.69
14kt	\$34.76	\$34.41	\$33.85	\$33.42	\$32.85	\$32.58	\$32.31
18kt	\$43.82	\$43.33	\$42.60	\$42.08	\$41.55	\$41.28	\$40.95
18kt palladium white	\$45.51	\$45.02	\$44.29	\$43.77	\$43.24	\$42.97	\$42.64
22kt	\$53.70	\$53.16	\$52.40	\$51.89	\$51.31	\$51.03	\$50.71
.950 platinum/ruthenium	\$64.22	\$64.12	\$63.72	\$63.21	\$62.96	\$62.62	\$62.30

## BEZEL-FLAT STRIP karat gold, platinum, and palladium

	MM size	min.	10kt dwt/inch	14kt dwt/inch	18kt dwt/inch	Pt/Ru dwt/inch	.950 Pd dwt/inch
2 x	— 2mm x 22ga	12"	0.239	0.271	0.326	0.375	0.434
	— 2mm x 24ga	12"	0.190	0.215	0.259	0.298	0.345
	— 2mm x 26ga	12"	0.150	0.170	0.205	0.236	0.273
	— 2mm x 28ga	12"	0.119	0.135	0.162	0.187	0.216
	— 2mm x 30ga	12"	0.094	0.107	0.129	0.148	0.172
3 x	— 3mm x 22ga	6"	0.358	0.406	0.488	0.562	0.652
	— 3mm x 24ga	6"	0.285	0.322	0.388	0.447	0.518
	— 3mm x 26ga	6"	0.225	0.255	0.307	0.353	0.410
	— 3mm x 28ga	6"	0.178	0.202	0.243	0.280	0.325
	— 3mm x 30ga	6"	0.142	0.160	0.193	0.222	0.258
4 x	— 4mm x 22ga	6"	0.478	0.541	0.651	0.750	0.869
	— 4mm x 24ga	6"	0.380	0.430	0.517	0.596	0.690
	— 4mm x 26ga	6"	0.300	0.340	0.409	0.471	0.546
	— 4mm x 28ga	6"	0.238	0.269	0.324	0.373	0.433
	— 4mm x 30ga	6"	0.189	0.214	0.257	0.296	0.343
5 x	— 5mm x 22ga	6"	0.597	0.676	0.814	0.937	1.086
	— 5mm x 24ga	6"	0.475	0.537	0.647	0.745	0.863
	— 5mm x 26ga	6"	0.375	0.425	0.511	0.589	0.683
	— 5mm x 28ga	6"	0.297	0.337	0.405	0.467	0.541
	— 5mm x 30ga	6"	0.236	0.267	0.322	0.370	0.429
6 x	— 6mm x 22 ga	6"	0.717	0.812	0.977	1.125	1.303
	— 6mm x 24ga	6"	0.569	0.645	0.776	0.894	1.036
	— 6mm x 26ga	6"	0.450	0.510	0.614	0.707	0.819
	— 6mm x 28ga	6"	0.357	0.404	0.486	0.560	0.649
	— 6mm x 30ga	6"	0.283	0.321	0.386	0.445	0.515

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## BEZEL-STEPPED

Karat gold bezel wire are available in 10kt, 14kt, 18kt yellow, and 14kt white.

- Minimum order is 3 inches per size.



### APPROX PRICING PER PENNYWEIGHT for stepped bezel stock

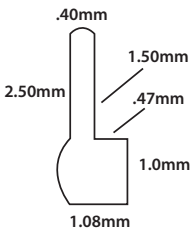
For the best pricing

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200 dwt
10kt	\$27.22	\$26.70	\$25.73	\$25.33	\$24.84	\$24.52	\$24.25
14kt	\$35.20	\$34.68	\$34.07	\$33.54	\$33.13	\$32.86	\$32.74
18kt	\$44.80	\$44.18	\$43.15	\$42.68	\$42.11	\$41.84	\$41.51

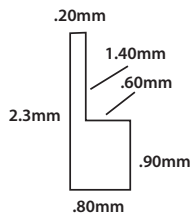
### BEZEL-STEPPED karat gold, platinum, and palladium

item no.	style	dimensions		10kt	14kt	18kt
		mm	inches	dwt/inch	dwt/inch	dwt/inch
# 1	Milgrain	.41 x 1.08 x 2.50	.016 x .042 x .098	.2916	.3085	.4125
# 2	Plain	.25 x .86 x 2.45	.010 x .034 x .096	.2047	.2666	.2737
# 3	Plain	.36 x .85 x 5.70	.014 x .033 x .224	.4492	.505	.6008

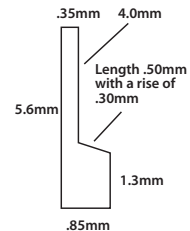
Item #1 Milgrain on top edge.



Item #2



Item #3



See Page 76 for sterling silver stepped bezel wire.

## BEZEL-FANCY STRIP

Manufactured using  technology.

- Supplied in 14K and 18KW gold.



### BEZEL-FANCY STRIP 14 kt yellow & white gold

series no.	mm size (length x width)	price per piece @\$1000 gold
772	75.5 x 3.5	\$97.85
769	75.0 x 3.0	\$74.97

See *The Findings Book* for more styles of Fancy Bezel.



# TUBING-ROUND

Seamless round tubing is available in 18kt yellow and .950 platinum/ruthenium in selected sizes. 14kt yellow and 14kt palladium white are available in all sizes listed. Supplied in straight lengths with a medium-hard temper. Minimum order lengths listed below. Same day shipping subject to order specifications and inventory on hand at time of order.

• 24 inch maximum order length.



For the best pricing

## APPROX PRICING PER PENNYWEIGHT for round tubing

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200 dwt
14kt	\$36.49	\$36.10	\$35.44	\$34.91	\$34.48	\$34.21	\$34.09
14kt palladium white	\$37.66	\$37.27	\$36.61	\$36.08	\$35.65	\$35.38	\$35.26
18kt	\$46.38	\$45.95	\$44.87	\$44.20	\$43.66	\$43.23	\$42.82
.950 platinum/ruthenium	\$77.32	\$76.57	\$76.07	\$75.44	\$75.23	\$74.84	\$74.54

## TUBING-ROUND karat gold, platinum, and palladium


wall thickness	cross section	outer diameter		inner diameter			14kt	18kt	pt/ru	insert
		mm	in	mm	in	min.	dwt/in	dwt/in	dwt/in	wire
light .010" 30ga	◦	1.00L	.039"	0.50	.020"	3"	0.125	0.151	*	25ga
	◦	1.13L	.044"	0.63	.025"	3"	0.147	0.177	*	23ga
	◦	1.25L	.049"	0.75	.030"	3"	0.167	0.201	0.269	21ga
	◦	1.43L	.056"	0.93	.037"	1"	0.198	0.238	*	20ga
	◦	1.60L	.063"	1.10	.043"	1"	0.226	0.272	0.363	18ga
	◦	1.80L	.071"	1.30	.051"	1"	0.260	0.313	*	17ga
	○	2.05L	.081"	1.55	.061"	1"	0.302	0.363	0.485	15ga
	○	2.25L	.089"	1.75	.069"	1"	0.335	0.403	*	14ga
	○	2.55L	.100"	2.05	.081"	1"	0.933	1.122	1.498	13ga
	○	2.85L	.112"	2.35	.093"	1"	0.436	0.525	0.700	12ga
medium .015" 26ga	○	3.13L	.123"	2.63	.103"	1"	0.483	0.581	0.776	10ga
	◦	2.00M	.079"	1.20	.047"	1"	0.293	*	*	16ga
	○	2.50M	.098"	1.70	.067"	1"	0.377	0.454	0.606	14ga
	○	3.00M	.118"	2.20	.087"	1"	0.461	0.555	0.741	12ga
	○	3.30M	.130"	2.50	.098"	1"	0.512	*	*	11ga
	○	3.75M	.148"	2.95	.116"	1"	0.587	0.707	0.943	9ga
	○	4.80M	.189"	4.00	.157"	1"	0.764	0.919	*	7ga
○	5.80M	.228"	5.00	.197"	1"	0.932	1.121	1.496	5ga	

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**TUBING-ROUND** karat gold, platinum, and palladium

	wall thickness	cross section	outer diameter		inner diameter		14kt dwt/in	18kt dwt/in	pt/ru dwt/in	insert wire
			mm	in	mm	in				
heavy .020" 24ga	○	2.00H	.079"	1.00	.039"	1"	0.293	0.353	0.471	19ga
	○	2.25H	.089"	1.25	.049"	1"	0.335	0.403	✱	17ga
	○	2.50H	.098"	1.50	.059"	1"	0.377	0.454	0.606	15ga
	○	2.85H	.112"	1.85	.073"	1"	0.436	0.525	✱	14ga
	○	3.13H	.123"	2.13	.084"	1"	0.483	0.581	0.776	12ga
	○	3.50H	.138"	2.50	.098	1"	0.545	0.656	0.876	11ga
	○	4.00H	.157"	3.00	.118"	1"	0.629	0.757	1.011	9ga
	○	4.25H	.167"	3.25	.128"	1"	0.671	✱	✱	8ga
	○	4.50H	.177"	3.50	.138"	1"	0.713	0.858	1.145	8ga
extra heavy .025" 22ga	○	5.00X	.197"	3.73	.147"	1"	0.797	0.959	✱	8ga
	○	5.10X	.201"	3.83	.151"	1"	0.814	0.980	✱	7ga
	○	5.50X	.217"	4.23	.167"	1"	0.881	1.060	1.415	6ga
	○	6.00X	.236"	4.73	.186"	1"	0.965	1.161	1.550	5ga
	○	6.50X	.256"	5.23	.206"	1"	1.049	1.263	1.685	4ga
	○	7.25X	.285"	5.98	.235"	1"	1.175	1.414	1.887	3ga
	○	7.50X	.295"	6.23	.245"	1"	1.217	1.465	1.955	3ga
	○	8.00X	.315"	6.73	.265"	1"	1.301	1.566	✱	2ga
	○	8.50X	.335"	7.23	.285"	1"	1.385	1.667	✱	1ga
○	9.00X	.304"	7.73	.354"	1"	1.469	✱	✱	1ga	
○	9.50X	.374"	8.23	.324"	1"	1.553	1.869	✱	✱	



**Tube Cutter Jig**  
This handy tool will securely hold tubing for precision cutting. Holds tubing up to 6mm round or 7.5mm square.

description	order no.	6+	3+	1
a. Tube Cutter Jig Economy	58-2462	\$20.66	\$22.03	\$22.95
b. Tube Cutter	58-2465	\$35.06	\$37.39	\$38.95



## TUBING-SQUARE & OVAL













14kt yellow square and oval tubing is supplied in straight lengths with a medium hard temper.

- Minimum order is 3 inches per size.




### APPROX PRICING PER PENNYWEIGHT for square and oval tubing

	1 dwt	5 dwt	10 dwt	20 dwt	50 dwt	100 dwt	200 dwt
14kt	\$36.99	\$36.60	\$35.94	\$35.41	\$34.98	\$34.71	\$34.59

### TUBING-SQUARE karat gold, platinum, and palladium

wall thickness	cross section	outer diameter		inner diameter		min.	14kt dwt/in
		mm	in	mm	in		
light .012" 28ga		1.50L	0.059	0.89	0.035	3"	.286
		2.00L	0.079	1.39	0.055	3"	.4417
		3.00L	0.118	2.39	0.094	3"	.7167
		4.00L	0.157	3.39	0.133	3"	.75
heavy .020" 24ga		3.18H	0.125	2.18	0.086	3"	1.1883
		3.81H	0.150	2.81	0.111	3"	1.4683
		4.56H	0.180	3.56	0.140	3"	1.7917
		5.08H	0.200	4.08	0.160	3"	2.008
		5.58H	0.220	4.58	0.180	3"	2.3292
extra heavy .024" 22ga		6.68X	0.263	5.46	0.215	3"	2.5667
		7.16X	0.282	5.94	0.234	3"	2.8417
		7.75X	0.305	6.53	0.257	3"	2.9417

### TUBING-OVAL karat gold, platinum, and palladium

wall thickness	cross section	outer diameter		min.	14kt dwt/in
		mm	in		
heavy .020" 24ga		3.81/0.150	7.01/0.276	3"	1.691
		4.44/0.175	7.97/0.314	3"	1.925
		5.08/0.200	7.85/0.309	3"	2.141

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

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# SOLDER -COLOR MATCH SHEET AND CHIPS PLUMB-CADMIUM FREE

This solder has been developed, tested, and is currently used in our day- to -day manufacturing. Our karat gold color-match solders provide excellent soldering characteristics as they were formulated to match the color of our karat gold shanks, findings, mountings and mill products. Each solder quality has been extensively tested in house for color match, flow, and polishing characteristics.



## SOLDER-COLOR MATCH SHEET karat gold

color-match solder quality	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
10kt yellow easy	1260	1270	\$25.21	\$24.79	\$24.44	\$23.91
10kt white easy	1255	1260	\$25.41	\$24.99	\$24.64	\$24.11
14kt yellow easy	1270	1280	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow medium	1375	1430	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow hard	1450	1480	\$34.27	\$34.00	\$33.62	\$33.07
14kt standard white easy	1305	1330	\$34.47	\$34.00	\$33.62	\$33.07
14kt standard white hard	1445	1500	\$34.47	\$34.00	\$33.62	\$33.07
14kt X1= white easy	1300	1330	\$34.62	\$34.15	\$33.77	\$33.22
14kt X1= white medium	1350	1390	\$34.62	\$34.15	\$33.77	\$33.22
14kt X1= white hard	1405	1635	\$34.62	\$34.15	\$33.77	\$33.22
18kt yellow medium	1345	1460	\$43.44	\$42.91	\$42.49	\$41.92
18kt standard white hard	1475	1530	\$43.64	\$43.11	\$42.69	\$42.12
18kt X1= white hard	1535	1565	\$47.42	\$46.89	\$46.47	\$45.90



## SOLDER-COLOR MATCH CHIP karat gold

color-match solder quality	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
10kt yellow easy	1260	1270	\$25.46	\$26.04	\$25.69	\$25.16
10kt white easy	1255	1260	\$26.66	\$26.24	\$25.89	\$25.36
14kt yellow easy	1270	1280	\$35.52	\$35.05	\$34.67	\$34.12
14ktt Yellow medium	1375	1430	\$35.52	\$35.05	\$34.67	\$34.12
4kt yellow hard	1450	1480	\$35.52	\$35.05	\$34.67	\$34.12
14kt standard white medium	1305	1330	\$35.72	\$35.25	\$34.87	\$34.32
14kt standard white hard	1445	1500	\$35.72	\$35.25	\$34.87	\$34.32
14kt X1= white easy	1300	1330	\$35.87	\$35.40	\$35.02	\$34.47
14kt X1= white medium	1350	1390	\$35.87	\$35.40	\$35.02	\$34.47
14kt X1= white hard	1405	1635	\$35.87	\$35.40	\$35.02	\$34.47
18kt yellow medium	1345	1460	\$44.69	\$44.16	\$43.74	\$43.17
18kt standard white hard	1475	1530	\$44.89	\$44.36	\$43.94	\$43.37
18kt X1= white hard	1535	1565	\$44.99	\$44.46	\$44.04	\$43.47

*Developed, manufactured, and approved. So good we use it ourselves.*

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12

# PLUMB SOLDER SHEET & WIRE CADMIUM BEARING



These karat gold sheet solders contain cadmium to improve solder flow characteristics, and are supplied in 1 dwt sheets in all qualities listed below.



*refined* Karats

## SOLDER-SHEET karat gold

solder quality	melting		flow			
	point (°F)	point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
6kt yellow easy	1165	1220	\$16.99	\$16.57	\$16.22	\$15.69
6kt white easy	1220	1230	\$17.19	\$16.77	\$16.42	\$15.89
8kt yellow easy	1150	1230	\$21.15	\$20.73	\$20.38	\$19.85
10kt yellow easy	1170	1240	\$25.21	\$24.79	\$24.44	\$23.91
10kt yellow medium	1230	1285	\$25.21	\$24.79	\$24.44	\$23.91
10kt yellow hard	1310	1360	\$25.21	\$24.79	\$24.44	\$23.91
10kt white easy	1250	1290	\$25.41	\$24.99	\$24.64	\$24.11
12kt yellow easy	1070	1165	\$29.71	\$29.29	\$28.94	\$28.41
14kt yellow ultra-easy	1070	1165	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow easy	1080	1320	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow medium	1230	1360	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow hard	1410	1460	\$34.27	\$33.80	\$33.42	\$32.87
14kt white easy	1235	1275	\$34.47	\$34.00	\$33.62	\$33.07
14kt white hard	1330	1380	\$34.47	\$34.00	\$33.62	\$33.07
14kt red weld	1600	1690	\$34.47	\$34.00	\$33.62	\$33.07
14kt green medium	1390	1425	\$34.47	\$34.00	\$33.62	\$33.07
18kt yellow easy	1095	1255	\$43.44	\$42.91	\$42.49	\$41.92
18kt yellow hard	1480	1550	\$43.44	\$42.91	\$42.49	\$41.92
18kt red medium	1395	1505	\$43.64	\$43.11	\$42.69	\$42.12
18kt green medium	1510	1545	\$43.64	\$43.11	\$42.69	\$42.12
21kt yellow hard	1545	1625	\$50.00	\$49.42	\$48.96	\$48.37

## SOLDER-WIRE

solder quality	gauge	melting		flow		
		point (°F)	point (°F)	1 dwt	10 dwt	20 dwt
14kt yellow ultra easy	24 ga	1070	1165	\$34.59	\$34.15	\$33.77
14kt yellow ultra easy	30 ga	1070	1165	\$34.59	\$34.15	\$33.77
14kt yellow easy	24 ga	1080	1320	\$34.59	\$34.15	\$33.77

## SOLDERING Tech Tip

The following steps will give you a perfect solder joint every time:

1. Clean solder with pickle compound, then alcohol.
2. If the article has been worn, run it through the ultrasonic cleaner. Clean the article to be soldered with pickle, then coat with boric acid/alcohol solution.
3. If sizing, you should have an absolute flush fit at the joint, which should also be extremely clean. Excluding either of these steps will usually result in pits.
4. Ignite boric acid/alcohol solution to produce a protective glaze that will inhibit oxidation.
5. Apply "self-pickling" flux as needed at solder joint to induce solder flow.
6. Apply proper heat to the article first, then to the piece of solder. If you overheat the solder, you will usually burn out the alloys eliminating proper solder flow, which will give the end result of improper adherence and pitting in solder.

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## PLUMB SOLDER-CHIPPED CADMIUM BEARING

This karat gold chipped solder contains cadmium and is pre-cut to .045”-.045”

- Maximum order is 1dwt per solder quality.



refined Karats

### SOLDER-CHIPPED karat gold

solder quality (chipped)	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
6kt yellow easy	1165	1220	\$18.24	\$17.82	\$17.47	\$16.94
10kt yellow easy	1170	1230	\$26.46	\$26.04	\$25.69	\$25.16
10kt yellow hard	1310	1360	\$26.46	\$26.04	\$25.69	\$25.16
10kt white easy	1250	1290	\$26.66	\$26.24	\$25.89	\$25.36
14kt yellow ultra-easy	1070	1165	\$35.52	\$35.05	\$34.67	\$34.12
14kt yellow easy	1080	1320	\$35.52	\$35.05	\$34.67	\$34.12
14kt yellow medium	1230	1360	\$35.52	\$35.05	\$34.67	\$34.12
14kt yellow hard	1410	1460	\$35.52	\$35.05	\$34.67	\$34.12
14kt white easy	1235	1270	\$35.72	\$35.25	\$34.87	\$34.32
14kt white hard	1330	1380	\$35.72	\$35.25	\$34.87	\$34.32
14kt red weld	1600	1690	\$35.72	\$35.25	\$34.87	\$34.32
18kt yellow easy	1095	1255	\$44.69	\$44.16	\$43.74	\$43.17

### SOLDERING Tech Tip

When soldering, wear protective goggles with a shade number of at least 4 to protect against infrared radiation. They should be approved by the American National Standards Institute (ANSI). Full-faced shields are also available to protect the face. Use leather protective gloves to handle hot metals.

## REPAIR SOLDER-SHEET CADMIUM BEARING

Gold repair solders are lower in karat than the work for which they are recommended. Repair solders are easier flowing than our plumb solders and are an economical way to perform various solder tasks.

- Sold in 1 dwt sheets.



refined Karats

### SOLDER-SHEET karat gold

solder quality (repair)	gold content	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
14 yellow easy	10kt	1170	1240	\$25.21	\$24.79	\$24.44	23.91
14 yellow hard	10kt	1310	1360	\$25.21	\$24.79	\$24.44	\$23.91
18 white easy	14kt	1235	1275	\$34.47	\$34.00	\$33.62	\$33.07

## PLUMB SOLDER-SHEET CADMIUM FREE

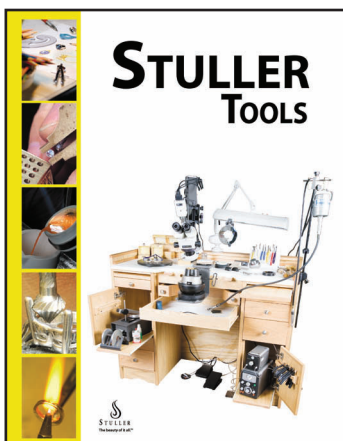
These solders are cadmium free and are offered in 1 dwt sheets. They are offered in standard karat golds and palladium.



refined Karats

### PLUMB SOLDER-SHEET karat gold, platinum, and palladium

solder quality (cadmium-free)	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
6kt yellow easy	1245	1300	\$16.99	\$16.57	\$16.22	\$15.69
8kt yellow easy	1210	1295	\$21.15	\$20.73	\$20.38	\$19.85
8kt white easy	1345	1370	\$21.35	\$20.93	\$20.58	\$20.05
10kt yellow easy	1200	1345	\$25.21	\$24.79	\$24.44	\$23.91
10kt yellow medium	1260	1375	\$25.21	\$24.79	\$24.44	\$23.91
10kt yellow hard	1395	1430	\$25.21	\$24.79	\$24.44	\$23.91
10kt white easy	1240	1290	\$25.41	\$24.99	\$24.64	\$24.11
10kt white hard	1305	1350	\$25.41	\$24.99	\$24.64	\$24.11
12kt yellow easy	1210	1365	\$29.71	\$29.29	\$28.94	\$28.41
12kt white easy	1270	1305	\$29.91	\$29.49	\$29.14	\$28.61
14kt yellow easy	1225	1335	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow medium	1300	1420	\$34.27	\$33.80	\$33.42	\$32.87
14kt yellow hard	1475	1500	\$34.27	\$33.80	\$33.42	\$32.87
14kt white easy	1235	1305	\$34.47	\$34.00	\$33.62	\$33.07
14kt white medium	1335	1365	\$34.47	\$34.00	\$33.62	\$33.07
14kt white hard	1450	1470	\$34.47	\$34.00	\$33.62	\$33.07
14kt palladium white hard	1370	1445	\$35.64	\$35.17	\$34.79	\$34.24
18kt yellow easy	1300	1360	\$43.44	\$42.91	\$42.49	\$41.92
18kt yellow medium	1365	1405	\$43.44	\$42.91	\$42.49	\$41.92
18kt yellow hard	1440	1475	\$43.44	\$42.91	\$42.49	\$41.92
18kt white easy	1330	1365	\$43.64	\$43.11	\$42.69	\$42.12
18kt white hard	1490	1525	\$43.64	\$43.11	\$42.69	\$42.12
18kt palladium white hard	1750	1775	\$45.33	\$44.80	\$44.38	\$43.81
19kt white weld	1635	1670	\$45.90	\$45.37	\$44.95	\$44.38



For all your  
soldering tools refer  
to the new *Tools  
Catalog Vol. 73.*

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.



## PLUMB SOLDER-CHIPPED CADMIUM FREE

These karat gold chipped solders are cadmium free and are pre-cut to .045" x .045".

• Minimum order is 1 dwt per solder quality.



Join  
the Club  
For the best pricing

SOLDER-CHIPPED karat gold, platinum, and palladium

solder quality (cad-free chipped)	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
10K Yellow Easy	1200	1345	\$26.46	\$26.04	\$25.69	\$25.16
10K White Hard	1395	1430	\$26.46	\$26.04	\$25.69	\$25.16
14K Yellow Easy	1225	1335	\$35.52	\$35.05	\$34.67	\$34.12
14K Yellow Medium	1300	1420	\$35.52	\$35.05	\$34.67	\$34.12
14K Yellow Hard	1475	1500	\$35.52	\$35.05	\$34.67	\$34.12
14K White Easy	1235	1305	\$35.72	\$35.25	\$34.87	\$34.32
14K White Medium	1335	1365	\$35.72	\$35.25	\$34.87	\$34.32
14K White Hard	1450	1470	\$35.72	\$35.25	\$34.87	\$34.32
18K Yellow Easy	1300	1370	\$44.69	\$44.16	\$43.74	\$43.17
18K White Easy	1330	1365	\$44.89	\$44.36	\$43.94	\$43.37
18K White Hard	1490	1525	\$43.64	\$43.11	\$42.69	\$42.12
19K White Weld	1635	1670	47.15	\$46.62	\$46.20	\$45.63

## REPAIR SOLDER-SHEET CADMIUM FREE

Gold repair solders flow easier than our plumb solders and are an economical way to perform various soldering tasks. These solders are lower in karat than the work for which they are recommended.

• Sold in 1 dwt sheets



Join  
the Club  
For the best pricing

SOLDER-SHEET karat gold, platinum, and palladium

solder quality (repair)	gold content	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
14 yellow easy	10kt	1200	1345	\$25.21	\$24.79	\$24.44	\$23.91
14 yellow hard	10kt	1395	1430	\$25.21	\$24.79	\$24.44	\$23.91
14 white easy	10kt	1240	1290	\$25.41	\$24.99	\$24.64	\$24.11
14 white hard	10kt	1305	1350	\$25.41	\$24.99	\$24.64	\$24.11

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



## SOLDER-PASTE

Our paste solder is packaged in a syringe that contains one pennyweight of gold solder and flux. This paste is excellent for chain repair and fine detail work due to the special formula that leaves little or no carbon residue providing clean, bright assemblies. It is compatible with our paste solder hand applicator. (see below)

### SOLDER-PASTE karat gold, platinum, and palladium

solder quality (paste)	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
1kt yellow gold filled	1135	1170	\$4.95	\$4.70	\$4.54	\$4.46
6kt yellow repair	1110	1295	\$16.99	\$16.57	\$16.22	\$15.69
6kt white repair	1120	1315	\$16.99	\$16.57	\$16.22	\$15.69
10kt yellow easy	1195	1290	\$25.21	\$24.79	\$24.44	\$23.91
10kt white easy	1130	1260	\$25.21	\$24.79	\$24.44	\$23.91
14kt yellow easy	1185	1330	\$34.27	\$33.80	\$33.42	\$32.87
14kt white easy	1160	1280	\$34.27	\$33.80	\$33.42	\$32.87
18kt yellow easy	1270	1320	\$43.44	\$42.91	\$42.49	\$41.92

## PASTE SOLDER HAND APPLICATOR

Sturdy plastic hand applicator designed to work with Stuller karat gold and silver paste solders. It was designed to deposit paste solder with pinpoint accuracy. Includes a special, reusable plunger that is interchangeable with all Stuller paste solders.



Paste sold separately

### MK3 Paste Solder Dispenser

Manual solder dispenser designed to deposit paste solders with pinpoint accuracy. Use with Stuller paste solders syringes.

description	order no.	6+	3+	1+
MK3 Solder Dispenser	54-4010	\$22.37	\$23.87	\$24.86

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

## SOLDER-PLATINUM REPAIR CADMIUM FREE

Solders for platinum are supplied in one pennyweight sheets. Prices are approximate and will fluctuate with platinum, palladium, gold, and silver market prices.

- Minimum order is one pennyweight per quality.



For the best pricing

### SOLDER-SHEET platinum

solders for platinum	pt %	melting point (°F)	flow point (°F)	1 dwt	10 dwt	20 dwt	50 dwt
1000°C Extra Easy	5%	1832	1932	\$30.90	\$30.35	\$29.80	\$29.27
1100°C Easy	0%	2012	2112	\$34.19	\$33.64	\$33.09	\$32.56
1200°C Medium	3%	2192	2292	\$43.44	\$42.89	\$42.34	\$41.81
1300°C Hard	0%	2372	2472	\$52.54	\$51.99	\$51.44	\$50.91
1400°C Extra Hard	5%	2552	2652	\$48.92	\$48.37	\$47.82	\$47.29
1500°C Welding	0%	2732	2832	\$48.67	\$48.12	\$47.57	\$47.04
1600°C Special Weld	75%	2912	3012	\$27.27	\$26.71	\$26.15	\$25.62
1700°C Seamless	75%	3092	3192	\$55.91	\$55.35	\$54.79	\$54.24
1773°C Platinum Weld	100%	3224	3324	\$65.29	\$64.74	\$64.19	\$63.66

## SOLDER-PLUMB PLATINUM CADMIUM FREE

Plumb platinum solders provide a superior white color as compared to traditional solders for platinum work. Because of the higher platinum content (90 to 95%), the color is nearly a perfect match with most platinum alloys. Polishing problems are also reduced as the hardness of these solders closely matches the surrounding platinum alloy.

- Minimum order is only 1/2 dwt per quality.



### SOLDER-SHEET platinum

plumb platinum solder	platinum content	melt point (°F)	flow point (°F)	1/2 dwt	1 dwt	10 dwt	20 dwt	50 dwt
Easy Plumb	90.00%	1300	2372	\$43.83	\$87.66	\$87.02	\$86.37	\$85.80
Medium Plumb	92.50%	1400	2552	\$43.83	\$87.66	\$87.02	\$86.37	\$85.80
Hard Plumb	95.00%	1500	2732	\$43.83	\$87.66	\$87.02	\$86.37	\$85.80

# STULLER SOLDER/KARAT GOLD COMPATIBILITY TABLE

Solder			Karat Gold Alloy											
Gold Solder (cadmium bearing)			standard yellow		bright yellow		rich yellow			lemon yellow	royal yellow	yellow for rolling		
(contains cadmium)	temp F		10kt	14kt	10kt	14kt	10kt	14kt	18kt	14kt	18kt	10kt	14kt	18kt
solder quality	melt °F/flow°F		1525 1645	1520 1615	1480 1610	1510 1590	1525 1645	1480 1580	1585 1630	1450 1535	1615 1655	1505 1605	1545 1600	1625 1665
6kt yellow easy	1165	1220												
6kt white easy	1220	1230												
8kt yellow easy	1150	1230												
10kt yellow easy	1170	1240												
10kt yellow medium	1230	1285												
10kt yellow hard	1310	1360												
10kt white easy	1250	1290												
12kt yellow easy	1070	1165												
14kt yellow ultra-easy	1070	1165												
14kt yellow easy	1080	1320												
14kt yellow medium	1230	1360												
14kt yellow hard	1410	1460												
14kt white easy	1235	1275												
14kt white hard	1330	1380												
14kt red weld	1600	1690												
14kt green medium	1390	1425												
18kt yellow easy	1095	1255												
18kt yellow medium	1315	1490												
18kt yellow hard	1480	1550												
18kt royal yellow hard	1430	1505												
18kt red medium	1395	1505												
18kt green medium	1510	1545												
21kt yellow hard	1545	1625												

Solder			Karat Gold Alloy											
Gold Solder (cadmium-free)			standard yellow		bright yellow		rich yellow			lemon yellow	royal yellow	yellow for rolling		
(contains cadmium)	temp F		10kt	14kt	10kt	14kt	10kt	14kt	18kt	14kt	18kt	10kt	14kt	18kt
solder quality	melt °F/flow°F		1525 1645	1520 1615	1480 1610	1510 1590	1525 1645	1480 1580	1585 1630	1450 1535	1615 1655	1505 1605	1545 1600	1625 1665
6K Yellow Easy	1245	1300												
8K Yellow Easy	1210	1295												
8K White Easy	1345	1370												
10K Yellow Easy	1200	1345												
10K Yellow Medium	1260	1375												
10K Yellow Hard	1395	1430												
10K White Easy	1240	1290												
10K White Hard	1305	1350												
12K Yellow Easy	1210	1365												
12K White Easy	1270	1305												
14K Yellow Easy	1225	1335												
14K Yellow Medium	1300	1420												
14K Yellow Hard	1475	1500												
14K White Easy	1235	1305												
14K White Medium	1335	1365												
14K White Hard	1450	1470												
14K Palladium White Hard	1370	1445												
18K Yellow Easy	1300	1360												
18K Yellow Medium	1361	1405												
18K Yellow Hard	1440	1475												
18K White Easy	1330	1365												
18K White Hard	1490	1525												
18K Palladium White Hard	1750	1775												
19K White Weld	1545	1625												



# STULLER BENCH

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The Stuller Solder-Karat Gold Compatibility Table is intended to provide a quick comparative reference between the flow points of a given solder with various karat gold alloys. The purple boxes denote that the flow point of the solder overlaps the melting point of the karat gold alloys, and special care must be exercised. This table applies to Stuller products only.

Karat Gold Alloy															Solder		
white			white for rolling		bright white		super palladium white	palladium white			red			green			Gold Solder (Cadmium bearing)
10kt	14kt	18kt	10kt	14kt	14kt	18kt	14kt	14kt	18kt	10kt	14kt	18kt	10kt	14kt	18kt		
1717	1655	1645	1780	1710	1715	1620	2030	1865	1895	1740	1675	1670	1455	1710	1800	Solder Quality	
1750	1750	1685	1850	1760	1740	1665	2165	1920	2040	1780	1720	1685	1480	1800	1860		
																6kt yellow easy	
																6kt white easy	
																8kt yellow easy	
																8kt white easy	
																10kt yellow easy	
																10kt yellow medium	
																10kt yellow hard	
																10kt white easy	
																12kt yellow easy	
																14kt yellow ultra-easy	
																14kt yellow easy	
																14kt yellow medium	
																14kt yellow hard	
																14kt white easy	
																14kt white hard	
																14kt red weld	
																14kt green medium	
																18kt yellow easy	
																18kt yellow medium	
																18kt yellow hard	
																18kt royal yellow hard	
																18kt red medium	
																18kt green medium	
																21kt yellow hard	

Karat Gold Alloy															Solder		
white			white for rolling		bright white		super palladium white	palladium white			red			green			Gold Solder (Cadmium-free)
10kt	14kt	18kt	10kt	14kt	14kt	18kt	14kt	14kt	18kt	10kt	14kt	18kt	10kt	14kt	18kt		
1717	1655	1645	1780	1710	1715	1620	2030	1865	1895	1740	1675	1670	1455	1710	1800	Solder Quality	
1750	1750	1685	1850	1760	1740	1665	2165	1920	2040	1780	1720	1685	1480	1800	1860		
																6kt yellow easy	
																8kt yellow easy	
																8kt white easy	
																10kt yellow easy	
																10kt yellow medium	
																10kt yellow hard	
																10kt white easy	
																10kt white hard	
																12kt yellow easy	
																12kt white easy	
																14kt yellow easy	
																14kt yellow medium	
																14kt yellow hard	
																14kt white easy	
																14kt white medium	
																14kt white hard	
																14kt palladium white hard	
																18kt yellow easy	
																18kt yellow medium	
																18kt yellow hard	
																18kt white easy	
																18kt white hard	
																18kt palladium white hard	
																19kt white weld	

**Purple** Solder and Karat Gold Alloy temperatures overlap. Use special care when using these combinations.

Get the best price possible on your Metals Purchases!





## THE WATCH STRAP COLLECTION



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# SILVER



## Bezel

Fine Silver Bezel Wire .....	81
Stepped Bezel Stock .....	76

## Grain

Casting .....	62
---------------	----

## Sheet

6" Wide .....	64
12" Wide .....	64
Argentium™ .....	65
Fine Silver .....	80

## Sizing Stock

Flat .....	66
Half Round .....	67
Slit Coil .....	72

## Solder

Chip .....	82
Paste .....	83
Sheet .....	82
Strip .....	82
Wire .....	83

## Tubing .....

## Wire

Bead .....	77
Coiled Double Half-Round .....	70
Coiled Flat .....	72
Coiled Half-Round .....	70
Coiled Low Dome .....	71
Coiled Pattern .....	74
Coiled Square .....	73
Diamond Cut .....	78
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Round Argentium™ .....	69
Round Fine Silver .....	80
Small Diameter .....	68
Small Diameter Fine Silver .....	80
Triangle .....	76
Twist .....	78

# CASTING GRAIN

We now offer a great selection of enhanced performance sterling silver grains. Sold by the pennyweight (dwt).

- Minimum order is 10 pennyweights per quality.

## Sterling Silver

melting point: 1640°F flow point: 1750°F



Our original standard sterling silver casting grain. Contains 92.5% silver and 7.5% copper.

## ARGENTIUM™ Sterling

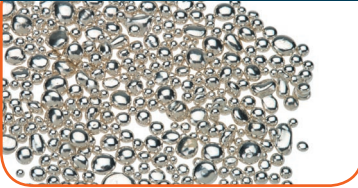
melting point: 1410°F flow point: 1610°F



Anti-oxidizing, anti-fire scale sterling alloy that is extremely tarnish resistant. It can be heat treated to achieve hardness approximately twice as strong as standard sterling silver (120 HV). Unlike traditional sterling silver, ARGENTIUM™ Sterling is laser weldable, and solders and casts without fire scale. The magic ingredient is germanium. Available in casting grain, sheet, and wire products. See ARGENTIUM™ Sterling tips on the following page.

## Sterling 935

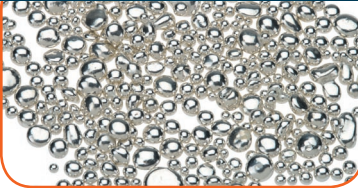
melting point: 1650°F flow point: 1750°F



Contains 93.5% silver instead of the traditional 92.5% in most other sterling silver casting grains. The additional silver content provides a white luster similar to pure silver, while maintaining the hardness and durability of standard sterling silver. Used by major manufacturers to enhance their silver product lines..

## Sterling 935 Deox

melting point: 1435°F flow point: 1610°F



Formulated to eliminate fire-scale and reduce porosity, while maintaining the hardness and durability of standard sterling silver. 93.5% silver content provides a richer silver luster as compared with standard sterling. Several times more tarnish resistant than standard sterling. May be reused with 50% fresh mix. Recommended casting temperature: 1800-1825°F

## Fine Silver

melting point: 1761°F flow point: 1860°F



.9995 + pure silver.

## Ultra Sterling

melting point: 1585°F flow point: 1655 °F



Deoxidized sterling silver designed to achieve maximum hardness and eliminate fire scale and porosity. Developed to have a hardness approximately equal to standard sterling silver.

## Super Sterling

melting point: 1555°F flow point: 1645 °F



Deoxidized sterling silver that is rather resistant to tarnishing. This alloy is softer than standard sterling silver and casts very well. Designed to reduce fire scale and porosity.



APPROX PRICING PER PENNYWEIGHT for casting grain

quality	unit	10 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	5000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	200 oz
Sterling Silver	dwt	\$0.78	\$0.75	\$0.73	\$0.69	\$0.67	\$0.65
	oz	\$15.60	\$15.00	\$14.60	\$13.80	\$13.40	\$13.00
ARGENTIUM™ Silver	dwt	\$0.83	\$0.80	\$0.75	\$0.74	\$0.72	\$0.70
	oz	\$16.60	\$16.00	\$15.00	\$14.80	\$14.40	\$14.00
Sterling 935 Deox	dwt	\$0.78	\$0.75	\$0.73	\$0.69	\$0.67	\$0.66
	oz	\$15.60	\$15.00	\$14.60	\$13.80	\$13.40	\$13.20
Sterling 935	dwt	\$0.78	\$0.75	\$0.73	\$0.69	\$0.67	\$0.65
	oz	\$15.60	\$15.00	\$14.60	\$13.80	\$13.40	\$13.00
Fine Silver	dwt	\$0.86	\$0.82	\$0.79	\$0.74	\$0.72	\$0.69
	oz	\$17.20	\$16.40	\$15.80	\$14.80	\$14.40	\$13.80
Ultra Sterling	dwt	\$0.83	\$0.80	\$0.78	\$0.74	\$0.72	\$0.70
	oz	\$16.60	\$16.00	\$15.60	\$14.80	\$14.40	\$14.00
Super Sterling	dwt	\$0.83	\$0.80	\$0.78	\$0.74	\$0.72	\$0.70
	oz	\$16.60	\$16.00	\$15.60	\$14.80	\$14.40	\$14.00

TIPS FOR USING ARGENTIUM™ STERLING SILVER (US PATENT NO. 6,168,071)

ARGENTIUM™ sterling silver is a patented, sterling formula that is extremely resistant to tarnish and fire scale. Fabrication and workability characteristics are much better than standard sterling silver, and it can be heat treated to achieve a hardness approximately twice as strong as standard sterling silver. Unlike traditional sterling silver, ARGENTIUM™ sterling cast and solders with little or no fire scale, and is laser and resistance weldable. Excellent for making durable, tarnish resistant silver jewelry. ARGENTIUM™ sterling silver is available in casting grain, sheet, round wire, and solders.

**Melting:** Traditional methods of melting regular sterling silver i.e. (as cool as possible) will work well. Solidus: 1410° F, Liquidus: 1610° F

**Casting Temperature:** 950-980° C / 1740-1780° F. It may take a few attempts to become familiar with these lower temperatures. If the metal looks yellow or light orange, it is too hot.

**Flask Temperature:** In most cases, use your normal flask temperature. Do not exceed 1250°F

**Fluxing:** Use of a protective atmosphere to protect the molten metal is recommended. Flux can be used if a protective atmosphere is not available. Boric acid is recommended. Skim any surface oxides off of the surface before stirring.

**Quenching:** Air cool for 15 minutes minimum before quenching (the minimum necessary to avoid cracking).

**Increasing the Hardness of Castings:** Flasks quenched after 15 minutes will be approximately the same hardness as regular sterling (70dph). Flasks cooled to room temperature will have a hardness of approximately 90dph. To achieve maximum hardness, a two-step process is used:

1. Anneal castings at 1050-1150° F for one hour followed by a rapid water quench.
2. Place castings in an oven set to 580°F for 45-60 minutes. At this point, a water quench is not necessary. Resulting hardness will be 110-125dph.

**Investment Removal:** Most standard investment removers will work well. The use of concentrated acids is NOT recommended.

**Tumble Finishing:** Successful tumble finishing has been carried out using rough cut with epoxy cones and triangles in a vibratory tumbler, and also by using a steel shot mixture in a rotary tumbler. It is very important to maintain clean shot and solution.

**Polishing:** To avoid contamination from other alloys, it is ideal to have separate polishing wheels for use on ARGENTIUM™ sterling. If this is not possible, thoroughly rake wheels before use.

**Remelting:** Stuller recommends using at least a 75% fresh/25% scrap mix. Using more fresh metal will improve the ductility of the castings. It is important that used trees and buttons are free of investment powder residue to avoid sulfate contamination. When trees become excessively dark, or any inclusions are present, the silver should be considered scrap. It has most likely been depleted or contaminated.

**Soldering:** Tarnish resistant ARGENTIUM™ solders are now available and are recommended for use with ARGENTIUM™ sterling silver. Standard low-temperature silver solders such as extra-easy, easy, and medium may also be used. ARGENTIUM™ sterling displays a lighter color when heated. If the metal looks yellow or light orange, it is too hot. Use standard soldering fluxes.

## SHEET

Sterling silver 6" wide sheet is available in dead soft/brushed finish as well as our original standard temper (medium-hard)/mill finish. One dimension must be 6 inches when ordering sterling silver sheet. Sterling silver sheet is available in even gauges only.

- Maximum length is 6" x 36".
- Minimum order is 6" x 1".

### SHEET 6" WIDE-sterling silver

thickness	gauge	mm	inch	Approximate pennyweights per size			
				6" x 1"	6" x 3"	6" x 6"	6" x 12"
—	30	0.25	0.010	6.6	19.9	39.9	79.7
—	28	0.32	0.013	7.7	23.2	46.4	92.8
—	26	0.41	0.016	10.6	31.9	63.8	126.0
—	24	0.51	0.020	13.3	39.9	65.0	159.5
—	22	0.64	0.025	16.6	50.0	100.0	200.1
—	20	0.81	0.032	21.3	63.0	126.0	252.0
—	18	1.02	0.040	26.6	79.7	159.5	318.9
—	16	1.29	0.051	36.7	110.3	220.6	441.3
—	14	1.63	0.064	42.3	126.5	253.0	506.1
—	12	2.05	0.081	53.8	159.1	318.2	636.4
—	10	2.59	0.102	66.9	200.7	401.4	802.8
—	8	3.25	0.128	83.7	251.1	502.2	1004.4

## SHEET

Sterling silver 12" wide sheet is supplied dead soft with a brushed finish in 16, 18, 20, 22, 24, and 26 gauge. One dimension must be 12 inches when ordering 12" wide sterling silver sheet.

- Maximum size sheet is 12" x 36."
- Minimum order is 12" x 1

### SHEET 12" WIDE-sterling silver

thickness	gauge	mm	inch	dwt/in	Approximate pennyweights per size		
					12" x 7"	12" x 12"	12" x 18"
—	26	0.41	0.016	1.77	147.0	252.0	378.0
—	24	0.51	0.020	2.22	185.6	318.2	477.3
—	22	0.64	0.025	2.77	233.5	400.3	600.4
—	20	0.81	0.032	3.54	294.0	504.0	756.0
—	18	1.02	0.040	4.43	372.1	637.9	956.9
—	16	1.29	0.051	5.65	514.9	882.7	1324.0

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## ARGENTIUM-SHEET

ARGENTIUM™ Sterling Silver is an anti-oxidizing, anti-fire scale sterling alloy that is extremely tarnish resistant. Fabrication and workability characteristics are much better than sterling silver, and it can be heat treated to achieve hardness approximately twice as strong as standard sterling silver. Unlike traditional sterling silver, ARGENTIUM™ Sterling is laser weldable, and solders without fire scale. Excellent for making durable, tarnish resistant silver jewelry. One dimension must be 6".



SHEET 6" WIDE- ARGENTIUM sterling silver

For the best pricing

Thickness	Gauge	mm	inch	Approximate pennyweights per size			
				6" x 1"	6" x 3"	6" x 6"	6" x 12"
—	30	0.26	0.010	6.66	19.98	39.96	79.9220
—	28	0.32	0.013	7.74	23.22	46.44	92.88
—	26	0.41	0.016	10.50	31.50	63.00	126.00
—	24	0.51	0.020	13.26	39.78	79.56	159.12
—	22	0.64	0.025	16.68	50.04	100.08	200.60
—	20	0.81	0.032	21.00	63.00	126.00	252.00
—	18	1.02	0.040	26.58	79.74	159.48	318.96
—	16	1.29	0.051	36.78	110.34	220.68	441.36
—	14	1.63	0.064	42.18	126.54	253.08	506.16

### STERLING Tech Tip

A hardness approximately twice as strong as standard sterling silver can be achieved by placing the silver pieces in an oven set to 580°F for 45 minutes.

## STERLING SILVER SHEET PRICES

PRICES PER PENNYWEIGHT (DWT)

Quality	Unit	20 dwt	100 dwt	200 dwt	400 dwt	1000 dwt
		00.05 oz	5 oz	10 oz	20 oz	50 oz
Sterling Silver 6"	dwt	\$0.735	\$0.695	\$0.663	\$0.613	\$0.588
	oz	<b>\$14.70</b>	<b>\$13.90</b>	<b>\$13.25</b>	<b>\$12.25</b>	<b>\$11.75</b>
Sterling Silver 12"	dwt	\$0.833	\$0.793	\$0.7601	\$0.7101	\$0.686
	oz	<b>\$16.60</b>	<b>\$15.86</b>	<b>\$15.21</b>	<b>\$14.21</b>	<b>\$13.71</b>
ARGENTIUM™ Sterling	dwt	\$0.798	\$0.757	\$0.725	\$0.675	\$0.650
	oz	<b>\$15.95</b>	<b>\$15.15</b>	<b>\$14.50</b>	<b>\$13.50</b>	<b>\$13.00</b>

*Start Saving TODAY!*





## SIZING STOCK - FLAT

Flat sizing stock is supplied in straight lengths with a medium hard temper, unless otherwise requested.

**Minimum order is 12" per size.**  
**Maximum straight length is 36 inches.**  
**Annealing is available upon request.**



### STERLING SILVER FLAT SIZING STOCK

profile	mm	dwt/ft	profile		
	10 x 1.5	30.58		4 x 1.5	12.09
	10 x 1	21.30		4 x 1.25	10.40
	8 x 2.5	39.50		4 x 1	8.18
	8 x 2	33.70		4 x .75	6.80
	8 x 1.5	24.90		3.5 x 2.5	17.90
	8 x 1	16.84		3.5 x 2	15.00
	7 x 2.5	37.10		3.5 x 1.5	11.00
	7 x 2	29.90		3.5 x 1	7.40
	7 x 1.5	21.90		3 x 2.5	14.90
	7 x 1	14.70		3 x 2	12.50
	6 x 2.5	31.40		3 x 1.5	8.96
	6 x 2	23.71		3 x 1.25	8.00
	6 x 1.5	17.88		3 x 1	6.03
	6 x 1	12.50		3 x .75	4.50
	5 x 2.5	26.60		2.5 x 2	10.40
	5 x 2	19.68		2.5 x 1.5	7.43
	5 x 1.5	15.16		2.5 x 1.25	6.50
	5 x 1.25	12.90		2.5 x 1	5.20
	5 x 1	10.12		2.5 x .75	3.80
	5 x .75	8.20		2 x 1.5	5.92
	4.5 x 2	18.90		2 x 1.25	5.00
	4.5 x 1.5	13.90		2 x 1	3.99
	4.5 x 1	10.90		2 x .75	3.00
	4 x 3	25.20		1.5 x 1	2.99
	4 x 2.25	20.20		1.5 x .75	2.24
	4 x 2	15.84			

## STERLING SILVER FLAT SIZING STOCK PRICES

### PRICES PER PENNYWEIGHT (DWT)

For the best pricing



Quality	Unit	20 dwt	100 dwt	200 dwt	400 dwt	1000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz
Sterling Silver	dwt	\$0.80	\$0.76	\$0.73	\$0.69	\$0.66
	oz	<b>\$16.00</b>	<b>\$15.20</b>	<b>\$14.55</b>	<b>\$13.70</b>	<b>\$13.20</b>



Need Help? Call the  
 Stuller Bench at 1-800-877-7777 ext.4300

## SIZING STOCK - HALF ROUND

Half round sizing stock is supplied in straight lengths with a medium-hard temper, unless otherwise requested.

- Maximum straight length is 36 inches.
- Annealing available upon request.



refined Karats

### STERLING SILVER FLAT SIZING STOCK

profile	mm	dwts/ft	profile		
	18 x 1.7	51.20		5 x 1.5	13.44
	15 x 1.7	43.00		5 x 1	7.48
	12 x 1.7	33.60		4.5 x 2	15.15
	12 x 1.5	29.00		4.5 x 1.5	11.20
	10 x 1.25	21.60		4 x 2	14.16
	8 x 2	24.35		4 x 1.5	10.32
	8 x 1.7	22.60		4 x 1	5.86
	8 x 1.5	18.00		3.5 x 2	12.20
	8 x 1.25	16.80		3.5 x 1.5	9.20
	7 x 2.5	28.20		3 x 2	10.10
	7 x 2	22.00		3 x 1.5	8.04
	7 x 1.5	14.40		3 x 1	4.40
	7 x 1	12.50		2.5 x 2	8.40
	6 x 3	30.20		2.5 x 1.5	6.50
	6 x 2.5	25.00		2.5 x 1.25	5.00
	6 x 2	19.20		2.25 x 1.5	5.60
	6 x 1.5	13.56		2 x 1.5	6.00
	6 x 1.25	13.00		2 x 1	3.20
	6 x 1	10.70		1.75 x 1	2.50
	5 x 3	25.40		1.5 x 1	3.36
	5 x 2.5	21.10		1.5 x .75	2.15
	5 x 2	16.44		1 x .5	1.10

## STERLING SILVER HALF-ROUND SIZING STOCK



### PRICES PER PENNYWEIGHT (DWT)

For the best pricing

Quality	Unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz
Sterling Silver	dwt	\$0.97	\$0.92	\$0.89	\$0.85	\$0.83
	oz	<b>\$19.40</b>	<b>\$18.40</b>	<b>\$17.80</b>	<b>\$17.00</b>	<b>\$16.60</b>

*Turn your clean scrap  
into New Product  
for more details see pages 4 and 5*



Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



## WIRE - ROUND

Coiled sterling silver round wire is available in Soft or Standard Temper (½ hard).

Small diameter sterling silver wire is sold in 100 pennyweight increments only. Supplied ½ hard in plastic spools. Available 26, 28 and 30 gauges.

• **Minimum order quantities are listed in the table below.**

### STERLING SILVER ROUND WIRE

profile	Diameter		min. order	approx. dwts/ft	20 dwt length(in)	100 wt length (ft)
	gauge	mm / inch				
●	4	5.18 / 0.204	12"	3.50	5.5	2.3
●	6	4.11 / 0.162	12"	28.32	8.5	3.5
●	8	3.25 / 0.128	12"	16.80	14.3	6.0
●	9	2.90 / 0.114	12"	13.44	17.9	7.4
●	10	2.59 / 0.102	12"	11.16	21.5	9.0
●	12	2.03 / 0.080	12"	6.72	35.7	14.9
●	14*	1.63 / 0.064	12"	4.08	58.8	24.5
●	16*	1.29 / 0.051	24"	2.71	88.6	36.9
●	18*	1.02 / 0.040	24"	1.74	137.9	57.5
●	20*	0.81 / 0.032	24"	1.00	240.0	100.0
●	21*	0.71 / 0.028	24"	0.80	300.0	125.0
●	22*	0.64 / 0.025	36"	0.65	369.2	153.8
●	24	0.51 / 0.020	36"	0.40	600.0	250.0

\* Straight Wire is available in all gauges 1/2 hard 12" lengths.

### STERLING SILVER SMALL DIAMETER ROUND WIRE

profile	gauge	Diameter		min. order (dwt)	approx. dwts/ft	100 dwt (5oz) length (ft)
		mm	inch			
*	26	.41	0.016	100	0.23	434.8
	28	0.33	0.013	100	0.15	666.7
	30	0.25	0.010	100	0.10	1000.0

## STERLING SILVER ROUND WIRE PRICES

### PRICES PER PENNYWEIGHT (DWT)

Quality	Unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz
Sterling Round Wire	dwt	\$0.91	\$0.86	\$0.83	\$0.78	\$0.76
(4 to 21 gauge, coiled)	oz	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.60</b>	<b>\$15.60</b>	<b>\$15.20</b>
Sterling Round Wire	dwt	\$0.93	\$0.88	\$0.85	\$0.80	\$0.77
(22 to 24 gauge, coiled)	oz	<b>\$18.60</b>	<b>\$17.60</b>	<b>\$17.00</b>	<b>\$16.00</b>	<b>\$15.40</b>
Sterling Small Dia Wire	dwt	N/A	\$0.89	\$0.85	\$0.80	\$0.78
(26 to 30 gauge, spooled )	oz	<b>N/A</b>	<b>\$17.80</b>	<b>\$17.00</b>	<b>\$16.00</b>	<b>\$15.60</b>
Sterling Straight Wire	dwt	\$0.91	\$0.86	\$0.83	\$0.78	\$0.76
(14 to 22 gauge, 12" lengths)	oz	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.60</b>	<b>\$15.60</b>	<b>\$15.20</b>

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## ARGENTIUM WIRE - ROUND

ARGENTIUM™ Sterling is an anti-oxidizing, anti-fire scale sterling alloy that is extremely tarnish resistant. It can be heat treated to achieve hardness approximately twice as strong as standard sterling silver (120 HV). Unlike traditional sterling silver, ARGENTIUM™ Sterling is laser weldable, and solders without fire scale. The magic ingredient is germanium. Excellent for making durable silver jewelry. ARGENTIUM™ Sterling is stocked soft and coiled in the sizes listed below.



### APPROX PRICING PER PENNYWEIGHT for ARGENTIUM™ sterling silver round wire

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt	4000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	100 oz	200 oz
<b>Argentium round wire</b>	dwt	\$0.92	\$0.88	\$0.84	\$0.79	\$0.77	\$0.74	\$0.73
	oz	<b>\$18.40</b>	<b>\$17.60</b>	<b>\$16.80</b>	<b>\$15.80</b>	<b>\$15.40</b>	<b>\$14.80</b>	<b>\$14.60</b>

All silver products are sold by pennyweight. Prices per troy ounce are provided in bold.

### ROUND WIRE ARGENTIUM™ STERLING SILVER

profile	gauge	diameter		min order	approx dwts/in	20 dwt (1 oz)	100 dwt (5 oz)
		mm	inch			length (in)	length (ft)
•	24	0.51	0.020	36"	.0349	.0581	242.0
•	22	0.64	0.025	36"	.0546	366.3	152.6
•	21	0.71	0.028	24"	.0692	289.0	120.4
•	20	0.81	0.032	24"	.0873	229.0	95.5
•	18	1.02	0.040	24"	.1385	144.4	60.2
•	16	1.29	0.051	24"	.2202	90.8	37.8
•	14	1.63	0.064	12"	.3502	57.1	23.8
•	12	2.03	0.080	12"	.5563	36.0	15.0
•	10	2.59	0.102	12"	.8849	22.6	9.4
•	9	2.90	0.114	12"	1.1157	17.9	7.5
•	8	3.25	0.128	12"	1.4076	14.2	5.9



## STULLER BENCH

Have you joined  
stullerbench.com?

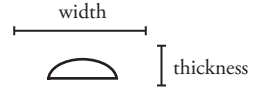
For more information see page 2.



## WIRE-HALF ROUND

Sterling Silver Half-Round Wire is supplied soft and coiled in 2 gauge through 16 gauge and 1/2 hard and coiled in 18 gauge through 22 gauge.

- **Minimum order quantities are listed below.**



In order to determine what size best fits your needs, you must first measure the width, then the thickness.



refined Karats

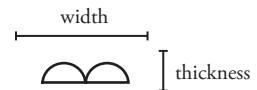
### HALF-ROUND WIRE STERLING SILVER

profile	gauge	width x thickness		min order	approx dwts/in	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (ft)	temper
		mm	inch					
	22	.64 x .32	.025 x .013	144"	.021	961.5	400.6	1/2 Hard
	21	.71 x .35	.028 x .014	144"	.033	600.6	250.3	1/2 Hard
	20	.80 x .40	.032 x .016	144"	.046	436.7	182.0	1/2 Hard
	18	1.02 x .51	.040 x .020	72"	.070	282.5	117.7	1/2 Hard
	16	1.30 x .64	.051 x .025	48"	.108	184.7	76.9	Soft
	14	1.63 x .81	.064 x .032	36"	.179	111.6	46.5	Soft
	12	2.03 x 1.02	.080 x .040	24"	.279	71.6	29.8	Soft
	10	2.56 x 1.27	.102 x .051	24"	.446	44.9	18.7	Soft
	8	3.25 x 1.63	.128 x .064	12"	.717	27.9	11.6	Soft
	6	4.11 x 2.05	.162 x .081	12"	1.158	17.3	7.2	Soft
	4	5.18 x 2.59	.204 x .102	12"	1.879	10.6	4.4	Soft
	2	6.53 x 3.25	.257 x .128	12"	2.929	6.8	2.8	Soft

## WIRE-DOUBLE HALF ROUND

Supplied soft and coiled in sizes listed below.

- **Minimum order quantities listed below.**



In order to determine what size best fits your needs, you must first measure the width, then the thickness.



refined Karats

### DOUBLE HALF-ROUND WIRE STERLING SILVER

profile	width x thickness		min order	approx dwts/in	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (ft)
	mm	inch				
	2.69 x .76	.106 x .030	48"	.296	67.61	28.2
	4.00 x 1.02	.157 x .040	36"	.558	35.82	14.9
	5.21 x 1.27	.205 x .050	24"	.875	22.86	9.5
	6.10 x 1.52	.240 x .060	12"	1.513	13.22	5.5

Supplied soft and coiled in the sizes listed above. Minimum order quantities are listed above.

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.



## WIRE-LOW DOME

Low dome wires are particularly designed to eliminate the sharp edges on conventional half round wires. Excellent for making bangle bracelets and rings. Supplied in soft and coiled.

• Minimum order is 6 inches per size.



In order to determine what size best fits your needs, you must first measure the width, then the thickness.



For the best pricing

### STERLING SILVER COILED LOW DOME

profile	width x thickness		min order	approx dwts/in	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (in)
	mm	inch				
	5 x 1.7	.196 x .066	6"	1.166	17.2	85.8
	5 x 2	.197 x .080	6"	1.446	13.8	69.2
	6 x 1.7	.236 x .067	6"	1.441	13.9	69.4
	6 x 2	.236 x .080	6"	1.735	11.5	57.6
	8 x 1.7	.315 x .067	6"	1.923	10.4	52.0
	8 x 2	.315 x .080	6"	2.313	8.7	43.2
	10 x 1.7	.394 x .067	6"	2.402	8.3	41.6
	10 x 2	.394 x .080	6"	2.891	6.9	34.6
	12 x 1.7	.472 x .067	6"	2.883	7.1	34.7
	12 x 2	.472 x .080	6"	3.469	5.8	28.8
	15 x 1.5	.591 x .060	6"	3.178	6.3	31.5
	15 x 1.7	.591 x .067	6"	3.603	5.6	27.8
	18 x 1.5	.708 x .060	6"	3.813	5.3	26.2
	18 x 1.7	.708 x .067	6"	4.324	4.7	23.1

### APPROX PRICING PER PENNYWEIGHT for sterling silver wire

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt	4000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	100 oz	200 oz
Sterling Half Round Wire	dwt	\$0.90	\$0.85	\$0.81	\$0.76	\$0.74	\$0.73	\$0.72
( 2 to 4 gauge )	oz	<b>\$18.00</b>	<b>\$17.00</b>	<b>\$16.20</b>	<b>\$15.20</b>	<b>\$14.80</b>	<b>\$14.60</b>	<b>\$14.40</b>
Sterling Half Round Wire	dwt	\$0.91	\$0.86	\$0.82	\$0.77	\$0.75	\$0.74	\$0.73
( 16 to 18 gauge )	oz	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.40</b>	<b>\$15.40</b>	<b>\$15.00</b>	<b>\$14.80</b>	<b>\$14.60</b>
Sterling Half Round Wire	dwt	\$0.94	\$0.89	\$0.86	\$0.81	\$0.78	\$0.77	\$0.76
( 20 to 24 gauge )	oz	<b>\$18.80</b>	<b>\$17.80</b>	<b>\$17.20</b>	<b>\$16.20</b>	<b>\$15.60</b>	<b>\$15.40</b>	<b>\$15.20</b>
Sterling Double Half Round Wire	dwt	\$0.92	\$0.88	\$0.84	\$0.88	\$0.78	\$0.75	\$0.74
	oz	<b>\$18.40</b>	<b>\$17.60</b>	<b>\$16.80</b>	<b>\$17.60</b>	<b>\$15.60</b>	<b>\$15.00</b>	<b>\$14.80</b>
Sterling Low Dome Wire	dwt	\$0.91	\$0.86	\$0.83	\$0.78	\$0.75	\$0.74	\$0.73
	oz	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.60</b>	<b>\$15.60</b>	<b>\$15.00</b>	<b>\$14.80</b>	<b>\$14.60</b>

All silver products are sold by pennyweight. Prices per troy ounce are provided in bold.



## WIRE - FLAT

Sterling Silver flat wire is supplied dead soft and coiled.

•Minimum order quantities are listed below.



### STERLING SILVER COILED FLAT WIRE

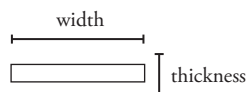
profile	width x thickness		min order	approx dwts/ft	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (ft)
	mm	inch				
—	1.63 x .25	.064 x .010	60"	.069	290.3	120.9
▬	2 x 1	.079 x .040	24"	.338	59.2	24.6
▬	3 x 1	.118 x .040	24"	.507	39.4	16.4
▬	3.25 x .4	.128 x .016	24"	.220	90.9	37.9
▬	4 x 1	.157 x .040	12"	.676	29.6	12.3
▬	5 x 1.25	.197 x .051	12"	1.057	18.9	7.9
▬	6 x 1.5	.236 x .059	12"	1.521	13.1	5.5
▬	7 x 1.5	.276 x .059	12"	1.775	11.3	4.7
▬	8 x 2	.315 x .080	12"	2.705	7.4	3.1



## SLIT COIL

Sterling silver slit coiled strip is supplied dead soft in continuous lengths. (Larger orders may receive multiple coils.) Available in six different sizes.

•Minimum order quantities are listed below.



In order to determine what size best fits your needs, you must first measure the width, then the thickness.



### STERLING SILVER SLIT COILED WIRE

profile	width x thickness		min order	approx dwts/in	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (ft)
	mm	inch				
—	1/8 x .020	3.18 x .51	36"	.274	73.0	30.4
▬	3/16 x .020	4.76 x .51	24"	.410	48.7	20.3
▬	1/4 x .020	6.35 x .51	24"	.547	36.5	15.2
▬	3/8 x .020	9.52 x .51	12"	.821	24.4	10.2
▬	1/2 x .020	12.70 x .51	12"	1.095	18.3	7.6
▬	5/8 x .020	15.88 x .51	12"	1.369	14.6	6.1

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

## WIRE - SQUARE

Sterling Silver Square Wire is now available soft and coiled in the sizes listed below. 1/2 hard coiled sterling square wire is available in 18 gauge through 22 gauge.

• Minimum order quantities are listed below.



For the best pricing

### STERLING SILVER SQUARE WIRE

profile	width x thickness		min	approx	20 dwt (1 oz)	100 dwt (5 oz)	temper	
	gauge	mm	inch	order	dwts/ft	length (in)		length (ft)
▪	24	.51	.020	60"	.0450	444.4	185.2	Soft
▪	22	.64	.025	60"	.0692	289.0	120.4	Soft or 1/2 Hard
▪	21	.71	.028	60"	.0852	234.7	97.4	1/2 Hard
▪	20	0.81	.032	36"	.1109	180.3	75.1	Soft or 1/2 Hard
▪	18	1.02	.040	24"	.1759	113.7	47.4	Soft or 1/2 Hard
▪	16	1.30	.051	24"	.2857	70.0	29.2	Soft
■	14	1.63	.064	12'	.4491	44.5	18.6	Soft
■	12	2.03	.080	12"	.6966	28.7	12.0	Soft
■	10	2.59	.102	6"	1.1339	17.6	7.3	Soft
■	8	3.25	.128	6"	1.7855	11.2	4.7	Soft
■	6	4.11	.162	6"	2.8554	7.0	2.9	Soft
■	4	5.18	.204	6"	4.5337	4.4	1.8	Soft







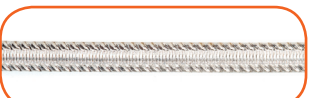

















### APPROX PRICING PER PENNYWEIGHT for sterling silver coiled wire

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt	4000 dwt
		00.05 oz	5 oz	10 oz	20 oz	50 oz	100 oz	200 oz
sterling flat wire	dwt	\$0.91	\$0.86	\$0.83	\$0.79	\$0.77	\$0.76	\$0.76
	<b>oz</b>	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.60</b>	<b>\$15.80</b>	<b>\$15.40</b>	<b>\$15.20</b>	<b>\$15.20</b>
sterling slit coil	dwt	\$0.89	\$0.84	\$0.81	\$0.76	\$0.74	\$0.72	\$0.71
	<b>oz</b>	<b>\$17.80</b>	<b>\$16.80</b>	<b>\$16.20</b>	<b>\$15.00</b>	<b>\$14.80</b>	<b>\$14.40</b>	<b>\$14.20</b>
sterling square wire ( 4 to 21 gauge )	dwt	\$0.89	\$0.84	\$0.81	\$0.77	\$0.75	\$0.73	\$0.73
	<b>oz</b>	<b>\$17.80</b>	<b>\$16.80</b>	<b>\$16.20</b>	<b>\$15.40</b>	<b>\$15.00</b>	<b>\$14.60</b>	<b>\$14.60</b>
sterling square wire ( 22 to 24 gauge )	dwt	\$0.91	\$0.86	\$0.82	\$0.77	\$0.75	\$0.73	\$0.73
	<b>oz</b>	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.40</b>	<b>\$15.40</b>	<b>\$0.15</b>	<b>\$14.60</b>	<b>\$14.60</b>

All silver products are sold by pennyweight. Prices shown are based on a \$12 silver market. Prices per troy ounce are provided in Bold.

# PATTERN WIRE

















## STERLING SILVER COILED PATTERN WIRE

	Profile	style number	Width x Thickness mm	Approx dwt/ft
		SS-210	7.63 x 1.24	14.10
		SS-211	4.13 x 1.35	8.80
		SS-212	4.70 x 1.50	9.40
		SS-213	5.35 x 1.47	11.00
		SS-214	5.67 x 1.33	11.15
		SS-215	2.40 x 1.45	4.80
		SS-216	2.04 x 1.28	3.80
		SS-217	2.85 x 1.50	6.00
		SS-218	2.42 x 1.27	4.60
		SS-219	1.55 x 1.35	3.40
		SS-240	2.60 x .55	2.20
		SS-241	7.25 x 1.20	12.30

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

Sterling silver pattern wire is available in 20 styles and sizes. Supplied soft and coiled.

• **Minimum order is 12 inches per size.**

	Profile	style number	Width x Thickness mm	Approx dwt/ft
		SS-242	3.67 x 1.10	6.70
		SS-243	4.65 x 0.85	6.30
		SS-244	6.45 x 0.88	7.60
		SS-245	6.35 x 1.58	14.60
		SS-246	3.54 x 1.40	7.40
		SS-247	3.45 x 1.35	7.20
		SS-249	19.0 x 0.87	29.20
		SS-250	9.55 x 1.30	22.60

For the best pricing 

**APPROX PRICING PER PENNYWEIGHT for sterling silver patterned wire**

quality	unit	1 dwt	100 dwt	200 dwt	1000 dwt	2000 dwt
		1 oz	5 oz	10 oz	50 oz	100 oz
sterling patterned wire	dwt	\$0.97	\$0.92	\$0.89	\$0.83	\$0.80
	<b>oz</b>	<b>\$19.40</b>	<b>\$18.40</b>	<b>\$17.80</b>	<b>\$16.60</b>	<b>\$16.00</b>

All silver products are sold by pennyweight. Prices shown are based on a \$12 silver market. Prices per troy ounce are provided in Bold.

## WIRE- TRIANGLE

Sterling silver triangle wire is supplied dead soft and coiled.

- Minimum order is one foot per size.

### STERLING SILVER TRIANGLE WIRE

profile	base x height			approx dwts/ft
	gauge	mm	inch	
▲	12	2.30 x 2.00	.091 x .079	.45
▲▲	8	3.39 x 3.02	.133 x .119	.95
▲▲▲	6	4.60 x 4.11	.181 x .162	1.975
▲▲▲▲	4	5.47 x 2.26	.215 x .089	1.3375
▲▲▲▲▲	2	6.91 x 4.19	.272 x .165	2.8292

## WIRE - BEZEL

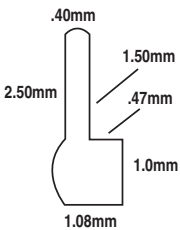
Sterling silver bezel wire are supplied in 1 foot increments (pieces).

- Minimum order is one foot per size.

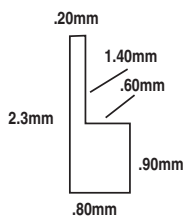
### STERLING SILVER BEZEL WIRE

item. no	style	dimensions		approx dwts/ft
		mm	inch	
#1	millgrain	.41 x 1.08 x 2.50	.016 x .042 x .098	3.29
#2	plain	.25 x .86 x 2.45	.010 x .034 x .096	2.18
#3	plain	.36 x .85 x 5.70	.014 x .033 x .224	4.78

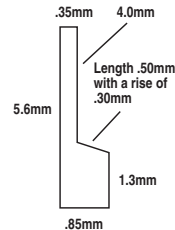
Item #1 Millgrain on top edge.



Item



Item #3



For the best pricing



### APPROX PRICING PER PENNYWEIGHT for sterling silver triangle wire and step bezel

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt	4000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	100 oz	200 oz
sterling triangle wire	dwt	\$0.91	\$0.86	\$0.82	\$0.77	\$0.75	\$0.73	\$0.73
	oz	<b>\$18.20</b>	<b>\$17.20</b>	<b>\$16.40</b>	<b>\$15.40</b>	<b>\$15.00</b>	<b>\$14.60</b>	<b>\$14.60</b>
sterling step bezel	dwt	\$1.03	\$1.00	\$0.97	\$0.93	\$0.91	\$0.89	\$0.89
	oz	<b>\$20.60</b>	<b>\$20.00</b>	<b>\$19.40</b>	<b>\$18.60</b>	<b>\$18.20</b>	<b>\$17.80</b>	<b>\$17.80</b>

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## WIRE- BEAD

Sterling silver round bead wire, half round bead wire and half round berry bead wire are supplied dead soft and coiled. Weights and measurements are approximate due to production variations.

• **Maximum length for same day shipping is 1,000 inches.**



### ROUND BEAD WIRE


profile	diameter			min order	approx dwts/ft
	gauge	mm	inch		
●	14	1.45	0.057	36"	2.80
●	12	2.03	0.080	24"	5.04
●	9	2.79	0.110	12"	9.36

### HALF ROUND BEAD WIRE

profile	diameter			min order	approx dwts/ft
	gauge	mm	inch		
◐	12	2.03 x 1.02	.080 x .040	24"	4.40
◐	9	2.72 x 1.45	.107 x .057	24"	4.56
◐	8	3.20 x 1.45	.126 x .057	24"	6.60
◐	6	4.08 x 2.60	.160 x .102	12"	12.84

### HALF ROUND BERRY BEAD WIRE

profile	diameter			min order	approx dwts/ft
	gauge	mm	inch		
◐	6	4.08 x 2.60	.160 x .102	12"	12.84

For the best pricing 

### APPROX PRICING PER PENNYWEIGHT for sterling silver bead wire

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt	4000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	100 oz	200 oz
sterling round bead wire	dwt	\$1.05	\$1.01	\$0.99	\$0.95	\$0.94	\$0.93	\$0.93
	<b>oz</b>	<b>\$21.00</b>	<b>\$20.20</b>	<b>\$19.80</b>	<b>\$19.00</b>	<b>\$18.80</b>	<b>\$18.60</b>	<b>\$18.60</b>
sterling half round bead wire	dwt	\$1.21	\$1.16	\$1.13	\$1.08	\$1.06	\$1.03	\$1.03
	<b>oz</b>	<b>\$24.20</b>	<b>\$23.20</b>	<b>\$22.60</b>	<b>\$21.60</b>	<b>\$21.20</b>	<b>\$20.60</b>	<b>\$20.60</b>
sterling berry bead wire	dwt	\$1.21	\$1.16	\$1.13	\$1.08	\$1.06	\$1.03	\$1.03
	<b>oz</b>	<b>\$24.20</b>	<b>\$23.20</b>	<b>\$22.60</b>	<b>\$21.60</b>	<b>\$21.20</b>	<b>\$20.60</b>	<b>\$20.60</b>

All silver products are sold by pennyweight. Prices shown are based on a \$12 silver market. Prices per troy ounce are provided in Bold.



## WIRE -DIAMOND CUT

This amazing sterling silver wire sparkles just like a diamond-cut chain. Great for making earrings, neck wires, and more. Supplied soft and coiled.

- Minimum order is 36 inches.

### STERLING SILVER DIAMOND CUT WIRE

profile	diameter			min order	approx dwts/ft
	gauge	mm	inch		
•	18	1.02	0.040	36"	1.60
•	16	1.27	0.050	36"	2.30
•	14	1.52	0.060	36"	2.70



## WIRE -TWIST

Sterling silver twist wire is made by twisting round wire of the same diameter together. Supplied soft and coiled.

- Minimum order length listed below.

### STERLING SILVER TWIST WIRE

profile	diameter			min order	approx dwts/ft
	gauge	mm	inch		
•	20	0.81	0.032	60"	0.63
•	18	1.02	0.040	60"	1.00
•	16	1.37	0.054	48"	1.60
•	14	1.70	0.067	36"	2.60
•	12	2.13	0.084	24"	4.00
•	10	2.59	0.102	12"	6.55



For the best pricing

### APPROX PRICING PER PENNYWEIGHT for sterling silver diamond cut and twist wire

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	100 oz
sterling diamond-cut wire	dwt	\$0.92	\$0.87	\$0.84	\$0.80	\$0.78	\$0.75
	<b>oz</b>	<b>\$18.40</b>	<b>\$17.40</b>	<b>\$16.80</b>	<b>\$16.00</b>	<b>\$15.60</b>	<b>\$15.00</b>
sterling twist wire	dwt	\$0.92	\$0.87	\$0.84	\$0.80	\$0.78	\$0.75
	<b>oz</b>	<b>\$18.40</b>	<b>\$17.40</b>	<b>\$16.80</b>	<b>\$16.00</b>	<b>\$15.60</b>	<b>\$15.00</b>

All silver products are sold by pennyweight. Prices shown are based on a \$12 silver market. Prices per troy ounce are provided in Bold.

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



# TUBING-ROUND

Sterling Silver tubing is supplied in soft, straight, stress-relieved, 12-inch lengths only.

- Available in 12 inch lengths only



## STERLING SILVER ROUND SEAMLESS TUBING

wall thickness	cross section	outer diameter		inner diameter		min order	approx dwt/ft	insert wire
		mm	inches	mm	inches			
light .010"	○	1.29L	.051	0.79	.031	12"	1.60	21ga
	○	1.63L	.064	1.13	.044	12"	2.20	18ga
	○	2.03L	.080	1.53	.060	12"	2.80z	15ga
medium .015"	○	2.54M	.100	1.74	.069	12"	5.20	14ga
	○	3.05M	.120	2.25	.089	12"	6.40	12ga
	○	3.56M	.140	2.76	.109	12"	7.80	10ga
	○	4.06M	.160	3.26	.128	12"	9.00	8ga
	○	5.08M	.200	4.28	.169	12"	11.40	6ga
	○	6.09M	.240	5.29	.208	12"	14.00	4ga
heavy .020"	○	2.03H	.080	1.03	.041	12"	5.00	19ga
	¼"	6.35H	.250	5.35	.211	12"	19.20	*
	5/16"	7.95H	.312	6.95	.274	12"	24.20	*
	3/8"	9.53H	.375	8.53	.336	12"	28.40	*
	½"	12.70H	.500	11.70	.461	12"	38.80	*
	1"	25.40H	1.000	24.40	.961	12"	82.20	*

\*Not Applicable

## NOW AVAILABLE

MORE SIZES OF ROUND TUBING IN KARAT GOLD ( REFER TO PAGES (46-47 )  
LIGHT, MEDIUM, AND HEAVY WALLS AVAILABLE IN STERLING SILVER (12" MINIMUM )

Join  
the Club  
For the best pricing

### APPROX PRICING PER PENNYWEIGHT for sterling silver tubing

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt
		1 oz	5 oz	10 oz	20 oz	50 oz	100 oz
sterling light wall tubing	dwt	\$1.20	\$1.15	\$1.12	\$1.07	\$1.05	\$1.02
	<b>oz</b>	<b>\$24.00</b>	<b>\$23.00</b>	<b>\$22.40</b>	<b>\$21.40</b>	<b>\$21.00</b>	<b>\$20.40</b>
sterling med & heavy wall tubing	dwt	\$1.13	\$1.08	\$1.06	\$1.02	\$1.01	\$0.98
	<b>oz</b>	<b>\$22.60</b>	<b>\$21.60</b>	<b>\$21.20</b>	<b>\$20.40</b>	<b>\$20.20</b>	<b>\$19.60</b>

All silver products are sold by pennyweight. Prices shown are based on a \$12 silver market. Prices per troy ounce are provided in Bold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



## SHEET - FINE SILVER

.9995 fine silver sheet is supplied dead soft in 6" widths. Maximum size is 6" x 24." Available in even gauges only. One dimension must be 6" when ordering.

- Minimum order is 6" x 1" per gauge.

### FINE SILVER SHEET

thickness	gauge	mm	inch	approximate pennyweights per size			
				6" x 1"	6" x 3"	6" x 6"	6" x 12"
—	30	0.25	0.010	6.6	19.62	39.24	78.48
—	28	0.33	0.016	7.86	23.58	47.16	94.32
—	26	0.41	0.016	9.84	29.52	59.04	118.08
—	24	0.51	0.020	13.08	39.24	78.48	156.96
—	22	0.64	0.025	16.38	49.14	98.28	196.56
—	20	0.81	0.032	20.28	60.84	121.68	243.36
—	18	1.02	0.040	26.16	78.48	159.96	313.92
—	16	1.29	0.051	32.70	98.10	196.20	392.40
—	14	1.63	0.064	42.10	126.50	253.0	506.10



## WIRE - FINE SILVER

.9995+ fine silver round wire is supplied dead soft and coiled. 26, 28 and 30 gauge wire are sold in 100 dwt spools only.

- Minimum order quantities listed.

### FINE SILVER ROUND WIRE

profile	gauge	diameter		min order	approx dwts/ft	20 dwt (1oz) length (in)	100 dwt (5oz) length (ft)
		mm	inch				
•	24	0.51	0.020	36"	0.40	606.6	250.0
•	22	0.64	0.025	36"	0.65	370.3	153.8
•	20	0.81	0.032	24"	1.00	240.0	100.0
•	18	1.02	0.040	24"	1.73	138.8	57.5
•	16	1.29	0.051	24"	2.71	88.6	36.9
•	14	1.63	0.064	12"	4.08	57.1	24.5
•	12	2.03	0.080	12"	6.72	35.7	14.9
•	30*	0.25	0.010	100 dwt	0.10	n/a	1000.0
•	28*	0.33	0.013	100 dwt	0.15	n/a	666.7
•	26*	0.41	0.016	100 dwt	0.23	n/a	434.8

\* sold in 100 dwt increments. Supplied dead soft on plastic spool.

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## BEZEL - FINE SILVER

Fine silver bezel wires are available in flat, serrated, and scalloped shapes. All fine silver bezel wires are supplied dead soft and coiled.

- Minimum order quantities are listed below.



### FINE SILVER BEZEL WIRE

profile	shape	inches	mm	gauge	min order	approx dwts/ft
—	<b>Flat</b>	$\frac{3}{16}$ x .012	4.76 x .31	4 x 28 GA	24"	3.0
—	<b>Flat</b>	$\frac{3}{16}$ x .010	4.76 x .25	4 x 30 GA	24"	2.6
—	<b>Flat</b>	$\frac{1}{8}$ x .016	3.18 x .40	8 x 26 GA	24"	2.5
—	<b>Flat</b>	$\frac{1}{8}$ x .012	3.18 x .31	8 x 28 GA	36"	2.0
—	<b>Flat</b>	$\frac{1}{8}$ x .010	3.18 x .25	8 x 30 GA	48"	1.6
—	<b>Flat</b>	$\frac{3}{32}$ x .012	2.38 x .31	10 x 28 GA	48"	1.4
—	<b>Flat</b>	$\frac{3}{32}$ x .010	2.38 x .25	10 x 30 GA	60"	1.2
-	<b>Cloisonné</b>	.040 x .010	1.02 x .25	18 x 30 GA	120"	0.5
—	<b>Serrated</b>	$\frac{3}{16}$ x .012	4.76 x .31	4 x 28 GA	24"	2.4
—	<b>Serrated</b>	$\frac{1}{8}$ x .012	3.18 x .31	8 x 28 GA	24"	2.0
—	<b>Scalloped</b>	$\frac{3}{16}$ x .012	4.76 x .31	4 x 28 GA	24"	2.8
—	<b>Scalloped</b>	$\frac{1}{8}$ x .012	3.18 x .31	8 x 28 ga	24"	1.9



For the best pricing

### APPROX PRICING PER PENNYWEIGHT for sheet, round, and bezel wire

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt	4000 dwt
		1oz	5 oz	10 oz	20 oz	50 oz	100 oz	200 oz
fine silver sheet	dwt	\$0.93	\$0.88	\$0.85	\$0.80	\$0.78	\$0.75	\$0.74
	<b>oz</b>	<b>\$18.60</b>	<b>\$17.60</b>	<b>\$17.00</b>	<b>\$16.00</b>	<b>\$15.60</b>	<b>\$15.00</b>	<b>\$14.80</b>
fine silver round wire (12 to 24 gauge)	dwt	\$0.93	\$0.88	\$0.85	\$0.80	\$0.78	\$0.73	\$0.73
	<b>oz</b>	<b>\$18.60</b>	<b>\$17.60</b>	<b>\$17.00</b>	<b>\$16.00</b>	<b>\$15.60</b>	<b>\$14.60</b>	<b>\$14.60</b>
fine silver small dia. round wire (26, 28, 30 gauge)	dwt	\$0.95	\$0.90	\$0.87	\$0.82	\$0.80	\$0.78	\$0.77
	<b>oz</b>	<b>\$19.00</b>	<b>\$18.00</b>	<b>\$17.40</b>	<b>\$16.40</b>	<b>\$16.00</b>	<b>\$15.60</b>	<b>\$15.40</b>
fine silver flat bezel wire	dwt	\$1.03	\$1.00	\$0.97	\$0.93	\$0.91	\$0.89	\$0.88
	<b>oz</b>	<b>\$20.60</b>	<b>\$20.00</b>	<b>\$19.40</b>	<b>\$18.60</b>	<b>\$18.20</b>	<b>\$17.80</b>	<b>\$17.60</b>
fine silver scalloped/serrated	dwt	\$1.09	\$1.06	\$1.03	\$0.99	\$0.97	\$0.95	\$0.94
	<b>oz</b>	<b>\$21.80</b>	<b>\$21.20</b>	<b>\$20.60</b>	<b>\$19.80</b>	<b>\$19.40</b>	<b>\$19.00</b>	<b>\$18.80</b>
fine silver Cloisonné wire (.040 x .010)	dwt	\$1.14	\$1.11	\$1.08	\$1.04	\$1.02	\$1.00	\$0.99
	<b>oz</b>	<b>\$22.80</b>	<b>\$22.20</b>	<b>\$21.60</b>	<b>\$20.80</b>	<b>\$20.40</b>	<b>\$20.00</b>	<b>\$19.80</b>

All silver products are sold by pennyweight. Prices shown are based on a \$12 silver market. Prices per troy ounce are provided in Bold.



## SOLDER - SHEET - CADMIUM FREE

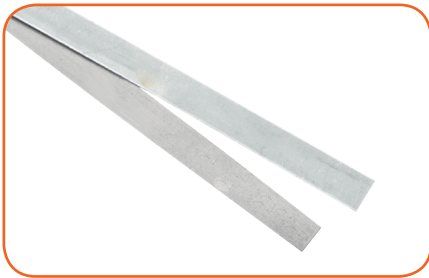
Supplied in 1 dwt sheets.



For the best pricing

### SILVER SHEET SOLDER-CADMIUM FREE

solder quality	silver content	melt point (°F)	flow point (°F)	approx cost/dwt
easy (1 dwt)	60%	1256	1325	\$1.39
medium (1dwt)	70%	1330	1390	\$1.40
hard (1 dwt)	80%	1360	1490	\$1.45



## SOLDER - STRIP - CADMIUM FREE

Supplied in convenient 12" x .016" strips. Each strip weighs approximately 5 dwt.

•Minimum order is one strip per quality.

### SILVER STRIP SOLDER-CADMIUM FREE

solder quality	silver content	melt point (°f)	flow point (°f)	approx cost/strip
extra easy (5 dwt)	56%	1145	1205	\$4.57
easy (5 dwt)	65%	1240	1325	\$4.69
medium (5dwt)	70%	1275	1360	\$4.77
hard (5 dwt)	75%	1365	1450	\$5.00



## SOLDER - CHIP - CADMIUM FREE

Supplied in convenient pre-cut 1 mm squares.

• Minimum order is 5 dwt per quality.

### SILVER CHIP SOLDER-CADMIUM FREE

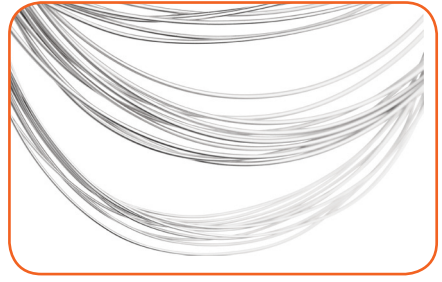
solder quality	silver content	melt point (°F)	flow point (°F)	approx cost/dwt
extra easy (5 dwt)	56%	1145	1205	\$.97
easy (5 dwt)	65%	1240	1325	\$.99
medium (5dwt)	70%	1275	1360	\$1.01
hard (5 dwt)	75%	1365	1450	\$1.05

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## SOLDER - WIRE

Easy & medium solder wire supplied in 20 gauge only. Hard silver solder wire is supplied in 20 and 28 gauge.

- Minimum order is 5 ft (approximately 5 dwt) per quality.



### SILVER SHEET SOLDER

solder quality	silver content	melt point (°f)	flow point (°f)	approx cost/5dwt
*easy (20 gauge)	60% w/cad	1145	1200	\$4.19
medium (20 gauge)	70% cad-free	1275	1350	\$4.40
hard (20 gauge)	80% cad-free	1365	1470	\$4.60
hard (28 gauge)	80% cad-free	1370	1475	\$.69

\*Contains cadmium.

## SOLDER - PASTE

Silver solder is powdered and mixed with the proper proportion of flux, and packaged in convenient, disposable syringes. Specially formulated binders assure that little or no carbon residue is left on the joint when soldering. Each syringe contains three pennyweights of silver solder and flux, and is designed to work in our new Paste solder hand applicator (see page 58).



### SILVER PASTE SOLDER

solder quality	silver content	melt point (°f)	flow point (°f)	approx cost/3dwt syringe
extra easy	56%	1145	1205	\$3.66
easy	65%	1240	1325	\$4.01
medium	70%	1275	1360	\$4.24
hard	75%	1365	1450	\$4.48

## SOLDER - ARGENTIUM™ - CADMIUM FREE

ARGENTIUM™ Silver solders are tarnish resistant and are designed for use on ARGENTIUM™ Sterling Silver. Supplied in 3 inch x 30 gauge x 5 dwt sheets.



### ARGENTIUM SILVER SHEET SOLDER-CADMIUM FREE

solder quality	silver content	melt point (°f)	flow point (°f)	approx cost/5dwt sheet
easy	65%	1146	1253	\$5.94
medium	70%	1237	1319	\$6.02
hard	75%	1272	1355	\$6.25

# Tap Directly into Our Knowledge Base

*Stuller Bench, how may I help you?* These are the first words you will hear when you dial extension 4300. Our Tech Group's mission is to provide a unique service to jewelers worldwide — free technical expertise covering a broad range of disciplines relative to jewelers, because we are jewelers!

Each of the six members of the Stuller Tech Group have extensive experience in the production of jewelry and in the tools and machines it takes to get the job done. From wax carving to rhodium plating, mold cutting to polishing, soldering to stone setting, someone on our staff is ready to provide assistance to our customers.

No one can say they know everything in an industry that has roots going back 6,000 years, and we certainly do not make that claim, but we openly share all we know with any of our customers. The six dedicated *Stuller Bench* associates have a combined total of 91 years of jewelry experience. We also have a talented pool of 1,500 people in the building that back us up. Metallurgists, gemologists, master stone setters and master craftsmen are just down the hall.

We can assist you with your tool purchases and recommend the right tool for your job. If you are looking to expand, we provide a free *Shop Set Up* service where we can outfit your entire shop with the tools and machines you really need (and none that you don't), so you can stay on budget.

Whether you are a one person outfit or a large manufacturing company, we can provide everything from dust collection systems to laser welders.

The members of our group came up through the ranks here at Stuller. We in the Tech Group are intimately familiar with our product as we made it, set it, cut the mold on it, cast it, or polished it. We can assist you with or make recommendations on which mounting or finding will work best for your projects.



Your calls are always welcomed; we will do our very best to get you the answers you need. We operate Monday thru Friday 8:30 a.m. to 6:00 p.m. Central time. We are but another tool Stuller offers to give you the competitive edge. We are not just a jewelry company; we are a jeweler's company!

**For your just have to know questions...**

**call the Stuller Bench at 800-877-7777 x 4300  
or visit the [stullerbench.com](http://stullerbench.com)**

# GOLD FILLED & BASE METAL CASTING



BASE METAL  
FOR CASTING } 89

YGF DOUBLE  
SIDED  
SHEET } 86

YGF SINGLE  
SIDED  
SHEET } 86

YGF HALF  
ROUNDED  
WIRE } 88

YGF ROUND  
WIRE } 87

YGF SQUARE  
WIRE } 88

PRECIOUS GOLD  
FILLED SHEET,  
WIRE & TUBING } 90

## SHEET - 1/10 10KT

10% 10kt yellow gold by weight (10/10) mechanically bonded to bronze base metal. Stocked in soft, 4" x 30" sheets.

- One dimension must be 4 inches when ordering.
- Minimum order is 4" x 1".

### 1/10th 10KT YELLOW GOLD FILLED SINGLE SIDE SHEET

thickness	gauge	mm	inch	Approximate pennyweights per size			
				4" x 1"	4" x 3"	4" x 6"	4" x 12"
—	16	1.27	0.050	18.8	56.4	112.8	225.6
—	14	1.52	0.060	22.6	67.8	135.6	271.2

## SHEET - 1/20 14KT

5% 14k yellow gold by weight (14/20). Sheet is clad on one side. Great for stampings and jewelry requiring a single sided gold filled surface. Stocked in soft, 3" x 30" sheets.

- One dimension must be 3" when ordering.
- Minimum order is 3" x 1" per size.

### 1/20th 14KT YELLOW GOLD FILLED SINGLE SIDE SHEET

thickness	gauge	mm	inch	Approximate pennyweights per size			
				3" x 1"	3" x 3"	3" x 6"	3" x 12"
—	22	0.64	0.025	7.2	21.6	43.2	86.4
—	20	0.81	0.032	14.1	42.3	84.6	169.6

## SHEET - 1/40 14KT

5% 14k yellow gold by weight (14/40 x 14/40). Excellent for earrings and other applications requiring double-sided, gold-filled surfaces. Stocked in soft, 3" x 30" sheets.

- One dimension must be 3" when ordering.
- Minimum order is 3" x 1" per size.

### 1/40th X 1/40th 14KT YELLOW GOLD FILLED DOUBLE SIDED SHEET

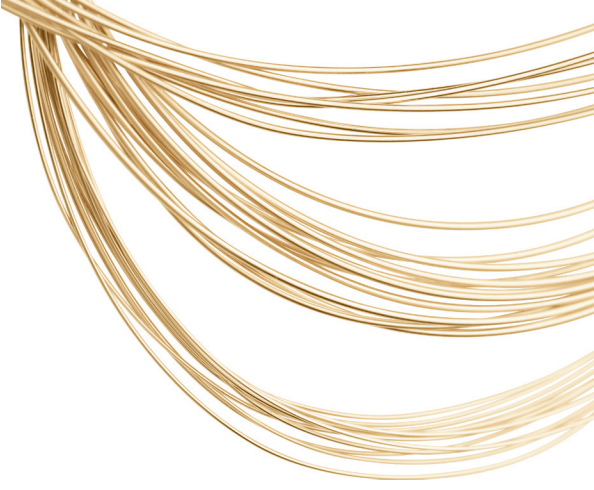
thickness	gauge	mm	inch	Approximate pennyweights per size			
				3" x 1"	3" x 3"	3" x 6"	3" x 12"
—	26	0.41	0.016	9.21	27.6	55.2	110.5
—	24	.51	0.020	5.6	16.8	33.6	67.2

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



# WIRE-ROUND

5% 14kt yellow gold by weight. YGF round wire is supplied soft and coiled in all gauges listed below. ½ hard coiled wire is available in 16 gauge through 24 gauge.



## 1/20TH 14KT YELLOW GOLD FILLED ROUND WIRE

profile	diameter		min order	approx dwts/ft	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (ft)	available temper	
	gauge	mm						inch
•	26	0.41	0.016	60"	0.24	1000.0	416.70	Soft
•	24	0.51	0.020	60"	0.36	666.7	277.80	Soft or ½ hard
•	22	0.64	0.025	60"	0.60	400.0	166.66	Soft or ½ hard
•	21	0.71	0.028	48"	0.24	1000.0	141.25	Soft or ½ hard
•	20	0.81	0.032	36"	0.96	250.0	104.10	Soft or ½ hard
•	18	1.02	0.040	24"	1.45	166.7	69.46	Soft or ½ hard
•	16	1.29	0.051	24"	2.28	105.3	43.87	Soft or ½ hard
•	14	1.63	0.064	12"	3.84	62.5	26.04	Soft
•	12	2.03	0.080	12"	4.80	50.0	17.88	Soft
•	10	2.59	0.102	6"	9.36	25.5	10.69	Soft
•	8	3.25	0.128	6"	15.00	16.0	6.66	Soft



For the best pricing

## YELLOW GOLD- FILLED SHEET AND ROUND wire prices per pennyweight (dwt)

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt
		1oz	5 oz	10 oz	20 oz	50 oz	100 oz
1/10 10k YGF sheet	dwt	\$2.53	\$2.41	\$2.35	\$2.33	\$2.32	\$2.31
	oz	<b>\$50.60</b>	<b>\$48.20</b>	<b>\$47.00</b>	<b>\$46.60</b>	<b>\$46.40</b>	<b>\$46.20</b>
1/20 & 1/40 x 1/40 14k YGF sheet	dwt	\$2.03	\$1.91	\$1.85	\$1.83	\$1.82	\$1.81
	oz	<b>\$40.60</b>	<b>\$38.20</b>	<b>\$37.00</b>	<b>\$36.60</b>	<b>\$36.40</b>	<b>\$36.20</b>
1/20 14kt YGF round wire	dwt	\$2.03	\$1.91	\$1.85	\$1.83	\$1.82	\$1.81
	oz	<b>\$40.60</b>	<b>\$38.20</b>	<b>\$37.00</b>	<b>\$36.60</b>	<b>\$36.40</b>	<b>\$36.20</b>

All gold filled products are sold by pennyweight. Prices shown are based on a \$600 gold market. Prices per troy ounce are provided in Bold.

## WIRE-SQUARE

1/20 14kt YGF square wire is available in all gauges listed below. 1/2 hard and coiled square wire is available in 20, 21, and 22 gauge. Excellent for wire wrapping applications.

• **Minimum order quantities listed below.**

### 1/20TH 14KT YELLOW GOLD FILLED SQUARE WIRE

profile	diameter		min order	approx dwts/ft	20 dwt (1 oz) length (in)	100 dwt (5 oz) length (ft)	available temper	
	gauge	mm						inch
▪	24	0.51	0.020	60"	0.36	666.6	277.7	Soft
▪	22	0.64	0.025	60"	0.84	285.7	170.1	Soft or 1/2 hard
▪	21	0.71	0.028	48"	0.96	250.0	104.1	Soft or 1/2 hard
▪	20	0.81	0.032	36"	1.20	200.0	83.3	Soft or 1/2 hard
▪	18	1.02	0.040	24"	1.80	133.3	55.6	Soft

## WIRE - HALF ROUND

1/20 14kt YGF square wire is available soft and coiled in 8 gauge through 22 gauge and 1/2 hard and coiled in 18 gauge through 22 gauge.

### 1/20TH 14KT YELLOW GOLD FILLED HALF - ROUND WIRE

profile	diameter		min order	approx dwts/ft	20 dwt (1 oz) length (in)	available temper	
	gauge	mm					inch
•	22	.64x.32	.025x.012	60"	0.36	666.6	1/2 hard
•	21	.71x.35	.028x.014	60"	0.48	500.0	1/2 hard
•	20	.81x.40	.032x.016	60"	0.48	500.0	Soft or 1/2 hard
•	18	1.02x.51	.040x.020	60"	0.84	285.7	Soft or 1/2 hard
◐	12	2.03x1.02	.080x.040	12"	3.84	62.5	Soft
◑	10	2.59x1.27	.101x.050	12"	4.44	54.0	Soft
◒	8	3.25x1.63	.128x.064	6"	7.44	32.2	Soft



For the best pricing

### YELLOW GOLD FILLED SQUARE AND HALF ROUND wire prices per pennyweight (dwt)

quality	unit	1 dwt	100 dwt	200 dwt	400 dwt	1000 dwt	2000 dwt
		1oz	5 oz	10 oz	20 oz	50 oz	100 oz
1/20 10kt YGF square	dwt	\$2.04	\$1.90	\$1.85	\$1.82	\$1.81	\$1.80
and half round wire	oz	\$40.80	\$38.00	\$37.00	\$36.40	\$36.20	\$36.00

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

# A PRECIOUS METAL SOLUTION FOR TODAY'S MARKET.

## PRECIOUS GOLD FILLED

This cost effective precious metal solution allows for distinctive design elements, such as etching and diamond cutting to reveal a two tone effect.

Now Available in Sheet, Wire and Tubing!

### SHEET- SINGLE SIDED

10% 14K Yellow gold by weight ( $\frac{1}{10}$ ) mechanically bonded to sterling silver.

Available in 3 inch widths and 12 inch maximum lengths.

One dimension must be 3 inch. Minimum order is 3" x 1".

#### PGF (PRECIOUS GOLD FILLED) SHEET

profile	gauge	Diameter		Approx Dwt Per Size			
		inch	mm	3" x 1"	3" x 3"	3" x 6"	3" x 12"
—	24	0.020	0.51	6.707	20.121	40.242	80.484
—	20	0.032	0.81	10.731	32.193	64.386	128.772
—	18	0.040	1.02	13.413	40.239	80.475	160.95

### WIRE

10% 14K Yellow gold by weight ( $\frac{1}{10}$ ) mechanically bonded to sterling silver.

Available in 12" minimum lengths.

#### PGF (PRECIOUS GOLD FILLED) WIRE

profile	gauge	Diameter		Approx Dwt
		inch	mm	
•	24	0.020	0.51	5.13
•	20	0.032	0.81	13.20
•	18	0.040	1.02	20.40

### TUBING

10% 14K Yellow gold by weight ( $\frac{1}{10}$ ) mechanically bonded to sterling silver.

Available in 26 gauge and 12" minimum lengths only.

#### PGF (PRECIOUS GOLD FILLED) TUBING

profile	26 gauge	wall thickness	OD		Approx. Dwt/ft
			mm	inch	
○ shown 4 mm	.015"	wall thickness	3.0	.118	6.51
			4.0	.157	8.98
			5.0	.198	11.504
			6.0	.236	13.969

For the best pricing



#### PRECIOUS GOLD FILLED PRICES PER PENNYWEIGHT (DWT)

Product Type	Unit	1 dwt	100 dwt	200 dwt	400 dwt
		1 oz	5 oz	20 oz	50 oz
PGF Sheet	dwt	\$4.67	\$4.55	\$4.50	\$4.47
	oz	\$93.40	\$91.00	\$90.00	\$89.40
PGF Wire	dwt	\$4.67	\$4.55	\$4.50	\$4.47
	oz	\$93.40	\$91.00	\$90.00	\$89.40
PGF Tubing	dwt	\$4.71	\$4.58	\$4.52	\$4.50
	oz	\$94.20	\$91.16	\$90.40	\$90.00

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12

# BASE METALS FOR CASTING



**Herculoy Casting Cubes:** An economical bronze alloy containing 5% zinc. The low zinc content releases little fumes or smoke when melted. Color approximates 14Kt Yellow gold. Readily accepts nickel, gold, or rhodium plating, and solders easily with silver solder. Sold by the pound. **54-8100**



**Art Brass Casting Cubes:** An economical brass alloy containing 30% zinc. The low casting temperature and bright yellow color lend itself to jewelry casting. Polishes bright and electroplates/solders beautifully. Overheating can create excessive fumes and smoke. Sold by the pound. **54-8102**



**J S Brass Casting Grain:** A high-quality brass casting alloy containing the same deoxidizing agents used in our karat gold casting grain. Castings are bright and firescale free. Color is very close to 14KT Yellow. Highly recommended for sculpture. Sold by the pound. **54-8104**



**Silicon Bronze Casting Grain:** Our silicon bronze's casting properties are superior to most other bronzes. Cast with few fumes or smoke and can readily be electroplated. Color is darker than our brass and Herculoy formulas. Highly recommended for sculpture. Sold by the pound. **54-8106**



**White Bronze Casting Grain:** A nickel-free white bronze alloy with a low casting temperature of 1,650F. Accepts rhodium plating after a nickel or gold preplate. Can be brazed and polished. Sold by the pound. **54-8108**

## CASTING CUBES/GRAIN

quality	order number	6+	3+	1	melt temp	metal to wax ratio
Herculoy Casting Cubes	54-8100	\$11.18	\$11.41	\$11.89	1850°F	8:1
Art Brass Casting Cubes	54-8102	\$11.18	\$11.41	\$11.89	1700°F	9:1
J S Casting Grain	54-8104	\$19.50	\$19.92	\$20.75	1950°F	9:1
Silicon Bronze Casting Cubes	54-8106	\$11.18	\$11.41	\$11.89	1850°F	9:1
White Bronze Casting Grain	54-8108	\$11.18	\$11.41	\$11.89	1850°F	8:1

Shipping weight is 1 lb



## ALLOY 99 REPLENISHER

Designed to deoxidize used gold for casting.

**10kt Scrap** Add 5 dwt #99 and 3.57 dwt of fine gold for each 100 dwt of 10kt scrap being melted.

**14kt Scrap** Add 4dwt #99 and 5.60 dwt of fine gold for each 100 dwt of 14kt scrap being melted.

**18kt Scrap** Add 2 dwt #99 and 6.00 dwt of fine gold for each 100 dwt of 18kt scrap being melted.

For **white gold**, the above ratios can be used, but use will be limited to one or two times due to the yellowing of the white color.

## ALLOY 99 REPLENISHER

Description	order no.	6+	3+	1+
2 Troy oz. bag	54-4409	\$9.86	\$10.51	\$10.95

**LEAD TIMES** 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.

# STAMPINGS



## GOLD STAMPINGS

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## STERLING SILVER STAMPINGS

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Stampings are available in 14kt yellow, 20 ga (0.81mm thickness) unless otherwise noted.

Weights are approximate.

Other gauges and qualities may be available MTO.

Stampings are available in sterling silver upon special request - special request orders do require a minimum order quantity.



ROUND STAMPINGS				
SERIES NO.	DIMENSIONS		DWT	PRICE EA.
	(MM)	(INCH)		
3788	4.76	3/16	0.12	\$ 5.61
3402	6.35	1/4	0.22	\$ 11.35
3789	7.94	5/16	0.33	\$ 16.21
3403	8.73	1/2	0.40	\$ 19.44
3404	9.53	3/8	0.48	\$ 23.13
3405	11.11	7/16	0.65	\$ 31.05
3790	12.70	1/2	0.85	\$ 40.22
3406	13.49	17/32	0.96	\$ 45.15
3407	14.29	9/16	1.05	\$ 49.32
3408	15.88	5/8	1.35	\$ 63.31
3791	17.46	11/16	1.59	\$ 74.20
3410	19.05	3/4	1.91	\$ 89.08
3411	20.64	13/16	2.29	\$106.70
3412	22.23	7/8	2.64	\$122.51
3413	23.81	15/16	3.01	\$139.66
3414	25.40	1	3.47	\$161.07
3415	26.99	1 1/16	3.89	\$180.23
3792	28.58	1 1/8	4.35	\$201.63
3416	30.16	1 3/16	4.85	\$224.60
3793	31.75	1 1/4	5.32	\$376.78
3794	33.34	1 5/16	5.93	\$264.09
3795	34.93	1 3/8	6.40	\$284.79
3417	38.10	1 1/2	7.66	\$340.74
3418	41.28	1 5/8	9.10	\$404.67
3796	44.45	1 3/4	10.23	\$438.28
3797	47.63	1 7/8	11.84	\$507.10
3100	50.80	2	13.58	\$581.58
3798	57.15	2 1/4	17.17	\$735.02
3799	63.50	2 1/2	21.20	\$870.35



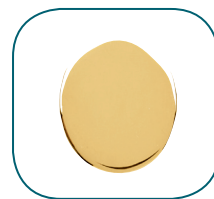
ROUND STAMPINGS with undrilled eyelet				
SERIES NO.	DIMENSIONS		DWT	PRICE EA.
	(MM)	(MM)		
3423	8.00		0.35	\$ 17.14
3424	9.50		0.53	\$ 25.63
3425	11.00		0.67	\$ 31.91
3426	13.50		0.97	\$ 46.08
3427	14.25		1.14	\$ 53.89
3428	16.00		1.42	\$ 66.52
3429	17.50		1.65	\$ 77.18
3430	19.00		2.08	\$ 97.16
3431	20.75		2.49	\$116.19
3432	22.25		2.64	\$122.82
3433	23.75		3.08	\$143.00
3434	25.25		3.40	\$158.14
3435	26.00		3.60	\$167.04
3436	27.25		3.89	\$180.44
3437	30.00		4.79	\$222.11
3441	41.25		9.06	\$403.04
3442	44.25		10.38	\$444.69

**Note: Some stampings appear larger than actual size.**

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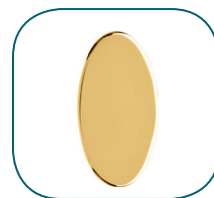
## OVAL STAMPINGS

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3471	8.25 x 6.75	0.30	\$ 14.83
3112	11 x 9	0.51	\$ 24.68
3281	12.75 x 11.25	0.77	\$ 36.50
3472	13.5 x 9.25	0.68	\$ 32.35
3473	17.25 x 12.75	1.13	\$ 53.33
3760	18.25 x 11.25	1.11	\$ 52.51
3463	18.25 x 13.75	1.36	\$ 63.76
3464	18.75x15.5	1.51	\$ 70.77
3759	19 x 12.25	1.22	\$ 57.37
3465	22 x 15.25	1.73	\$ 81.09
3467	26.5 x 19.5	2.77	\$128.80
3468	31.75 x 25.5	4.30	\$199.36
3469	37 x 31	6.11	\$272.25
3470	38.25 x 29	5.87	\$261.61



## LONG OVAL STAMPINGS

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3113	11 x 5	0.27	\$ 13.74
3477	12.5 x 6.75	0.45	\$ 21.77
3111	19 x 7.75	0.77	\$ 36.62
3476	20.5 x 10.75	1.19	\$ 56.05
3475	26 x 9.5	1.32	\$ 61.86
3474	24.5 x 12.75	1.68	\$ 78.45
3107	42 x 20	4.30	\$199.51



## OVAL STAMPINGS with small undrilled eyelet

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3483	19.75 x 16.25	1.78	\$ 83.26
3481	26 x 16	2.27	\$ 105.85
3484	28.25 x 21.25	3.18	\$147.96
3486	32 x 25.5	4.37	\$202.53



## OVAL STAMPINGS with small undrilled eyelet

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3479	28.5 x 21	3.33	\$154.70
3485	31.75 x 23	3.97	\$184.34



Note: Prices are jeweler's cost. Based on \$1,000 gold.



SQUARE STAMPINGS			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3449	9.75 x 9.75	0.63	\$ 30.20
3444	12.75 x 12.75	1.10	\$ 51.83
3445	14 x 14	1.31	\$ 61.63
3446	16.25 x 16.25	1.68	\$ 78.45
3447	17 x 17	1.96	\$ 91.76
3448	19.25 x 19.25	2.48	\$ 115.61
3450	22.25 x 22.25	3.30	\$ 153.53
3451	28.75 x 28.75	5.40	\$ 240.91



SQUARE STAMPINGS with undrilled eyelet			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3452	17.5 x 17.5	2.08	\$ 96.90
3453	2.5 x 22.25	3.42	\$ 158.91
3454	28.75 x 28.75	5.65	\$ 251.89



DIAMOND STAMPINGS with undrilled eyelet			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3455	13 x 13	1.15	\$ 54.17
3456	14 x 14	1.32	\$ 62.01
3457	16 x 16	1.75	\$ 81.91
3458	17 x 17	2.03	\$ 94.82
3459	19 x 19	2.48	\$ 115.46
3461	25.5 x 25.5	4.31	\$ 199.88
3462	28 x 28	5.54	\$ 246.79



RECTANGLE STAMPINGS			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3487	8.5 x 5.5	0.31	\$ 15.29
3117	13 x 11	0.95	\$ 45.17
3488	17 x 11.75	1.32	\$ 62.02
3490	19.25 x 12.75	1.62	\$ 75.75
3489	19.25 x 16.25	1.98	\$ 92.40
3491	20.75 x 16.75	2.34	\$ 108.88
3492	22.5 x 18.5	2.77	\$ 129.09
3493	25.5 x 22.25	3.73	\$ 173.08
3494	28.75 x 23.25	4.51	\$ 209.21
3495	32.75 x 27	5.86	\$ 261.03

**Note: Some stampings appear larger than actual size.**

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



### RECTANGLE STAMPINGS with undrilled eyelet

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3507	14.25 x 19	1.84	\$ 85.83
3508	17.5 x 22	2.63	\$ 122.62
3500	19.25 x 22.5	2.94	\$ 136.80
3501	19.5 x 25.5	3.40	\$ 157.88
3502	21 x 27	3.89	\$ 180.69
3503	22.25 x 25.5	3.79	\$ 175.73
3504	24 x 32	5.23	\$ 233.03
3505	26.25 x 32	5.64	\$ 251.37
3506	29.75 x 32.50	6.58	\$ 293.15



### LONG RECTANGLE STAMPINGS with undrilled eyelet

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3521	13.75 x 6.5	0.61	\$ 29.15
3519	22.25 x 9.5	1.51	\$ 70.97
3509	19.25 x 16.25	2.16	\$ 100.97
3520	27 x 22.25	4.13	\$ 191.60



### RECTANGLE STAMPINGS with round edge

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3496	18.25 x 13.5	1.59	\$ 74.38
3499	22.5 x 11.25	1.68	\$ 78.36
3498	22.25 x 18	2.66	\$ 124.05
3497	22.25 x 19.5	2.84	\$ 132.28



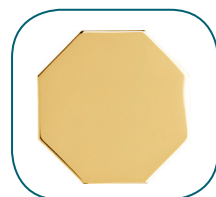
### RECTANGLE STAMPINGS with round edge and undrilled eyelet

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3522	14.25 x 12.25	2.25	\$ 104.92
3523	15.5 x 12	2.18	\$ 101.78
3524	16.5 x 15	7.19	\$ 320.32



### OCTAGON STAMPINGS

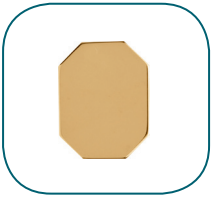
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3526	20.25 x 20.25	2.23	\$ 104.04
3525	31.75 x 31.75	5.55	\$ 247.45



Note: Prices are jeweler's cost. Based on \$1,000 gold.



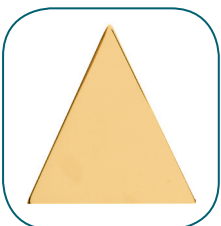
OCTAGON STAMPINGS with undrilled eyelet			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3527	20 x 20	2.31	\$107.68
3528	24.25 x 24.5	3.32	\$154.14
3529	27 x 27	4.09	\$189.68
3530	31.75 x 32	5.48	\$244.21



LONG OCTAGON STAMPINGS			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3537	14.25 x 12.25	1.05	\$49.79
3179	15.5 x 12	1.10	\$51.71
3538	16.5 x 15	1.46	\$68.69



LONG OCTAGON STAMPINGS with undrilled eyelet			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3288	27.5 x 27.5	4.63	\$214.72
3175	36 x 26.5	5.42	\$241.86
3388	32 x 31.75	6.05	\$269.41



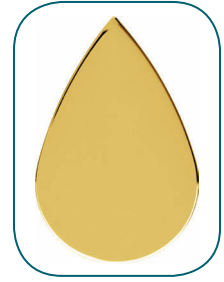
TRIANGLE STAMPINGS			
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
3545	20.75 x 24	1.69	\$ 79.31
3546	27.5 x 25.5	2.40	\$111.94
3547	33 x 38	4.13	\$191.41

**Note: Some stampings appear larger than actual size.**

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd qualities.

## TEARDROP STAMPINGS

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
<b>3164</b>	11.5 x 8	0.42	\$ 20.46
<b>3163</b>	14 x 8.5	0.49	\$ 23.98
<b>3775</b>	17.75 x 11.25	0.93	\$ 43.88
<b>3531</b>	19 x 13	1.17	\$ 53.55
<b>3532</b>	32.75 x 21.5	3.29	\$152.96
<b>3533</b>	36.25 x 24.75	4.37	\$202.59



## HEART STAMPINGS

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
<b>3125</b>	5 x 5	0.11	\$ 6.09
<b>3305</b>	6.5 x 6.75	0.21	\$ 10.68
<b>3123</b>	8 x 8	0.33	\$ 16.60
<b>3122</b>	10 x 10	0.46	\$ 22.32
<b>3121</b>	13 x 12	0.75	\$ 35.70
<b>3120</b>	17 x 15	1.15	\$ 54.14
<b>3316</b>	20 x 19.25	1.77	\$ 82.67
<b>3342</b>	24.5 x 24.5	2.79	\$129.63
<b>3307</b>	31 x 31	4.50	\$208.62
<b>3313</b>	39.5 x 39.25	7.76	\$345.50



## HEART STAMPINGS with undrilled eyelet

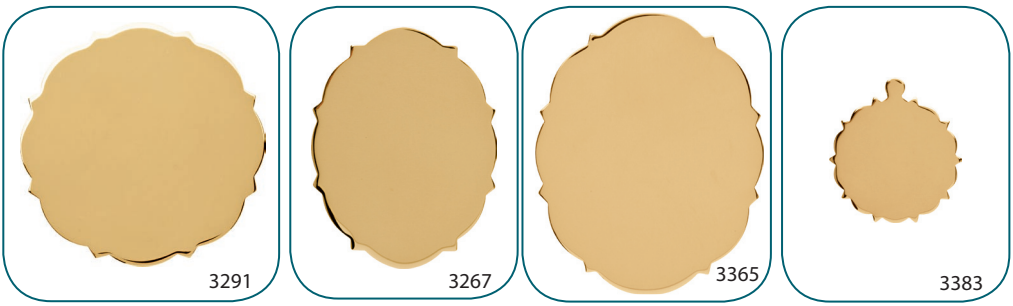
SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
<b>3332•</b>	6.75 x 6.75	0.09	\$ 5.15
<b>3321</b>	7.5 x 5.5	0.19	\$ 10.04
<b>3323</b>	10 x 9.25	0.42	\$ 20.36
<b>3346</b>	12.75 x 13.25	0.84	\$ 40.17
<b>3325</b>	18.25 x 18.75	1.72	\$ 80.62
<b>3315</b>	20 x 19.25	1.86	\$ 86.79
<b>3340</b>	21.5 x 20.5	2.18	\$ 101.51
<b>3344</b>	26 x 24.25	3.12	\$ 145.27
<b>3334</b>	30.75 x 31	4.54	\$ 210.44
<b>3339</b>	33.75 x 31	5.21	\$ 232.44
<b>3328</b>	36.75 x 36	6.52	\$ 290.49
<b>3327</b>	40 x 39.5	7.62	\$ 339.18



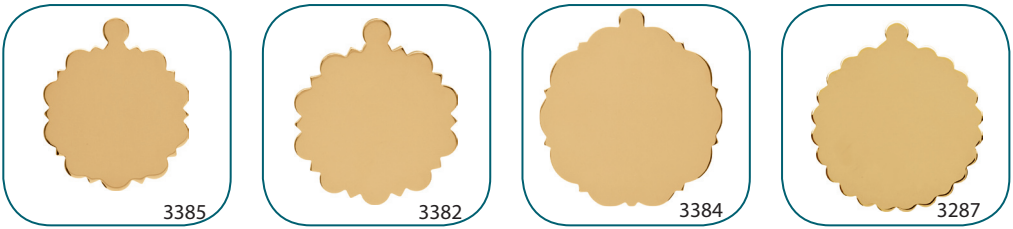
• available in 30 gauge only

**Note: Some stampings are shown enlarged to show detail.**

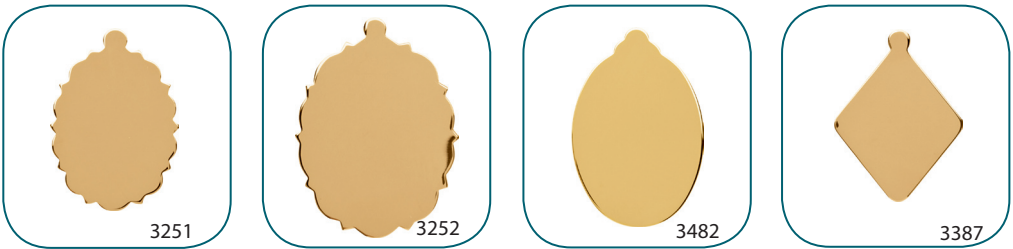
LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



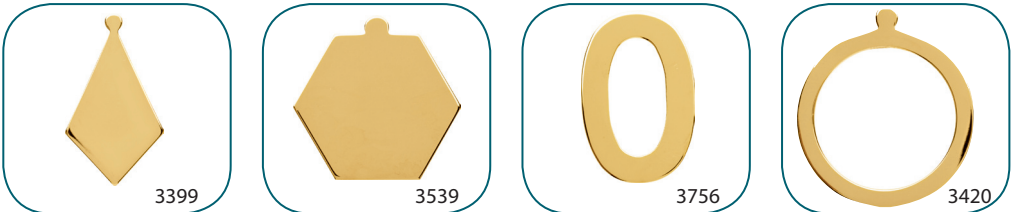
SERIES NO.	3291	3267	3365	3383
DIMENSIONS (MM)	32.25	32 x 24.5	37.25 x 30.75	19.25
DWT	5.09	3.95	5.69	1.75
PRICE EA.	<b>\$227.18</b>	<b>\$183.11</b>	<b>\$253.64</b>	<b>\$81.88</b>



SERIES NO.	3385	3382	3384	3287
DIMENSIONS (MM)	21.25	21.5	26.25	25.25
DWT	2.38	2.39	3.61	3.33
PRICE EA.	<b>\$110.86</b>	<b>\$111.59</b>	<b>\$167.44</b>	<b>\$154.53</b>



SERIES NO.	3251	3252	3482	3387
DIMENSIONS (MM)	24 x 19	29 x 23.5	26.25 x 19.5	22.75 x 19.25
DWT	2.31	3.42	2.85	1.74
PRICE EA.	<b>\$107.90</b>	<b>\$158.75</b>	<b>\$132.48</b>	<b>\$81.31</b>



SERIES NO.	3399	3539	3756	3420
DIMENSIONS (MM)	22.75 x 14.25	21.75 x 24.75	22.5 x 14.75 OD 15.75 x 7.5 ID	23.5 OD 18.5 ID
DWT	1.19	2.81	1.12	1.14
PRICE EA.	<b>\$56.03</b>	<b>\$130.63</b>	<b>\$52.79</b>	<b>\$53.89</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



3419



3253



3372

SERIES NO.	3419	3253	3372
DIMENSIONS (MM)	21.5 OD 13.0 ID	24.5 x 19.5 OD 16 x 11 ID	37.5 x 31.25 OD 26.5 x 19.75 ID
DWT	1.83	1.62	3.48
PRICE EA.	<b>\$85.74</b>	<b>\$75.87</b>	<b>\$161.84</b>



3732



3733



3735



3731

SERIES NO.	3732	3733	3735	3731
DIMENSIONS (MM)	14.5 x 12.5	15.25 x 14	15.5 x 14	18.25 x 14.75
DWT	0.95	1.04	1.35	1.49
PRICE EA.	<b>\$44.96</b>	<b>\$49.37</b>	<b>\$63.69</b>	<b>\$69.89</b>



3734



3742



3736



3739

SERIES NO.	3734	3742	3736	3739
DIMENSIONS (MM)	18.75 x 17.5	21 x 17.75	21.75 x 19.25	21.25 x 19.25
DWT	1.54	1.98	2.05	2.21
PRICE EA.	<b>\$72.02</b>	<b>\$92.31</b>	<b>\$95.68</b>	<b>\$103.22</b>



3737



3787



3738



3730

SERIES NO.	3737	3787	3738	3730
DIMENSIONS (MM)	22.5 x 20	14 x 12.5	21.5 x 21	22.75 x 18.75
DWT	2.32	0.94	2.78	2.22
PRICE EA.	<b>\$108.28</b>	<b>\$44.68</b>	<b>\$129.30</b>	<b>\$103.74</b>

**Note: Some stampings are shown enlarged to show detail.**

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SERIES NO.	3160	3161	3806	3807
DIMENSIONS (MM)	30 x 20	31 x 20.5	22.5 x 15.5	22.75 x 17.75
DWT	2.83	2.61	1.62	1.76
PRICE EA.	<b>\$131.86</b>	<b>\$121.35</b>	<b>\$75.81</b>	<b>\$82.20</b>



SERIES NO.	3710	3709	3713	3656
DIMENSIONS (MM)	24.25 x 11.25	24.5 x 13.75	18.25 x 15.25	22.75 x 20.75
DWT	1.32	1.54	1.20	2.36
PRICE EA.	<b>\$61.86</b>	<b>\$72.13</b>	<b>\$56.61</b>	<b>\$110.00</b>



SERIES NO.	3829	3655	3651	3823
DIMENSIONS (MM)	24 x 6.5	18.5 x 9.25	22.25 x 13.75	23.25 x 17.75
DWT	1.98	0.86	1.11	1.81
PRICE EA.	<b>\$92.29</b>	<b>\$40.83</b>	<b>\$52.26</b>	<b>\$84.45</b>



SERIES NO.	3865	3727	3722	3721
DIMENSIONS (MM)	23.5 x 21	14 x 14	18 x 17.75	21.75 x 21.75
DWT	1.29	0.44	1.03	1.79
PRICE EA.	<b>\$60.77</b>	<b>\$21.60</b>	<b>\$48.92</b>	<b>\$83.85</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



3137



3719



3146



3136

SERIES NO.	3137	3719	3146	3136
DIMENSIONS (MM)	12 x 7.5	11.5 x 8	19 x 15	22 x 13
DWT	0.19	0.21	0.56	0.50
PRICE EA.	<b>\$9.76</b>	<b>\$10.83</b>	<b>\$27.08</b>	<b>\$24.35</b>



3145



3135



3723



3621

SERIES NO.	3145	3135	3723	3621
DIMENSIONS (MM)	25.5 x 15.5	30 x 18	7 x 6.5	8 x 7.25
DWT	0.75	0.93	0.15	0.19
PRICE EA.	<b>\$35.95</b>	<b>\$43.99</b>	<b>\$8.04</b>	<b>\$10.04</b>



3725



3726



3744



3745

SERIES NO.	3725	3726	3744	3745
DIMENSIONS (MM)	12.25 x 5.75	25.75 x 11	6.25 x 6.5	6.5 x 6.75
DWT	0.21	0.59	0.12	0.13
PRICE EA.	<b>\$10.68</b>	<b>\$28.55</b>	<b>\$6.58</b>	<b>\$6.99</b>



3743



3747



3157



3360

SERIES NO.	3743	3747	3157	3360
DIMENSIONS (MM)	10 x 10.25	18.25 x 19	40.5 x 35.5	13.75 x 9.75
DWT	0.27	0.87	2.81	0.51
PRICE EA.	<b>\$13.45</b>	<b>\$41.36</b>	<b>\$130.61</b>	<b>\$24.51</b>

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3361



3359



3818



3771

SERIES NO.	3361	3359	3818	3771
DIMENSIONS (MM)	10.5 x 5.5	10 x 5.25	11.25 x 7	15.75 x 13.25
DWT	0.12	0.15	0.23	0.56
PRICE EA.	<b>\$6.53</b>	<b>\$7.92</b>	<b>\$11.60</b>	<b>\$27.00</b>



3770



3362



3649



3199

SERIES NO.	3770	3362	3649	3199
DIMENSIONS (MM)	20.25 x 16.75	28 x 23	19.75 x 13.25	7.5 x 7.5
DWT	0.70	1.59	0.76	0.38
PRICE EA.	<b>\$33.27</b>	<b>\$74.31</b>	<b>\$36.23</b>	<b>\$18.52</b>



3331



3804



3306



3312

SERIES NO.	3331	3804	3306	3312
DIMENSIONS (MM)	8 x 18	13.5 x 17.5	11 x 9.75	17.75 x 18.5
DWT	0.73	0.93	0.59	1.43
PRICE EA.	<b>\$35.02</b>	<b>\$43.88</b>	<b>\$28.51</b>	<b>\$66.93</b>



3336



3329



3320



3311

SERIES NO.	3336	3329	3320	3311
DIMENSIONS (MM)	18.25 x 18.75	16.5 x 12.5	17 x 11	18.75 x 18
DWT	1.79	0.89	0.86	0.73
PRICE EA.	<b>\$83.86</b>	<b>\$42.22</b>	<b>\$38.88</b>	<b>\$35.08</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12





3318



3317



3779



3310

SERIES NO.	3318	3317	3779	3310
DIMENSIONS (MM)	21.75 x 20.5 OD	21 x 19.5 OD	22 x 22	25 x 24
	16.25 x 15.5 ID	11.25 x 11.25 ID		
DWT	1.02	1.39	0.97	2.82
PRICE EA.	<b>\$48.43</b>	<b>\$65.47</b>	<b>\$45.95</b>	<b>\$131.13</b>



3309



3338



3809



3810

SERIES NO.	3309	3338	3809	3810
DIMENSIONS (MM)	28.5 x 27.5	22.25 x 22	19.25 x 17.25	20 x 17
DWT	3.72	2.24	1.27	1.04
PRICE EA.	<b>\$172.54</b>	<b>\$104.58</b>	<b>\$59.94</b>	<b>\$49.01</b>



3826



3821



3802



3887

SERIES NO.	3826	3821	3802	3887
DIMENSIONS (MM)	19.75 x 18.75	21.25 x 18.5	8 x 18	23 x 20.25
DWT	2.44	1.96	0.71	0.51
PRICE EA.	<b>\$113.49</b>	<b>\$91.73</b>	<b>\$33.73</b>	<b>\$24.51</b>



3890



3761



3596



3595

SERIES NO.	3890	3761	3596	3595
DIMENSIONS (MM)	22.5 x 19.5	10 x 5.75	6.5 x 5.5	8 x 8
DWT	0.71	0.12	0.12	0.28
PRICE EA.	<b>\$33.96</b>	<b>\$6.76</b>	<b>\$6.53</b>	<b>\$13.91</b>

**Note: Some stampings are shown enlarged to show detail.**

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3594



3592



3586



3587

SERIES NO.	3594	3592	3586	3587
DIMENSIONS (MM)	11.75 x 12.25	19.25 x 19	24 x 22.5	33.25 x 31
DWT	0.68	0.76	1.43	2.43
PRICE EA.	<b>\$32.49</b>	<b>\$36.27</b>	<b>\$66.93</b>	<b>\$113.34</b>



3851



3897



3618



3356

SERIES NO.	3851	3897	3618	3356
DIMENSIONS (MM)	18.25 x 16.5	15.5 x 16	11.25 x 13.25	13 x 11.25
DWT	1.25	1.06	0.75	0.66
PRICE EA.	<b>\$58.90</b>	<b>\$45.80</b>	<b>\$35.95</b>	<b>\$31.43</b>



3269



3560



3861



3755

SERIES NO.	3269	3560	3861	3755
DIMENSIONS (MM)	12.25 x 12.5	22 x 17	12.75 x 9.75	17.75
DWT	0.68	1.47	0.43	0.93
PRICE EA.	<b>\$32.74</b>	<b>\$69.13</b>	<b>\$20.82</b>	<b>\$44.22</b>



3817



3812



3631



3757

SERIES NO.	3817	3812	3631	3757
DIMENSIONS (MM)	14.75 x 12.25	14.75 x 17	23.75 x 32	18 x 16.5
DWT	0.78	0.72	2.23	2.10
PRICE EA.	<b>\$37.42</b>	<b>\$34.41</b>	<b>\$104.18</b>	<b>\$97.90</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



SERIES NO.	3758	3638	3637	3824
DIMENSIONS (MM)	22 x 16.5	22.25 x 14.5	22.25 x 14.25	22.5 x 19.75
DWT	1.10	1.39	1.41	2.06
PRICE EA.	<b>\$52.14</b>	<b>\$65.14</b>	<b>\$66.01</b>	<b>\$96.04</b>



SERIES NO.	3652	3859	3232	3822
DIMENSIONS (MM)	14.25 x 13.75	13.75 x 9	6.5 x 8.5	12.75 x 5
DWT	0.91	0.49	0.05	0.19
PRICE EA.	<b>\$43.31</b>	<b>\$23.59</b>	<b>\$3.31</b>	<b>\$9.76</b>



SERIES NO.	3230	3237	3819	3229
DIMENSIONS (MM)	10 x 7	10.5 x 6.5	22.5 x 8.5	21.5 x 10
DWT	0.29	0.11	0.65	0.97
PRICE EA.	<b>\$14.54</b>	<b>\$6.07</b>	<b>\$30.97</b>	<b>\$45.77</b>



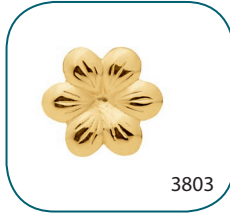
SERIES NO.	3608	3620	3300	3220
DIMENSIONS (MM)	17.5 x 12	8.75 x 9.5	9.75 x 9.25	13.25 x 7.75
DWT	0.72	0.41	0.27	0.08
PRICE EA.	<b>\$34.19</b>	<b>\$19.98</b>	<b>\$13.68</b>	<b>\$4.80</b>

**Note: Some stampings are shown enlarged to show detail.**

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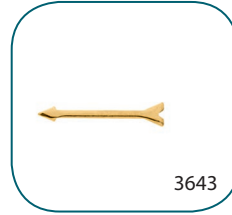
3201



3803



3849



3643

SERIES NO.	3201	3803	3849	3643
DIMENSIONS (MM)	9.25 x 9	10.75	16 x 19.5	2.5 x 13
DWT	0.47	0.17	0.53	.08
PRICE EA.	<b>\$22.72</b>	<b>\$8.84</b>	<b>\$25.44</b>	<b>\$4.69</b>



3213



3706



3875



3697

SERIES NO.	3213	3706	3875	3697
DIMENSIONS (MM)	8.25 x 13.5	7.75 x 7.5	8.75 x 8.75	10 x 12.75
DWT	0.33	0.15	0.29	0.86
PRICE EA.	<b>\$16.44</b>	<b>\$8.26</b>	<b>\$14.44</b>	<b>\$40.81</b>



3705



3702



3700



3838

SERIES NO.	3705	3702	3700	3838
DIMENSIONS (MM)	18 x 17	16.25 x 20.75	16.25 x 18.75	8 x 16
DWT	1.22	1.29	1.47	0.73
PRICE EA.	<b>\$57.61</b>	<b>\$60.80</b>	<b>\$68.96</b>	<b>\$34.66</b>



3805



3855



3870



3853

SERIES NO.	3805	3855	3870	3853
DIMENSIONS (MM)	10.75 x 17.5	14.75 x 18.75	9.5 x 17.75	16.25 x 18.75
DWT	0.64	1.12	0.55	0.91
PRICE EA.	<b>\$30.58</b>	<b>\$52.95</b>	<b>\$26.59</b>	<b>\$43.11</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



3842



3898



3830



3832

SERIES NO.	3842	3898	3830	3832
DIMENSIONS (MM)	13.5 x 19.25	32.75 x 12.25	22.75 x 19.25	22.75 x 19.25
DWT	2.05	0.77	2.01	2.01
PRICE EA.	<b>\$95.77</b>	<b>\$36.89</b>	<b>\$93.90</b>	<b>\$93.72</b>



3831



3862



3660



3353

SERIES NO.	3831	3862	3660	3353
DIMENSIONS (MM)	22.75 x 19.25	28.5 x 25.5	27.5 x 22	12.75 x 11
DWT	2.0	3.37	0.48	0.25
PRICE EA.	<b>\$93.42</b>	<b>\$156.78</b>	<b>\$23.34</b>	<b>\$12.53</b>



3257



3813



3261



3218

SERIES NO.	3257	3813	3261	3218
DIMENSIONS (MM)	14.5 x 9.75	15.25 x 12.5	4.75	8.5 x 3.75
DWT	0.49	0.58	0.05	0.20
PRICE EA.	<b>\$23.87</b>	<b>\$27.84</b>	<b>\$3.31</b>	<b>\$10.60</b>



3663



3184



3166



3165

SERIES NO.	3663	3184	3166	3165
DIMENSIONS (MM)	6 x 4.5	6 x 6	6.5	5.5 x 5.5
DWT	0.11	0.13	0.15	0.17
PRICE EA.	<b>\$6.07</b>	<b>\$7.34</b>	<b>\$8.24</b>	<b>\$8.99</b>

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3632



3601



3674



3598

SERIES NO.	3632	3601	3674	3598
DIMENSIONS (MM)	5 x 6.75	5.75 x 5.75	7.75 x 6	6.0
DWT	0.14	0.14	0.14	0.17
PRICE EA.	<b>\$7.45</b>	<b>\$7.45</b>	<b>\$7.45</b>	<b>\$8.84</b>



3814



3192



3597



3606

SERIES NO.	3814	3192	3597	3606
DIMENSIONS (MM)	17.75 x 6.5	10 x 15.5	6.25 x 10	16.25 x 3.5
DWT	0.34	0.29	0.21	0.24
PRICE EA.	<b>\$16.83</b>	<b>\$14.37</b>	<b>\$10.68</b>	<b>\$12.06</b>



3607



3169



3600



3667

SERIES NO.	3607	3169	3600	3667
DIMENSIONS (MM)	17 x 3.75	18 x 3.5	19 x 5.25	15 x 8.25
DWT	0.20	0.32	0.24	0.27
PRICE EA.	<b>\$10.22</b>	<b>\$16.03</b>	<b>\$12.06</b>	<b>\$13.45</b>



3170



3837



3215



3880

SERIES NO.	3170	3837	3215	3880
DIMENSIONS (MM)	11.5 x 4	20.75 x 2.75	15.75 x 5.5	13 x 9
DWT	0.22	0.20	0.30	0.24
PRICE EA.	<b>\$11.26</b>	<b>\$10.23</b>	<b>\$14.83</b>	<b>\$12.30</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12



3879



3888



3889



3877

SERIES NO.	3879	3888	3889	3877
DIMENSIONS (MM)	12.5 x 9	18 x 9.25	17.5 x 9.25	17.5 x 11
DWT	0.24	0.29	0.29	0.46
PRICE EA.	<b>\$12.06</b>	<b>\$14.37</b>	<b>\$14.37</b>	<b>\$22.44</b>



3850



3878



3894



3893

SERIES NO.	3850	3878	3894	3893
DIMENSIONS (MM)	18.5 x 12.25	17.5 x 11	18 x 11.25	17.75 x 11.25
DWT	1.14	0.68	0.55	0.55
PRICE EA.	<b>\$53.56</b>	<b>\$32.54</b>	<b>\$26.36</b>	<b>\$26.63</b>



3883



3884



3886



3885

SERIES NO.	3883	3884	3886	3885
DIMENSIONS (MM)	13.5 x 13.25	13.25	16 x 15.75	15.75
DWT	0.48	0.48	0.68	0.66
PRICE EA.	<b>\$23.19</b>	<b>\$23.43</b>	<b>\$32.35</b>	<b>\$31.73</b>



3882

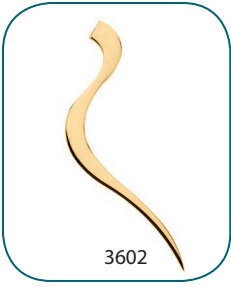


3881

SERIES NO.	3882	3881
DIMENSIONS (MM)	14 x 12	14 x 12
DWT	0.53	0.54
PRICE EA.	<b>\$25.59</b>	<b>\$25.90</b>

**Note: Some stampings are shown enlarged to show detail.**

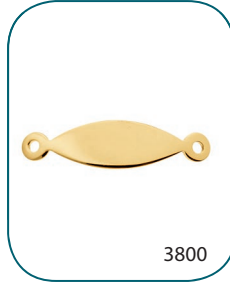
LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



3602



3544



3800



3801

SERIES NO.	3602	3544	3800	3801
DIMENSIONS (MM)	37.25 x 11.5	26.5 x 20	24.25 x 16.25	6.25 x 12.5
DWT	0.58	2.76	0.25	0.47
PRICE EA.	<b>\$27.94</b>	<b>\$128.25</b>	<b>\$12.53</b>	<b>\$22.93</b>



3892

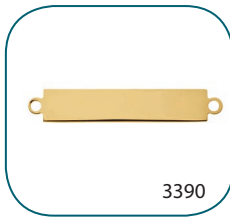


3891



3296

SERIES NO.	3892	3891	3296
DIMENSIONS (MM)	10.25 x 20.5	8.25 x 23.75	9.25 x 20.25
DWT	0.46	0.43	0.28
PRICE EA.	<b>\$22.21</b>	<b>\$21.06</b>	<b>\$14.35</b>



3390



3397



3396

SERIES NO.	3390	3397	3396
DIMENSIONS (MM)	5.25 x 24.5	5.25 x 33	7 x 39
DWT	0.89	1.21	1.87
PRICE EA.	<b>\$42.10</b>	<b>\$57.11</b>	<b>\$87.48</b>



3297



3398



3133



3393

SERIES NO.	3297	3398	3133	3393
DIMENSIONS (MM)	6.25 x 19.25	7.25 x 17.5	8 x 23	9 x 20.5
DWT	0.24	0.75	0.93	0.83
PRICE EA.	<b>\$12.06</b>	<b>\$35.81</b>	<b>\$43.88</b>	<b>\$39.50</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12

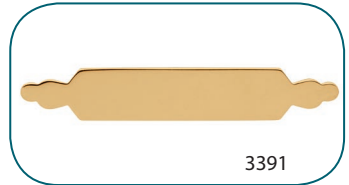




3134

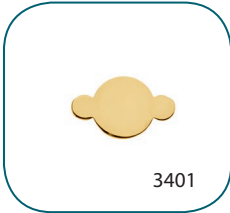


3295



3391

SERIES NO.	3134	3295	3391
DIMENSIONS (MM)	12 x 22	7.25 x 36.25	6.75 x 39
DWT	1.35	1.27	1.44
PRICE EA.	<b>\$63.63</b>	<b>\$59.62</b>	<b>\$67.56</b>



3401



3183

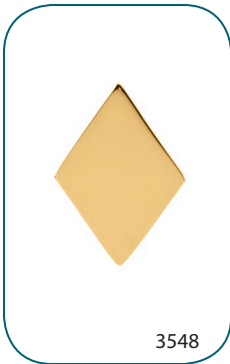


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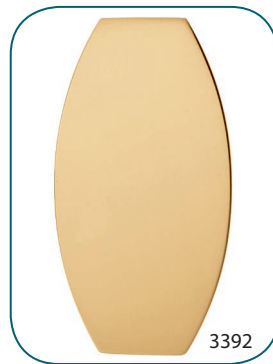


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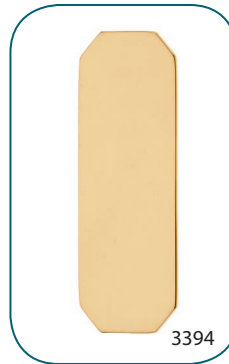
SERIES NO.	3401	3183	3746	3345
DIMENSIONS (MM)	5.25	12.00	12 x 12.25	8.25 x 9.5
DWT	0.06	0.74	0.47	0.17
PRICE EA.	<b>\$3.77</b>	<b>\$35.42</b>	<b>\$23.09</b>	<b>\$9.25</b>



3548



3392



3394



3400

SERIES NO.	3548	3392	3394	3400
DIMENSIONS (MM)	27.75 x 18	34.5 x 18.5	37.25 x 13	39.5 x 18.5
DWT	1.68	3.61	3.04	4.22
PRICE EA.	<b>\$77.81</b>	<b>\$167.50</b>	<b>\$141.52</b>	<b>\$195.56</b>



3279



3168



3542

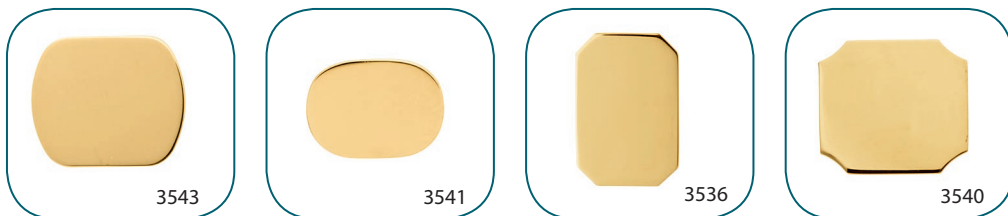


3178

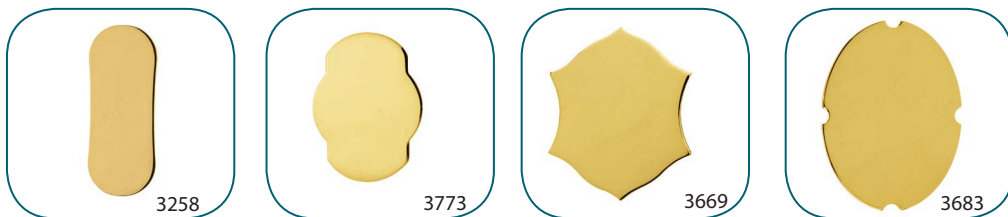
SERIES NO.	3279	3168	3542	3178
DIMENSIONS (MM)	9 x 6.75	13 x 5.5	11.75 x 11.75	12.5 x 13
DWT	0.26	0.35	0.83	1.03
PRICE EA.	<b>\$13.05</b>	<b>\$17.25</b>	<b>\$39.37</b>	<b>\$48.87</b>

**Note: Some stampings are shown enlarged to show detail.**

LEAD TIMES 10kt yellow, 14kt yellow & white, and 18kt yellow will ship same day in most cases. Backorders will ship the following day. All other metal qualities will ship the following day in most cases. Same day shipping subject to order specifications and inventory on hand at time of order. Additional charges may apply to odd quantities.



SERIES NO.	3543	3541	3536	3540
DIMENSIONS (MM)	19.5 x 16.25	15 x 11	19 x 12.75	17.5 x 16
DWT	1.84	0.93	1.53	1.70
PRICE EA.	<b>\$85.95</b>	<b>\$44.28</b>	<b>\$71.57</b>	<b>\$79.78</b>



SERIES NO.	3258	3773	3669	3683
DIMENSIONS (MM)	16.5 x 6.75	20.25 x 15	24.25 x 20.25	26.5 x 20
DWT	.69	1.53	2.31	2.87
PRICE EA.	<b>\$33.17</b>	<b>\$71.74</b>	<b>\$107.50</b>	<b>\$133.62</b>



SERIES NO.	3224	3282	3283	3286
DIMENSIONS (MM)	4.75	7.5	9.25	12.25
DWT	0.12	.40	.44	0.82
PRICE EA.	<b>\$6.53</b>	<b>\$19.44</b>	<b>\$21.70</b>	<b>\$38.81</b>



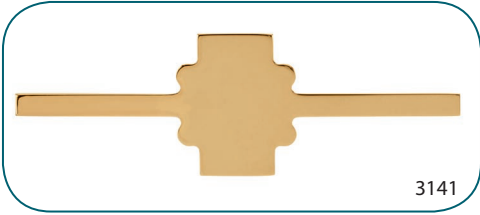
SERIES NO.	3210	3364	3363
DIMENSIONS (MM)	12.5	14.5 x 12.5	19.5 x 15.25
DWT	0.50	0.91	1.52
PRICE EA.	<b>\$24.42</b>	<b>\$43.36</b>	<b>\$71.37</b>

Note: Prices are jeweler's cost. Based on \$1,000 gold.

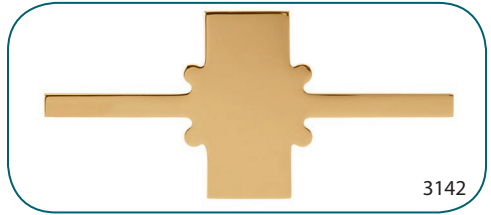
Gold Market: \$1000  
Iridium \$425

Platinum Market: \$1100  
Ruthenium Market: \$80

Palladium Market: \$225  
Silver \$12

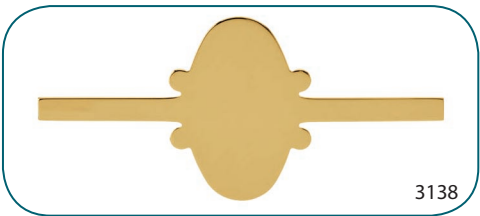


3141

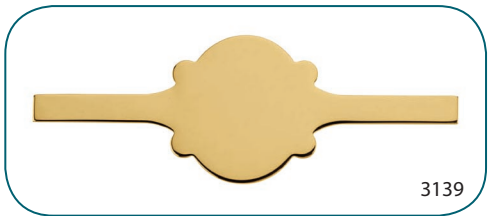


3142

SERIES NO.	3141	3142
DIMENSIONS (MM)	20.5 x 11	29 x 13
DWT	3.01	4.07
PRICE EA.	<b>\$140.20</b>	<b>\$188.92</b>

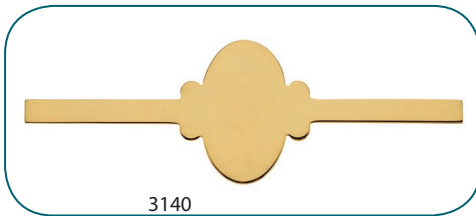


3138



3139

SERIES NO.	3138	3139
DIMENSIONS (MM)	29 x 16	21 x 14
DWT	4.06	3.20
PRICE EA.	<b>\$188.31</b>	<b>\$148.81</b>



3140

SERIES NO.	3140
DIMENSIONS (MM)	21 x 11
DWT	2.74
PRICE EA.	<b>\$127.35</b>



3904



3903

## Personalized Dog Tags

----- An Expression of You -----

Often a celebration of love and commitment is expressed with a gift of fine jewelry. So, how do we remember the past and commemorate it? Blank Dog Tags are used as a template to give tribute to the past or seen as a celebration of love and commitment!



3902

SERIES NO.	DIMENSIONS (MM)	DWT	PRICE EA.
<b>3395</b>	28.75 x 50.75	8.94	\$397.85
<b>3902</b> ✱	28.75 x 50.75	8.62	\$383.43
<b>3903</b>	28.75 x 50.75	8.77	\$390.36
<b>3904</b> ✱	28.75 x 50.75	8.62	\$383.43

✱ Available in Sterling Silver.

FOUR STYLES AVAILABLE: 14KY, 14KW, 10KY, 10KW, 18KY, and 18KW. (14 ga and 20 ga only)



3395

## Display YOUR Way

### Myth:

*Beautiful customized color displays take a long time to get and they're expensive.*

### Truth:

- You can have them in your showcases in 6 weeks after design approval
- Minimum order of \$600 per color/fabric.
- You can see what they would look like in your showcase BEFORE you spend a dime!

### How can this be?

#### With Case by Case™ from Stuller!

#### Our Technology:

- New, computerized technology allows you to see it before you buy it.
- Preconfigured or customized designs available based on showcase size (3', 4', 5' or 6') at 3 different price levels.
- You can tell us how many rings, pendants and earrings you would like to have in the case, and we can render the possibilities for you.

#### Your Choices:

- 3 design styles: Cologne, Contour & Designer
- More than 50 colors/fabrics; more than 200 display ideas



To brand your store with personalized showcase presentations, send a picture of your showcase(s) to our Personalized Showcase Planners: Sandi Segura at sandi\_segura@stuller.com, or Trissy Boutin at trissy\_boutin@stuller.com.

## STERLING SILVER ROUND STAMPINGS (22 GAUGE)

Sterling Silver round stampings are available in a 22 gauge thickness and are supplied in pre-determined package quantities. The quantity of discs in each package varies according to the diameter and weight of each disc. Package quantity and approximate costs for all sizes are listed in the table below.



SERIES NUMBER	DIAMETER		THICKNESS	DWT PER CIRCLE	QUANTITY PER PACK	WEIGHT (DWT) PER PACK	APPROX COST PER PACK @ \$12 SILVER
	INCHES	MM					
3402	¼	6.35	22 ga (.025")	0.14	75	10.17	\$13.14
3789	⅝	7.94	22 ga (.025")	0.21	50	10.59	\$13.69
3404	⅜	9.53	22 ga (.025")	0.31	35	10.68	\$13.80
3405	7/16	11.11	22 ga (.025")	0.42	25	10.38	\$13.41
3790	½	12.70	22 ga (.025")	0.54	20	10.85	\$14.02
3407	9/16	14.29	22 ga (.025")	0.69	15	10.30	\$13.31
3408	⅝	15.88	22 ga (.025")	0.85	12	10.17	\$13.14
3410	¾	19.05	22 ga (.025")	1.22	8	9.76	\$12.61
3412	7/8	22.23	22 ga (.025")	1.66	6	9.97	\$12.88
3414	1	25.40	22 ga (.025")	2.17	5	10.85	\$14.02
3792	1⅛	28.58	22 ga (.025")	2.75	4	10.98	\$14.19
3793	1¼	31.75	22 ga (.025")	3.39	3	10.17	\$13.14
3795	1⅜	34.93	22 ga (.025")	4.10	3	12.31	\$15.91
3417	1½	38.10	22 ga (.025")	4.88	2	9.76	\$12.61
3418	1⅝	41.28	22 ga (.025")	5.73	2	11.46	\$14.81
3796	1¾	44.45	22 ga (.025")	6.64	2	13.29	\$17.17
3797	1⅞	47.63	22 ga (.025")	7.63	2	15.26	\$19.72
3100	2	50.80	22 ga (.025")	8.68	2	17.36	\$22.43
3798	2¼	57.15	22 ga (.025")	10.98	1	10.98	\$14.19
3799	2½	63.50	22 ga (.025")	13.56	1	13.56	\$17.52

**Note: Other stampings are available in sterling silver upon special request. Special request orders do require a minimum order quantity.**



# METAZA MPX-80

## PHOTO IMPACT PRINTER

The MPX-80 is Roland's most advanced impact printer to date, with faster speed, higher resolution and the ability to imprint on curved surfaces.

The MPX-80 quickly turns ordinary gifts and promotional items into cherished mementos and takes it even further by customizing curved objects like pens, cuff links and money clips.

The MPX-80 Impact printer can add impact to business events with unique personalized gifts.



### Three easy steps to imprinting with METAZA

**DESIGN**

**SECURE ITEM IN PLACE**

**PRESS PRINT**

- A Complete Creative Solution

The MPX-80 is a complete solution that comes with everything required to start and run a successful business. Included easy-to-use design software accepts artwork, design and photos from a variety of sources including digital cameras, mobile phones, jpg, or bmp files, and common design files such as Adobe ai and eps<sup>1</sup>.

- No Special Training Required

The MPX-80 is incredibly easy to operate, even without any professional engraving experience. Simply plug in your USB cable and you're ready to begin. The sleek desktop design fits perfectly in any jewelry store, mall kiosk or photography studio.

- Fast and Convenient

The MPX-80 works quickly so your customers don't have to wait. 30% faster than a traditional engraver, the MPX-80 imprinted this bookmark with 2mm text in well under a minute<sup>2</sup>.



<sup>2</sup> Test conducted by Roland DG.

Roland Photo Impact Printer quickly and easily adds text, photos, logos and illustrations to a wide variety of items from souvenirs and plaques to charms and pendants. Their advanced cartridge strikes metal surfaces<sup>3</sup> with high speed and precision, leaving durable photographic impressions of your original design. They remove no material and operate quietly, making it ideal for jewelry stores, mall kiosks and stationary stores.

The MPX-80 imprint on a variety of materials including platinum, gold, silver, brass, stainless steel, aluminum and acrylic. Some shapes can not be imprinted.



# TECHNICAL INFORMATION

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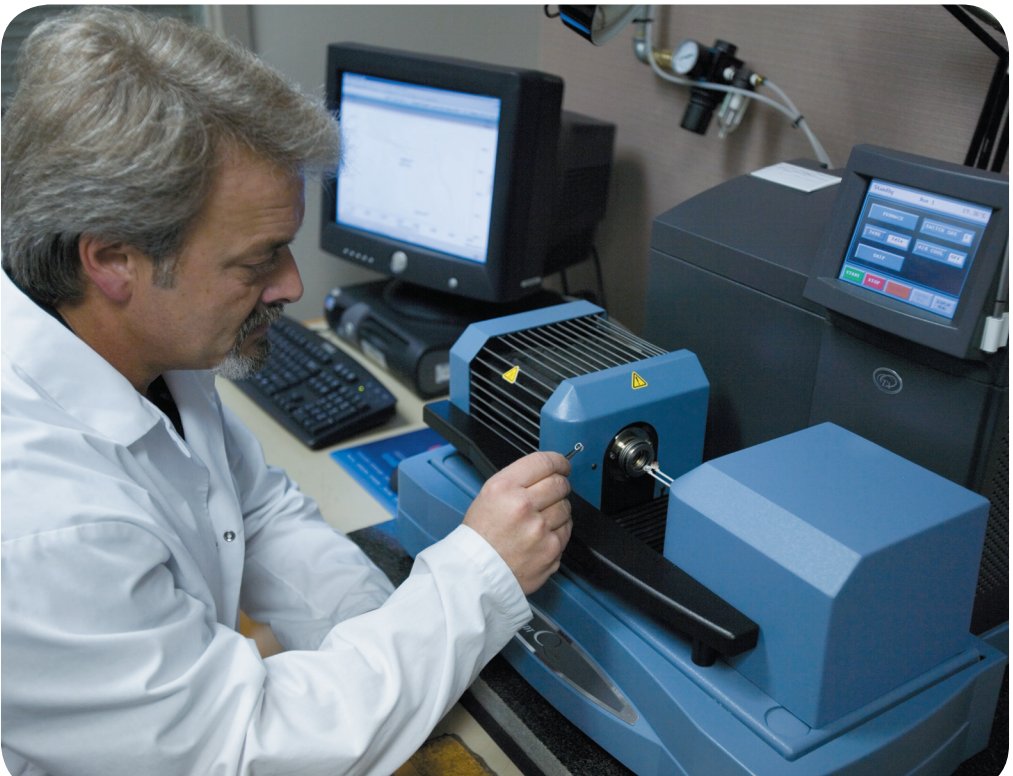
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## FOREWORD

This technical section is an effort to help the user understand the characteristics and properties of various precious metals and to provide helpful tips and instructions on the use of specific precious metal alloys.

With well over 100 years of combined experience in jewelry fabrication and precious metal processing and development, Stuller's Metals Technology Division has prepared the following material to guide the precious metals user to a deeper understanding of precious metal alloys that are commonly used in today's world to produce fine jewelry. Information about alloys and processes have been selected and presented in terms of the basic principles that apply to specific applications.

As is always the case, the technical staff at Stuller is available to consult with customers regarding any problems and issues that they might wish to discuss.





## HOW WHITE IS WHITE GOLD?

Guidelines to define Color of White Gold announced by MJSA and World Gold Council!

The White Gold Task Force, an initiative of MJSA and the World Gold Council set guidelines to define the color of White Gold in March 2005. These are voluntary USA Industry Guidelines that were widely adopted internationally (and which may lead to an ISO standard).

The lack of an industry-accepted definition of white as applied to white gold has been a problem in the industry where rhodium plating of white gold has become common, thus hiding the real color of the white gold from the consumer at the time of purchase. Rhodium plating of white gold is legal in most countries. For good technical and economic reasons, the term 'white' has been used elastically to encompass a wide range of color, and this has led to consumer dissatisfaction.

The technical issues surrounding white gold were discussed at a Round Table meeting at EXPO NY in March 2003 resulting in a consensus for action by US industry participants.

The MJSA and World Gold Council set up the White Gold Task Force to define white as a color in white golds. Finding a user-friendly procedure to determine the degree of whiteness of a particular piece of white gold jewelry has been the challenge.

Color, of course, can be measured quantitatively in a reproducible way. The conditions of measurement, especially the incidental lighting, are important. Generally a 'Northern Daylight' illumination is preferred. The degree of whiteness of a white gold can be described in terms of a numerical parameter called the ASTM Yellowness Index: 1925 and is calculated from the basic tri-stimulus values, X, Y & Z, measured with a color spectrophotometer. The lower the value, the whiter is the gold. [For more information on this parameter, see the scientific article by *Manchandra and Henderson in Gold Bulletin, volume 38 (2), June 2005* on the website, [www.goldbulletin.org](http://www.goldbulletin.org)]

### *The Guidelines: [1] Definition of White Gold*

White gold has been defined as having a Yellowness Index value of 32.0 or less.

This is additionally limited in terms of CIE Lab co-ordinates as having an L value of at least 75, and an a\* value between +3.0 and -3.5

Measurement conditions are:

Illuminant C (D65 is a close approximation), observer angle 2°, specular and ultraviolet components included. Samples polished to 6 micron finish.

Such measurements should be carried out in a light box with the correct lamp or at least under a lamp with a D65 illuminant. These are available through the MJSA or directly through Gretag MacBeth.

### *The Guidelines: [2] The Grades of White Gold*

Within the definition of the color of white gold, it is proposed that 3 grades of white gold are defined:

- GRADE 1 (Premium white grade) – these alloys have a good white color and do not need rhodium plating.
- GRADE 2 (Standard grade) – reasonable white color; rhodium plating is optional for these alloys
- GRADE 3 (Off-white color) – such alloys need to be rhodium plated

Any alloys falling outside of these three grades are classed as non-white. In terms of the Yellowness Index, these grades can be defined as follows, Table 2 Grades of white in white golds:

Grade	Yellowness Index value
Grade 1 (Premium)	< 19.0
Grade 2 (Standard)	19.0 – 24.5
Grade 3 (Off-white)	24.5 – 32.0
Non white	>32.0

### *Application of the Guidelines: The Whiteness Index*

For many retailers and manufacturers, quantitative measurement of white golds for whiteness, using a color spectrophotometer instrument is not practical or economical. This problem has been overcome by the development of The Whiteness Index, a color chart, by the Munsell laboratories of Gretag-McBeth Inc. This color chart comprises seven metal foil based samples spanning the range of Yellowness Index values covered by the three grades within the overall definition. Using the correct lighting conditions, the Whiteness Index enables a speedy and easy comparison of the whiteness of a piece of white gold against the samples, thus facilitating an estimate of which grade it is and its Yellowness Index value.

### *Application of the Guidelines: Implications for the trade*

1. It is envisaged that jewelry retailers and manufacturers will increasingly specify the grade of white when placing orders with their suppliers. At the top end of the market, there will be a preference to specify Grade 1 or possibly Grade 2 alloys in the appropriate karatage. At the lower, mass end of the market, where price is important, many will prefer to specify the off-white Grade 3 and to rhodium plate the jewelry. It is notable that many karat gold alloy suppliers are already defining their range of white golds in terms of the three grades (and the grade selected will be reflected in the price; the Grade 1 alloys will include high palladium alloys and so tend to be more expensive).
2. It should be noted that the Grades of white gold are based solely on color (whiteness) and not on alloy composition. Thus, any of the grades can include nickel-containing alloys that may not comply with the European Directive on nickel.
3. In the case of customer complaints concerning the underlying poor color of white golds, when the rhodium plating wears through, it should be easy, using the Whiteness Index, to establish if the jewelry alloy complies with the industry definition of white gold or lies outside. If outside of the definition, the retailer is vulnerable in cases of litigation. A good reason to specify the Grade when ordering jewelry from their supplier!
4. It is not envisaged that the grade of white gold used in a piece of jewelry will be disclosed to the customer. The grades are intended solely for use within the trade. However, it is an option for retailers (and manufacturers) to disclose to their customers whether the white gold jewelry is rhodium plated. This is a commercial decision! However, there is a body of opinion that failure to disclose rhodium plating could be in breach of national trade laws in many countries where there is a requirement on descriptions of products to be full and accurate.
5. For information about purchasing the Whiteness Index and/or lightboxes or lamps, contact the MJSA: e-mail: [mjsa@mjsainc.com](mailto:mjsa@mjsainc.com) or [www.mjsainc.com](http://www.mjsainc.com) ; tel: +1 401 274 3840; fax: +1 401 274 0265. Courtesy of World Gold Council ([www.gold.org](http://www.gold.org))

## HOW WHITE IS WHITE?



14K standard white gold



14K X1 white gold



.950 Platinum/Cobalt



Rhodium plated

### *The many colors of WHITE....*

Please refer to page 15 for our whiteness chart and the exceptional benefits for X1 white gold!

# THE EUROPEAN DIRECTIVE ON NICKEL IN JEWELRY

## *The European approach:*

Following unilateral action by some European Union (EU) countries, the EU decided to enact a Directive to prevent sensitized persons from suffering allergic reaction when wearing jewelry and other items that come into contact with the skin.

The important thing to note here is that the law applies to all jewelry (including costume/fashion jewelry) and other items that come into contact with the skin. Thus watches and watch straps are also embraced, as are metallic items on clothes— zips, rivets on jeans, catches on underwear, etc. It does not only apply to white gold jewelry.

## *What does the Directive cover?*

The Directive has the following requirements:

1. **Ear Posts** (including posts inserted into other parts of the body) inserted into the wound during the healing period following piercing: Prohibits the use of nickel in posts inserted into the wound during the healing period, if the concentration of nickel in the post is 0.05% wt. nickel or more. The UK guidelines suggest that other contacting surfaces of earrings are included here.
2. **Parts of jewelry and other items coming into direct and prolonged contact with the skin:**
  - a. Release of nickel above 0.5 micrograms per square centimeter per week is prohibited.
  - b. This release rate not to be exceeded for a period of at least 2 years of normal use of product.

*Note: Nickel release is defined in terms of a Standard Test for nickel release which is based on immersion in a salt solution to simulate human sweat. Interpretation of test results is also subject to some “adjustment” factor.*

## *What does it mean?*

1. For ear posts inserted into a healing wound, the law is straightforward to interpret. Effectively, NO NICKEL, whether the ear post is made from gold, steel, titanium or whatever! This applies to items that may be coated with a non-nickel coating.
2. For normal use, any jewelry or other items in direct and prolonged contact with the skin must comply with the nickel-release requirement. This affects mainly gold and costume/fashion jewelry (gold plated often has a nickel-plate underlayer).
3. For gold jewelry, we are talking mainly white golds but not exclusively so! Some yellow golds may contain some small nickel alloying additions! If mixed scrap is recycled in jewelry production, then some nickel white gold can contaminate a yellow gold melt.
4. White golds: there are essentially two types of white golds—the nickel whites and the palladium whites, but beware... some low palladium whites may contain nickel alloying additions too. Many white golds are rhodium plated to give a good white appearance. If so, the item still needs to comply with nickel-release requirements over a 2-year period. Rhodium plating will wear through!

It is possible to use (small) nickel alloying additions in golds and meet the nickel-release requirements but one cannot define a threshold nickel content below which all alloys will meet the requirement. Nickel-release rate depends on many factors, metallurgical and otherwise. One has to test and determine release rate on individual completed jewelry items to be certain it complies!

In practice, many retailers and producers are opting for complete safety by using only ‘nickel-free’ alloys. For white golds, this means switching to the more expensive palladium whites (and high-palladium alloys are usually a good white color and do not need rhodium plating).

## *Who is affected by this Directive?*

Clearly, all manufacturers, importers, wholesalers and retailers within EU countries must comply for all jewelry sold within the EU.

Reports have been received of alloys, claimed to be nickel-free, that have been analyzed and found to contain significant amounts of nickel. Ensure your alloy supplier certifies that his alloys are nickel free and meet the requirements. For countries outside of the EU: Producers in India, the Middle and Far East, who are exporting into EU countries, must comply with those products that they export into the EU. Again, reports have been received of producers in such countries who are totally unaware of the Nickel Directive and continue to export nickel white gold jewelry into Europe.

### Testing for nickel release

There are EU Standards for test procedures for measuring nickel release. Some Laboratories in Europe, such as the Birmingham and Sheffield Assay Offices in the UK, offer a commercial testing service. Birmingham also offers an accredited quality system for due diligence in meeting these laws (remember, if a product fails a test the penalties can be severe, so producers need to prove that they have good preventive procedures in place to avoid such penalties).

### Concluding comment

The EU Directive is now law in most, if not all, EU countries. In practical terms, this means that the Nickel Directive is now effectively law in all EU countries, and that all jewelry should comply. Many EU countries have produced guidelines on the interpretation of the law. For example, in the UK, the law banning nickel in posts inserted into a healing wound also applies to the skin-contacting surfaces of the adjacent parts of the earring.

## Nickel Release Testing Of Stuller White Gold Alloys

Material Tested*	Nickel Release§, µg/cm <sup>2</sup> /week
10kt X1 White	Less than 0.1
14kt White (low nickel)	Less than 0.1
14kt Standard White	Less than 0.1
14kt White for Rolling	Less than 0.1
14kt Bright White	Less than 0.1
14kt X1 White	0.1
18kt Soft White (low nickel)	Less than 0.1
18kt White	Less than 0.1
18kt White for Rolling	Less than 0.1
18kt X1 White	Less than 0.1
19kt X1 White	0.1

\* Disc samples, ground flat and polished with red rouge (6.5 microns)

§ Nickel release may vary as condition of sample can affect test results

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### Need Help?



**Call the Stuller  
Bench**

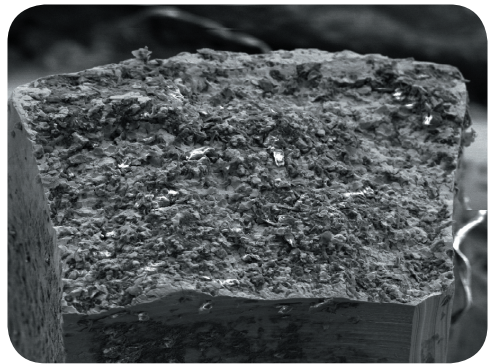
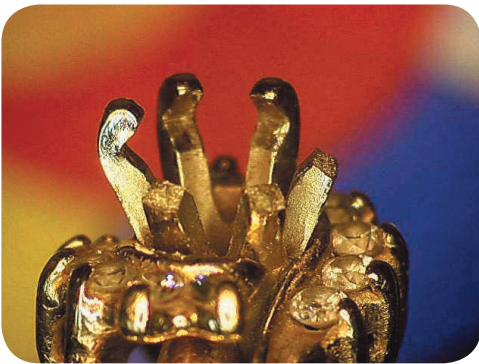
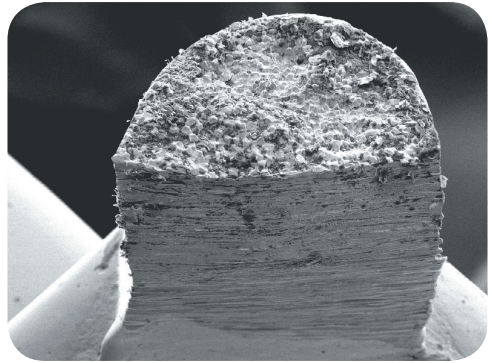
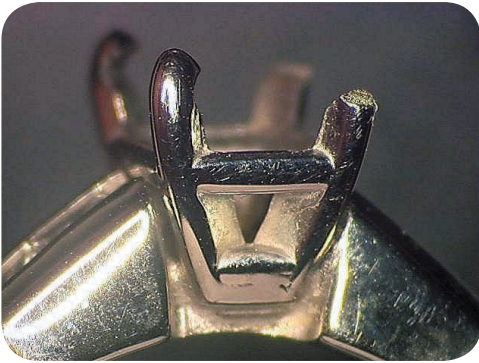
### PRODUCT SUPPORT & TECHNICAL ASSISTANCE

Product support and technical assistance are just a phone call away. Whether it is a casting problem, soldering question, or you just need help determining which alloy is best for your application, call **The Stuller Bench** at 1-800-877-7777 extension 4300. Our staff of knowledgeable professionals is available to help you succeed.

## STRESS CORROSION CRACKING AND ITS EFFECT ON KARAT GOLD ALLOYS

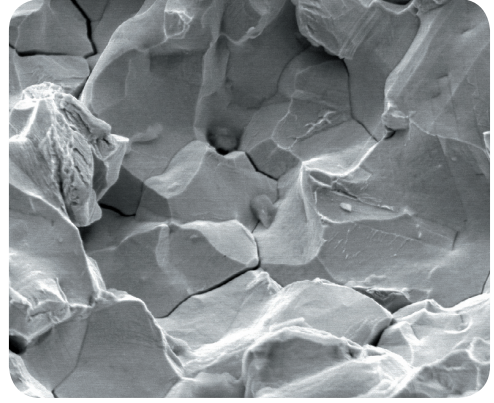
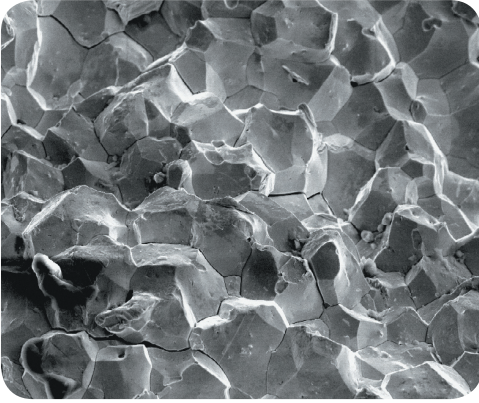
You are behind your sales counter when one of your repeat customers enters your store. One look at her immediately warns you that something is very wrong. After a short greeting, the customer produces a piece of jewelry that has missing prong tips, and, even worse, the diamond or gemstone is also missing. After a few questions and a quick visual examination, it becomes obvious that this is not the typical fracture as seen when a prong has been torn off. Closer inspection of the fracture surface reveals a grainy appearance that is very porous. The odd appearance of the fracture surface and the infrequency of this type of failure lead you to believe that the problem is “bad metal” or “bad casting.” Was the problem really due to defective metal or casting, or is there another explanation and solution? The correct answer may surprise even the most skilled and experienced craftsman.

It is not surprising to initially blame the material as the cause of fracture, but, with the use of high-powered magnification and literature that is not readily available to the craftsman, the real cause can be found. The photos below illustrate several products with a “mysterious” failure that you may have encountered during your career. The prong tips broke off with little or no indication of onset of failure. As a matter of fact, they all appear to have fractured in a brittle manner showing very little ductility.



All of the examples in the above photos illustrate that none of the failed prongs exhibit evidence of ductility around the broken prong tip or on the fracture surface. Features like “orange peel” texture or a dimpled fracture surface are always present when a ductile alloy has been broken by bending, twisting or pulling too many times. Most karat gold alloys typically used to produce jewelry are usually quite ductile. You are able to bend each of the prongs to correctly seat the stone with no obvious complications.

This lack of ductility becomes very clear when the fracture surface of the broken prong tips are viewed under high magnification using a scanning electron microscope (SEM). The black and white photos seen above are SEM images taken at lower magnifications, typically 20X to 100X. At higher magnifications, the fracture surfaces appear as shown in the SEM images on the following page.



The “rock candy” appearances of grains in these images are merely facets of grain boundaries. Each grain has separated from its neighbors along the grain boundaries it once shared with them. This is known as intergranular fracture, which is typically associated with the brittle mode of failure. The brittle fracture surface often appears specular or shiny (when it is not covered with debris) to the unaided eye. At low magnification, the intergranular fracture surface may appear porous. At higher magnification, it becomes apparent that the pockets are created by clusters of crystals being removed at multiple levels. This intergranular fracture is clear evidence of how the initially ductile gold alloys used in jewelry applications have become brittle at the notched areas of the prong tip. So, why did the prong fail in a brittle manner?

Brittle mode failure of a ductile gold alloy is not typical. The three most common causes of brittle mode failure are stress corrosion, hot tearing and contamination of the alloy.

Hot tearing typically results in intergranular failure and occurs when stress is applied to the material at elevated temperatures near its melting point. These fractures usually exhibit oxidation on the fracture surface and a “waxy” appearance on the crystal facets. Examples of hot tearing would be fractures occurring during soldering operations and fractures found on castings due to fast quenching of investment molds. If these type fractures are present in a prong they would usually become obvious when the prong was manipulated during stone setting.

Gross contamination of gold alloys can also lead to intergranular fracture. Lead is a well documented contaminant in gold alloys and levels as little as 0.01% can result in brittle failure. Alloys with gross contamination would almost never make it through stressful operations such as rolling, drawing or stone setting without suffering severe cracking.

Stress corrosion cracking (SCC) is a brittle mode failure that is well documented and has been extensively studied in all families of different engineering alloys. For example, certain types of stainless steel are known to be susceptible to SCC when exposed to chlorine or chlorine containing compounds. Copper alloys such as brass or bronze are susceptible to SCC when exposed to ammonia.

Elements that are known to promote SCC of gold jewelry alloys can be found in the halogen group. These corrosive elements include iodine, chlorine, fluorine, and bromine. For a karat gold jewelry piece to suffer SCC, two factors must be present and act simultaneously - residual stress (prong tension, etc...) and exposure to a corrosive environment. The jewelry will not fail due to SCC if either one of the components is absent.

Residual stresses remain in a metal after it is deformed. Operations such as bending, stretching, and compression are known sources of residual stresses. Increasing the level of residual stress also increases the chances of failure when exposed to a corrosive environment. Residual stress can be reduced or eliminated by either annealing or by using a low-temperature, stress-relieving, heat treatment cycle. The low-temperature treatment is preferred when stones or solder joints are involved and requires holding the jewelry at 650°F for one hour.

The detrimental effect of notching has been studied at great length in applications to structural assemblies. Notches and cuts which come to a sharp angle are undesirable due to the concentration of stress at the notch tip. There are many cases where notching is introduced to cause failure. Examples are scoring glass and sheet-rock, and timber cutting.

Care must be taken when notching a prong for stone setting. A radius helps to distribute stress over a larger area and minimizes stress concentration. Avoid manipulation of notched prong tips to prevent micro tears and rapid buildup of residual stress. Also avoid compressing notched prong tips too tightly against stones as this will increase the residual stress at the notched area of the prong by acting as a wedge.

Consideration should also be given to alloy selection to reduce chances of failure due to SCC. Platinum and gold alloys of 18K or higher are much more resistant to SCC than 14K and lower karat gold alloys. In a similar fashion, 14K palladium white gold alloys are extremely resistant to SCC where as 14K nickel white alloys are susceptible to SCC.

Now that we know that the failure of a piece of jewelry due to SCC can only occur with certain alloys that have been exposed to a corrosive environment and only if residual stress exists, we can address the SCC phenomena by controlling many of the variables that cause SCC. Educating the end user about exposure of jewelry to corrosive environments is important but impossible to monitor. As a jeweler, you can minimize the risk of failure by SCC with proper alloy selection and stone setting techniques to reduce residual stress.

We hope that the above discussion has removed the mystique from this type of “mysterious” failure and provided you with the tools and knowledge to recognize and prevent prong failures incorrectly attributed to “bad metal” or “bad casting.”

Metals Technology Team  
Stuller, Inc

## **PRECAUTIONARY MEASURES TO AVOID STRESS CORROSION**

- 1) If stress has been applied or loaded into a product, coat piece with boric/alcohol, soak at 650°F for 45 minutes, allow to air cool. This will relieve the stress without adverse effects such as loss of temper. Standard torch or oven annealing is sufficient to relieve stress.
- 2) How much stress? When reducing sheet or wire, avoid overworking. This can be identified by edge notching, which is undesirable. Reductions of 50% are standard between anneals, 37% reduction is considered full hard.
- 3) Avoid sharp notching. Use a slight radius if applicable, especially if stretching and compression must be applied to the notched areas.
- 4) Use 18K or platinum in key areas instead of low karat or nickel whites. These metals have a much higher tolerance to corrosives.
- 5) Avoid too much heat or excessive time exposure to heat. Allow pieces to cool slowly. Repetitious heating to red zones is not recommended unless sufficient cold work is applied between heats. Avoid dull cutting tools and use a lubricant to avoid generating excess heat.
- 6) Avoid contact with corrosive liquids, solids or gasses. The seacoast and semi-tropical areas produce chlorides which combine with the salts produced through perspiration to form a corrosive element that discolors the skin. Smog fumes filled with particles of silver dioxide and phosphate also gradually attack jewelry.
- 7) Prong work is of particular concern. Take care to not stretch prongs out of parallel. This increases the angle required to move the prong tip over the stone thus increasing stress and compression. It's the jeweler's responsibility to control and decrease stress. Make it a point to work “stress free.”

# MELTING AND INVESTMENT CASTING

## MELTING

All metals used in any finished products have gone through at least one melting and freezing cycle during their production. It may seem trivial, but it is worth keeping in mind. Even cold finished wire, sheet or die struck product was melted and allowed to freeze at some point in its processing history. Every metal has a processing history. It all starts with melting, and this process step is worth a great deal of attention. Melting is an integral part of investment casting, so investment casting has been included in this section.

## RAW MATERIALS

### *Pure Metals*

Only high-purity raw metals should be used to formulate and melt karat gold alloys for jewelry applications. Fortunately, gold, silver, copper, nickel and zinc and other elements used in precious metal alloys are readily available at purity levels of 99.9+%. Copper and nickel have their own special situations, however.

Electrolytic tough pitch copper is commonly available, and, on a metallic basis, it is a high-purity metal. However, it is actually melted and processed to contain a residual amount of oxygen. This oxygen is typically present in the range of 0.020 to 0.040%. The presence of this amount of oxygen must be recognized and dealt with in melting operations.

Nickel is typically available as electrolytic or carbonyl nickel. Carbonyl nickel is purified at high temperatures by a vapor deposition process that uses carbon monoxide. Carbonyl nickel contains residual trace levels of carbon from the carbon monoxide. Melting pure nickel into a karat gold alloy is a tedious process because the melting point of nickel is so much greater than the melting point of typical karat gold alloys. The use of a master alloy, which may be combinations of nickel and copper or nickel, copper and zinc, makes the alloying process much faster, easier and more reliable.

### *Master Alloys*

Master alloys are a convenient tool for formulating karat gold alloys. These alloys contain all the elements at the required concentrations, so that when an addition of fine gold is made to the master alloy, an alloy of desired karat and color is produced. Only high-purity materials should be used to formulate master alloys. They must be melted with as much care as is used when melting karat gold alloys.

Sometimes individual master alloys are formulated so that they can be used to produce gold alloys of different karat qualities. For example, reducing the amount of fine gold added to a master alloy can create a 10K alloy instead of a 14k alloy. This works some of the time, but it might not work all of the time, especially when high karat, 18K alloys are being formulated. The lesson is, don't expect a master alloy to be useful for formulating all karat qualities for all applications.

### *Karat Gold Scrap*

Karat gold scrap can be used to prepare or formulate alloys if done with adequate care and information. Accurate, reliable information about the karat quality of the scrap must be available before any attempt is made to reuse it. Gold articles that are purchased from pawn shops for remelting and recycling require special consideration. If these articles were made before October 1, 1981, then the karat quality may be a full half karat less than the indicated quality. For example, an article stamped 14 karat may be only 13 1/2 karat.

This may not sound like much, but 14K is equivalent to 583.3 as a decimal fineness. On the other hand, 13 1/2 karat has a decimal fineness of 562.5. If 13 1/2 karat scrap is used to prepare fresh, 14K metal, the composition will not comply with current hallmarking regulations unless extra fine gold is added to make up for the difference as indicated by the difference in decimal fineness. Current regulations which went into effect on October 1, 1981 allow unsoldered articles to be only 3 parts per thousand below the indicated decimal fineness; soldered articles are allowed to be 7 parts per thousand less than indicated decimal fineness.



Old high school and college class rings are used by some jewelry craftspersons as a source of gold. These types of emblematic jewelry typically have a year date that indicates when a student graduated. Do not make the mistake of thinking that this date is an indication of when such a ring was manufactured. Students sometimes purchase class rings years before their final graduation day. This means that a student who graduated in 1982 or 1983 could very well have purchased their ring before October 1 of 1981, and the ring could be a half karat less than the indicated quality.

### *Air Melting*

Many different types of melting processes are used in metals processing. They range from the simple to the exotic. For example, parts that are used in a jet turbine engine have to survive for many operating hours in red hot, corrosive environments, while people travel in safety and comfort. It would not be surprising if some exotic vacuum melting techniques were used to process these types of materials. However, it makes no sense to consider any exotic processes for precious metal alloys used in jewelry applications, except in rare and unusual circumstances. These rare and unusual circumstances will be neglected in this discussion. Basically, all typical methods used to melt and formulate jewelry alloys are equivalent to “air melting.”

Melting metals typically requires large amounts of heat. This heat is first used to heat a metal charge to its melting point. Additional heat is required at the melting point of the metal to convert a solid into a liquid. Additional energy is then needed to superheat the metal to some casting temperature that is above the liquidus temperature of the alloy. Electricity and fuel gases are the two most common sources for the energy that is needed to melt a metal charge.

Induction melting has become the most common electrical method for melting. It is extremely clean, rapid, and highly efficient. Simple techniques can be used to monitor and control temperatures during the different phases of a melting practice. Different methods to prevent and reduce oxidation can be used at the same time without interfering with one another. It's a preferred method.

Melting to formulate precious metal alloys is sometimes done by gas melting. However, gas melting has its own set of issues because it uses a combustion process as a source of heat. Natural gas is mostly methane, CH<sub>4</sub>, and is the most common fuel used for gas melting. When burned with combustion air, the products of combustion include carbon dioxide, carbon monoxide, water vapor and nitrogen.

Combustion products from flames that are adjusted for maximum flame temperature and heat output will contain very little or no carbon monoxide. This type of flame will contain about 18% water vapor and 9% carbon dioxide.

The presence of carbon dioxide and water vapor can not be ignored in a metal melting operation that is expected to produce a high-quality, gas-free product. In gas-fired furnaces, the metal charge is in intimate contact with the gas flame and the combustion products. At high temperatures, carbon dioxide can oxidize some of the elements in a karat gold alloy such as zinc, silicon and boron. In other words, the flame products can consume the alloying elements that might have been added to deoxidize the metal. Water vapor can behave the same way. However, when water vapor oxidizes liquid metal, hydrogen is released. This hydrogen

can be dissolved in the liquid metal and cause gas porosity when the metal is cast. Extra care must be used to protect liquid metal when gas-fired melting equipment is used because the products of flame combustion can react with the metal and cause serious quality problems.

### *Melt Protection*

In any type of air melting operation, whether it is done with induction or gas heating, serious steps must be taken to protect liquid metal from the effects of oxygen at all times. Air contains 20% oxygen. Oxygen is a very reactive element, especially at elevated temperatures. Air also contains significant amounts of water vapor. Molten metal will react with oxygen to produce oxides at the smallest provocation. As mentioned earlier, molten metal can also be oxidized by contact with water vapor. This is particularly serious, because, as metal is oxidized by water vapor, hydrogen is released. This hydrogen can and will dissolve into the liquid metal. When the metal subsequently solidifies during any casting operations, hydrogen gas is released, creating gas porosity.

The amount of water vapor in air is typically determined by weather conditions. Values for “dew point” are commonly used to describe the amount of moisture in the air when local weather conditions are reported. Dew point temperatures can be used to evaluate the concentration of water vapor in ambient air. Some values for dew point, and percent of moisture in air are summarized in Table I.

**TABLE I****Volume percent moisture in air at various dew point temperatures**

DEW POINT TEMP., °F	WATER VAPOR, VOLUME
86	4.2
73	2.8
64	2.0

The data in the Table 1 indicates that air can contain up to 4% water vapor on a humid, summer day. It is a reported fact that commercial metal casters have more problems with gas contents in metals during the summertime because of increased humidity in the air. One induction melting operation known to this writer changes melting practices in the summer to control hydrogen content in metal that is caused by water vapor.

Inert or reducing gases, like Ar, N<sub>2</sub>, and H<sub>2</sub>, and reducing gas flames can be used as “gas covers” in melting operations. Gases and flames are unstable and do not stay in the same place all the time. It is wise to use excess amounts of gas and flame to compensate for their buoyancy and instability with regard to their physical location.

### Fluxes

For the previously-mentioned reasons, molten metal must be protected at all times from contact with the oxygen and water vapor in ambient air. Flux layers are typically used to cover the surface of liquid metal to provide this protection. These layers provide physical barriers to prevent contact with oxygen. Common fluxes include charcoal, boric acid and boric oxide.

Charcoal is a chemically active flux, because it can reduce some metallic oxides back to the metallic state. Boric acid or boric oxide are “glassy” fluxes and are chemically passive to liquid metal. They can and do dissolve and collect metal oxides. Analyses of glassy fluxes used in melting operations have indicated that high concentrations of zinc oxide and smaller concentrations of copper oxides are present.

### Deoxidation

If a metal has been melted in air, the issue of dissolved oxygen and oxides in the metal must be addressed. The degree of deoxidation that is required will depend on the future processing that is planned for the metal. If the metal is to be cast into some ingot form and processed through cold working and annealing operations, only a minimal amount of deoxidation is required. Enough deoxidizer should be added to the metal to remove dissolved oxygen without leaving residual amounts that will interfere with the plastic deformation which will happen during cold working.

Many jewelry people do not believe it is necessary to deoxidize a metal that is going to be cold worked. This is not true. All alloys that have been melted in air require some type of treatment to control the oxygen. The real problem is to consistently control the dosage rates of the deoxidizer. Only small amounts are generally required, and, if overdone, problems with cracking and reduced ductility can be created. It’s a situation where more is not necessarily better. Figure 1 describes “blisters” that have formed on a piece of cold rolled gold alloy that was treated with insufficient deoxidizer during melting. These blisters formed when the material was annealed in a reducing atmosphere. The reducing gas reacted with oxides in the metal to form steam. Expansion of the steam at elevated furnace temperatures resulted in the raised “blisters” on the surface of the gold alloy.

Metal that is going to be used in an investment casting process typically requires higher levels of deoxidizer than if it was going to be fabricated by cold working operations. When casting grain is first produced, enough deoxidizer has to remain in the casting grain to survive a second melting step when the final casting is poured.

The amount of deoxidizer that survives and is available for this second melting step depends on the equipment, the melting methods and the techniques for metal protection that are used. Some important aspects of these issues will be discussed.



Figure 1. Blisters seen on a cold rolled 14k yellow gold sheet after annealing in a reduced atmosphere. Figure 1. Blisters seen on a cold rolled 14k yellow gold sheet after annealing in a reduced atmosphere.

## Deoxidizer Additions

Melting techniques that protect metal as much as possible while it is in the liquid state are required for two reasons. The first is to prevent or minimize the formation of oxides. The second is to achieve control over the deoxidation process that is used to remove whatever oxygen does get into the metal. A deoxidation procedure that is in control results in an alloy with very low residual levels of oxygen in the metal and residual levels of deoxidizer that are within some desirable, pre-determined range. Residual oxygen levels of only several parts per million should be consistently and routinely achieved by simple deoxidation practices.

Crucibles used in precious metal melting operations are commonly made of graphite or carbon. Carbon functions as a deoxidizer when used in this application. Charcoal can be used as a flux for the purpose of deoxidation as well as melt protection.

The zinc that is present in most precious metal jewelry alloys is the first line of defense against oxygen. Zinc oxide forms very readily. If oxygen dissolves into a melt, a significant portion of it will react with the zinc. The zinc oxide that is produced is removed from the metal when it dissolves into a flux, if present. As mentioned previously, high concentrations of zinc oxide have been measured in fluxes after melting operations. This makes sense because of the inherent deoxidizing power of zinc.

Other elements can be added to karat gold alloys to remove oxygen. It makes sense to consider elements that combine more readily with oxygen than zinc. Some of these elements are silicon, boron, phosphorous, calcium, aluminum, magnesium, and lithium. Silicon and boron are the most common deoxidizing additions that are used in karat gold casting alloys. Lithium is reported to be used in some circumstances. Silicon is not a suitable deoxidizer for use in products that are to be cold worked. It can cause reduced ductility and cracking in rolling and wire drawing operations.

## For more tools see *The Tools Book, Vol. 73*



Micro welding insert with 3 needles. This unit will attach to the torch tip by removing the rosebud attachment. You can then do small soldering jobs.

description	order no.	6+	3+	1+
a. Torch Handle	14-0700	\$64.99	\$66.35	\$67.70
Torch Tip 27,000 KJ/H	14-0701	\$83.64	\$84.50	\$85.35
b. Torch Tip 38,000 KJ/H	14-0702	\$79.92	\$80.73	\$81.55
c. Micro Welding insert with 3 needles	14-0703	\$101.12	\$102.12	\$103.15
d. Gas Saver	14-0704	\$322.65	\$325.94	\$329.23

## Melting Dishes Kits



These kits come with 2 melting dishes that are made of fused silica for melting precious metals, and one handle ideal for torch melts with removable, wooden handle that resists heat. For temperatures up to 2800°F

**Small Kit** contains: 1-20 DWT (22-7930), 1-40 DWT (22-7931) and 1-holder 22-7913

**Large Kit** contains: 1-100 DWT (22-7932), 1-175 DWT (22-7933) and 1-holder 22-7914

description	order no.	6+	3+	1+
<b>Small Kit</b>	22-7913KIT	\$8.41	\$8.59	\$8.95
a. Holder Only	22-7913	\$15.93	\$16.27	\$16.95
<b>Large Kit</b>	22-7914KIT	\$9.35	\$9.55	\$9.95
b. Holder Only	22-7914	\$18.75	\$19.15	\$19.95

# THE INVESTMENT CASTING PROCESS

## *Overview*

Investment casting is an ancient process with a special moment of truth. This moment of truth happens when molten metal is poured into a mold to fill the mold cavities. This moment lasts for as long as it takes for the mold cavities to fill and the metal to freeze. Depending on the size of the cast part, this moment lasts for about 2 to 45 seconds. For example, experiments at Stuller using high-speed temperature measurement techniques with vacuum-assisted, static pouring methods indicate that a mold cavity for a 16 dwt ring can fill in about 0.5 to 0.7 seconds. Freezing such a large ring takes about 30 to 45 seconds. Smaller mold cavities will fill and freeze faster. Mold cavities cast with centrifugal methods would fill even faster. This information tells us that all the preparations that are made to produce a high-quality casting have to be made with the idea that the right things have to happen during this 2 to 45 second time interval of mold cavity filling and freezing.

The single major issue that has to be considered in the casting process is solidification shrinkage. For example, one gram of pure liquid copper has a volume of 0.1259 cubic centimeters at its melting point of 1083°C. The same gram of solid copper at the same temperature has a volume of 0.1198 cubic centimeters. So, in the act of freezing, one gram of copper shrinks by 0.0061 cubic centimeters or 4.52%. This shrinkage can cause porosity defects in castings. This change in volume is not to be confused with the thermal contraction that occurs when a solid metal is cooled from a high temperature to a low temperature. In our case, the one gram of copper that is described shrinks and contracts further as the solid is cooled from the freezing point. Contraction of solid during cooling does not cause porosity defects. Only changes in dimensions will occur.

The major details of jewelry investment casting will be reviewed in this section and recommendations for “best practices” will be given.

## *Spruing/Gating*

Setting up a tree for casting is usually called “spruing” by jewelry casters. The segment of wax that attaches parts to a “down sprue” are called “sprues.” In the commercial casting industry, these wax segments are called “gates.” It is useful to read about commercial casting practices and processes and learn new ideas and principles that can be adapted to jewelry casting.

The sprue post and sprues/gates used to assemble patterns into a tree is the plumbing system that is required to get liquid metal into mold cavities. It is also a system that establishes the temperature patterns that are necessary to solidify the casting into its final shape. This plumbing system has to do all this under difficult circumstances. For several reasons, the jewelry caster wants to keep spruing and gating systems as small as possible. One reason is to make the smallest possible area on the casting that will need to be cleaned up. Another reason is to use minimum amounts of expensive, precious metal. Also, gates/sprues tend to get located where contours and profiles are smooth and easy to blend during clean-up and finishing operations. Compromises have to be made. The following issues have to be considered when making the great spruing compromise.

## *Optimum Sprue Location*

When designing a spruing system, the first decision to make is, “Where should the sprue or gate be attached to the piece?” The answer is without a doubt, “At the heaviest section of the piece.” If a sprue or gate can not be attached at the heaviest location, get as close to it as possible. The freeform nature of jewelry designs makes it difficult to always be able to exactly follow the “best practices” and getting as close as possible to “best practices” is all that can be done. Sprue sizes should be selected so that metal flow is as balanced as possible while the piece is being filled. For example, if a ring shank is being cast and the sprue is attached to the palmside of the shank, the metal will divide and flow down each side of the shank during casting. Figure 4 describes different examples of how sprues can be attached to shanks. If the cross sectional area of the sprue is smaller than the total cross sectional area that includes each side of the ring shank, the metal flow rate will slow down abruptly when it enters the mold cavity. If the sprue cross section is much greater than the total cross sections of each side of the ring shank, the metal flow rate will increase by a very great deal within the mold cavity. The trick is to make the sprue size such that the flow rate of the metal does not change too abruptly when metal enters the mold cavity.

People who are comfortable with numbers can calculate flow cross sections very easily by using circles, squares, rectangles and ellipses, which approximate the flow cross section. The cross-sectional areas of these simple shapes can be easily estimated. It is not necessary to spend a great deal of time to do these calculations to the third decimal point. Feel free to use what are called “engineering estimates.”

Hand and eye can also be used to easily develop sprue sizes. An imaginative mind can identify paths of flow and estimate how flow fronts will spread and converge in accordance with the design features of a piece that is being cast. No matter what gating or spruing design method is used, it is important to imagine how metal is moving into and through a mold cavity. The molten metal behaves just like water.

## Shrinkage

A properly sized and located sprue can prevent the solidification shrinkage described in the introduction to this section from ruining a cast piece. The trick here is to visualize the solidification times of the piece being cast, gate or sprue, and the sprue post.

In general, bulky, chunky objects that look kind of spherical will take longer to freeze than cylindrical objects that look like a barrel. Pieces that look thin and flat like a slab or sheet will freeze in even shorter time intervals. Remember from Figure 1 that we are talking about times that are measured in seconds.

Castings freeze only because they lose heat. If liquid metal is poured into a mold cavity and no heat is removed from the metal, then the metal will not freeze. Since mold temperatures used for investment casting are lower than pouring temperature of the metal, heat flow into the mold causes the metal to solidify. Heat always flows from hot locations to cool locations. It helps to remember this at all times.

With the previous facts in mind, it becomes possible to visualize a casting set up where the piece freezes before the gate sprue and the gate sprue freezes before the sprue post. Under these conditions, liquid metal can flow into the piece through the gate sprue and feed the solidification shrinkage in the piece as it occurs. The sprue post can feed the gate and at the end of the freezing cycle, all the shrinkage is in the sprue post and who cares about that!

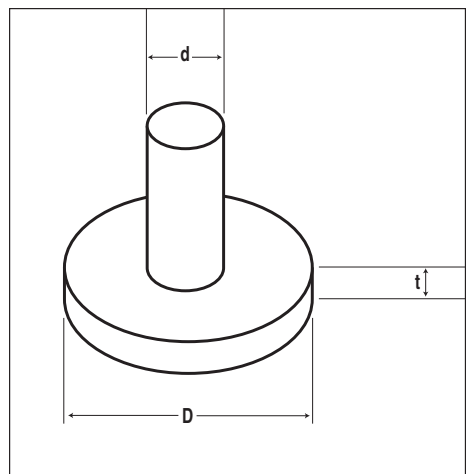
The idea of attaching gates to a casting so that the casting freezes first and the gates and sprue last is an ideal condition that is very difficult to achieve in practice. However, this type of freezing sequence should be the goal of every caster that is deciding how to set up a piece for investment casting.

Gates and sprues can be attached to the piece at the locations which will provide feed metal to compensate for solidification shrinkage in the cast piece. Authors have used simplified heat flow calculations to estimate the size of a gate which would be required to cast a thin disc. The sketch in Figure 3 shows a disc with a diameter,  $D$ , and a thickness,  $t$ . The center of the disc will be the last location to freeze.

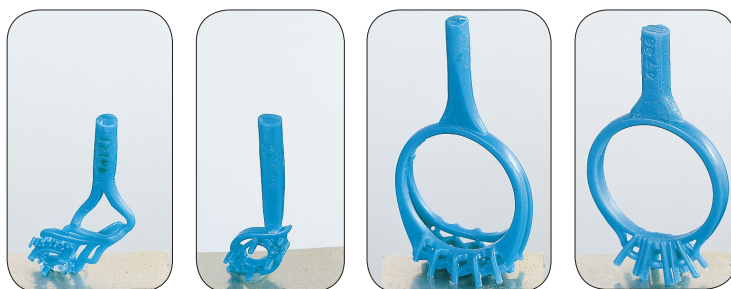
If a rod-shaped sprue gate with a diameter,  $d$ , is attached at the center of the disc, estimates of freezing time can be used to show that the rod will freeze later than the center of the disc if the rod diameter,  $d$ , is greater than twice the thickness of the disc. So, if the disc is 1/8 of an inch thick, the sprue gate should be at least 1/4 inch in diameter. This simple exercise gives us an idea of what physical sizes of gate sprues may be necessary to achieve a shrinkage-free casting.

The images on the following page are a collection of some typical wax patterns that are used for precious metal jewelry castings. The figure includes information about gate sizes and indicates where gates are attached to the piece. This is useful reference material for jewelry casting situations. However, a caster must always be prepared to compromise with the design of a specific piece and the requirements of finishing when setting up a pattern for casting. Casting parameters are for 14K yellow gold with a liquidus temperature of 1592°F.

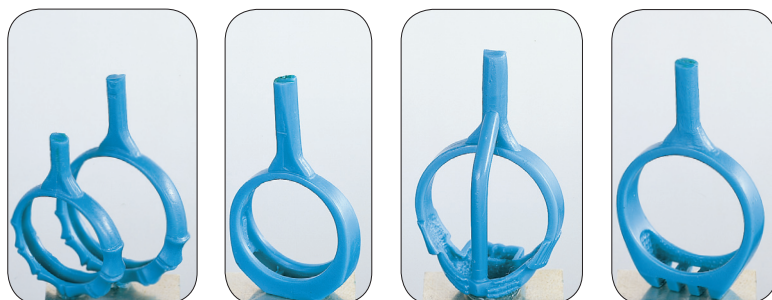
If heat flow governs how a casting will freeze, then pouring conditions help to establish the temperature profiles in both the metal and the mold which will promote a sound casting with the least amount of visible shrinkage. These pouring conditions are the temperature of the liquid metal and the temperature of the flask at the moment when metal is poured into the mold. As a general rule, “lower” flask temperatures are to be preferred over hot, “higher” flask temperatures. Adjustments in flask temperatures will have a greater impact on the quality of a casting than adjustments in metal temperatures. Notations have been included with each example that indicate what values of flask temperature and metal temperature have been found to produce good castings with these parts.



## FIGURE 4. USEFUL CASTING GUIDELINES

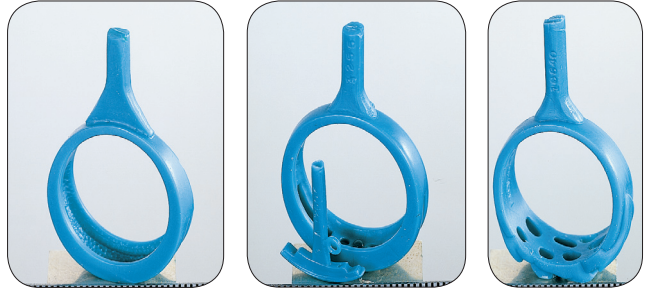


Weight		0.610 DWT	0.57 DWT	2.35 DWT	2.0 DWT
Style/Category		Wire filigree 18ga. or less wire	Wire filigree 18ga. or less wire	Ladies fashion 2x1mm shank	Ladies fashion 2x1mm shank
Gate/Sprue dimensions, mm		3mm, round	3mm, round	3-3.5mm	3-3.5mm
Casting Parameters	Metal Temp., °F	1760	1760	1740	1740
	Mold Temp., °F	1100	1100	1050	1050

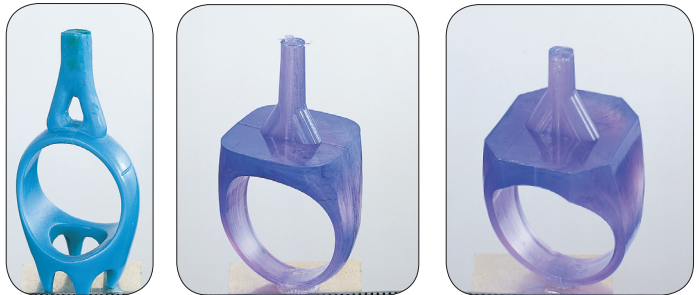


Weight		3.2 DWT	3.7 DWT	5.2 DWT	5.0 DWT
Style/Category		Heavy Ladies 3 x 1.5mm shank	Heavy Ladies 3 x 1.5mm shank	Hollow back Gents 1 - 1.5mm wall 4 x 1.5mm shank	Hollow back Gents 1 - 1.5mm wall 4 x 1.5mm shank
Gate/Sprue dimensions, mm		3-3.5mm	3-3.5mm	2x4.5	8x4.5
Casting Parameters	Metal Temp., °F	1700	1700	1690	1698
	Mold Temp., °F	1020	1020	950	950

**FIGURE 4. USEFUL CASTING GUIDELINES (cont.)**



Weight		5.9 DWT	6.6 DWT	6.53 DWT
Style/Category		Heavy wall, hollowback gents 1.5 - 2.5mm wall	Heavy wall, hollow back gents 1.5 - 2.5mm wall	Solid Gents 2-3mm shanks
		2.5 - 4.75mm	2.5 - 4.75mm	4 x 2mm shanks
Gate/Sprue dimensions, mm		3.25 x 4.0mm	3.25 x 4.0mm	3.5mm/4 x 5.5mm
Casting Parameters	Metal Temp., °F	1680	1680	1680
	Mold Temp., °F	875	875	800



Weight		10.2 DWT	18 DWT	21.3 DWT
Style/Category		Solid Gents, 2 - 3mm wall, > 4 x 2mm	Large, solid Gents 4mm top thickness	Large, solid Gents 4mm top thickness
Gate/Sprue dimensions, mm		3.5mm/4x4.5mm	4mm gate/5x10 mm contact area	4mm gate/5x10 mm contact area
Casting Parameters	Metal Temp., °F	1680	1680	1680
	Mold Temp., °F	800	700	700

# INVESTING AND MOLD BURN-OUT

## Investing

Molds used to make investment castings from most common gold and silver alloys are made with gypsum-bonded silica investment materials. These investments contain 25 – 27% gypsum,  $\text{CaSO}_4$ , and 70% silica,  $\text{SiO}_2$  plus other additives to promote wetting. Platinum and some karat golds which contain high levels of palladium require the use of phosphate-bonded silica molds because of the high casting temperatures that are required. The gypsum bond in investments used to cast gold and silver is developed because the shape of the gypsum phase changes during the mixing and setting process. During setting, needles of gypsum crystals form and capture the silica particles in a rigid network. Figure 5 is an SEM photograph of the silica particles embedded in a felt-like network of gypsum crystals.

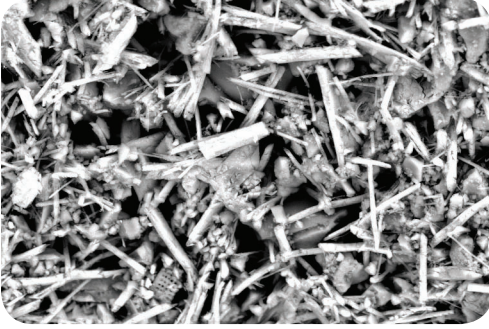


Figure 5  
SEM photograph of gypsum-bonded silica investment after burnout.  
Photo courtesy of Dr. Gabriel Maria Ingo, Istituto di Chimica dei Materiali, Rome, Italy.

The most important thing to do when mixing investment is to follow the manufacturer's instructions to the letter. Carefully measure the amounts of water and investment powder that is required for a batch. Mix and vacuum for the recommended times. A very experienced person may find it necessary and possible to mix investment by slightly varying the recommended procedure in order to squeeze the last ounce of performance out of an investment. However, these variations will only be of the slightest amount. If they are not, then something is wrong. In fact, if mixing directions are followed, then the water temperature and water chemistry will have the greatest effect on investment quality and performance.

## Mold Burnout

The mold burnout process accomplishes two things. Wax and or plastic materials used as patterns for the parts to be cast are removed from the sprue and mold cavities. Water that has been used to mix the investment is removed, so that molten metal can be safely poured into the mold. Most of the wax and water is removed at temperatures below about 350° F. Molds require heating to elevated temperatures of about 1200 – 1400° F to remove all final traces of wax and plastic residues.

Figure 6 describes the temperature profiles in a flask during a complete burnout cycle. Notice that the drying time is arrested at low temperatures and extends for 4 - 5 hours.

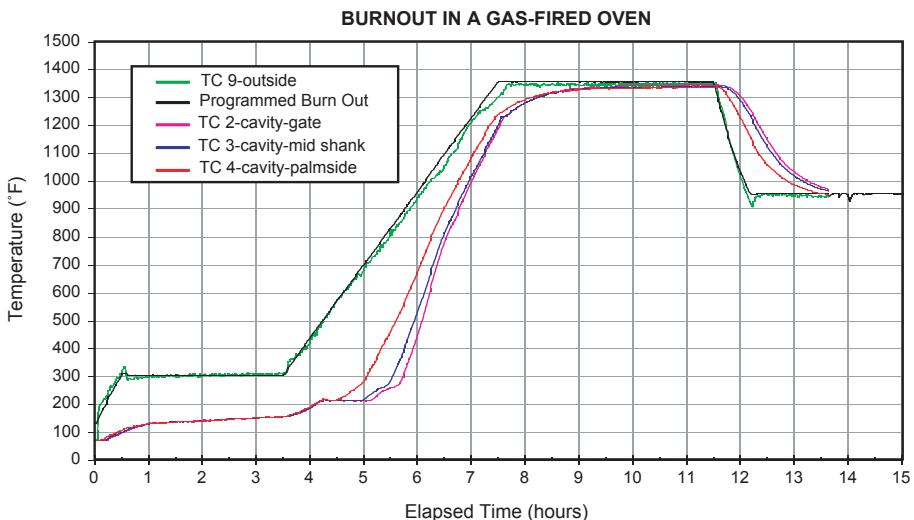


Figure 6. Temperature profile in a gypsum bonded investment casting flask at three locations during burnout in a gas fired oven.



Thermocouples located in a mold cavity at palmside, midshank and gate locations responded differently depending on their distance from the outside of the flask. These temperature profiles indicate differences in the rate of flask drying. The flask dries from the outside towards the center. Maximum temperature differences within the investment were observed to be about 250° F.

Weight loss measurements have been used to evaluate the rate of wax and water removal from gypsum bonded molds. Figure 7 describes how the weight of a flask changes during a burnout cycle.

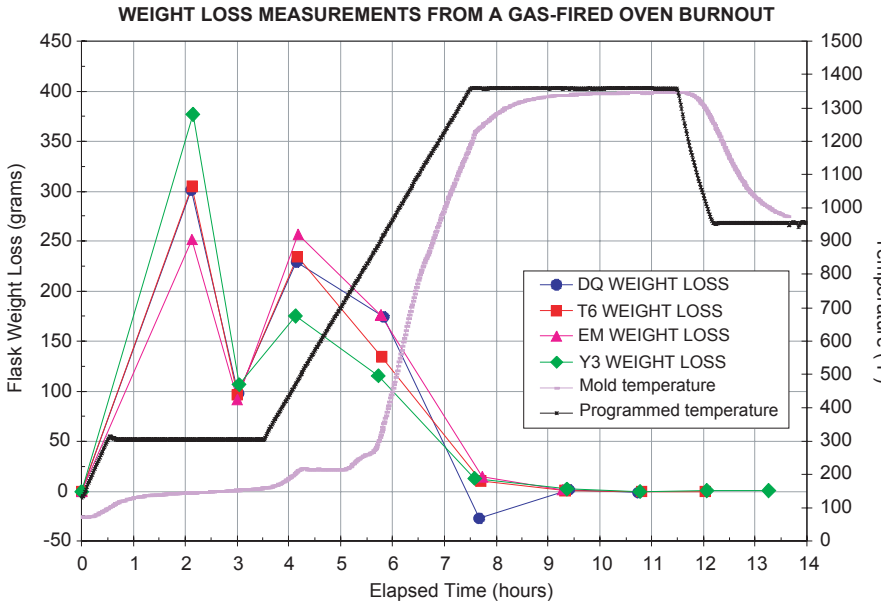


Figure 7. Weight loss caused by removal of wax and water from a gypsum-bonded investment casting flask during burnout in a gas-fired oven. Two peaks in weight loss were observed in this figure. Wax removal appears to happen first during the first two hours of the cycle. Maximum rate of water removal appears to happen about 4-5 hours after the start of the burnout cycle.



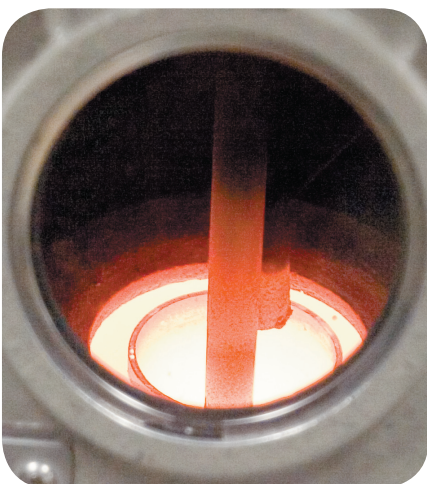
Investment manufacturers provide recommendations for the time-temperature cycles that are necessary to process molds made with their products. Once again, it is useful to follow the recommended procedures. In general, any burnout procedure is based on the following facts:

- Water boils at 212°F at sea level. The temperature of a flask cannot be heated above 212°F as long as excess or “free” water is present in the investment.
- All the water that is used to mix the investment required for a flask must be removed during the burnout process. Essentially no water is removed from the flask during the investment drying/setting process at room temperature.
- “Chemical” water that is combined with CaSO<sub>4</sub> as the “water of hydration” is removed from the investment at temperatures greater than 212°F. The last water removal from CaSO<sub>4</sub> • ½ H<sub>2</sub>O occurs at 350°F.
- The rate at which a flask can be heated is ultimately governed by the rate at which heat can be transferred from the burnout oven and into the investment.
- Investment can be fractured and damaged by heating too fast. Steam must have adequate opportunity to escape from the investment to prevent localized pockets of steam pressure which can fracture investment.
- Patterns made from carving waxes and “plastics” should receive more careful heating during the low temperature burnout phase than wax.
- Actual mold temperatures always lag far behind oven temperatures during heating and cooling, see Figure 6. This fact must always be considered when trying to estimate the effect of an oven burnout schedule on actual mold temperatures. It is useful to approximate a 1-hour lag during heating and a 2-hour lag when cooling a 4-inch diameter flask.

A burnout oven must supply adequate heat and oxygen to the flasks to accomplish a safe, clean, effective burnout. Every pound of water in the burnout oven must absorb 1,000 BTU of thermal energy to be converted to water vapor at 212°F. Additional heat is required by the process to heat the flask to 212°F where water evaporation occurs most rapidly. An “underpowered” burnout oven will require longer burnout times to complete the process. It appears that perforated flasks which are used with vacuum assist pouring tend to dry faster than molds made with solid, unperforated flasks.

Oxygen is required in a burnout oven for combustion of wax and plastic residues in mold cavities. In a gas-fired burnout oven, the gas flame and the mold residues end up in competition for the available oxygen in the oven. This is one reason why the burner flame should be adjusted, so it is as oxidizing as possible. The extra oxygen in this type of flame is of some help to make oxygen available to burn mold residues.

In general, 3-4 hours of drying time at 350-400°F are required to remove all the water from a flask during the initial stages of burnout. Large flasks or unperforated flasks may require longer times and small or highly perforated flasks may require shorter times. All traces of wax and plastic residues are usually removed from molds after 3-4 hours at 1200-1350°F. Gypsum starts to decompose at about 1375°F, and heating above this temperature for long periods of time is not recommended. Cooling an oven and its load of flasks to casting temperature is a slow process and typically takes 1 ½ to 2 ½ hours to be sure it is complete.



## Casting Equipment

Different types of equipment are available for melting a charge of metal and delivering it into a mold. Not all methods for casting a mold can be discussed in this section, but a few of them are: crucible melting with static pouring, centrifugal casting and static pouring with vacuum assist. Basically, all these techniques do the same thing. Metal is melted and prepared for pouring into a mold.

Two types of casting equipment are in common use for jewelry casting. Centrifugal casting is the older method; many styles of machine have been made by different companies. These machines use centrifugal force to spin metal out of a crucible and into a mold. The mold may spin in a horizontal or vertical plane. Melting may be done by induction heating or with a gas flame.

More recent developments of casting machine technology have resulted in bottom pouring systems that utilize induction heating. In these machines, melting is done in a crucible that has a small hole in the bottom. During melting, the hole is closed with a stopper rod. When the metal is ready to be cast, the rod is lifted and metal is allowed to flow through the pouring hole into a mold that is located directly under the crucible. By the use of shrouds of inert gas, these machines usually provide the most protection for the liquid metal and the pouring stream. Molds are usually located in a vacuum chamber to provide a vacuum assist to metal flow during mold filling.

Induction melting is a preferred method for processing precious metal alloys. Heating is very rapid, the temperature or heating rate can be controlled, so that metal is not overheated and the use of a graphite crucible can help prevent oxidation of the metal. Inert gases can be introduced at various locations in the furnace to retard the infiltration of air and subsequent oxidation of the metal. Units typically have very compact and well protected melting and casting stations that protect the metal while it is molten.

Melting with a torch or burner fueled by some type of hydrocarbon gas can be effective but has its own set of special issues. A burning flame produces combustion products. The chemical composition of the combustion products depends on how the flame is “adjusted.” If more oxygen than the amount required to burn the fuel gas is present, then the flame will be “oxidizing.” If just the right amount of oxygen for complete fuel combustion is used, only carbon dioxide and water vapor will be present in the flame envelope. Unfortunately, carbon dioxide is oxidizing to zinc and other deoxidizers that are present in the molten metal and the flame must still be considered oxidizing. This situation tells us that any flame used around molten metal should always be adjusted so no carbon dioxide is present in the flame. This type of flame is called a “reducing” flame and under ideal conditions, this type of flame contains only carbon monoxide and water vapor.

However, we are not completely home yet. We have already discussed that water vapor present in combustion flames can also be oxidizing to molten metal. There is no way to adjust the flame in a torch so that no water vapor is produced in the flame envelope and still get enough heat out of the torch to melt a charge of metal. This exercise should show that torch melting for investment casting is a delicate process, and there are limits to the amount of protection for the metal that can be achieved. It is no wonder that advanced production methods for investment casting all use induction melting techniques.

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*The Tools Book, Vol. 73.*



Mastercast may be  
found on page 166  
of *The Tools Book*.

### *Mold Quenching*

Investment molds must be cooled or quenched after casting with some degree of care. Quenching or rapid cooling can cause fractures if done too soon. In the case of nickel white gold alloys, not quenching soon enough after casting can result in extremely hard, brittle castings. Some useful guidelines are as follows:

- Castings should never be quenched while the sprue button has any “red” color, if thermal cracking is to be avoided
- Yellow gold alloys that have been heavily deoxidized with silicon should be cooled 10 – 15 minutes after the red color has disappeared from the sprue button before quenching to minimize chances of cracking
- Nickel white gold alloys should be quenched 10 – 15 minutes after casting. Longer cooling times may cause excessive hardening of the pieces
- Sterling silver can be quenched 10 – 15 minutes after casting

The previous guidelines have been found to be useful when casting 4-inch diameter flasks. Smaller flasks could be quenched sooner since they will cool faster. Larger diameter flasks, or flasks that have been cast at unusually high temperatures will require longer cooling times to prevent cracking. In small-scale casting operations, quenching is a useful technique for removing the investment from cast pieces as long as it is done in a manner that does not cause the pieces to become cracked and damaged.



## THE STULLER INVESTMENT CASTING CHECKLIST

This is meant to serve as a reminder or quality-control list. The information in parenthesis is a possible condition which may result from lack of, or improper control of, the parameter.

### MOST COMMON PROBLEMS FOUND

#### *Quality of Waxes*

- Model quality ..... casting will never be better in quality than the model
- Mold and model defects ..... casting will never be better in quality than the model
- Venting of mold ..... insufficient venting causes air pockets because air cannot get out
- Air lines used and location of compressor water in line ..... water may end up in your wax pot or rubber molds
- Life of rubber mold # of pieces run ..... substandard molds will produce substandard castings
- Wax/plastic type used ..... can cause sinks if wax pot is too hot for type used, improper burnout can cause carbon deposits (black spots or shiny spots)
- Wax quality reusing, treating..... trash or water in used or new wax ends up in your finished waxes
- Loading and melting method used to fill wax pot ..... could cause incomplete waxes if not completely melted
- Cleanliness of rubber mold entry and cavity ..... may draw air into rubber mold around gaps
- Temperature of wax ..... too hot will cause sinks; too cold, incompletes
- Injection pressure ..... too high may blow up rubber mold; too low, incompletes
- Dwell time on injection..... too short causes incompletes; too long will blow up rubber mold
- Silicons, talcs, parting agents used ..... excess will cause rough wax surfaces
- Alignment of rubber mold halves ..... misalignment causes seam lines

#### *Treeing*

- Number of pieces and spacing ..... too close may result in hot spots (shrinkage porosity or fins from cracking due to stresses set up)
- Separation of light and heavy pieces ..... shrinkage porosity in heavy pieces when light pieces finally complete
- Types of pieces and location on tree ..... shrinkage porosity in heavy pieces when light pieces finally complete
- Joining techniques sharp corners ..... sharp ends or points may break and get trapped in pieces resulting in large holes in piece
- Angling of pieces ..... assists in smooth metal flow
- Sprue size ..... sprue or main tree rod, button, and feeders weigh at least as much as total of pieces or porosity may result
- Gate size and connection ..... if smaller than section attached to it may result in shrinkage porosity; if more than 20% larger it may result in porosity also
- Pattern wash ..... check investment procedures or burnout procedur

## Investing

- Water temperature ..... too hot, sets too quick causing nodules; too cold sets too slow, causes investment weakness and/or watermarks (fins)
- Investment temperature..... too hot sets too quick causing nodules; too cold sets too slow causes investment weakness and/or watermarks
- Investment storage..... moisture may cause weakening of investment (fins)
- Ratio of investment to water ..... too much water extends work time and weak investment; too little cuts time causing grainy surface or nodules
- Mixing of investment ..... insufficient may cause nodules or bubbles
- Turbulence on filling flask..... fine pieces may be bent or broken off
- Vacuum on investment ..... insufficient vacuum causes nodules or bubbles on pieces
- Vibration of investment..... insufficient vibration causes nodules or bubbles on pieces; too long may cause fins or spauling if investment starts to set
- Time to setting up..... too long causes weakness; too short grainy surface or fins
- Moving to early/rough movement..... results in fins or cracks
- Cure time after investing ..... placing in oven too early may cause fins or spauling

## Burnout Cycle

- Calibrated oven ..... don't exceed 1450°F, burnt investment causes dark, rough castings
- Heat distribution in burnout oven ..... too hot a flask causes porosity; too cold incompletes
- Loading methods in oven ..... too hot a flask causes porosity; too cold incompletes
- Air flow through oven ..... too hot a flask causes porosity; too cold incompletes
- Actual cycle time and temperatures ..... what the dials say isn't always so; calibrate regularly
- Wax residue burn out complete..... black spots, shiny spots, incompletes all may result from varying carbon deposits
- Time flask is held at pouring temperature..... too short a time at final cycle and the flask will be hotter than your oven causing porosity or brittle fractures
- Final temperature of flask ..... too hot a flask causes porosity; too cold incompletes

## Casting of Flask

- Fresh to scrap ratio ..... too much scrap is never good; 60 scrap/40 fresh for yellow and 50 scrap/50 fresh for white
- History of metal melting ..... overheated metal or dirty metal is trouble
- Type of metal, freezing range, grain refined, etc ..... know your metal's properties
- Crucible, stopper rod, stir rod, cement types and ages ..... reactions with metal may occur causing many problems; avoid graphite with nickel whites

- Calibrated thermocouple/pyrometer ..... too hot a melt causes shrinkage; too cold incompletes
- Metallurgical properties of metal ..... know your metal's properties  
Thermal conductivity, shrinkage rate, wettability, etc.
- Crucible designated for metal type ..... avoid graphite with nickel whites, if possible
- Cleanliness of scrap/fresh metal free of investment ..... investment in metal will cause porosity or discoloration
- Melt temperature ..... too hot a melt causes shrinkage; too cold incompletes
- Flask temperature ..... too hot a melt causes shrinkage; too cold incompletes
- Vacuum achieved vacuum assist ..... insufficient vacuum causes incompletes
- Rotation speed centrifugal ..... too slow may cause incompletes; too fast may cause investment to fracture or pieces to break off
- Protective gas covers used melt/flask ..... air will oxidize metals decreasing their life
- Travel distances and flow paths of metal ..... the longer the distance the cooler the metal will become and the more unstable the flow becomes
- Possible contamination sources ..... iron, investment, rouge, etc. are never good in a melt
- Pressure assists used ..... if you have it, take advantage of it
- Acceleration rate centrifugal ..... too slow may cause incompletes; too fast may cause investment to fracture or pieces to break off
- Type and duration of heating used ..... gas flames should always be gas rich
- Reactivity of metal and investment ..... too hot a metal and/or flask may result in reactions causing porosity or dark sulphate regions
- Time before flask is moved ..... let it sit until metal is solid, if moving is required, be gentle until bottom loses its red glow
- Time before metal solidifies in flask ..... button should solidify in 15-45 seconds
- Flux type used and condition ..... use only fluxes recommended for golds (boric acid/borax mix)
- Quantity/when flux is used ..... too much flux may end up in your pieces (bright spots)
- Rate of pour ..... too slow may cause incompletes on hand pours

### *Breakout*

- Time before breakout ..... wait at least 15 minutes
- Method used dry, wet, hammering, etc. .... wait at least 15 minutes; dry hammering wait until flask is well below 600°F

### *Cleaning*

- Pickles used ..... avoid hydrochloric acid; safety pickles are good
- Concentration/temperature/duration in pickle ..... use minimum temperature, concentration, and time that will get the job done (any high temperature may cause fractures)
- Cleanliness of tree after cleaning ..... investment should be completely removed in reusing metal
- Clipping methods ..... avoid bending pieces

## DESIGNING JEWELRY PIECES

Before making the model, it is a good idea to plan what would make casting easier. One never wants to compromise on the artistry and beauty of the piece, but some simple tips may prevent frustration from repeatedly casting bad pieces.

- Avoid sharp and acute angles which can break off when casting. Round ends of notches or tips.
- Avoid alternating thick and thin cross sections which may result in porosity.
- Design articles so they can cool evenly and distribute stress incurred by cooling. It may mean assembling a part to achieve this.
- Avoid points, thin edges, and fine wires as these are difficult to fill without overheating the metal.
- Avoid “x” type intersections, the point of intersection will tend to cause turbulence and/or have porosity.

## GENERAL CASTING TIPS FOR KARAT GOLDS

### MELT TEMPERATURE RECOMMENDATIONS

#### *For Various Casting Methods*

- Vacuum assist casting: 100° to 200° F over melt temperature.
- Centrifugal/sling casting: 50° to 125° F over melt temperature.
- Pieces with less detail require lower superheats.
- Experience is the best guide.

### FLASK TEMPERATURE VERSUS CASTING METHOD

#### *Piece Size and Design*

- Smaller pieces (findings) and pieces with great detail (filigree rings) require higher flask temperatures 1100° to 1300°F.
- Large pieces (gent’s rings) and pieces with few details require a lower flask temperature, 800° to 1000°F.
- White golds generally require flask temperatures on the high end of the recommendations.
- Centrifugal casting tends to have flask temperatures on the lower end of the recommendations.
- Large and small pieces on a single tree require flask temperatures closer to those needed for light pieces.
- Experience is the best guide.

#### *About the Metal*

- Ratios in excess of 50% scrap are not recommended.
- Clean metal thoroughly before using (no investment).
- Purge system periodically. Start fresh every 6 months.
- The weight of the metal in the button and tree should at least equal the weight of the pieces cast.

## INVESTING PROCEDURES

#### *Ratios of Investment to Water*

- Follow instructions of the supplier.
- Pieces with great detail may need a slightly greater amount of water for investment.

#### *Vacuuming Investment*

- Make sure you have a good vacuum.
- Vibrate table to help remove trapped air.

#### *Burnout Cycle*

- Don’t move invested trees too early (wait 1 hour).
- Follow instructions of investment supplier.
- Check that temperature read was accurate.
- The casting flask temperature (final step) should be maintained for at least one hour before the first flask is removed.



### *Proper Spruing and Gating*

- Improper spruing is the leading cause of shrinkage porosity.
- Don't use chock gates. They cut off the feed metal.
- Place sprue (gates) at heaviest cross sections of the piece.
- Use runners to heavy areas if they are separated by thin cross sections.
- Flair the gate at the connection to the piece. This will help reduce turbulence in the metal flow.
- Don't put pieces too close together.
- Smooth all surfaces to avoid sharp corners which may break off during casting (i.e. connections between main sprue and gates; and gates and piece).

### *Breakout*

- Don't rush to break out. Place flask in shaded area, quench when red glow is no longer visible in button.
- Clean investment off thoroughly if you plan on reusing the scrap. Investment in the melt will cause porosity problems over time.
- If breaking out dry by hammering, be sure flask is well below 600°F to help reduce potential cracking.



# COLD WORKING AND HEAT TREATING

## *Cold Working*

Cold working is any process such as rolling, wire drawing, swaging, bending, stretching or other processes that are used to harden and work a material to its final shape. To cause this shape change, a force must be applied which exceeds the yield point of the material. Cold working a metal results in an increase in strength or hardness and a decrease in ductility. It is an important industrial process that is used to harden metals or alloys, which do not respond to heat treatment. Microstructurally, cold work produces elongated grains in the principal direction of the work.

The formation and movement of dislocations allows a gold alloy to be deformed. Dislocations are submicroscopic imperfections in the crystalline structure of the material, which are not visible to the naked eye. Plastic deformation causes the number of existing dislocations and other structural defects to move and multiply. The accumulation of dislocations and defects causes an alloy to become harder. If the density of dislocations and defects becomes so great that plastic deformation can no longer occur, the material being cold worked will crack or fracture.

Dislocation movement can be compared to stretching a carpet by creating a ripple or ridge in the carpet and moving the ripple to the opposite end. The ridge is equivalent to a dislocation. By repeating this procedure, the carpet can be moved a considerable distance as the total effect of all of the ripple movement accumulate at one end of the carpet. Unlike the carpet, the strained gold alloy can be returned to a structure that is ready for more cold work by annealing it.

The driving force for annealing is the elimination of the stored energy that accumulates in the piece during cold working (plastic deformation). About 5% of the energy used for plastic deformation is stored in the material while the remainder is converted into heat. A good question to ask at this point is “How much cold work should I or can I do to my product?”

The amount of cold work that can be done to a product is dictated by several major factors. Some of the most important factors are:

- Type of alloy
- Degree of cold work already in the product
- Presence of as-cast, or dendritic structure

Most of the standard gold alloys can be cold worked up to 70% reduction without risking failure. Dendritic, or as-cast structures can have a dramatic impact on the degree of deformation which some alloys can tolerate. Some alloys require special handling during or after casting to achieve good cold working characteristics.

Gold alloys such as nickel whites, age-hardenable colored gold alloys and palladium white gold alloys modified with copper, nickel or zinc should not be allowed to slow cool past the red color or a decrease in ductility can be experienced. 18 karat red and 18 karat white gold are especially sensitive and may crack immediately when cold worked if allowed to slow cool past the red color. This is especially true for gold cast into investment molds. Determining the degree of cold work in a purchased product would be difficult without information either from the vendor, a metallographic cross section or experience.

When producing sheet, plate or shaped wires it is best to develop a schedule for the cycles of cold work and annealing that will be required. A schedule consists of a series of reductions totaling 50–70% followed by annealing. It is the total percentage of reduction between anneals that is important, and it is independent of whether the process is rolling flat sheet, square wire or drawing round wire. These processes are only different ways to achieve the total reduction required to produce a desired product.

The ultimate goal of any cold working process is to produce a final product with the desired shape and the smallest possible grain size. A logical starting point is to determine what thickness and temper is required for the final product and work back up to the initial starting size required. Some basic steps are as follows:

1. Determine the thickness and temper of the final product.
2. Reduction of an as-cast, “dendritic” structure should be a minimum of 45% but should not exceed about 55%. This will prevent damage to less ductile dendritic structure.
3. Total reduction at the intermediate stages between anneals should be a minimum of 55% and should not exceed 70%.
4. Best results are achieved if at least two intermediate stages of cold work followed by annealing are scheduled prior to the final stage.
5. Unless a dead soft product is desired, more consistent results are obtained if a product is cold worked to its final temper instead of trying to anneal the final product to a desired temper.

At this point, some formulas will be required to assist in calculating the percentage reduction between desired points where annealing should take place. Since it would be difficult to cover the variety of shapes that could be created, we will focus on the three most common mill products: flat sheet, square wire and round wire.

The thickness of sheets and diameter of wires are usually described by Brown and Sharpe (B&S) or American Wire Gauge (AWG) measuring systems. Tables of gauge numbers with English and metric dimensions are given in the appendix.

In strict mathematical terms, the percent reduction that occurs during any type of cold-working process, be it sheet rolling or wire drawing, is calculated based upon the change in cross-sectional area. It is calculated using the equation given below:

$$\% \text{ REDUCTION} = (\text{INITIAL AREA} - \text{FINAL AREA}) / \text{INITIAL AREA}$$

For sheet materials, the reduction during rolling is usually based on the decrease in sheet thickness for simplicity:

$$\% \text{ REDUCTION} = (\text{INITIAL THICKNESS} - \text{FINAL THICKNESS}) / \text{INITIAL THICKNESS}$$

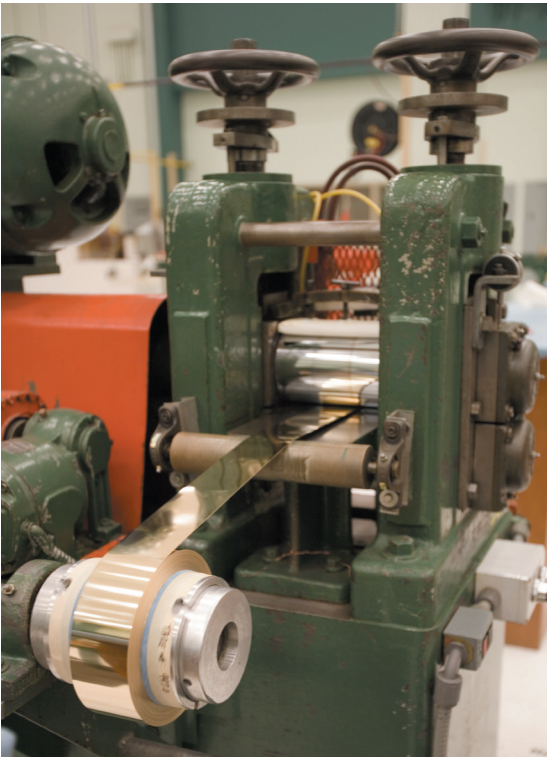
Note, however, that this equation is strictly valid only if the width of the sheet does not change during the rolling operation.

For wire drawing the equation can be simplified to:

$$\% \text{ REDUCTION} = (\text{INITIAL DIAMETER})^2 - (\text{FINAL DIAMETER})^2 / (\text{INITIAL DIAMETER})^2$$

For square rod rolling, use the following equation:

$$\% \text{ REDUCTION} = (\text{INITIAL THICKNESS})^2 - (\text{FINAL THICKNESS})^2 / (\text{INITIAL THICKNESS})^2$$



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## Flat Rolling

The production of sheet and strip material uses flat rolling techniques. Material is passed through the gap between two parallel, hardened steel rolls. The rolls rotate and pull the material into the roll gap, squeeze it so that the thickness of the material is reduced and push the thinner material out the exit side of the roll gap. In general, material passing through a rolling mill does not spread very much in width. It increases greatly in length.

Gold Reference Data in the Appendix contains a great deal of information about how hardness and mechanical properties of 14K, 18K, and 22K yellow gold alloys increase with increasing amounts of cold work. Photomicrographs describe how the grain structure is altered during deformation. Cold rolling will cause grain structures to become stretched and elongated in the direction of rolling. Sometimes this elongated grain is called a rolling texture.

## Rolling Tips

### 1. Material is not flat

- a. Check rolls on mill. If the rolls are not exactly the same diameter, the material being rolled will stretch more on one side and cause the stock to “bow” upward or down.
- b. Tighten roll gap to apply more force onto the product with the rolls (more reduction).
- c. Material has been cross-rolled in previous operations. Once the material has been rolled in one direction, do not change the rolling direction by rotating the material 90° to the initial rolling direction. If cross rolling must be done, anneal material prior to changing the direction of rolling.
- d. Material must be level with the gap between the rolls on both the entrance and exit side of the mill. Feeding or exiting the stock at an angle will create a “bow” in the stock.
- e. If the stock is not flat and all conditions during rolling seem to be correct, try passing the stock through the mill several times without changing the gap between the rolls.

### 2. Edges of stock has cracks

- a. Total percentage of reduction between anneals was too great. Total reduction approaching 70% can be risky.
- b. Maximum softness was not achieved during annealing. Check time and temperature.
- c. Maximum softness was achieved during annealing, but the alloy has “age-hardening” characteristics. The material increased hardness during cooling, because it was not quenched rapidly enough.
- d. Flat rolls on mill are worn in the center, and, therefore, edges of stock work harden more rapidly than the center. Measure the thickness on the edges and the center of the sheet. Also a “V” configuration on both ends of the sheet may indicate a problem with rolls.
- e. Roll deflection occurs when the rolls bow away from each other while stock is being rolled. This can cause the edges to be reduced further than the center and possibly prematurely crack.

### 3. Sheet stock is curving

- a. Rolls on mill are adjusted tighter on one side. The side that is adjusted tighter will cause the sheet to stretch more on that edge and curve to the opposite side. Make adjustments until sheet straightens.
- b. Material is thicker on one edge causing more deformation on thicker side.
- c. A large notch or crack on an edge can cause the stock to suddenly curve during the rolling process.

### 4. Thickness of stock is not uniform down the length

- a. Rolls on mill are not round. If true, the distance between the areas of non-uniform thickness will be the same as the circumference of the rolls.
- b. Width of the stock varies, which, in turn, varies the degree of resistance against the rolls.
- c. Shrinkage voids in cast ingots can cause non-uniform stock thickness.

### 5. Thickness of stock is not uniform across the width.

- a. Roll deflection that causes the edges to reduce further than the center section across the width. Diameter of the rolls and the width need to be matched to the job.
- b. Rolls on the mill have become crowned in the middle due to excessive wear on the edges. This will cause the sheet to run from the middle to either side of the roll gap.

### 6. Poor finish on stock

- a. Stock was not properly cleaned prior to rolling. Forces that are used to create plastic deformation are great enough to push dust and liquids into the surface of the stock and leave impressions.
- b. Rolls need to be cleaned prior to rolling operations to remove all residues, including oily films that are not visible to the naked eye.

## PRODUCTION OF FABRICATED SHEET

Static Pouring the Ingot:

- Clean all crucibles and molds before starting.
- Always preheat mold to 300°F, and lubricate prior to pouring. (Wipe away excess lubricant to avoid splitting)
- Always preheat crucible prior to melting.
- Flux and/or protective gas should always be used on top of the melt (boric acid and/or natural gas are sufficient).
- Don't overheat the metal (100°-200°F over the melting point is sufficient.).
- Slow the rate of pour as the end of the melt approaches.
- Check compatibility of the metals being melted with crucibles, stir rods and molds. (Ideally graphite should be avoided when using nickel-bearing alloys.).
- Quench ingot in water to achieve softest cast state. Yellow golds can generally be done almost immediately. White golds and solders should air cool until the red color has disappeared, then quench. 18K red and/or white require quenching immediately after red glow is lost.

### *Rolling of Metals:*

- Ingots should have shrinkage pipe trimmed, prior to rolling.
- Do not anneal ingot until significant reduction is achieved through cold working. (White gold needs 50% to reduce the likelihood of fire cracking.)
- Use multiple passes at the same setting on mill head to flatten sheet.
- Reduction of the load on the mill can be achieved by using a light oil on the rollers while rolling. (Lint and dust from billet are also washed away.).
- Avoid light passes on thick material (thicker than 0.125"). Light passes can cause billet to bow, or, even worse, split down the center due to uneven stress.
- Sharp corners on feed side of sheet should be trimmed to help preserve surface of rolls on mill.
- If cracks do happen, drilling a hole in the tip of the crack will help prevent it from continuing.

## GUIDE FOR ROLLING AND ANNEALING

Gauge	Thousandths of an inch	Gauge	Thousandths of an inch
	.9074	16	.0508
	.8080	17	.0452
	.7196	18	.0403
	.6408	19	.0358
	.5706	20	.0319
	.5082	21	.0284
	.4525	22	.0253
	.4030	23	.0225
	.3589	24	.0201
	.3196	25	.0179
1	.2893	26	.0159
2	.2576	27	.0141
3	.2294	28	.0126
4	.2043	29	.0112
5	.1819	30	.0100
6	.1620	31	.0089
7	.1442	32	.0079
8	.1284	33	.0070
9	.1144	34	.0063
10	.1018	35	.0056
11	.0907	36	.0050
12	.0808	37	.0044
13	.0719	38	.0039
14	.0640	39	.0035
15	.0570	40	.0031

Chart of approximate hardness required to obtain specific rolling results. (Decimal equivalents in inches)

### *Number of Gauges or Dies Temper*

1	¼ Hard
2	½ Hard
3	¾ Hard
4	Hard
5	Full Hard
6	Extra Hard
7	Spring Temper
8	Extra Spring Temper

Example: To finish sheet at .028" with a hard temper. Starting with .257" annealed stock, do the following:

Roll to .144" and anneal.  
Roll to .080" and anneal.  
Roll to .045" and anneal.  
Finish roll to .028" hard.

### *Torch Annealing:*

- If annealing in air, coat the piece with a good commercial flux or a mixture of alcohol and boric acid.
- Yellow golds are heated to low red color, then quenched in water or pickle solution.
- White golds are heated to low red color. Wait until red is lost and quench in water or pickle solution. 18K red and 18KW are exceptions and require quenching at low red.

### *Stress Relieving Anneals:*

- To greatly reduce the risk of stress-corrosion cracking, heat material to 650°F for about 45 minutes and cool slowly before final polishing.
- Standard furnace or torch annealing is sufficient for stress relieving.

## COMMON CAUSES OF INGOT FLAWS:

Fractured ingot (as-cast):

- 1) quenched too fast

Massive sink hole in ingot:

- 1) hot pour
- 2) hot mold
- 3) rate of pour is too fast

Cracking after annealing:

- 1) not enough cold work
- 2) quenched too fast

Surface flaking:

- 1) delaminated due to pouring down side of ingot mold
- 2) oxide inclusions, melt too hot and/or better protection

Cracked while rolling:

- 1) contaminated
- 2) too much cold work
- 3) annealing not done properly
- 4) centerline shrinkage

Large void(s) on edges:

- 1) poured down side of mold
- 2) too cold of a pour
- 3) too cold of a mold
- 4) lack of mold lubricant

## WIRE DRAWING

Drawing operations involve pulling metal through a die by means of a tensile force applied to the exit side of the die. Most of the plastic flow and hence cold work is caused by compressive radial forces, which arise from the reaction of the metal with the die. The reduction in diameter of a solid bar or rod by successive drawing is known as bar, rod or wire drawing, depending on the diameter of the final product.

Wire drawing is usually carried out at room temperature. However, because large deformations are usually involved, there is considerable temperature rise during the drawing operation. The main reason that the wire drawing works is because of the work hardening of the soft annealed wire as it gets drawn through the die.

The following points should be noted before any wire drawing operation.

1. Starting stock is annealed square wire that is approximately the same size as the first wire die. If multiple dies are required to change the cross section from square to round, seams can be formed down the length of the wire. Example: If the first die is .080" round, start with a .080" square stock.
2. Lubricant is very important during wire drawing. A common lubricant for drawing short lengths of wire through drawplates is bee's wax. Wire drawing machines with multiple die capacity require special water-soluble lubricants. Companies that specialize in lubricants should be consulted.
3. Individual wire dies are available with "nibs" made from either natural diamond or synthetic diamond or inserts made of tungsten carbide. Dies with diamond nibs are often the choice for the final wire die. Dies with tungsten-carbide inserts are often used for intermediate dies.
4. Draw dies eventually wear out with use. When the die loses the polished finish, particles from the wire being drawn will build at the entrance of the die. Another more obvious indication of die wear is the size of the wire becomes larger than the indicated die size.

5. Excessive die wear can be caused by:
  - a. Abrasive particles (trash) attached to the outside of the wire stock. Clean the wire stock prior to drawing.
  - b. Abrasive particles in the lubricant used for drawing.
  - c. Improper lubrication (not enough lubricant or the wrong lubricant).
6. Reduction between sequential dies must be matched to the multiple, die-wire drawing machine being used. Drawing drums on wire mills have fixed rates of speed that vary with each pass that is done during a multi-die sequence. Failing to match the reduction per draw can result in breaking the wire being drawn.
7. Wire that is annealed will sometimes “neck” (stretch to a smaller cross section) when being drawn, resulting in a wire size that is smaller than the die size. To ensure accurate final wire size, avoid trying to finish wire with one single die after annealing.
8. Minimize the distance between the die and the drawing source. Movement of the wire stock from side to side during drawing will result in wave patterns on the drawn wire.
9. Failing to keep wire dies clean and free of residues can result in a diminished surface quality on the drawn wire.
10. Platinum alloys used for jewelry often leave particles of the platinum alloy bonded to the surface of the die and are difficult to remove. Failing to remove these particles will negatively impact the surface quality of wire stock being drawn afterwards.

## WIRE DRAWING TIPS

### *1. Wire stock breaks during drawing*

- a. Too great of a reduction for the feedstock being drawn.
- b. Insufficient lubrication, which causes increased friction.
- c. Defects in wire stock such as voids or delamination.
- d. Wire being drawn in the wrong direction through die.
- e. Reductions between dies are not matched to the draw speed of the wire drawing machine.
- f. Wire stock is tangled on feed side of draw die.
- g. Wire die is at an angle in relation to the wire being drawn.
- h. Dies used are not designed for nonferrous materials.

### *2. Poor quality finish on wire*

- a. Insufficient lubrication which results in increased friction.
- b. Trash at entrance of die which feeds into the die with the feed stock.
- c. Wire being drawn the wrong direction through die.
- d. Poor finish on die either due to excessive die wear or poorly polished die from manufacturer.
- e. Feedstock is of poor quality possibly from grain growth as a result of over annealing, blistering on surface of stock resulting from excessive copper oxide in stock and annealing in hydrogen atmospheres or surface defects on stock.
- f. Lubricant is contaminated with abrasive particles.

### *3. Wire size drawn is not accurate*

- a. Die is worn to a larger size.
- b. Wire stock is too soft for final draw and stretches (necks) at output side of die.

### *4. Wire has grooves on the surface*

- a. Die has trash caught at the entrance and is fed in with the wire stock.
- b. Square stock not drawn to round cross section with one die.
- c. Original feedstock was defective. Stock may have become finned while square rolling.

### *5. Wire has wavy patterns (chatter marks)*

- a. Distance between die and drawing source is too large, which causes wire to vibrate as it feeds through the die.
- b. End of wire stock on the feed side of die is not held in a fixed position and vibrates.

## WORKING WITH WIRE AND SIZING STOCK

Selecting a metal, pouring ingots, cold working, annealing and stress relieving procedures are identical to the fabricated sheet methods described.

### *Special Tips and Pointers*

- To straighten our stocks and wire: first, anneal and quench to soften; then, fasten one end and pull on the opposite end with tongs or draw bench until you feel a slight movement. Release pressure, and the piece should be straight.
- To help prevent pits when sizing, you need an absolute flush fit at the joint which should also be as clean as possible. Paste solder is not designed for sizing work and should not be used.
- You can request tempers other than what we stock when you place your order. Allow three extra working days for us to ship.  
Reminder – Stress relieving product will greatly reduce the likelihood of stress-corrosion cracking.

### *Seamless Tubing*

Seamless tubing is available in a variety of stock sizes in round, oval and square. Tubing is used to manufacture large, lightweight jewelry.

- Drawing down to a smaller outside diameter can be done simply by pointing the end, waxing or oiling the outside of the tube and pulling through the desired dies on your draw plate. The wall thickness will increase slightly with each reduction.
- Too great a reduction in a single pass may collapse the tubing, so use care.
- The amount of work and annealing procedures are identical to fabricated sheet, please see this section on page 147.
- Arboring of round tubing is done as follows:
  - 1) Anneal tubing.
  - 2) Insert a lubricated wire no greater than two-thirds the inside diameter of tubing.
  - 3) Gently pull the ends of the wire, so the tube wraps around the mandrel (Let the wire do the work.).
  - 4) Remove the wire insert.
  - 5) The larger the tube diameter is, the larger the arbor must be. If multiple draws are required, the arbor will become difficult to remove from the tube stock. Some scheduling is required.
- Arboring of square tubing is done as follows:
  - 1) Anneal tubing.
  - 2) Insert lubricated wire no greater than two-thirds the inside diameter of tubing.
  - 3) Gently pull the ends of the wire, so the tube wraps around the mandrel (Let the wire do the work).
  - 4) Between each draw, the tube needs to be loosened on the arbor. Making a light pass through one set of the grooves on a square rod mill does this.
  - 5) Prior to final tube size, loosen the tube and remove arbor. Draw to final size.

### *Heat Treating*

Heat treatments are powerful methods for changing the structure of a material and altering its properties. There are several reasons why annealing is done. They are as follows:

1. To soften metal after cold-working operations so that further cold work can be done.
2. To decrease segregation in age-hardenable gold alloys so that a maximum hardness will be achieved during the age hardening process.
3. To eliminate concentration gradients that occur as a result of solidification events during the casting processes.



4. To strengthen and harden alloys that respond to “age-hardening” process steps. Heat treating to remove the effects of cold work is probably the most common treatment given to precious metals. This section will review annealing and age-hardening heat treatments in separate sections. Hopefully, the reader will obtain a deeper understanding of some processing techniques that can be used to great advantage.

## *Annealing Cold-Worked Structures*

The cold-worked state is a condition of higher internal energy than the undeformed metal. Although the cold worked structure is mechanically stable, it is not thermodynamically stable. With increasing temperature, the cold-worked state becomes more and more unstable, and, eventually, the metal softens and reverts to a stress-free condition.

Annealing is a process which eliminates the stresses created during mechanical working or deformation of an alloy, so that the material can be restored to maximum softness. In the metals industry, this involves heating a metal to an elevated temperature for a controlled length of time followed by natural or forced cooling back to room temperature. Annealing is very important commercially, because it restores ductility to a metal that has been severely cold worked. Therefore by interposing annealing operations after severe deformation, it is possible to deform metal to a great extent.

It is important to realize both time, temperature, and cooling rate are important variables in controlling the outcome of an annealing process. In general, annealing should be completed in a time that is measured in minutes, not hours. Stuller, Inc., received a distress call from a person who destroyed a white gold piece by annealing it overnight in an attempt to make it “really soft.” Unfortunately, the gold alloy was severely damaged by trying to achieve the impossible. Metals can be softened to a certain point and no further, regardless of how long they are exposed to elevated temperatures.

The Gold Alloy Data in the Appendix contains many graphs for 14K, 18K and 22K yellow gold alloys that describe how hardness, strength and ductility change with annealing conditions. To create these graphs, samples were annealed for 30 minutes at increasing temperatures. This graphical information is worth some study. For example, the graphs demonstrate how hardness, strength and ductility change drastically after 30 minutes of exposure to temperature around 500°C - 600°C. The graphs indicate that a 30-minute anneal at 800°C results in hardness values that are only slightly less than those achieved by annealing at 500°C - 600°C for the same length of time.

This extra decrease in hardness is a result of grain growth. Large grains are undesirable in material that is cold formed, because they will create “orange peel” texture, which is very difficult to polish and finish. Thus, it is best to choose an optimum temperature for annealing where recrystallization occurs readily and grain growth occurs slowly.

Many of us may look at annealing as idle time or even nonproductive time since the product does not appear to get any closer to its final shape. With this in mind, there are basic rules that should be considered that will minimize the time required to achieve a complete anneal.

### *1. Degree of cold work*

There is a minimal amount of cold work that is required, so complete recrystallization occurs during an annealing cycle. This is approximately 30 to 40% reduction for most common gold alloys. Putting more cold work into a gold alloy prior to annealing will accelerate the process and decrease the time and temperature required to achieve recrystallization. Some reductions that are typical for most standard gold alloys would range from 50% to 75%. The greater the residual stored energy of cold work, the quicker and more uniformly recrystallization will take place during the anneal cycle.

### *2. Temperature*

Annealing can be done at a number of temperatures, but some common temperatures used for annealing would be 1200°F for yellow gold alloys and 1350°F for most white gold alloys. Higher temperatures will speed up recrystallization but can cause very rapid grain growth and have a negative impact on the product. Recrystallization can also be achieved at lower temperatures, but the length of time required for completion of the process increases and, therefore, becomes counterproductive. Again, the degree of cold work can change the time and temperature required to achieve the same results.

### 3. Time

When calculating the time required to anneal a specific product, several factors must be considered. These include type of alloy, degree of cold work, temperature and the time required for the product to reach the selected annealing temperature. Once the product reaches the proper temperature, the clock starts for measuring time required for the recrystallization process to be completed. For small pieces, the time required for a yellow gold alloy will be approximately 15 minutes at 1200°F. For a typical white gold alloy the time required would be approximately 20 minutes at 1350°F. Large, heavier pieces will require longer times to heat to annealing temperatures, and this fact has to be considered when process parameters are selected.

### 4. Quenching

In this discussion, only water quenching will be considered. The purpose of quenching is to capture the structure formed at elevated temperatures. This is generally the structure with the most desirable properties. Most yellow gold alloys can be quenched or sometimes even air cooled and still maintain their annealed properties. However, an exception to this are the yellow gold alloys which fall into the category of age-hardenable alloys. These should always be quenched at the last red color to avoid an increase in hardness. Nickel white gold alloys should always be quenched to prevent the precipitation process that hardens the white gold at lower temperatures. Avoid letting nickel white gold alloys cool slowly, because hardening reactions can and will occur. Some alloy systems which should always be quenched from red temperatures are 18 karat red and 18 karat nickel white golds because of the extreme hardness and brittleness these alloys can develop if slowly cooled.

There are many benefits that can be gained from annealing. The most obvious is softening an alloy, so that mechanical deformation can be done. The greatest benefit is what can be termed as “conditioning the alloy.” When cold work and anneal cycles are performed to the correct schedule, the end result is an alloy that will have a fine, uniform grain with good strength and elevated ductility. A fine grain structure is more resistant to tearing, easier to polish to a high gloss and has decreased concentrations of contaminants in the grain boundaries. The mechanical strength, ductility and forming characteristics of fine-grained material are all generally superior to the same properties of coarse-grained material.

## AGE HARDENING OF GOLD ALLOYS

Gold alloys are most commonly hardened and strengthened by cold work, or deformation. Sometimes it is desirable or necessary to harden a gold alloy without deforming it. There are particular gold alloys that gain various degrees of hardness when subjected to a controlled sequence of temperature, time and cooling rate. For example, the hardness of a certain 10K yellow gold alloy can be increased almost 50%, or 30 points on the RB scale by special, heat-treating steps. Many individuals refer to this group of alloys as heat-treatable alloys. It is more accurate and informative to refer to them as age-hardenable alloys. At this point, we will discuss three key issues:

1. Concept of age-hardening alloys
2. Choosing the correct alloy
3. Process parameters to achieve age hardening

## METALLURGY OF AGE HARDENING

Two types of precipitation-hardening phenomena occur with age-hardenable gold alloys. They are precipitation hardening and order-disorder transformations. Both phenomena require heating the alloy through a sequence of designated temperatures for a determined period of time to facilitate the hardness increase. The critical process steps in precipitation hardening are:

- Annealing at sufficiently high temperatures, so that the material becomes saturated with alloying elements followed by quenching
- “Ageing” the material at a lower temperature for a sufficient length of time to create a favorable distribution of fine precipitates to cause maximum hardening and strengthening.

Precipitation hardening is a phenomenon where a second phase in the gold alloy forms and grows, while the alloy is in the solid state. At a specific temperature phase B is encouraged to precipitate at the grain boundaries and within the crystals of a solid phase. The result is a large number of microscopic particles within the alloy matrix. These precipitate particles make it difficult for dislocations to move through the alloy matrix during cold working and increased stress levels are required to deform the alloy.

A second type of precipitation hardening occurs when the precipitate has a special relationship with the matrix in which it forms. In gold alloys, these special types of precipitates form during what are called order-disorder transformations. These transformations occur in alloys with Au/Cu atomic ratios of 1:1 and 3:1.

When these alloy systems are at high temperatures, the atoms are randomly distributed on the crystal lattice points and the structure is considered to be “disordered.” When cooled below a specific temperature, the atoms become regularly spaced with gold and copper atoms located on special sites in the gold FCC crystal lattice. This is called the “ordered” state of the alloy. The ordered structure creates an extra degree of stress in the atomic lattice because of the size differences between gold and copper atoms. The crystal lattice then becomes strained and distorted. Sometimes these types of precipitates are called “coherent precipitates” because of their special relationship to the crystal lattice in which they reside. The lattice strain created by these precipitates is then called “coherency strain.” This distortion makes it more difficult for dislocations to move through the structure, and higher stresses are required to deform the alloy.

## AGE-HARDENABLE ALLOYS

To incorporate an age-hardening process, three steps require special attention. The first step is selection of a gold alloy that will age harden, the second step is conditioning the alloy structure and the third is the actual heat-treatment process referred to as aging. Proper selection of a gold alloy will be discussed first.

In karat yellow golds with or without zinc, copper and silver are responsible for the age-hardening characteristics of a particular gold alloy. More specifically, it is the copper/silver ratio that determines whether a gold alloy will respond significantly to an age-hardening process. Additions of zinc will modify the (Au, Cu, Ag) system, and, as zinc levels are increased, the alloy’s ability to age harden is somewhat reduced.

## AGE-HARDENING PROCESS PARAMETERS

Once it is determined that an alloy will respond to age hardening, the process steps required to achieve a maximum response must be followed. A second important issue is to assure that the alloy structure is in a condition that will yield a maximum increase in hardness. This maximum response can be assured by homogenizing the alloy with the heat treatment step. At this point, it is useful to discuss some differences in the production of cast vs. die struck or fabricated metal products. Solution annealing is often referred to as homogenizing and is designed to blend any micro segregation that may be the result of nonuniform cooling of the alloy structure. If the alloy structure is not homogenous, the product will not evenly harden.

Homogenizing an alloy structure can be done either by annealing solution or by cold working. If the product will be left in the as cast condition such as investment cast pieces, then solution annealing is required to homogenize the alloy structure prior to aging. Solutionizing is done by holding the product at an elevated temperature for a period of time followed by rapid cooling, such as quenching. The first cycle is typically called “solutionizing,” and the second cycle is called “aging” and is the driving force behind the structural changes discussed below. Quenching from above a specific temperature is critical to avoid any micro segregation that may result from slow cooling. An oven is highly recommended for the solutionizing treatment due to better control of temperature and the length of time required for proper treatment. Cold work followed by proper annealing is an excellent way to homogenize an alloy structure. Cold work by itself will homogenize an alloy if the amount of cold work is significant. Therefore sheet and wire products formed by cold working should be homogenous and should not require solution annealing prior to heat treatment to increase the hardness.

As mentioned earlier, as cast structures should be solution annealed and quenched prior to age hardening to decrease segregation which may be present due to uneven cooling. Temperatures and times recommended for solution annealing colored gold alloys are as follows:

18 karat colored gold	550°C-600°C	30 minutes
14 karat colored gold	650°C	30 minutes

The third and final stage of the process is the low-temperature treatment known as aging. Increasing the hardness of the alloy is dependent on both time and temperature. If the aging time is too short, maximum hardness will not be achieved. When the aging time is too long, a loss of hardness and strength could occur. If the temperature used for the aging step is too high, an increase in hardness will not occur. In fact, an article which may have been tempered due to cold work may start to anneal and lose hardness. Temperatures and times recommended for aging colored gold alloys are as follows:

18 karat colored gold	280°C	60 minutes
14 karat colored gold	260°C-350°C	60 minutes

The information that has been presented is intended for use as a general guide for selection and aging of colored gold alloys, it is not intended for white gold alloys. When handled properly these gold alloys can be beneficial for multiple applications. Some of the many applications follow:

1. Jewelry products can be hardened to help resist indentation during mass media finishing or service in the field.
2. Jewelry products such as clips that require using annealed stock for bending processes could be hardened afterwards. Some examples of these products would be earring clutches, catches for jewelry and money clips.
3. Thin wall gold products such as hollow beads, charms, light weight rings and thin wall tubing used for bracelet stock can be hardened to help prevent distortion.
4. Wire products used for earring posts, stick pins and hinge pins can be hardened after soldering operations.



# SOLDERING

During the fabrication of jewelry, several joining techniques are used such as, soldering, laser beam welding, fusion welding, diffusion soldering and adhesive joining. In this section, only soldering is discussed.

## *Definition Of Soldering*

Soldering is the process of joining two or more pieces of metal using a metal alloy called filler metal or solder, whose melting temperature is lower than those of the metals being joined. The molten solder must wet and flow across the surfaces of the joint to form a strong metallurgical bond between the solder and the pieces being joined. The action of the solder is assisted by flux, a chemical applied to the joint, which displaces oxides from the surfaces to be joined and promotes wetting of the joint surfaces by solder.

The temperature at which a solder becomes liquid and begins to flow so that it fills a joint is called as flow point or working temperature of the solder. It is typically 25-75°F above the liquidus temperature of the solder (the temperature at which it is completely liquid).

The melting range of a solder is the difference between the liquidus and the solidus temperature of the solder (the temperature at which it only begins to melt). It enables you to choose the solder best suited to the clearances of the joint and the melting point of the parts to be joined. Some solders are formulated to melt in a narrow temperature range. They are very fluid when completely melted and flow easily into close-clearance joints (typically less than 0.005"). Other solders are formulated for a wide melting range. Their relatively sluggish flow is designed for filling wide gaps.

## *Principles Of Soldering*

To ensure a successful soldering operation, several criteria must be satisfied.

1. The solder alloy must have a lower working temperature than the melting point of the metals being joined. This means that the liquidus temperature of the solder is below the solidus temperature of the alloy used to make pieces to be joined. Ideally, there should be a difference of at least 100°F between the working temperature of the solder and the solidus temperature of the parent metal to avoid localized melting of the parts being joined.
2. The molten solder alloy must wet the joint surfaces, so that it can flow through the joint gap. To obtain wetting conditions, it is essential that the joint surfaces are clean and free from grease, dirt and oxide films. This necessitates the use of a flux to clean surfaces or furnaces with protective atmospheres to prevent oxidation.
3. The molten solder is drawn into the joint gap by the action of a capillary force. The smaller the joint gap, the farther the liquid solder will travel into the clearance between the joint surfaces. It is recommended that a joint gap in the range 0.0004-0.004" should be used to achieve adequate filling and to ensure strong bond.
4. It is known that surface roughness has a beneficial effect on the spread and flow of molten solder. Abrasion of the joint surfaces with a 400 grit paper is likely to give a better filled joint than if they are highly polished. Also, it is a good practice to radius the edges at the entrance to the gap where possible to assist flow of solder into the joint gap.

## *Fluxes*

Flux is an inorganic chemical compound added to areas to be soldered in preparation for a joint. The function of a flux is to promote wetting of the joint surfaces by solder by removing any oxide from the joint area and from the solder and to prevent further oxidation during the soldering operation. Because oxides start to form well below the melting point of solders, it is important to use a flux that becomes completely fluid and chemically active before the solder melts and remains so until after the solder has solidified. A good flux therefore, should:

- dissolve oxide scales.
- inhibit the formation of oxides during heating by providing a protective surface cover.
- promote the wetting of the surfaces by the molten solder and facilitate the flow of solder.
- be easily removable when the soldering operation is completed.

There are essentially two types of fluxes – chemically active and chemically passive. Some of the halide-containing fluxes like the Handy Paste flux are examples of the former, while borax or boric acid fluxes fall into the latter category. As the karatage of the work decreases, more active fluxes are needed to clean and keep both the solder and the joint free from oxidation.

## FUELS AND FLAME CHEMISTRY

During assembly of jewelry pieces heating is done using torches, which mix mostly oxygen and gas and sometimes air and gas. The fuel gases commonly used in these torches are hydrogen, natural gas, acetylene, propane and butane.

It is important to control the fuel to oxygen ratio. For instance, consider the combustion of natural gas, which is mostly methane ( $\text{CH}_4$ ). When completely burned, methane reacts with oxygen.

An excess of oxygen in the oxygen-natural gas mixture will give rise to an oxidizing flame.

This oxygen, which is not captured by the flame, is free to attack the metal, creating oxides that form on the surface of the metal. Therefore an oxidizing flame should be avoided.

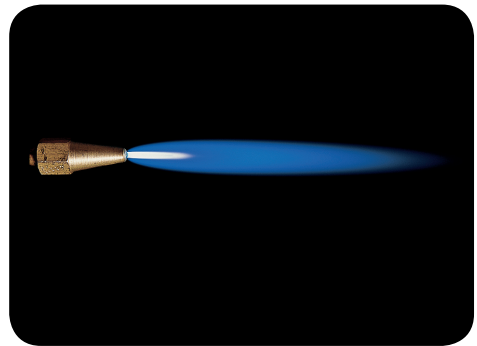
A lack of oxygen below the level needed for complete combustion will result in a reducing flame.

The flame now will contain carbon monoxide, instead of carbon dioxide and water vapor. If there is too little oxygen, unburned fuel particles risk contaminating the metal and producing a cooler flame.

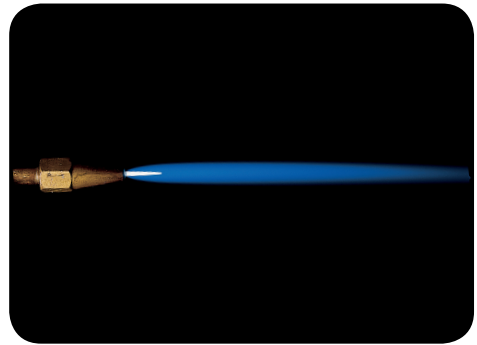
A little practice is needed to achieve the correct mix of fuel and oxygen. The proper flame is a balance in which there is sufficient oxygen to fully burn all the fuel present, and nothing more. A reducing flame will be a soft-edged, bushy flame with a yellow color. If the oxygen supply is increased, the flame will become sharper and narrower with a pale blue color. The tip of the neutral flame will be rounded. With further increase in oxygen supply, a pointed conical flame forms at the head of the torch. It consists of two flame cones, one within the other, a bluish inner flame cone and a dark blue outer cone. Figure 1 is an actual photograph of an oxygen-propane torch showing the characteristics of neutral, oxidizing and reducing flames.

High-karat golds are not adversely affected by heating with a slightly oxidizing flame, but the lower-karatage alloys require neutral or slightly reducing conditions to prevent oxidation of the base metal constituents.

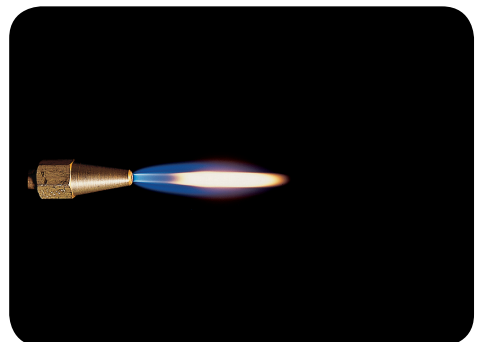
Oxidation is not much of a concern while soldering platinum. However, a reducing flame should be avoided when using the hydrocarbon fuels due to the embrittling effects of carbon in platinum. More specifically, acetylene torches should be avoided, because acetylene flame is considered to be “dirty” due to the fact that flakes of carbon are always found on the pieces being soldered. For this reason, acetylene torches are not recommended for soldering platinum.



**Neutral Flame**



**Oxidizing Flame**



**Reducing Flame**

*Figure 1. Photograph of propane torch with three types of flames.*

## SOLDERING STAINLESS OR SURGICAL STEEL TO GOLD OR SILVER

Always use silver solder in combination with a flux such as Dandix, which is formulated specifically for use with silver, when soldering stainless/surgical steel to gold or silver. Gold solders and other fluxes will not produce satisfactory results when working with stainless steel.

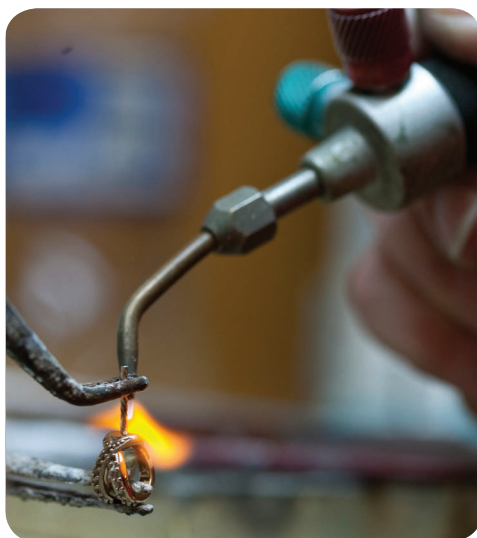
### *Soldering Titanium*

With the growing use of titanium in jewelry, eyeglasses and other consumer products, jewelers are asked with increasing frequency to repair these products. Unfortunately, ordinary torch and solder techniques will not work with titanium, as it forms an oxide barrier immediately when a fresh surface is exposed. Titanium is normally welded in a vacuum or protective gas atmosphere. In jewelry applications, it is easily welded using a laser welder such as the Rofin Starweld Performance Laser (available from Stuller, #14-0110).

### *Solder tips*

**Everyone has a method of soldering, but here are a few tips which have proven successful for us.**

- When you receive your solders, use a scribe to mark the color on the bottom edge of one side and the solder type on the other. Start using the solder at the opposite edge from the scribe marks. This way when you get down to the smallest piece you will know what it is.
- Clean the sheet solder with pickle compound, then straight denatured alcohol.
- If the article has been worn, first run it through the ultrasonic cleaner. Then, clean with pickle compound and coat with a boric acid/denatured alcohol solution. When using paste solder, apply the solder first, then the solution.
- Ignite the boric/alcohol solution to produce a protective glaze that inhibits oxidation.
- If sizing a ring, you should have a flush fit at the joint, which should be as clean as possible. Neglecting either of these steps will usually result in pits. Paste solder is not designed for sizing work.
- Apply proper heat to the article then to the piece of solder. When using paste solder, simply apply heat to the article. If solder is overheated, pits may result from burning off alloy additions.
- Apply “self pickling” flux as needed at the solder joint to induce solder flow (not needed for torch solder pastes).
- Solder flow can be stopped from flowing where you don't want it by using tripoli, yellow ochre, a graphite pencil, stop off or garlic. To tell if a ring has been soldered, hit it with a torch flame until a light oxide forms; the solder will stand out. When performing multiple soldering operations on a piece, start with a high temperature solder (hard) for first operation, then move down in temperature (medium or easy) for subsequent soldering. To prevent flowing, first joint sizing of rings is generally done with hard solders. Minimize gaps between parts to be assembled (good fit).
- Always use a well-ventilated area, and make sure the solder you choose doesn't have a higher flow point than your articles (Some hard solders fall into this category.). The law gives you more negative tolerance on soldered product, but our advice is to use plumb gold solders for the karat on which you are working.



## RING SIZING TECHNIQUES

Ring sizing is a fairly straightforward process and one of the most commonly used by the bench jeweler. It involves either adding or removing a piece of metal from the shank of a ring to increase or decrease the diameter, or ring size. 2.61mm added to or removed from the shank will change the ring by one full size (US sizes). There are a variety of techniques used to affect the size of a ring.

### *Swaging*

There are two techniques that can be used to reduce the size of a ring: swaging or removing a piece of the shank.

Swaging requires the use of a set of dies and press to force the ring into the die. Most commercial ring stretchers have a swaging set at their base. Swaging should only be used on plain half round wedding bands that are not tapered. It is important that the band has not been cut and sized before. This will affect the ability of the metal to upset (swage) uniformly. Flat bands and bands with patterns will be distorted by this process.

Begin by annealing the band. Select a die that allows about one third of the band width to protrude above the die surface. The surface of the die should be polished and free of any defects or rust. If the press has an adjustable ram, set it so the ram does not touch the surface of the die plate when it is at the bottom of the stroke. It is not necessary to lubricate the ring or die when it is being swaged.

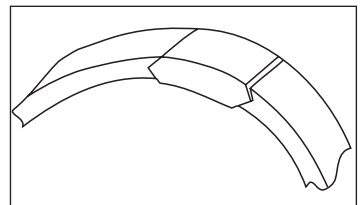
Center the ring in the die and position it under the ram. Slowly lower the ram and allow it to level the ring in the die. Using firm pressure, push the handle of the ram down about half of the stroke. Raise the ram and turn the ring over and repeat this process. Because this process tends to roll the edges of the ring inward, it is necessary to reduce the ring size one half size smaller than the intended size.

Now position the ring on the ring stretcher or steel ring mandrel and bring it back to the desired size. This step will eliminate the cupping that is produced on the inside of the shank from the rolled edges. After swaging, the ring should be stress relieved and polished. If the size of the ring must be reduced by more than two sizes, this technique is not recommended.

### *Sizing*

If the ring is cut to be sized it must be rejoined. There are two common joints used: butt and dovetail.

The butt joint is formed when the shank is cut flat on the ends, and brought together to form a tight seam or joint. The dovetail joint is formed by making a “V” shaped cut or notch in the shank (when viewed from the side) and shaping the other side of the joint into a blunt point to match the “V” (Fig. 1).



**Fig. 1**

Although the butt joint is more commonly used of the two, the dovetail is a much stronger joint. The main reason for its infrequent use is due to two factors; the jeweler is not familiar with this technique or the joint is difficult to fit properly. Because most jewelers are familiar with fitting a butt joint, I will focus on fitting the dovetail.

One of the more common problems that jewelers have in fitting the dovetail is caused by trying to make the angles too sharp (acute). The “V” should be fairly open, no sharper than 90° and open no more than 120°. This angle can be cut in one of two ways, sawed or filed. Sawing is my preference.

Lay the ring flat on the bench pin and loosen one end of the sawblade and pass it through the ring. Slowly saw halfway through the shank (from the inside outward) at a 45° angle. Be sure to keep the saw perpendicular to the shank. Loosen the blade and remove the ring from the saw. Put the ring back on the bench pin and, from the outside, saw inward to the previous cut at a 45° angle, opposite the first cut, to form a “V”. Use a #1 saw blade to make the cut, and the fitting will be much easier. This will form the female side of the joint.



To form the male end of the joint, I use a pair of diagonal cutters (a heavy pair of wire cutters) to form the basic shape. The final shape can be formed very quickly with the use of a flat hand file. Use long straight strokes to keep the surfaces flat. Trial fit the joint and make any adjustment to make the surfaces set flush. If you are adding a plug to the shank (sizing up) don't try to fit both ends at the same time. Concentrate on one end and solder it into place before fitting the other end. This will make the fitting process much easier.

When using a file to form the "V," a square needle file is a good choice. It is important to use long smooth strokes to keep the surfaces flat. Use a saw to start the groove in the center of the shank to allow the file to track along. A #1 saw blade works well. It is not necessary to make the cut any deeper than the sawblade. A three-corner file also works well, but keep in mind that the angle must be opened up, so only file one surface at a time. Care must be taken to prevent the corner from drifting into the opposite surface. After one side is fit, solder it into place (if the ring is being sized up) and begin fitting the remaining side.

The soldering process is fairly straightforward. There are a few considerations that should be noted. First, be sure to protect the surface of the metal from oxidation with a powdered boric acid and alcohol solution before heating. Flux the joint to further prevent oxidation and reduce surface tension to allow the solder to flow. Remember that solder always flows toward the heat, so heat the joint from the opposite side that the solder is placed. Always heat the mounting and never the solder directly.

If solder erosion does occur, it usually happens on the side that the solder is placed prior to melting. If the solder is placed on the inside surface of the ring and drawn through to the outside surface, pitting along the solder joint can usually be reduced. In addition, the solder is much easier to position and remains in place better during the heating process.

When heating the shank it is best to heat along the shank, not back-and-forth in line with the solder joint. Use an on/off heating technique while heating the shank. This will allow the heat to stabilize in the shank and give better control over the solder flow. Do not try to over flow the solder. Remove the heat source the moment the solder flows through the joint, even if some solder remains piled on the opposite side. Solder only needs to flow to the outer surface of the joint and not flood over the surface of the shank. Trying to flood the solder over the surface is the main factor in overheating the solder, which promotes solder erosion. Solder erosion will appear as a group of small pits in the area of the solder. These pits will be along the edges of the joint and not in the joint itself.

Before the shank is rounded out again, it is best to file the inside joint flush. Leaving the joint uneven while rounding can add undue stress to the solder joint and may lead to failure. After the inside is filed flush, use a rawhide mallet or dead blow mallet to round out the shank.

Slide the ring over the mandrel and pull it tight. Strike the shank directly against the mandrel and not with a glancing blow. Remember, the goal at this time is to round out the shank and not adjust the ring size. If the ring size remains a little smaller than the required size, use a steel hammer (a chasing hammer is good) and tap the shank lightly directly against the mandrel to increase the diameter. Never try to wedge the ring down the mandrel to increase the size. This practice will often deform or torque rings with a gallery top and limit all control over where the metal is stretching. If the ring has been sized up, hammer against the plug to increase the size. The plug should be slightly thicker than the surrounding shank and the slight thinning effect of hammering the shank will not affect the overall shank thickness.

After the ring is round and to size, file the shank to the proper shape. If the sides of the shank are filed first it is much easier to edge to contour and thickness of the shank. Be sure to remove all excess solder (if any) surrounding the joint. Use an emery buff stick to remove the file marks on all surfaces of the shank. The ring can be polished in the conventional manner.

## Preform SIZING SYSTEM

### BENEFITS & ADVANTAGES:

- SEAMLESS FIT
- LESS PITTING
- STRONG JOINTS
- HANDS-FREE SOLDERING
- SAVES TIME
- EASY TO USE
- HIGH-QUALITY CONSTRUCTION
- LESS WASTED METAL

SEE PAGES 36-37 FOR PREFORM BULK AND PRECUT PIECES.

## HOW TO WORK PLATINUM

Working with platinum is similar in many ways to working with other precious metals. Skilled jewelers shouldn't have difficulty working with platinum once they become accustomed to its unique properties. It has a much higher melting point than gold alloys. As a result, eye protection is extremely important. In addition, platinum combines with other metals readily at elevated temperatures, so tool and workplace cleanliness are also important. Further details on these two topics are included in this section.

### *Eye Protection*

Most soldering, and all welding operations on platinum jewelry, involve temperatures in excess of 1500°C (2732°F) at the joint face, and between 2000°C (3632°F) and 2800°C (5072°F) in the heat source. The white radiation at these temperatures is very intense and is hazardous to the unprotected eye. Even a short exposure is certain to leave an after-image on the retina that will persist for several minutes and distort both positioning and color judgement. Longer exposures will produce “arc-eye” or even permanent damage to the retina. Choosing a correct filter system requires a reasonable compromise between filtering out all possible dangerous radiation and leaving enough intensity and color to enable the operator to judge position, temperature and the condition of the piece of jewelry being heated. Platinum sections are likely to be lightweight, but they are melted at even higher temperatures than steel. Grade 5/GW (Shade 5, gas welding) filters can be used for short work periods when soldering platinum alloys, but choose at least grade 6/GW when using the highest temperature platinum solders for longer periods. BS679 9EW, or its international equivalent (shade 9, electric welding), to 11EW filter glasses, should be used for long welding exposures.

Although perhaps less dangerous to the eye itself, the infrared component of high-temperature flames also needs to be guarded against. While an occasional short exposure to the skin may not be harmful in itself (Personal discomfort usually quickly reminds the occasional operator that welding and soldering heat sources radiate heat very directly!), repeated or prolonged exposure is dangerous. The skin should be covered, or the head and shoulder area screened, not just the eyes.

Warning: Never try using even the densest sunglasses. At the ultraviolet end of the spectrum, they may offer some protection against general sunlight but not against a sharp concentrated image of an arc or oxy-gas flame.

### *Annealing Platinum*

Protect eyes with welding glasses or goggles during annealing to eliminate ultraviolet rays (see “Eye Protection”). Unlike most other materials, platinum alloys can be safely annealed without taking precautions to prevent oxidation. Annealing can be done using a hand-held torch made for use with oxygen and either natural gas, LPG, or artificial gas. The piece to be annealed must be clean – if there is any doubt about this, it is wise to pickle before bringing to temperature – and supported on a clean brick used exclusively for this purpose. The properties of platinum change quickly when contamination occurs, and the need for cleanliness cannot be overemphasized. Even minute quantities of lead, aluminum, steel and other metals are to be avoided. Lead, in particular, dissolves in platinum making further work difficult or impossible.

Only experience and personal observation can indicate the precise time when annealing is required. Excessive or extending annealing can cause grain growth which may affect subsequent forming or polishing operations.

The flame should be bright, blue oxidizing flame in order to achieve the temperatures required. Stress buildup from cold working metal can be relieved by heating the piece to 600°C (1112°F). Softening occurs rapidly at 1000°C (1832°F) or when the metal is bright orange in color. Where thin or highly-stressed sections are involved, it is better to stress relieve for a few minutes before taking to the higher temperature for annealing. The time that the piece should be held at the “bright orange” temperature will depend on its size and thickness. As a rough guide, a piece 1” square by .040” thick will require about 1 minute. The time will be proportionately more or less for other sized pieces. For example, an average ring would required 30 seconds.

Furnace annealing is preferred for large pieces to ensure even heat distribution, which may be difficult to achieve using a torch. Do not use a hydrogen oven because of the danger of hydrogen embrittlement.

Platinum alloys can be cooled in air or quenched in clean water immediately after annealing. Do not use standard tweezers to handle the red hot piece; let it cool to normal color or use tungsten-carbide tweezers.

## IMPORTANT INFORMATION ABOUT PLATINUM/COBALT ALLOY

Stuller cast platinum products are made from a 95/5 Platinum-Cobalt alloy.

Since cobalt is ferromagnetic, like iron, this alloy is slightly magnetic. Avoid contamination of the piece with magnetized bench scrap.

The melting temperature of this alloy is 1677° C (3050° F), compared to 1788° C (3250° F) for 90/10 Platinum-Iridium alloy. This difference makes fusing the two alloys practically impossible.

When sizing a platinum/cobalt shank, use a 1700° C solder. When joining to gold, it is important to use a cadmium-free karat gold solder as cadmium will migrate into the grain boundaries, causing brittleness.

This alloy will tarnish (oxidize) during soldering. Do not coat the piece with boric acid prior to soldering, as this will lead to brittleness and breaking along the joint. After soldering, coat with boric acid, heat to approximately 1200° C (low, red color), and pickle to remove the oxides.

### PREPARING THE METAL

After annealing the platinum, there is usually no need for further treatment. Platinum does not have to be pickled, as there is no oxidation or discoloration from heating. All fabrication should include as much pre-polishing as possible, since heating for soldering has little or no effect on final finish.

In rolling the metal down to the desired thickness, never reduce the thickness by more than 70% without annealing. Excessive annealing will create an orange-peel effect, which adds to the difficulties of polishing; 30% should be considered the minimum reduction.

In rolling down for wire or square wire, follow the same directions as for plate. Anneal after rolling down from 30% to 70%.

In drawing wire, the best drawplate for the final draw is a drawplate with diamond nibs. This will give you a polished surface. Since most platinum alloys do not discolor, the polished surface will remain after soldering.

The initial wire bezel should be closed with 1600 platinum solder. All soldering thereafter should be done with lower melting solders. This will give plenty of latitude for subsequent setting soldering into the piece of jewelry.

### CONTAMINATION

Platinum is readily contaminated by other metals when heated. It is important, therefore, to use clean tools which will not leave residue or particles of other metals on the platinum. Because of extreme differences in melting points, other metals tend to sink into the surface of platinum as it is heated for annealing or soldering, causing both pits and discoloration of the surface. Once another metal is alloyed into the platinum, it is impossible to remove except by refining. Separate files, abrasives, polishing compounds and buffs should be used to prevent surface contamination. Particles of gold and other materials can be forced into the surface by contaminated tools.

A somewhat less drastic form of contamination occurs from the use of tweezers, clamps, pins and binding wire as holding or fastening devices for soldering. If steel, iron, chrome or nickel-plated elements are within the high-heat area required to flow platinum solder, they produce a blackish stain on the metal. Surface contamination with ferrous metals can usually be removed with hydrochloric acid. If they are actually in contact with the joint, total contamination through fusion may result, for which there is no salvation. The staining is less likely far away from the actual heat area (at least 1/2" away from the tip of the flame).

## WELDING

**Protect eyes with welding glasses or goggles during welding to eliminate ultraviolet rays (see “Eye Protection”).**

Torch tips recommended for soldering or welding: .025 to .040 diameter. Stainless hypodermic needles can be silver soldered to a spare torch tip to make an even smaller flame. The size of the orifice is stamped on the side of the hypodermic needle.

For all small flames, an oxygen regulator with a low-end capacity should be used to maintain one to two pounds of pressure without fluctuation.

The most ideal fuel for soldering and welding is natural gas and compressed oxygen; however, propane gas could be used in place of natural gas on most gas/oxygen torches (check specifications) for a portable heat source. Acetylene should not be used as it readily contaminates platinum, leading to brittleness and cracking.

Apart from the high temperatures involved, platinum alloys weld readily without the need for flux. Because filler material, if needed, is the same as the components to be joined, it is easily possible to close the seam without any visible color change. This is a decided advantage in sizing rings, for instance. Even so, it is good practice to minimize the amount of filler needed (whether welding or soldering) by making joints as close and accurate as possible; platinum alloys do not readily bridge large gaps.

If the joint is made tightly, the only filler material needed is a thin piece (0.1 to 0.5mm) of the same alloy, cut to just outside (0.5 to 1mm) of the two sections. In ring joining, the two are likely to be the same section anyway, and this avoids any contraction of the whole joint.

The two components to be joined are clamped on either side of the vertical filler, and the whole joint is heated slowly, beginning with the heavier sections on either side and gradually moving the torch flame to concentrate on the fringe of filler material. The filler should melt down into the joint before even superficial fusing of the two components occurs at the interface. Remove the flame as soon as fusion has taken place. If the joint is longer in one direction, like a seam, the filler will be a long strip with its long edge pointing along the seam, but still horizontal. Concentrate on one end, and as fusion begins, move slowly along the joint. If the seam is extensive, it is possible to use a thin wire pointing into the flame. Because platinum has relatively low thermal conductivity, the heat tends to stay concentrated near the point of application, unlike gold and silver, where the heat is conducted away readily. This helps control the size of the joint and simplifies making multiple joints in the same piece of jewelry. The joint should finish with the smallest “bulge” of matching color which can be smoothed down to the original cross-section. This technique is well suited to joining relatively heavy, and particularly matching, sections such as ring shanks, shanks to head settings with shoulders, bangle sections, and pendant and brooch parts.

## SOLDERING

**Protect eyes with welding glasses or goggles during soldering to eliminate ultraviolet rays. (see “Eye Protection”)**

Platinum can be soldered with a variety of solders, which flow at different temperatures. Platinum in its pure state can be used to form a welded joint at 1740°C (3164°F). Platinum solders are available in 1700, 1600, 1500, 1400, 1300, 1200, 1100 and 1000 number designations, which correspond roughly to flow points in Centigrade measurements. In addition, platinum can be soldered with lower temperature silver and gold solders, although this is not recommended except when joining platinum to other metals which cannot tolerate the high heat of platinum solders.

Flux is not necessary for any solders over 1300 since platinum does not oxidize. However, a liquid flux is helpful in placing solder chips and holding them in position during heating. It is important to use the flux sparingly and to dry it slowly to prevent displacement of solder.

Platinum is difficult to solder without a perfectly-fitted joint. The two pieces to be joined must be in contact with one another for the solder to flow properly. Platinum solder does not fill gaps by flowing from one piece to another. If the solder flows onto one piece, there should be no attempt to reheat without applying a new piece of solder. Time and care should be taken to ensure a close fit prior to soldering.

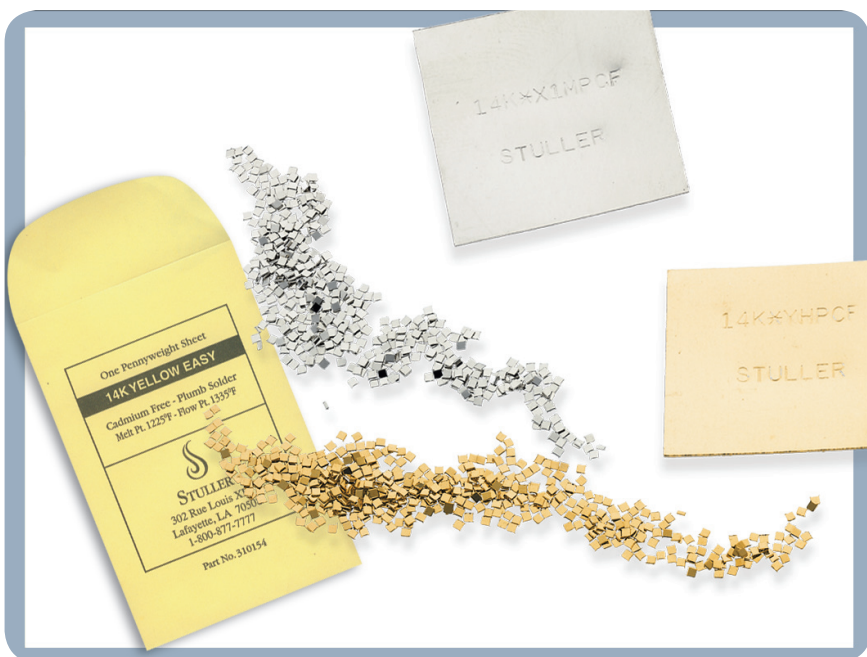
Solder is generally supplied in sheet form. It should be rolled down to the thinnest gauge possible (.005 or less) and then cut with small shears into very thin strips. Platinum solder is best used in very small areas at a time and by moving the torch down the length of a seam 1/8" at a time. A delicately-pointed pair of soldering tweezers is helpful for placing solder (AA stainless are recommended).

Small tips (.025 to .040 diameter) are used in soldering to provide a sharp, direct and intense flame. Heat-dispersion or vented-type tips are not recommended since soldering does not occur by conduction but rather by quick, direct application of heat. It is not necessary to heat the area to be soldered slowly (except to dry the flux). Instead, the flame is placed directly on the joint, or on one section of a long seam, and held steady until the solder flows. Heating too much of the seam at one time can cause warping. Quick and direct heat with a small flame keeps distortion to a minimum. If the flame is positioned correctly, and the joint is well fitted, soldering will occur very rapidly. It can be seen as a shiny flow. After the solder flows, remove the flame immediately to avoid pitting and frosting of the soldered joint.

Lower-temperature solders deteriorate with repeated heatings. Higher-temperature solders can be reheated with proper temperature control. Since most platinum alloys do not oxidize when heated, all parts can be completely finished and polished before being assembled by soldering. This is a decided advantage in complex assemblies providing that correct amounts of solder are used, and no cleanup is required on the joints and seams.

The positioning of pieces for soldering can be a difficult problem because the possibility of contamination from tweezers or iron binding wire. Any steel, holding devices must be placed sufficiently far away from the heat area to avoid contamination. An easy solution is to use the GRS Third Hand equipped with tungsten-carbide tips and a tungsten-carbide poker, both available in our *Tools and Supplies Catalog*. Steel pokers cannot be used to reposition pieces during soldering or to move solder into a joint. If a poker is necessary, it must be made of tungsten carbide.

If multiple solders are used, they should be in diminishing order: 1700, 1600, 1500 and so on. However, it is possible to make multiple joints, even in close proximity, with only one grade of solder because of the low thermal conductivity of the metal. Experience indicates that 1400 solder is preferable for long joints on this gauge material; 1500 solder is good for most basic sheet fabrication; 1600 is excellent for wire fabrication; 1700 and pure platinum are good for weld joints in both wire and sheet. If only one solder is to be used, 1500 is recommended for most general fabrication.



**STULLER OFFERS A WIDE SELECTION OF SOLDERS,  
INCLUDING, COLOR-MATCH SOLDERS. WE HAVE  
WHAT YOU NEED TO GET THE JOB DONE.**

*See pages 51-57 for karat gold & platinum solders See pages 82-83 for silver solder*

## FINISHING PROCEDURES

The density of platinum seems to make finishing somewhat more laborious. However, a fine, high polish is readily achieved by following regular polishing procedures and finishing sequences. Whenever possible, it is best to pre-finish components prior to assembly as solders are more easily polished than platinum and may be over-finished or dragged out of the seam otherwise. Always begin with the least aggressive abrasive that will accomplish the task and remove all defects before moving to the next step. Use closely-spaced abrasives as skipping a step to save time will ultimately require more time and result in a less attractive finish. It is essential to maintain a separate set of files, buffs, brushes and compounds reserved exclusively for platinum to avoid contamination and achieve the ultimate platinum finish. The following sequence and materials are used to finish platinum products at Stuller and are available from our Tools and Supplies Catalog:

1. Remove sprues using a 120 grit 3M Sanding belt or a # 3 cut Grobet File.
2. Hand burnish or tumble in Stainless Steel Burnishing Media to compact surface and fill minor pitting.
3. Remove surface blemishes with # 5 & # 6 cut Grobet Files
4. Sand inside of ring with a 320 grit 3M Cartridge Roll
5. Sand inside of ring with a fine grit, Grey Silicone, Inside-Ring Cylinder.
6. Deburr mounting with a 3M Light Deburring Wheel
7. In areas inaccessible to a Light Deburring Wheel, use a 180-grit, 7/8," Knife-Edged Silicone Wheel.
8. Repeat using a 220 grit, 7/8," Knife-Edged Silicone Wheel.
9. Use a 3/4" medium bristle brush and Grey Star polishing compound to polish prongs and other difficult-to-access areas.
10. Use a 6," stitched Yellow, Treated Muslin Buff to smooth shank and other broad areas.
11. Polish inside of ring with a Felt-Inside Ring Buff using Grey Star Compound.
12. Lap sides and angles with a 6 x 1/2 Paramount Split Lap, using Grey Star Compound.
13. Clean thoroughly using steam or ultrasonic.
14. Polish with an Unstitched, 6," Finex White Muslin Buff using Green Rouge.
15. Clean, then polish with a 6," Purple Treated Buff using Bright White Platinum Polish.
16. Clean, then polish with a 6" Purple Treated Buff using Carrot Rouge.

## COLORED KARAT GOLDS

The precious metal alloys can be grouped based on the color as follows:

**GOLD-SILVER-COPPER-ZINC ALLOY SYSTEM**

Yellow, Pink, Red, Green Golds

**GOLD-COPPER-NICKEL ALLOY SYSTEM**

Nickel White Golds

**GOLD-SILVER-PALLADIUM ALLOY SYSTEM**

Palladium White Golds

Apart from the major alloying elements, silicon, iridium, rhenium, ruthenium and cobalt are added as deoxidizers or grain refiners.

## EFFECTS OF ALLOYING ELEMENTS ON THE PROPERTIES OF KARAT GOLDS

Gold alloys consisting of a single solid solution or mixtures of solid solutions, generally have lower melting ranges than pure gold. Adjusting the ratio of pure constituents produces a wide range of physical and mechanical properties compared with the pure metals. In general, the properties are enhanced due to alloying, and, for this reason, alloys are used rather than pure metals. The alloys can often be designed to have minor alloying elements that, when exceeded, could result in diminished properties for the gold alloy. On the other hand, malleability and ductility of gold alloys can be considerably reduced by even smaller quantities of contaminants or impurities, such as lead, antimony and arsenic. In general, major alloying elements such as copper, silver, nickel, palladium and zinc are added to gold to control color, hardness, workability and castability of karated gold. Minor alloying elements like silicon, boron, phosphorus, iridium, rhenium, and cobalt are added to control grain size, deoxidation and fluidity of karated gold.

### COLOR OF WHITE GOLD

The color of any karat gold alloy is determined by the distribution of colors in the light that is reflected from its surface. “White” light contains a distribution of all colors. A rainbow is the most common example of all the colors that are present in the white light of the sun.

Metal interacts with light that falls on its surfaces. The color of the metal, which is detected by the eye, is actually the resultant of all the colors that are reflected from surfaces after the interaction of the incidental light beam with the metal surface. Unfortunately for we jewelers, the ranges of color in light reflected from polished metal surfaces cannot be completely controlled. In other words, “It’s not like mixing paint.”

Silver is known to be the “whitest” metal. This is because the fraction of incidental light, which is reflected from a polished silver surface exceeds 90%, no matter what the color of the light. Pure gold and pure copper are yellow and pink, because they reflect yellow and red colors efficiently. Only about 30 to 35% of other colors are reflected. The result is that yellow and pink predominate in the viewer’s eye when gold and copper are observed.

White golds are created by replacing the silver in the traditional gold-copper-silver-zinc compositions used for 14 and 18K yellow gold with nickel. The nickel and zinc present in white golds reduce the red and yellow colors reflected by the copper and gold. Unfortunately, this reduction in the red-yellow reflections is nowhere near 100% efficiency, and some red-yellows are still reflected. These nickel and zinc additions also do not increase the reflection of the green-blue-violet colors in white light. Remember that silver has a very high reflectivity compared with other colors in the visible spectrum. The net result is that nickel white golds can have a yellow tint, and they are not as white as silver.

Palladium white golds are similar to nickel white golds at lower concentrations of nickel or palladium. However, very high concentrations of palladium in white gold appear to be able to increase the reflection of the green-blue-violet range of colors, and these alloys may appear to be “whiter” than lower palladium or nickel white alloys.

Any alloy-selection process is a compromise between color or appearance, alloy behavior in jewelry fabrication operations and cost. Metals do not adjust their characteristic behaviors to cost, style and fashion. We might not like it sometime, but metals and alloys are what they are.

The nickel and zinc contents of nickel white golds are adjusted to achieve properties that are suitable for jewelry fabricating operations, final appearance and wear performance. Alloys that must be ductile for forming operations may have reduced nickel and zinc concentrations. Alloys that do not require great ductility may have higher nickel and zinc concentrations. High nickel-zinc alloys are “whiter” than low nickel-zinc alloys. Unfortunately, they fire crack, fracture, and fail by stress-corrosion cracking more readily than low nickel-zinc alloys.

Indeed the normal colors of 14 and 18-karat white gold alloys are slightly yellow as they contain 58.33 and 75% fine gold respectively plus some amount of copper. This hint of yellow can intensify with time and exposure to chlorine and other chemicals found in a typical household. To counteract this naturally occurring patina, and to complement fine diamonds, the normal procedure is to apply a decorative, rhodium electroplated finish. Rhodium is one of the platinum-group metals and, when applied to a well-finished white gold ring, results in a brilliant white appearance. A rhodium finish, however, is not impervious to the effects of wear and abrasion that may occur in everyday use. To limit wear, avoid household cleansers, gardening and other activities that can quickly destroy the rhodium plating, thus exposing the slightly yellow tint. Even talc, which is found in many cosmetics, is known to have an abrasive effect on jewelry items.

What are the alternatives? Where permanent whiteness is required, platinum is the white metal of choice as it is by nature, white and virtually impervious to chemical attack.

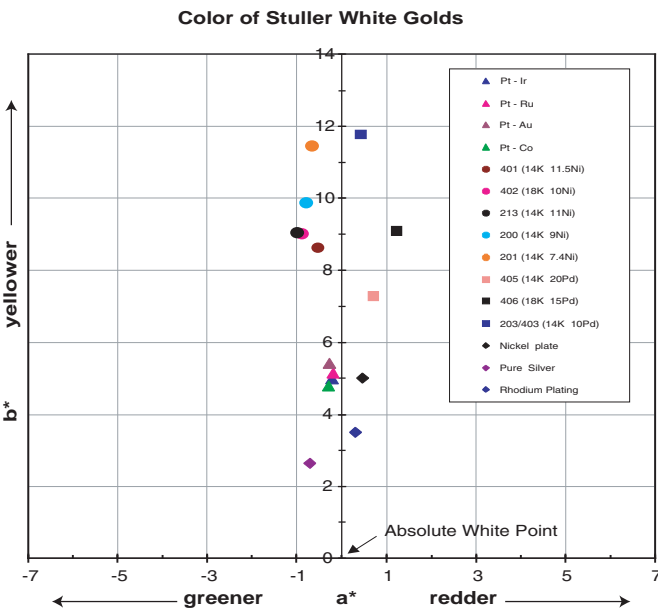


Figure 12. Color Chart of some Stuller white golds.

Figure 12 shows the color of a few nickel white golds that are commercially available. From the chart it is clear that as the nickel content in the white gold increases, its color point moves down towards the cluster of color points of platinum alloys. However, in order for a nickel white gold to appear nearly as white as a platinum alloy, we may have to add nickel to such an extent that the alloy becomes unworkable and suffers from excessive fire cracking.

## Forever White ... See the Difference

- premium white color
- no need to rhodium plate
- excellent casting characteristics
- meets European specification
- look of platinum with the cost of 14kt
- maintains a bright white finish
- brilliant surface finish





# WEIGHT CONVERSIONS FOR SIMILAR VOLUMES

If you have one (1) pennyweight of:

	STERLING	10Y	14Y	18Y	14W	18W	PLATINUM	Pt 10lr	BRASS	PEWTER	LEAD	WAX
<b>Sterling</b>	1.00	0.90	0.79	0.67	0.82	0.71	0.49	0.48	1.23	1.43	0.91	10.36
<b>10Y</b>	1.11	1.00	0.89	0.74	0.92	0.79	0.54	0.54	1.36	1.60	1.02	11.60
<b>14Y</b>	1.27	1.13	1.00	0.84	1.03	0.89	0.61	0.61	1.54	1.80	1.15	13.08
<b>18Y</b>	1.49	1.34	1.19	1.00	1.23	1.06	0.73	0.72	1.84	2.15	1.38	15.60
<b>14W</b>	1.22	1.09	0.97	0.81	1.00	0.86	0.59	0.59	1.49	1.74	1.12	12.65
<b>18W</b>	1.41	1.26	1.12	0.94	1.16	1.00	0.68	0.68	1.72	2.02	1.29	14.65
<b>Pt</b>	2.04	1.85	1.64	1.38	1.70	1.46	1.00	1.00	2.52	2.95	1.89	21.45
<b>Pt 10lr</b>	2.08	1.86	1.65	1.38	1.70	1.47	1.00	1.00	2.53	2.96	1.90	21.54
<b>Brass</b>	0.81	0.73	0.65	0.54	0.67	0.58	0.40	0.39	1.00	1.17	0.75	8.50
<b>Pewter</b>	0.70	0.63	0.56	0.47	0.57	0.50	0.34	0.34	0.86	1.00	0.64	7.27
<b>Lead</b>	1.09	0.98	0.87	0.73	0.90	0.77	0.53	0.53	1.33	1.56	1.00	11.34
<b>Wax</b>	0.10	0.09	0.08	0.06	0.08	0.07	0.05	0.05	0.12	0.14	0.09	1.00

Example: You have a two (2) pennyweight ring in 10K yellow and you would like to know what it would weigh as 14K yellow. Find 10 yellow across the top row and read down until you reach 14 yellow, then multiply your two (2) pennyweights by this number.  
 (2 DWT) x 1.13 Factor = 2.26 DWT as 14K Yellow

# SHEET METAL WEIGHT PER SQUARE INCH BY B & S GAUGE

B&S GAUGE	FINE THICKNESS IN.	STERLING SILVER OZS.	FINE SILVER OZS.	24K YELLOW GOLD DWTs	10K YELLOW GOLD DWTs	14K YELLOW GOLD DWTs	18K GOLD DWTs	PLATINUM OZS.
8	.128	.7130	.7140	26.20	15.70	17.70	21.10	1.450
10	.102	.5650	.5580	20.80	12.40	14.00	16.70	1.150
12	.081	.4480	.4430	16.50	9.85	11.10	13.30	.913
14	.064	.3560	.3510	13.10	7.81	8.82	10.50	.724
16	.051	.2820	.2780	10.40	6.21	7.70	8.35	.574
18	.040	.2240	.2210	8.22	4.91	5.55	6.62	.455
19	.036	.1990	.1960	7.32	4.38	4.94	5.89	.406
20	.032	.1770	.1750	6.52	3.90	4.40	5.25	.361
22	.025	.1410	.1390	5.17	3.09	3.49	4.16	.286
24	.020	.1120	.1100	4.10	2.45	2.77	3.30	.227
26	.016	.0884	.0873	3.25	1.94	2.19	2.62	.180
28	.013	.0701	.0689	2.58	1.86	1.62	1.95	.143
30	.010	.0556	.0549	2.04	1.17	1.38	1.60	.113

## DETERMINING RING BLANK LENGTHS IN B & S GAUGE

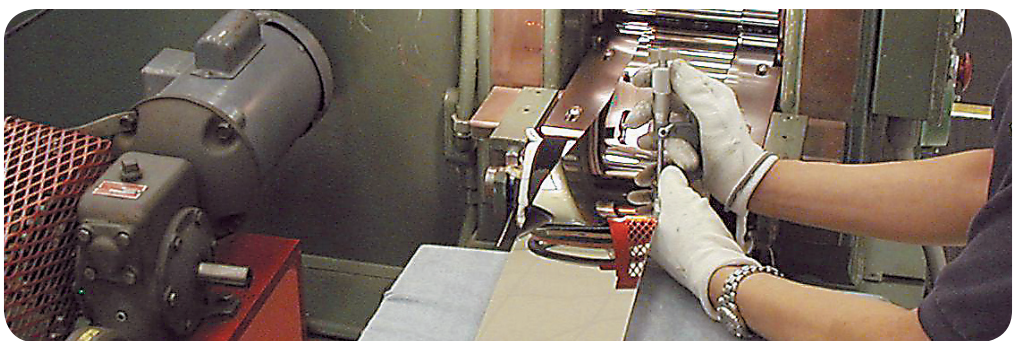
RING FINGER SIZE (U.S.A.)	DIAMETER (MM)	LENGTH (MM)	METAL THICKNESS IN MILLIMETERS						
			2MM	1.6MM	1.3MM	1.0MM	.80MM	.60MM	.50MM
1	12.44	39.09	45.29	44.09	43.09	42.09	41.49	40.89	40.59
1 ½	12.85	40.37	46.57	45.37	44.37	43.37	42.77	42.17	41.87
2	13.26	41.64	47.84	46.64	45.64	44.64	44.04	43.44	43.14
2 ½	13.66	42.92	49.12	47.92	46.92	45.92	45.32	44.72	44.42
3	14.07	44.20	50.40	49.20	48.20	47.20	46.60	46.00	45.70
3 ½	14.47	45.47	51.67	50.47	49.47	48.47	47.87	47.27	46.97
4	14.88	46.75	52.95	51.75	50.75	49.75	49.15	48.55	48.25
4 ½	15.29	48.03	54.23	53.03	52.03	51.03	50.43	49.83	49.53
5	15.69	49.30	55.50	54.30	53.30	52.30	51.70	51.10	50.80
5 ½	16.10	50.58	56.78	55.58	54.58	53.58	52.98	52.38	52.08
6	16.51	51.86	58.06	56.86	55.86	54.86	54.26	53.66	53.36
6 ½	16.91	53.13	59.33	58.13	57.13	56.13	55.53	54.93	54.63
7	17.32	54.41	60.61	59.41	58.41	57.41	56.81	56.21	55.91
7 ½	17.73	55.69	61.89	60.69	59.69	58.69	58.09	57.49	57.19
8	18.13	56.96	63.16	61.96	60.96	59.96	59.36	58.76	58.46
8 ½	18.54	58.24	64.44	63.24	62.24	61.24	60.64	60.04	59.74
9	18.95	59.52	65.72	64.52	63.52	62.52	61.92	61.32	61.02
9 ½	19.35	60.79	66.99	65.79	64.79	63.79	63.19	62.59	62.29
10	19.76	62.07	68.27	67.07	66.07	65.07	64.47	63.87	63.57
10 ½	20.16	63.35	69.55	68.35	67.35	66.35	65.75	65.15	64.85
11	20.57	64.63	70.83	69.63	68.63	67.63	67.03	66.43	66.13
11 ½	20.98	65.90	72.10	70.90	69.90	68.90	68.30	67.70	67.40
12	21.38	67.18	73.38	72.18	71.18	70.18	69.58	68.98	68.68
12 ½	21.79	68.46	74.66	73.46	72.46	71.46	70.86	70.26	69.96
13	22.20	69.73	75.93	74.73	73.73	72.73	72.13	71.53	71.23
13 ½	22.60	71.01	77.21	76.01	75.01	74.01	73.41	72.81	72.51
14	23.01	72.29	78.49	77.29	76.29	75.29	74.69	74.09	73.79
14 ½	23.42	73.56	79.76	78.56	77.56	76.56	75.96	75.36	75.06
15	23.82	74.84	81.04	79.84	78.84	77.84	77.24	76.64	76.34

*Add 0.5mm to these lengths if the ring band is wider than 4mm.*



# COMPARATIVE HARDNESS SCALES

Rockwell Hardness Number		Vickers	Brinell Hardness Number 10mm Ball		Gold Hardness Range					Rockwell Hardness Number	Vickers	Brinell Hardness Number 10mm Ball		Gold Hardness Range					
C	B		3000Kgf	500Kgf	14K	14K	18K	18K	Pt 95			C	B	3000Kgf	500Kgf	14K	14K	18K	18K
					Y	W	Y	W	Ru 5					Y	W	Y	W	Ru 5	
41	...	402	381	...						...	88	176	176	151					
40	...	392	371	...						...	87	172	172	148					
39	...	382	362	...						...	86	169	169	145					
38	(110)	372	353	...						...	85	165	165	142					
37	(109)	363	344	..						...	84	162	162	140					
36	(108.5)	354	336	...						...	83	159	159	137					
35	(108)	345	327	...						...	82	156	156	135					
34	(107.5)	336	319	...						...	81	153	153	133					
33	(107)	327	311	...						...	80	150	150	130					
32	(106.5)	318	301	...						...	79	147	147	128					
31	(106)	310	294	...						...	78	144	144	126					
30	(105.5)	302	286	...						...	77	141	141	124					
29	(104.5)	294	279	...						...	76	139	139	122					
28	(104)	286	271	...						...	75	137	137	120					
27	(104)	279	264	...						...	74	135	135	118					
26	(103)	272	258	...						...	73	132	132	116					
25	(102)	266	253	...						...	72	130	130	114					
24	(101)	260	247	...						...	71	127	127	112					
23	100	240	240	201						...	70	125	125	110					
22	99	234	234	195						...	69	123	123	109					
21	98	228	228	189						...	68	121	121	107					
20	97	222	222	184						...	67	119	119	106					
(18)	96	216	216	179						...	66	117	117	104					
(16)	95	210	210	175						...	65	116	116	102					
...	94	205	205	171						...	64	114	114	101					
...	93	200	200	167						...	63	112	112	99					
...	92	195	195	163						...	62	110	110	98					
...	91	190	190	160						...	61	108	108	96					
...	90	185	185	157						...	60	107	107	95					
...	89	180	180	154						...	59	106	106	94					



## CONVERSIONS (WEIGHTS AND MEASURES)

To CONVERT	MULTIPLY BY	To OBTAIN
Centimeters	0.3937	Inches
Cubic Centimeters	0.06102	Cubic Inches
Cubic Inches	16.39	Cubic Centimeters
Cubic Feet	28.32	Cubic Centimeters
Feet	30.48	Centimeters
Feet	0.3048	Meters
Grams	0.64301	Pennyweights (DWT)
Grams	0.03527	Ounces, Avoir
Grams	0.03215	Ounces, Troy
Inches	2.54	Centimeters
Inches	25.4	Millimeters
Kilograms	35.274	Ounces, Avoir
Kilograms	32.1507	Ounces, Troy
Kilograms	643.014	Pennyweights (DWT)
Kilograms	2.205	Pounds, Avoir
Liters	1.057	Quarts (Liquid)
Meters	3.281	Feet
Meters	39.37	Inches
Meters	1.094	Yards
Millimeters	0.03937	Inches
Ounces, Avoir	28.35	Grams
Ounces, Avoir	.9115	Ounces, Troy
Ounces, Avoir	18.2291	Pennyweights (DWT)
Ounces, Troy	20	Pennyweights (DWT)
Ounces, Troy	0.0311	Kilograms
Ounces, Troy	1.0971	Ounces, Avoir
Ounces, Troy	31.1035	Grams
Pennyweights (DWT)	1.5552	Grams
Pennyweights (DWT)	0.001555	Kilograms
Pennyweights (DWT)	0.05486	Ounces, Avoir
Pennyweights (DWT)	0.05	Ounces, Troy
Pounds, Avoir	0.4536	Kilograms
Pounds, Avoir	16	Ounces, Avoir
Pounds, Avoir	14.5833	Ounces, Troy
Pounds, Troy	12	Ounces, Troy
Square Centimeters	0.155	Square Inches
Square Feet	144	Square Inches
Square Inches	6.452	Square Centimeters
Square Inches	645.2	Square Millimeters
Square Millimeters	0.00155	Square Inches
Yard	0.9144	Meters



## CONVERSIONS (WEIGHTS AND MEASURES) CONTINUED

### GRAM WEIGHT

1 gram = 15.43 grains Troy	1 grain = 0.0648 grams
1.555 grams = 1 pennyweight (DWT)	1 grain = 64.80 milligrams
31.104 grams = 1 ounce Troy	1 milligram = .015432 grams
28.35 grams = 1 ounce Avoir	1 gram = .035274 Avoir oz.
	1 gram = .032151 Troy oz.

### TROY WEIGHT *Used in weighing the precious metals.*

24 grains = 1 pennyweight (DWT)	1 kilogram = 2.68 pounds
20 DWT = 1 ounce Troy	1 kilogram = 32.15 Troy ozs.
12 ounces = 1 pound Troy	1 kilogram = 2.2046 lbs. Avoir
5,760 grains = 1 pound Troy	1 kilogram = 35.2740 oz. Avoir
480 grains = 1 Troy oz.	1 kilogram = 15,432 grains
	Troy oz - 1.0972 Avoir oz.

### AVOIRDUPOIS WEIGHT *Used in weighing base metals*

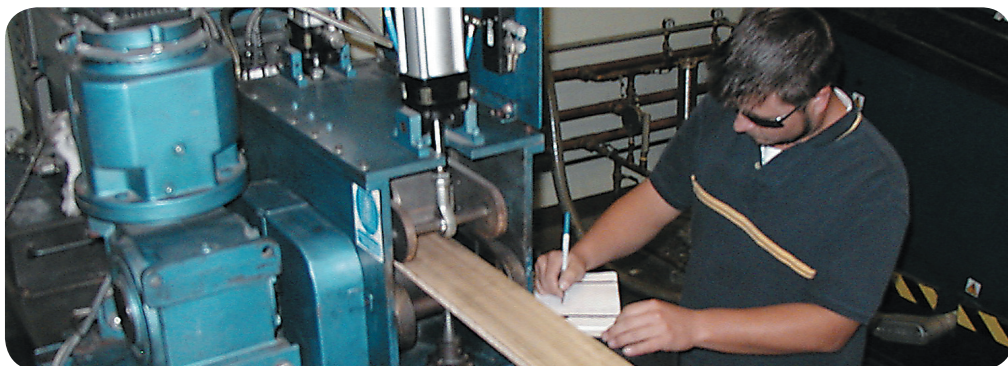
16 drams (or drachms) = 1 oz. Avoir	1 pound Avoir = 14.5833 Troy oz.
16 ounces = 1 pound Avoir	1 ounce Avoir = 0.914 Troy oz.
16 ounces = 7,000 grains	1 pound Avoir = 7,000 grains
28 pounds = 1 quarter English	1 ounce Avoir = 437.5 grains
4 quarters = 1 hundredweight (cwt.)	1 pound Avoir = .4359 kilo.
	20 hundredweight = 1 ton Avoir

## CIRCLES AND SQUARES CIRCUMFERENCES AND AREAS

### RULES RELATING TO CIRCLES AND SQUARES

The circumference of a circle is the diameter times 3.1416. The area of a circle is the radius squared times 3.1416. The area of a square is the length of one side squared.

SIZE IN INCHES	CIRCUMFERENCE OF CIRCLE (IN)	AREA OF CIRCLE (IN <sup>2</sup> )	AREA OF SQUARE (IN <sup>2</sup> )
1	3.142	.7854	1.000
2	6.283	3.142	4.000
3	9.425	7.069	9.000
4	12.57	12.57	16.00
5	15.71	19.64	25.00
6	18.85	28.27	36.00
7	21.99	38.48	49.00
8	25.13	50.27	64.00
9	28.28	63.62	81.00
10	31.42	78.54	100.00
11	34.56	95.03	121.00



# TEMPERATURE CONVERSION TABLE

## CONVERSION FORMULAS

$$^{\circ}\text{F} = (9/5 \times ^{\circ}\text{C}) + 32^{\circ}$$

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32^{\circ})$$

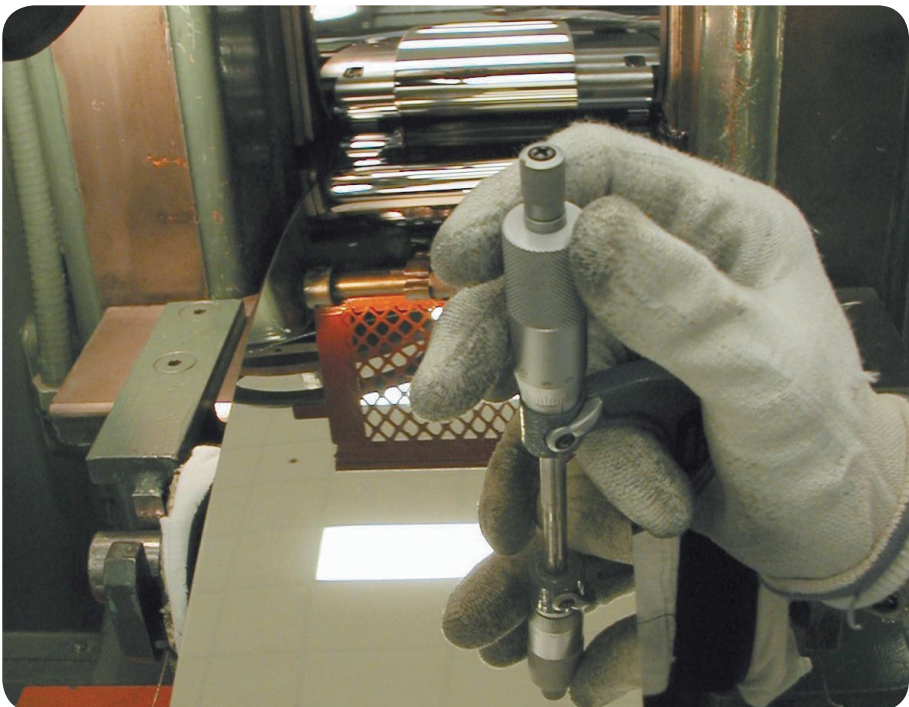
$^{\circ}\text{F}$	$^{\circ}\text{C}$
600	316
620	327
640	338
660	349
680	360
700	371
720	382
740	393
760	404
780	416
800	427
820	438
840	449
860	460
880	471
900	482
920	493
1000	538
1020	549
1040	560
1060	571
1080	582
1100	593
1120	604
1140	616
1160	627
1180	638
1200	649
1220	660
1240	671
1260	682

$^{\circ}\text{F}$	$^{\circ}\text{C}$
1280	693
1300	704
1320	716
1400	760
1420	771
1440	782
1460	793
1480	804
1500	816
1520	827
1540	838
1560	849
1580	860
1600	871
1620	882
1640	893
1660	904
1680	916
1700	927
1720	938
1800	982
1820	993
1840	1004
1860	1016
1880	1027
1900	1038
1920	1049
1940	1060
1960	1071
1980	1082
2000	1093



## SPECIFIC GRAVITY, MELTING POINT, OF VARIOUS METALS & ALLOYS

METAL	CHEMICAL ABBREVIATION	MELTING POINT		DENSITY	
		°F	°C	GRAMS/CM <sup>3</sup>	WEIGHT IN TROY OUNCES PER CUBIC INCH
Cadmium	Cd	610	321	8.65	4.557
Cobalt	Co	2723	1495	8.92	4.689
Copper	Cu	1981	1083	8.94	4.719
Gold	Au	1945	1063	19.32	10.180
Iridium	Ir	4449	2454	22.65	11.849
Iron (pure)	Fe	2802	1539	7.87	4.145
Nickel	Ni	2651	1455	8.91	4.691
Palladium	Pd	2831	1555	12.0	6.322
Platinum	Pt	3224	1773	21.45	11.301
5% Cobalt Platinum		3050	1677	20.1	10.59
5% Ruthenium Platinum		3295	1813	20.7	10.906
15% Iridium Platinum		3310	1821	21.59	11.373
10% Iridium Platinum		3250	1788	21.54	11.349
5% Iridium Platinum		3235	1779	21.50	11.325
Rhodium	Rh	3571	1967	12.44	6.553
Ruthenium	Ru	4500	2250	12.20	6.428
Silicon	Si	2605	1430	2.33	1.247
Silver	Ag	1761	961	10.49	5.525
Sterling Silver		1640	893	10.36	5.457
Coin Silver		1615	879	10.31	5.430
Tin	Sn	450	232	7.30	3.846
Zinc	Zn	787	419	7.13	3.758



## GAUGE TO INCHES TO MILLIMETERS CONVERSION TABLE

B & S	INCH	MILLIMETER	INCH
GAUGE	(DECIMAL)	(MM)	(FRACTION)
1	0.289	7.348	.
2	0.258	6.543	.
.	0.250	6.350	¼
.	0.234	5.953	15/64
3	0.229	5.827	.
.	0.219	5.556	7/32
4	0.204	5.189	.
.	0.203	5.154	11/64
.	0.188	4.762	3/16
5	0.182	4.621	.
.	0.172	4.366	11/64
6	0.162	4.115	.
.	0.156	3.969	3/32
7	0.144	3.664	.
.	0.141	3.572	9/64
8	0.128	3.263	.
.	0.125	3.175	1/8
9	0.114	2.906	.
.	0.109	2.778	7/64
10	0.102	2.588	.
.	0.094	2.381	3/32
11	0.091	2.304	.
12	0.081	2.052	.
.	0.078	1.984	3/64
13	0.072	1.828	.
14	0.064	1.628	.
.	0.063	1.588	1/16
15	0.057	1.449	.
16	0.051	1.291	.
.	0.047	1.191	3/64
17	0.045	1.149	.
18	0.040	1.024	.
19	0.036	0.912	.
20	0.032	0.812	.
.	0.031	0.795	1/32
21	0.028	0.723	.
22	0.025	0.644	.
23	0.023	0.573	.
24	0.020	0.511	.
25	0.018	0.455	.
26	0.016	0.405	.
.	0.016	0.396	1/64
27	0.014	0.360	.
28	0.013	0.321	.
29	0.011	0.286	.
30	0.010	0.255	.
31	0.009	0.226	.
32	0.008	0.200	.
33	0.007	0.180	.
34	0.006	0.160	.
35	0.006	0.142	.
36	0.005	0.130	.



# STAMPINGS INDEX

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3112	92	3224	107	3329	109	3407	110	3457	92
3113	92	3229	100	3331	109	3408	110	3458	92
3117	93	3230	100	3332	94	3410	110	3459	92
3120	94	3232	100	3334	94	3411	110	3461	92
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3138	113	3279	106	3359	108	3423	111	3472	92
3139	113	3281	92	3360	96	3424	111	3473	92
3140	113	3282	107	3361	108	3425	112	3474	92
3141	113	3283	107	3362	109	3426	112	3475	92
3142	113	3286	107	3363	107	3427	112	3476	92
3145	95	3287	98	3364	107	3428	112	3477	92
3146	95	3288	93	3365	97	3429	112	3479	92
3157	96	3291	97	3372	97	3430	112	3481	92
3160	94	3295	105	3382	98	3431	112	3482	98
3161	94	3296	105	3383	97	3432	112	3483	92
3163	93	3297	105	3384	98	3433	112	3484	92
3164	93	3300	101	3385	97	3434	112	3485	92
3165	103	3305	94	3387	98	3435	112	3486	92
3166	103	3306	109	3388	93	3436	112	3487	92
3168	106	3307	94	3390	105	3437	112	3488	93
3169	103	3309	108	3391	106	3441	112	3489	93
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3201	101	3320	109	3401	106	3451	92	3498	99
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3509	99	3631	97	3756	98	3832	102
3519	99	3632	103	3757	97	3837	103
3520	99	3637	100	3758	100	3838	101
3521	99	3638	100	3759	92	3842	102
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3523	99	3649	109	3761	108	3850	104
3524	99	3651	95	3770	109	3851	96
3525	100	3652	100	3771	108	3853	102
3526	100	3655	95	3773	107	3855	101
3527	93	3656	95	3775	93	3859	100
3528	93	3660	102	3779	107	3861	97
3529	93	3663	102	3787	97	3862	102
3530	93	3667	103	3788	109	3865	95
3531	93	3669	107	3789	110	3870	102
3532	93	3674	103	3790	110	3875	101
3533	94	3683	107	3791	110	3877	104
3536	106	3697	101	3792	111	3878	104
3537	93	3700	101	3793	111	3879	104
3538	93	3702	101	3794	111	3880	104
3539	98	3705	101	3795	111	3881	104
3540	107	3706	101	3796	111	3882	104
3541	106	3709	95	3797	111	3883	104
3542	106	3710	94	3798	111	3884	104
3543	106	3713	95	3799	111	3885	104
3544	105	3719	95	3800	105	3886	104
3545	93	3721	95	3801	105	3887	108
3546	93	3722	95	3802	108	3888	104
3547	93	3723	95	3803	101	3889	104
3548	106	3725	95	3804	109	3890	108
3556	96	3726	95	3805	101	3891	105
3560	97	3727	95	3806	94	3892	105
3586	96	3730	97	3807	94	3893	104
3587	96	3731	97	3809	108	3894	104
3592	96	3732	97	3810	108	3897	96
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3596	108	3735	97	3814	103		
3597	103	3736	97	3817	97		
3598	103	3737	97	3818	108		
3600	103	3738	97	3819	100		

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