

# Part Six

## 6

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Soldering Investment

# A Little About Gold Solders



Gold solders come in the same basic forms that silver solder comes in: Sheet, Wire, Chip and Paste.

And, like silver solder, gold solder is graded according to its melting temperature, but also by its karat and color.

# What does “*plumb*” mean when referring to gold solders?



*Plumb* refers to the precious metal content of the solder (or in some cases the entire piece of jewelry)

If the solder used matches or is superior to the purity of the metal it is intended to join, then it is called *plumb* solder.

If it has a lesser precious metal content, it is considered “*repair grade*” solder.

**Karat:** The *K* in 18Kt, 14Kt, etc.;  
denotes purity

(Also spelled *carat*, but don't confuse  
with the other definition of carat – as in a  
unit of measure to determine the weight  
of gemstones)

$$X = 24 \frac{M_g}{M_m}$$

Karatage denotes the purity of gold  
by fractions of 24

18Kt gold is 75% pure gold by mass  
( meaning it has 18 parts of gold  
out of 24 parts total)



A range of karat gold solders from 8Kt up to 22Kt are available commercially. Gold solders are also formulated according to the color of the metal they are meant to join (i.e, yellow gold solder, rose gold solder, etc.)



Different manufacturers of solder may use different terminology for low karat solders (i.e. easy, extra easy, ultra easy, soft, etc) but *plumb* always means that the solder at least matches the precious metal content between the solder and the jewelry.

If you are soldering 14Kt gold parts together with 14Kt plumb easy solder, you know that you have not lessened the overall percentage of gold content in your finished object.

Under the National Stamping Act, articles or parts made of gold or gold alloy containing no solder have a permissible tolerance of 3 parts per thousand. If the part contains solder, the permissible tolerance is 7 parts per thousand.

Sterling silver articles or parts that contain no solder have a permissible tolerance of four parts per thousand. If the part tested contains solder, the permissible tolerance is ten parts per thousand.

# Comparison of Metal Melt Points to 14k Yellow Gold Plumb Solder Melt Points

Metal	Melt Point	Composition
Platinum	3224	.995 Pt
Nickel Silver (German Silver)	2030	2030 65 Cu 17 Zn 18 Ni
Copper	1981	99.9 Cu
Fine Gold	1950	99.9 Au
Red Brass (Merlin's Gold)	1877	85 Cu 15 Zn
14K White	1825	58.33Au 22.1Cu 10.8 Ni 8.77 Zn
Fine Silver	1761	99.9Ag
18 Kt Yellow	1620-1715	75% Au 15 Ag 10 Cu
Yellow Brass	1706	70 Cu 30 Zn
Sterling Silver	Solidus: 1475 Liquidus: 1640	92.5 Ag 7.5 Cu
<b>14Kt Yellow Gold</b>	<b>1615</b>	<b>58.33 Au</b> <b>8.3 Ag</b> <b>29.2 Cu</b> <b>4.17 Zn</b>
Zinc	787	99.9 Zn
Tin	450	99.9 Sn

Note: These Hoover and Strong gold solders do not contain cadmium

Hoover & Strong 14K Yellow Plumb Gold Solders	Melt ° F	Flow ° F
Hard	1375	1460
Medium	1345	1440
Easy	1305	1415
Extra Easy	1105	1255



## Yellow Gold Solders

Hoover & Strong <b>14K Yellow Plumb Gold Solders</b>	Melt ° F	Flow ° F
Hard	1375	1460
Medium	1345	1440
Easy	1305	1415
Extra Easy	1105	1255

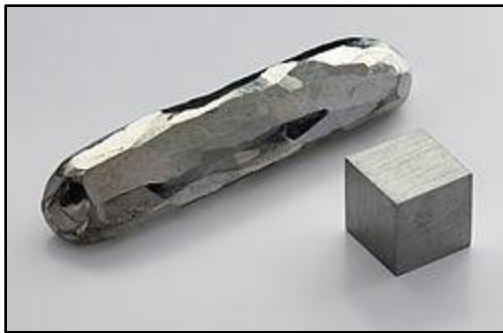
## Silver Solders

Hoover & Strong Silver Solders	Melt ° F	Flow ° F
Hard	1370	1490
Medium Hard	1330	1375
Medium	1265	1295
Soft	1235	1260
Extra Soft	1170	1190

# Side Note

## The Role of **Cadmium** in Solders:

The use of cadmium has particular advantages in lowering the melting temperature and providing good flow properties for making the joint.



However.....



Cadmium solder presents issues of toxicity for the metalsmith

**AVOID USING SOLDERS CONTAINING CADMIUM  
AND ALWAYS USE GOOD VENTILATION WHEN SOLDERING!**

While it has a low melting point, cadmium has a high vapor pressure.

This means that, when the solder melts, the cadmium boils off and forms a vapor that reacts with air to form poisonous cadmium oxide fumes. Repeated exposure can cause long term health problems.

Hoover and Strong and Rio Grande both offer cadmium-free silver and gold solders.

Even non-cadmium solders produce fumes that are harmful. so it is important to always use good ventilation



Just Because You're Using  
Non-Cadmium Solders Does Not Mean You  
Don't Need Good Ventilation !

# Examples of 18k gold solder alloys: cadmium-containing and cadmium-free

	Gold, wt %	Silver, wt %	Copper wt %	Zinc, wt %	Tin, wt %	Indium wt %	Cadmium wt %	Melting Range °F
Easy	75.0	5.0	9.3	6.7	-	4.0	-	1338 -1382
Medium	75.0	6.0	10.0	7.0	-	2.0	-	1409 -1437
Hard	75.0	6.0	11.0	8.0	-	-	-	1466 -1479
Medium	75.0	2.8	11.2	9.0	-	-	2.0	1376 -1450
Hard	75.0	-	15.0	1.8	-	-	8.2	1459 - 1511

Melting range of typical 18k yellow gold: 1620-1715°F

# Noticeable Differences Between Silver Soldering and Gold Soldering

While you can use paste flux for gold soldering, a self-pickling flux is also a good choice

Gold solders often have higher melting points than silver solders and therefore require a little more heat

Gold is not as conductive as silver therefore you can get by with a little more localized heat at the solder area, but you still must heat the entire work piece – especially for larger pieces.

Gold will obtain a red firescale (firestain) when heated to soldering temperatures. Avoid this by coating the work with a solution made of boric acid powder and denatured alcohol. Dip the work in the solution and light with flame, allow alcohol to burn off then continue with normal soldering operation (does not take the place of regular flux)

The General Rules Of  
Hard Soldering  
Also Apply To Gold Solders



# Remember These Important Facts About Soldering



- 1. A Tight Fit is Imperative**
- 2. All Surfaces Must be Clean and free of oxidation**
- 3. Flux All Parts *and* the Solder**
- 4. Choose the right solder type for the job**
- 5. Use no more solder than necessary**
- 6. Heat the entire piece first, then the joint area**



# Soldering Objectives:

- Strongest bond necessary
- Neatest seam possible for least amount of clean-up
- Good color match

# Remember These Facts Too!



- Solder flows toward the heat source
- Solder likes to flow in cracks and crevices due to capillary action
- Solder likes to flow down due to gravity

Aim to make the above work to your advantage!

# Video on Soldering Gold

<http://www.youtube.com/watch?v=Ssmg-D3bjUU&feature=relmfu>

4:13 minutes

# Mixing Your Metals

What solder to use when joining gold and silver parts?

**Consider where solder “bleed” or pudeling is likely to occur and match the solder color to that part.**

*Example: Use silver solder to solder a gold accent piece onto a larger silver backplate.*

*Hard silver solder (which has less copper) is the best color match for sterling silver and therefore will blend best if it spreads onto the silver surface during soldering.*

*Another reason to choose silver solder over gold solder in this case is because it is less expensive than gold solder !*

# Tips For Soldering Gold-filled Material:

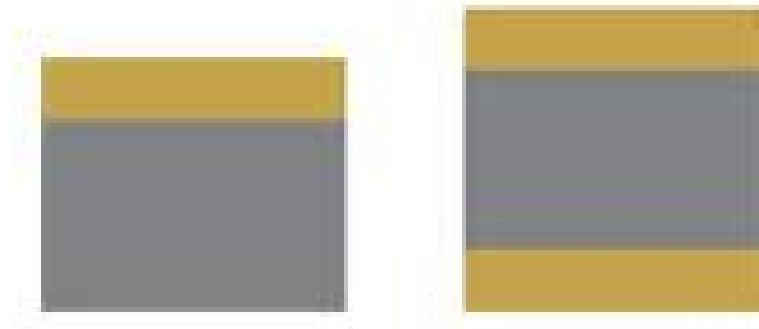
- Don't attempt to construct complex fabrications
- Use lower-melting gold solders only or try an easy-flow gold-filled paste solder
- Maintain a focused flame and apply for the shortest time possible
- Use a boric acid and alcohol coating or a commercial firescale preventer
- Don't overheat
- Don't sand or polish through the thin gold layer



Note: To be marked gold-filled, the quantity of gold must be at least 1/20th by weight of the total product. This is commonly indicated as 14/20, 12/20 or 10/20, which mean respectively 1/20th by weight 14 Karat. gold-filled, 12 Karat. gold-filled, etc.

## Soldering Bi-Metal:

- On gold surfaces use: 10K, 14K or 18K yellow easy (soft) solder
- On sterling surfaces use: easy or medium silver solder
- Remember that edges that show will be a different color
- Take same precautions as gold-filled: Work quickly, don't overheat, coat with firescale preventer, etc.



# Soldering Gold-Plated Parts:



Not Recommended!

# Rio Grande Video on Soldering Gold-Filled Parts

<http://www.riogrande.com/Content/Soldering-Gold-Filled-Chandelier-Earrings-VID-psd?pos=9>

6:49 minutes



Do Not Attempt This at Home –  
Or At School !!

[Os](http://www.youtube.com/watch?v=ownjsViJN)

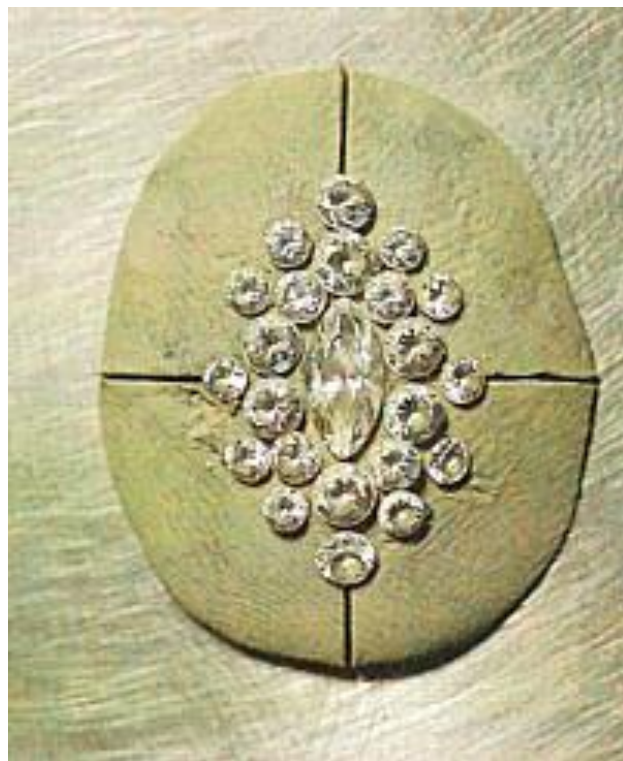
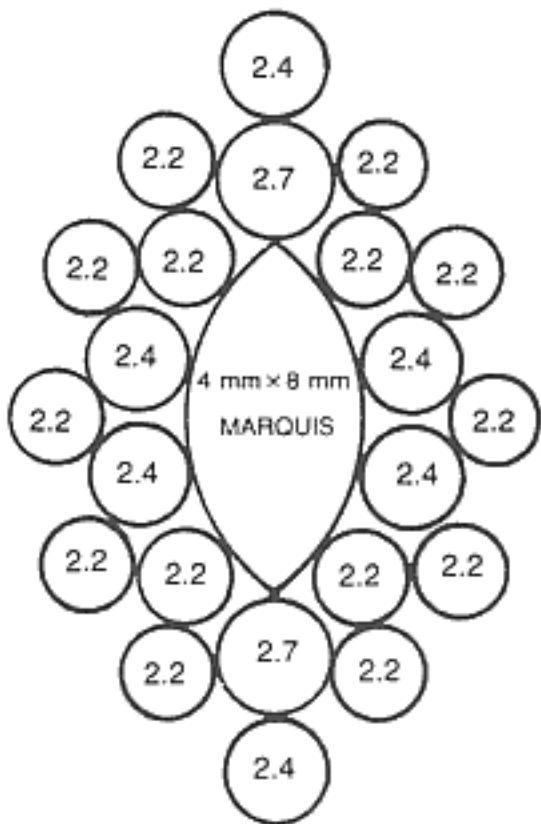
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Using Soldering Investment to Join  
Multiple Parts In One Soldering Action

# Cluster Ring

As Illustrated in Alan Revere's book,  
Professional Goldsmithing

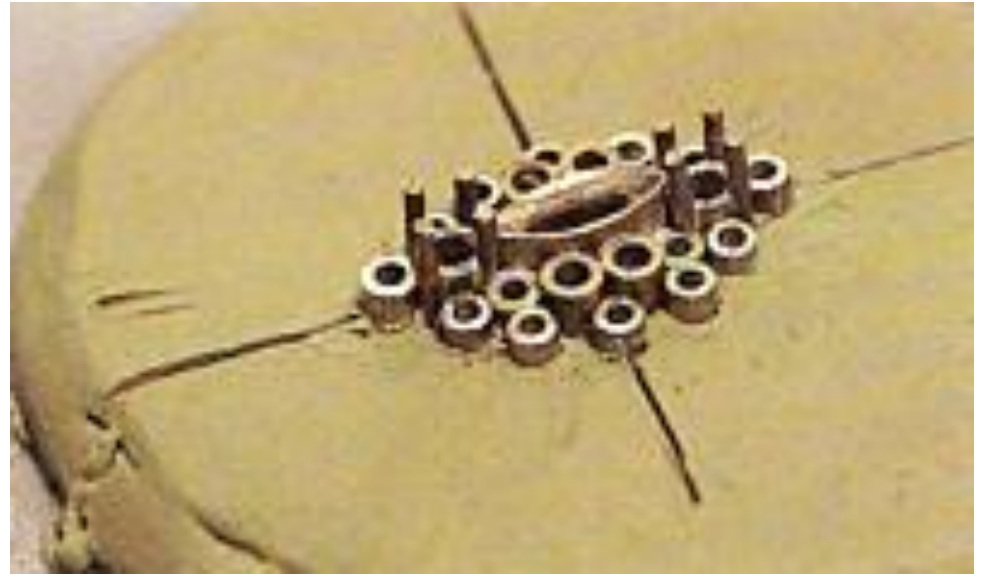
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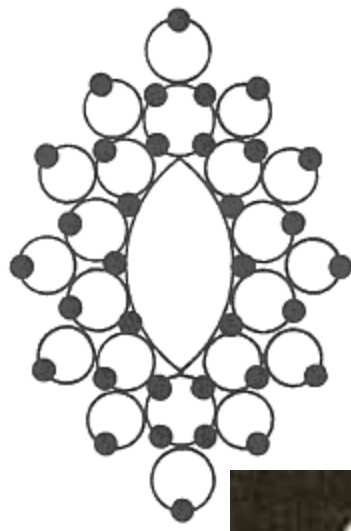


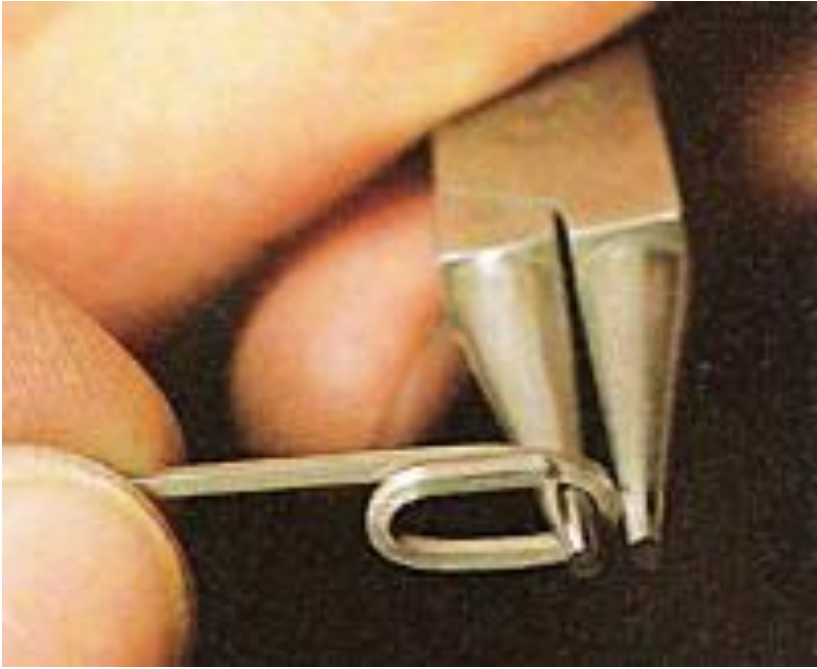


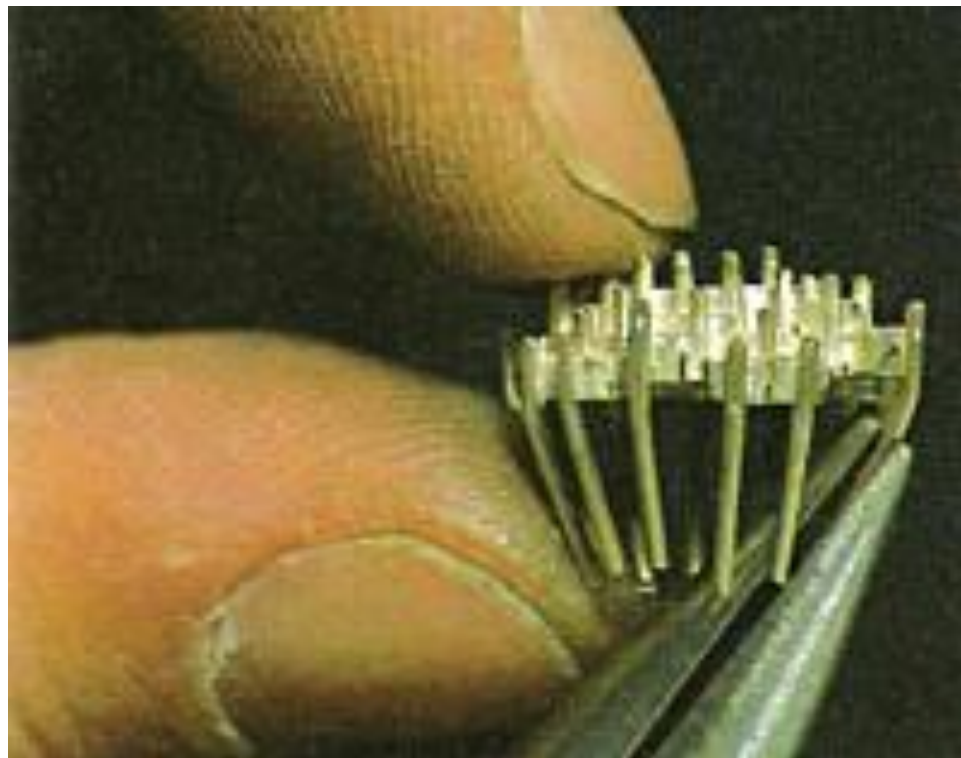








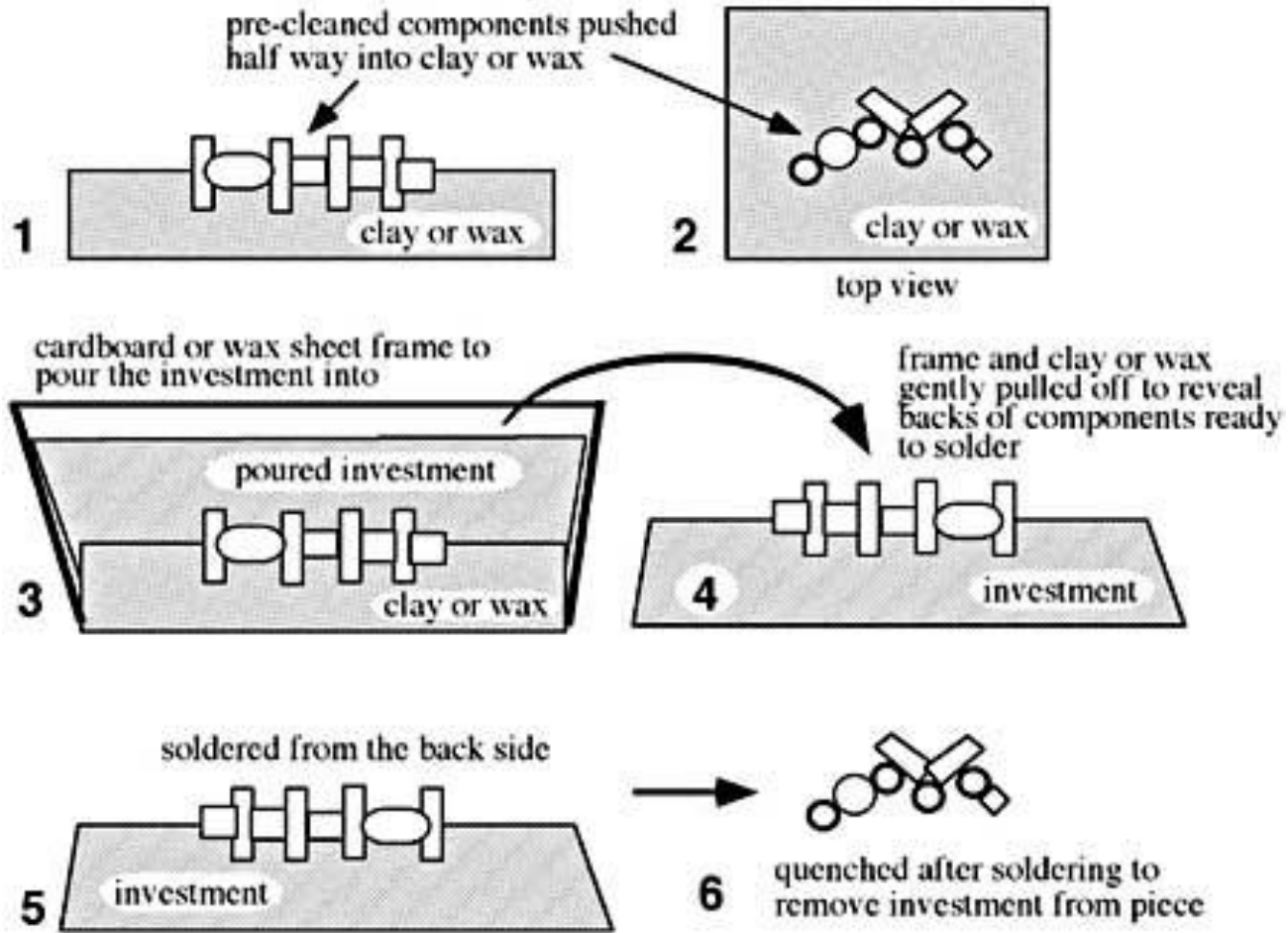








# Tips From Charles Lewton Brain



# Re-usable Soldering Jigs For Repeatable Production Soldering:

1/3 casting investment

1/3 Portland Cement

1/3 fibrous refractive material (Fiberfax or similar ceramic fiber)

Make a clay or wax slab, set the components in, build the walls and pour the jig mixture in. Use broken saw blades as “rebar” in the jig.

Up to 50 solderings possible before jig breaks down

## End Part Six

Thanks for your interest and support of the ACC  
Jewelry/Metals Program!

Send your comments and feedback to me at:

[diane@dianefalkenhagen.com](mailto:diane@dianefalkenhagen.com)

Please help me promote my future classes by spreading the  
word on Facebook and other social networking sites

Link to online registration for Fall Semester Jewelry Classes:

[https://epay.alvincollege.edu/C20358\\_ustores/web/product  
detail.jsp?PRODUCTID=22](https://epay.alvincollege.edu/C20358_ustores/web/product_detail.jsp?PRODUCTID=22)