





## SOLDERING, *plating*, AND STONE SETTING

SWAROVSKI ELEMENTS offers an ideal product selection for soldering, allowing for simple and problem-free production of state of the art jewelry pieces and accessories.

Further techniques such as plating and stone setting complement the comprehensive and diverse application options offered by SWAROVSKI ELEMENTS.

## PRODUCT OVERVIEW

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The following products are suitable for soldering, plating, and stone setting:

	SOLDERING	PLATING	STONE SETTING
Round Stones			✓
Flat Backs No Hotfix			✓
Fancy Stones			✓
Cupchains & Findings	✓	✓	
Settings	✓	✓	

## MACHINES, TOOLS, AND AIDS

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The following machines, tools, and aids are necessary for soldering SWAROVSKI ELEMENTS.



Micro soldering kit



Propane gas burner



Blow torch



### Solder wire

It is recommended that solder wire with a flux core is used, which guarantees an even flow of solder.



### Solder paste

Solder paste containing flux must be applied at exactly the right spot to create a clean solder joint.



### Solder pellets

Solder pellets should be placed in an acid flux before being used. This ensures that the solder will flow correctly.



### Soldering molds

J-board, express cement



Gloves



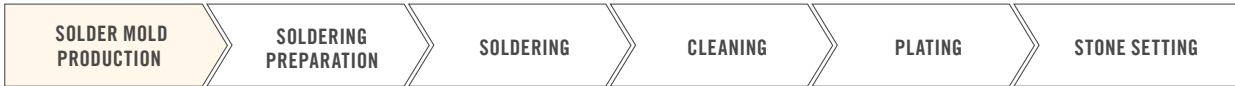
Protective eyewear

## SUPPLIERS



This list provides an overview of select suppliers worldwide.

MACHINES / TOOLS / AIDS	SUPPLIER	CONTACT
Micro soldering kit	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
Propane gas burner	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
	Horbach	<a href="http://www.horbach-giesstechnik.de">www.horbach-giesstechnik.de</a>
Blow torch	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
	SRA - Stan Rubinstein Association	<a href="http://www.sra-solder.com">www.sra-solder.com</a>
	Siegfried Remschnig	<a href="http://www.remschnig.at">www.remschnig.at</a>
Solder wire	Adola	<a href="http://www.adola.com">www.adola.com</a>
	Ögussa	<a href="http://www.oegussa.com">www.oegussa.com</a>
	SRA - Stan Rubinstein Association	<a href="http://www.sra-solder.com">www.sra-solder.com</a>
Soldering paste	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
	Ögussa	<a href="http://www.oegussa.com">www.oegussa.com</a>
	SRA - Stan Rubinstein Association	<a href="http://www.sra-solder.com">www.sra-solder.com</a>
Solder pellets	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
	Ögussa	<a href="http://www.oegussa.com">www.oegussa.com</a>
	SRA - Stan Rubinstein Association	<a href="http://www.sra-solder.com">www.sra-solder.com</a>
Flux	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
	Ögussa	<a href="http://www.oegussa.com">www.oegussa.com</a>
	SRA - Stan Rubinstein Association	<a href="http://www.sra-solder.com">www.sra-solder.com</a>
J-board (solder mold)	SRA - Stan Rubinstein Association	<a href="http://www.sra-solder.com">www.sra-solder.com</a>
Express cement (solder mold)	3M	<a href="http://www.3m.com">www.3m.com</a>
Settings	Swarovski	<a href="http://www.swarovski-elements.com/business">www.swarovski-elements.com/business</a>
	Josef Bergs GmbH & Co. KG	<a href="http://www.josef-bergs.de">www.josef-bergs.de</a>
	Simm Metall- und Druckverglaswaren GmbH	<a href="http://www.simm-metallwaren.de">www.simm-metallwaren.de</a>
	Rio Grande	<a href="http://www.riogrande.com">www.riogrande.com</a>
	Jablonex Group	<a href="http://www.jablonexgroup.com">www.jablonexgroup.com</a>
	E.H. Ashley & Company, Inc.	<a href="http://www.ehashley.com">www.ehashley.com</a>



A solder mold is required to reproduce jewelry pieces. First the original model of the jewelry piece is soldered. This is then used to make an impression in a suitable medium. Depending on the size of the jewelry piece and mold medium, this impression can be made several times.



1 Soldering the original model



2 Strengthening the rear of the original model with wire



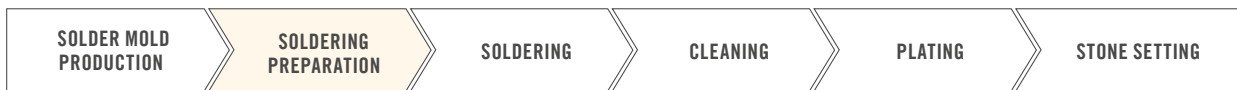
3 Pressing the original model into a suitable impression material



4 Once the material hardens, the original model can be removed

**Note:** The solder mold must be designed in such a way that hardly any pressure is needed to position the Cupchain segment into the mold. The crystals may be damaged if there are high levels of mechanical stress on the cups, or if they are deformed.





Materials and aids should be clean, and particularly **free of any grease**, to ensure proper application. When soldering and plating, adequate ventilation is essential. In addition, it is recommended that protective eyewear and protective gloves are worn in line with the manufacturer's safety information sheets. Wearing protective gloves also prevents aids from getting dirty.



## Selecting the optimum solder and flux

When selecting solder, the working temperatures and flow characteristics are particularly important. Solder is available from various manufacturers in wire form, with or without a flux core, as a paste and as pellets.

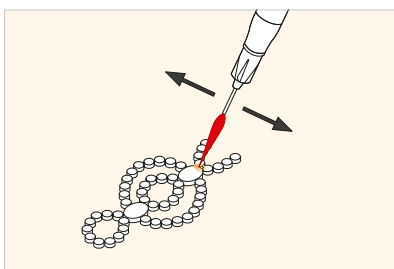
When using lead-free solder (Silox 227; tin/copper solder Sn 99/Cu 1), the high working temperature means precise workmanship and exact temperature control are necessary.

When soldering cupchains, solder wire with a flux core is more suitable. If solder pellets are being processed, or the wire used does not have a flux core, the flux should be adapted according to the solder manufacturer's instructions, while any corrosive effects on the foiling should be checked via pre-testing. These effects should be assessed after plating, as damage done during soldering is often only visible at this point.



## Soldering time and temperature

The right flame size and the time it is applied are important criteria when manufacturing soldered cupchain pieces. The size of the flame must comply with the instructions for use provided by the tool's supplier. Only heat the part of the jewelry piece in which the solder should flow. If the flame is held too long on the jewelry piece, the piece and the crystals may become overheated and therefore damaged or destroyed.

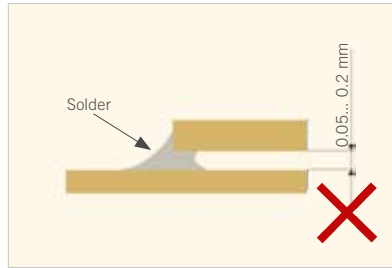
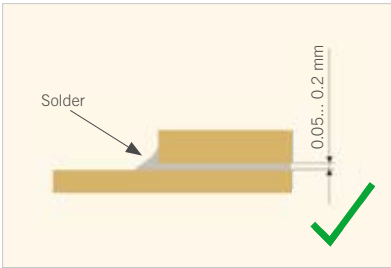


**Note:** A sudden drop in temperature during the soldering process can cause tension in the crystals. This can result in the crystal being damaged, for example by chipping. Avoid extreme differences in temperature during and after the soldering process.



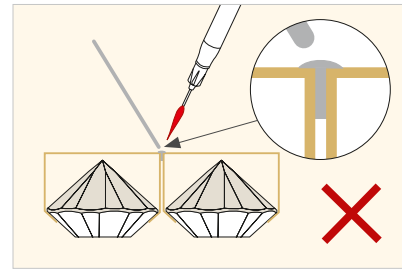
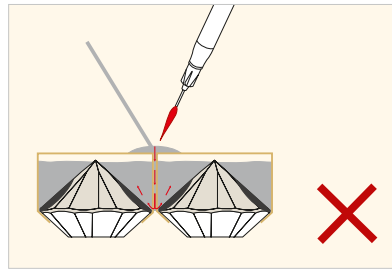
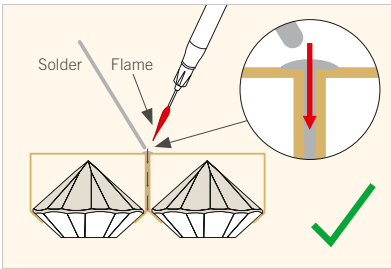
## Optimum soldering joint

The width of the joint to be soldered should be between 0.05 mm and 0.2 mm. If the joint is wider than 0.5 mm, the solder will not fill the joint sufficiently. A joint that is too narrow will also not contain enough solder to make it strong and neat.



## Optimum solder quantity

The right amount of solder ensures strong and clean soldered joints, which can then be cleanly plated. Correctly applied solder flows into the joints of the jewelry piece and provides a strong connection. Either too much or too little solder can damage the creations or result in unwanted discoloring of the crystal.



### Exact amount of solder

The solder is drawn into the solder gap via capillary action.

### Too much solder

Too much solder results in the cup backfilling, with the hot solder damaging the foiling. This damage creates a corroding surface following plating, and the foiling is destroyed. As such, these types of soldering errors are only really visible after plating.

### Too little solder

Too little solder means the soldering gap is not completely filled, and the joint is weakened.

## Soldering



1 Cut the Cupchain to the required length.



2 Put the Cupchain in the solder mold.



3 Solder the required spots.



4 Remove the soldered Cupchain from the mold.



Soldered items should be cleaned as soon as possible after the soldering process, to avoid corrosion. This will make the plating process significantly easier. Care must be taken when using mechanical polishing devices. Polishing media that are too hard or drums that rotate too quickly can damage the items and the crystals. Check the quantity, the polishing agents and time, the rotating speed and the height of the fall, in order to keep mechanical stress levels as low as possible.

In order to preserve the high quality of the creations, we recommend not using organic solvents and not exceeding a maximum temperature of 100°C (212°F).

SOLDER MOLD  
PRODUCTION

SOLDERING  
PREPARATION

SOLDERING

CLEANING

PLATING

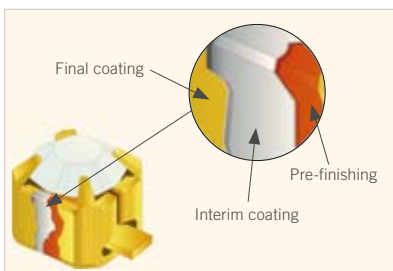
STONE SETTING

Plating serves to finish the jewelry piece. Here, metallic coatings are electrolytically added to the surface of the material. The process can only be carried out if the material to be plated is conductive. During the design process, please ensure that individual colors and coating effects can withstand plating. For further information, see the color overview in the SWAROVSKI ELEMENTS collection.

The most important criteria for an excellent finishing process are:

- Selecting reliable electrolyte suppliers who offer good service and who can provide detailed operating instructions
- Selecting suitable high performance electrolytes
- Careful care and maintenance of the unit and the electrolytes
- Using the recommended settings for plating cupchains

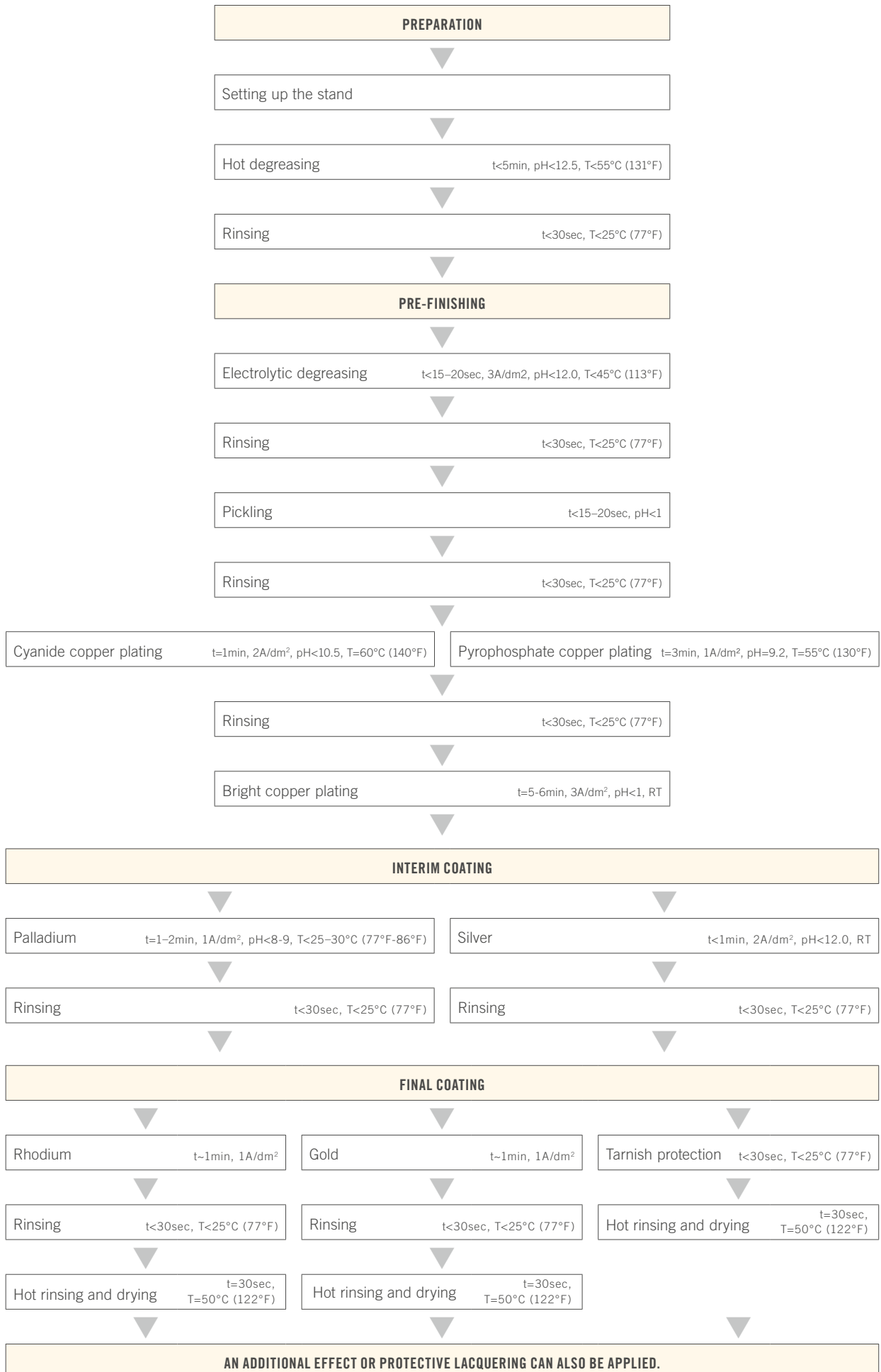
**Note:** Strong alkaline solutions, long exposure times in alkaline baths, the incorrect use of ultrasound, and high current densities usually lead to chemical and/or mechanical damage to crystals.



## Short descriptions of the processing steps

- **Hot degreasing:** Here, most of the dirt, grease, and soldering flux is removed.
- **Electrolytic degreasing:** Only cathodic degreasing, suitable for brass and non-ferrous metals, is recommended for fine cleaning Cupchain jewelry.
- **Pickling:** This part of the process serves to remove oxidization from the metal and also the remains of any scale left from the soldering process.
- **Cyanide copper plating:** This processing step serves to improve adhesive strength and conductivity, above all when using solder containing lead.
- **Pyrophosphate copper plating:** Like cyanide copper plating, this process improves adhesive strength and conductivity. The advantage is that the process does not involve cyanide, though the disadvantage is that higher current densities and longer exposure times are required.
- **Bright copper plating:** The use of sulfuric bright copper plating is recommended because of its excellent ability to cover surface flaws and create an even finish.
- **Palladium:** Palladium is presently the only recommended replacement for nickel since the bronze electrolytes currently available on the market can, through their extreme alkalinity, lead to damage to the foiling.
- **Silver coating:** Shiny silver coatings are usually separated from cyanide solutions that contain alkali silver (I)-cyanide, alkali cyanide, alkali carbonate, and organic and/or inorganic additives.
- **Anti-tarnish treatment**
  - **Temporary protection against tarnishing:** These are based either on wax mixtures in organic solvents or long chained sulfuric organic compounds, which can be used as wet-on-wet aqueous emulsions.
  - **Permanent tarnishing protection systems:** Cataphoretic lacquering systems have been proven especially effective as a longer lasting protective system for Cupchain jewelry. They have the advantage over conventional dipping and spray lacquers based on acrylic or zapon varnish (cellulose lacquer) in that only the conductive surfaces are very evenly coated while the isolated facets of the crystals remain uncoated.
- **Gold coating:** It is recommended to use phosphorus or citric acid electrolytes (pH ~3–4), which contain potassium gold (I)-cyanide.
- **Rhodium coating:** Sulfur or phosphoric acid based electrolytes are used for rhodium plating, from which shining, nearly silver-white layers can be applied.

## Parameter settings for plating Cupchains



SOLDER MOLD  
PRODUCTION

SOLDERING  
PREPARATION

SOLDERING

CLEANING

PLATING

STONE SETTING

Alongside the application methods outlined in this manual, SWAROVSKI ELEMENTS can also be employed using metal settings. Crystals can be set manually (using pliers, metal spatulas or punching tools) or by machine.

According to how the crystals are integrated into the metal settings, there are various types of setting, both plated and un-plated. Whenever possible, the settings should be plated before the stones are set. The SWAROVSKI ELEMENTS range also features crystal elements (Cupchains & Findings) that have already been set, as well as settings for Fancy Stones.

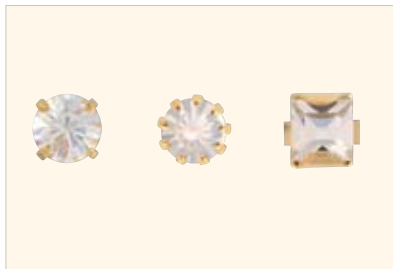
For further information on this, see the SWAROVSKI ELEMENTS Collection.

## Setting types



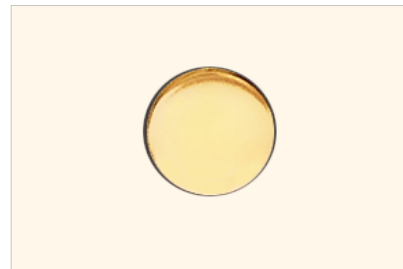
### Bezel settings

With bezel settings, the crystals are bezelled in to remain in the cup.



### Prong settings

With prong settings, the SWAROVSKI ELEMENTS are held in position by claws. In most cases there are four prongs. If the setting has more than four prongs it is referred to as a "Tiffany setting". Settings with flaps have significantly broader claws. The advantage here is that the broader claws are much less likely to damage very sensitive carrier material.

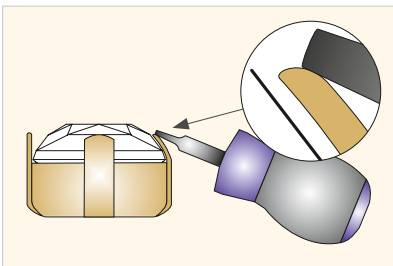


### Settings for gluing

In this type of setting crystal elements are glued in.

## Setting by hand

1. Depending on the shape and size, the cup is held using tweezers, flat nose pliers, or flat head pliers, without deforming it.
2. Place the crystal in the setting using a pair of tweezers or vacuum tweezers.
- 3a. Bezel setting: Press the cup shut using a setting closer. Setting closers are available from jewelry suppliers.
- 3b. Prong setting: The prongs of round cups can be pressed in place using a suitable setting closer. For all other forms, the prongs are individually closed in opposite positions, using a suitable pressing tool.



**Note:** After setting, the crystal should still be slightly movable in the setting.

The setting must be constructed so that the crystal can be entered into it without damaging the foiling. When settings are too tight or prongs are bent, the foiling or the protective lacquering can be damaged, possibly resulting in corrosion. If the setting is closed too strongly, the crystal can be damaged.



## Application methods

The following application possibilities are available for set crystals:



### Sewing

Sew-on cups are applied by sewing onto textiles and leather. There are holes in the cups for the thread to pass through.



### Soldering

These types of settings are suitable for soldering together with other cups and/or with Cupchains. They are mostly used in the jewelry segment.



### Mechanical application

With this special type of setting, the set crystal is applied onto the textile using claws.



### Threading

Settings that can be used as a pendant have an eyelet at the top, to which a chain can be attached. Settings with two eyelets can be attached to other elements.

## Working with end connectors (brass components)

Plated Cupchains & Findings can easily be combined with end connectors (brass components) in order to create striking pieces of jewelry.



The end connectors can be attached to the end of the Cupchain with flat-nosed pliers and interconnected by either jump rings or lobster claws.

This section offers a brief overview of the ways in which SWAROVSKI ELEMENTS can be integrated into jewelry design software, and a summary of the two most important production techniques for jewelry: rubber mold and lost wax.

## Jewelry design software

Leading software manufacturers offer special programs with 3-dimensional display possibilities for the design of jewelry and accessories. These 3D-design programs feature a whole range of functions that simplify and support the design process and therefore also the entire production process.

Special software solutions that have integrated a range of digitally processed SWAROVSKI ELEMENTS in their programs are already available ([www.3design.com](http://www.3design.com)). These can be simply and quickly integrated into any design, thus allowing the designer to work with SWAROVSKI ELEMENTS right from the beginning of the design phase.

## Production process

### Rubber mold processes

This process is very widely used in the production of fashion jewelry. Tin alloys are mostly used here, and the biggest advantage of this procedure is that the required tools are favorably priced.



1 Several original models are shaped out of metal, which must already exhibit an excellent surface quality. The expected shrinkage during casting must be taken into account.



2 A rubber mold is vulcanized from these models and then a rubber casting model is made.



3 Channels are cut in this rubber plate for the casting process.



4 The completed rubber molds are filled with the molten metal alloy (centrifugal casting procedure).



5 After cooling and removing from the mold, the casting channels are cut off.



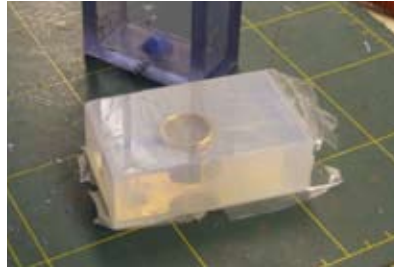
6 The cast model achieved by this process is ground and polished in preparation for the plating process.

## Lost wax process

The lost wax process is used for metals with a higher melting point, for example brass, silver, and gold. It is mainly used for the manufacture of high-quality fashion jewelry and fine jewelry.



1 Production of a prototype, e.g. through rapid prototyping; the better the surface quality is here, the better the casing will be later. The expected shrinkage during casting must be taken into account.



2 This prototype is either formed with silicone or vulcanized between raw rubber plates.



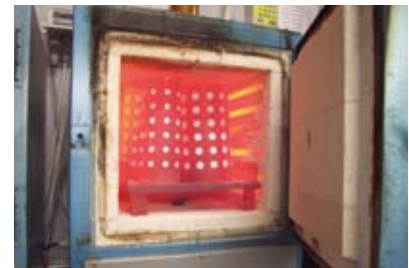
3 The mold that has already been produced is injected with molten wax with a wax injector (production of the wax component).



4 The wax forms created this way are each melted onto a wax tree format with a wax welding device. The trunk of the wax tree later serves as the casting channel.



5 The tree is now placed into a cuvette, the holes are glued up and it is embedded in implantation paste under vacuum and vibration.



6 The wax is melted out after the implantation paste has hardened. Remaining wax is burnt out in a kiln. The wax must be completely burnt out, leaving only the clean cavities.



7 While it is still hot, the cuvette is filled, under vacuum, with the molten, liquid metal. Because of the porosity of the form, the molten metal fills every part of it.



8 After casting, the still hot cuvette is plunged into cold water (except for when crystals have been cast at the same time). The casting tree is then cleaned.



9 After the jewelry pieces are removed from the casting tree, they are finished by grinding and polishing.

The following table outlines common problems and causes when soldering, plating, and stone setting SWAROVSKI ELEMENTS, and offers advice on how to avoid them. Further details and more extensive descriptions can be found in the section marked with a ?!



PROBLEM	CAUSE
<b>Metal components</b>	
Cracked solder joints	1, 2, 3, 4
The jewelry piece has restricted movement	2, 5
Overall defective metal surface	2, 6
Uneven surface	7
Defective finishing on the soldered areas	8
Corrosion	9
<b>Crystal</b>	
Chipped crystal	10, 11, 12, 13
Discolored crystal	14, 15, 16, 17

CAUSE	RECOMMENDATION
1 Too little solder	Using too little solder weakens the solder joint, as the soldering gap is not completely filled.
2 Too much solder	The use of too much solder can result in cracks. The solder joint is too large, which means that any force applied to the piece directly affects the solder. The thicker the layer of solder, the weaker it is, which can result in it cracking. Special attention should be paid not to use too much solder near the moving parts.
3 Insufficient flow of solder	Various factors can contribute to an insufficient flow of solder. <ul style="list-style-type: none"> <li>▪ If the flame is too small, the solder and the cup do not heat up enough.</li> <li>▪ If the soldering temperature is too high, the flux can vaporize. This means that the solder is not able to cover the metal surface.</li> <li>▪ The melting temperature of the solder is too high.</li> </ul>
4 Dirty metal surface, solder, flux or solder mold	Special attention must be paid to having clean (and above all grease free) metal surfaces.
5 Exposure to the finishing process has been too long	The exposure time for functional and flexible elements should be kept as short as possible. Optimizing the polishing processes and the use of high quality electrolytes is also recommended.
6 Insufficient cleaning	Insufficient or incorrect cleaning after soldering has a negative impact on the finishing processes. Carefully check the cleaning processes.
7 Faults in the finishing process	If there are irregularities in the metal surface, such as burns, pores or orange peel, this is generally a result of poor quality polishing or the processor plating baths not being correctly set up.
8 Faults in soldering, cleaning or finishing processes	Unightly finishing on the solder areas can be the result of incorrect soldering, insufficient cleaning after the soldering process, or – if solder containing lead has been used – by the use of sulfuric acid in the pickling process or by the absence of or incorrect use of copper plating.
9 Faults in the finishing process	Tarnishing or corrosion is often caused by insufficient rinsing or by contaminated rinsing water. The transfer times between the individual stages of the process should be kept as short as possible. Rapid tarnishing of silver can be prevented by using effective tarnishing protective systems (e.g. coatings, wax, lacquer etc.).

CAUSE		RECOMMENDATION
10	Faulty solder mold	The solder mold must be designed in such a way that hardly any pressure is needed to position the Cupchain segment into the mold. The crystals may be damaged if there are high levels of mechanical stress on the cups, or if they are deformed.
11	Thermal shock	A sudden drop in temperature during the soldering process can cause tension in the crystals. This can result in the crystal being damaged, for example by chipping. Avoid extreme differences in temperature during and after the soldering process.
12	Use of polishing drums	Hard polishing components in a rotating polishing drum can damage the surface of the crystals. Check the quantity, the polishing agents and time, the rotating speed and the height of the fall. Mechanical stress levels should be kept as low as possible.
13	Use of barrel plating	In general it is recommended that Cupchain jewelry should be finished on a plating rack. Please note however that crystals incorporated into heavy or sharp designs may be damaged if barrel plating is used, due to the size or shape. Choose the best type of drum and optimize the rotation and the fall height. When the drum is between the different stages of the finishing process and contains no liquid, the items being plated inside the drum may damage each other.
14	Soldering temperature too high	Soldering temperatures that are too high (e.g. soldering flame too high, soldering times too long) can lead to an overheating of the solder joints and damage to the crystals. It may be helpful to use a solder that melts at a lower temperature.
15	Too much solder	The use of too much solder can lead to damage to the foiling on the crystals and their subsequent discoloring. In this case one crystal should be removed to ascertain whether there is any solder left in the cup and the amount of solder being used should be reduced. This can be achieved by using a solder wire with a maximum diameter of 1 mm.
16	Cleaning with ultrasound	The foiling on the crystals may be damaged if ultrasound is used too intensively or too long.
17	Faults in the finishing process	Possible causes of discolored crystals may lie with the individual steps in the finishing process. Things to check include the alkalinity, currency density, exposure times, and temperatures of the plating baths used. Other causes may be the use of ultrasound, incorrect rinsing techniques, and post processing techniques.