



# ENIG IG300 Immersion Gold

## DESCRIPTION

The ENIG IG300 Immersion Gold solution is specially formulated to deposit immersion gold over electroless nickel on printed circuit boards. This is the last step of the ENIG process designed to produce a solderable finish. The gold deposit produced is 2 – 4 microinches (0.05 – 0.10 microns) thick.

## OPERATING PARAMETERS

Make-Up	See section IV. Control Procedures
Temperature	160-175°F (71-79°C) – 170°F nominal
Immersion Time	10-20 minutes (15 min nominal)
Process	Batch Tank
Agitation	Required
Circulation	Panel agitation & pump circulation at 10-15 turnovers/hour
Filtration	Periodic activated carbon filtration – see section IV.
Ventilation	Recommended
Tanks	Polypropylene, Polyethylene, supported for high temp.
Racks/Baskets	Plastic coated stainless steel; use polypro or Halar
Heaters	Quartz or derated PTFE coated
Cooling coil	Strongly recommended

Please refer to our ENIG Process Flow for more details on dwell times and temperatures at each stage.

## PHYSICAL PROPERTIES

	<b>IG300 Concentrate</b>
Specific gravity	1.21-1.23
Appearance	Clear to light amber liquid
Odor	None
pH	4.8-5.0



## CONTROL PROCEDURES

The makeup quantities are shown below. Follow the order given in the table for additions, and mix well after each step.

Bath Makeup Step	ENIG IG300 GOLD
Step 1	Add about 50% by volume of DI water
Step 2	Add 20% by vol of IG300 and mix
Step 3	Add 0.15 oz/gal of potassium gold cyanide (0.10 oz/gal gold metal) and mix
Step 4	Bring tank to level with DI water
Step 5	With the mixing pump on, heat up to 170°F
Step 6*	Adjust bath pH to 4.9 and 5.1 using 10% v/v reagent grade, potassium hydroxide or 20% by wt citric acid dissolved in DI water.
Step 7	Dummy plate the bath with 0.1 to 0.2 ssf/gal (0.25 to 0.50 dm <sup>2</sup> /liter) of nickel plated area for about 10 min. Do not use copper.

\*Use reagent grade materials diluted in DI water for pH adjustment.

### Bath Controls

The immersion gold bath control ranges are listed below. Nominal values are listed in parentheses ().

Parameter	U.S Units	Metric Units
Temperature	160-175°F (170°F)	71-79°C (76°C)
pH	4.9 to 5.1 (5.0 initially)	4.9 to 5.1 (5.0)
Gold metal	0.06 to 0.12 oz/gal (0.10 oz/gal)	0.50 to 1.0 g/L (0.75 g/L)
IG300	18-22% by vol (20% vol)	18-22% by vol (20% vol)
Nickel metal	800 ppm max	800 ppm max
Copper metal	6 ppm max	6 ppm max
Plating time	10-20 min (15 min)	10-20 min (15 min)
Gold thickness	2-3 microinches	0.05-0.08 microns

Make sure that the heater is only turned on when the mixing pump is running. Do not heat the bath without mixing.

### Filtration

Carbon filtration can be used to extend the immersion gold bath life and reduce running costs. Please consult with an FCT representative for more details.

### Replenishment

- Gold metal is replenished based on analysis as shown in section V below.
- IG300 is added based on analysis shown in section V below.
- Adjust the pH with potassium hydroxide diluted to 10% by volume in DI water, or with citric acid dissolved at 20% by weight in DI water. Use reagent grade, potassium hydroxide 45% by wt., or reagent grade, citric acid anhydrous for pH adjustments.

#### Specific Gravity (SG)

Additions of DI water should be made regularly to maintain the liquid level in the IG300 bath. This should be done slowly with good mixing so that the bath is not shocked by a sudden dilution. Adding DI water reduces the specific gravity, so this should be done before the specific gravity is measured.

Specific gravity is a rough measurement of the IG300 concentration. The titration method for IG300 concentration is a more accurate method of analysis. The specific gravity will change over time due to drag out and use. The temperature at which the specific gravity is measured affects the results. For example, at 70 F (room temperature) a fresh IG300 working bath has a SG around 1.045. At 170 F (operating temperature) this same bath has a SG around 1.029. If specific gravity measurement is done, it should be run at operational temperature (170 F).

#### Bath Replacement

The immersion gold bath should be replaced based on contaminate levels. Copper readily dissolves in this solution, so exposed copper surfaces should be kept out of the solution. The bath should be replaced when the nickel level reaches 800 ppm or when the copper content reaches 6 ppm. Spent solutions should be reclaimed to recover the remaining gold metal.

## ANALYSIS

#### Gold, Nickel, and Copper Concentrations by AAS

Dilutions:

1. Pipet 10.0 ml of the working solution into a 100 mL volumetric flask.
  2. Dilute to the mark with DI water and mix. This solution will be used for Nickel analysis.
  3. Pipet 10.0 mL of this dilute solution into another 100 mL volumetric flask.
  4. Dilute to the mark with DI water and mix. This solution will be used for Gold analysis.
- Note: the IG300 bath will be analyzed directly for Copper without dilution.

Gold analysis:

5. Calibrate the AAS with 1.0, 5.0, and 10.0 ppm gold standard solutions.
6. Read the gold content of the second dilute solution.
7. Calculation:

Gold metal content (oz/gal) = (ppm Au reading) x 0.013

Gold metal content (g/L) = (ppm Au reading) x 0.1

Maintain the gold metal content between 0.06 to 0.12 oz/gal (0.50 and 1.0 g/L) through additions of potassium gold cyanide. Calculations for additions are shown below.

Potassium gold cyanide addition (oz) = (0.10 - gold metal in oz/gal) x (bath vol. in gal) x 1.5

Potassium gold cyanide addition (grams) = (0.75 - gold metal in g/L) x (bath vol. in liters) x 1.5

Potassium gold cyanide contains approximately 68.4% wt gold metal.

Nickel analysis:

8. Calibrate the AAS with 10.0, 50.0, and 100.0 ppm Ni standard solutions.
9. Read the Ni content of the first dilute solution.
10. Calculation:

Nickel content (ppm) = (ppm Ni reading) x 10

Discard the bath when the nickel content reaches 800 ppm.

Copper analysis:

11. Calibrate the AAS with 1.0, 5.0, and 10.0 ppm Cu standard solutions.

12. Read the Cu content of the IG300 bath as is.

13. Calculation:

Copper content (ppm) = (ppm Cu reading)

Discard the bath when the copper content reaches 6 ppm. It is recommended to carbon treat the bath in order to remove contaminants. This can also remove copper metal, and extend the bath life.

IG300 Concentration by Titration (preferred)

Reagent makeup for 0.01 M copper (II) nitrate solution:

Dissolve 2.32 grams of copper (II) nitrate crystals into 900 mL of 2% by volume nitric acid. Dilute to 1 liter in a volumetric flask and mix well.

1. Pipet 10.0 mL of the working bath into a 250 mL titration flask.

2. Add 75–100 mL of DI water and mix.

3. Add 2 Murexide indicator tablets and mix until dissolved.

4. Titrate with 0.01 M copper (II) nitrate solution from purple to the yellow-orange endpoint.

5. Calculation:

IG300 content (% volume) = (mLs of copper nitrate) x 1.48

Maintain the IG300 concentration between 18 and 22% by volume (20% nominal) through IG300 and/or DI water additions.

IG300 Concentration by Specific Gravity (rough measurement)

1. Tare a 100 mL volumetric flask on a 600 gram balance.

2. Fill to the mark with IG300 working solution at operating temp (e.g. 170F).

3. Record the mass of the IG300 solution.

4. Calculation:

Specific gravity (g/mL) = (mass in grams) / 100

A fresh IG300 working bath has an SG of about 1.029 at 170 F. If the specific gravity is lower than this, an addition of IG300 may be required. We recommend using the titration method above for more precise determination of IG300 concentration.

## SAFETY AND STORAGE

- Reference the MSDS sheets for detailed information.

Bath components contain potassium gold cyanide. Great care must be taken to avoid mixing with strong acids, or poisonous hydrogen cyanide gas could be produced. Avoid breathing vapors. Use in a well-ventilated area. When handling concentrate or working solution, wear protective clothing, gloves and chemical safety goggles. In case of skin contact, remove contaminated clothing and flush affected area with plenty of cold water. In case of eye contact, flush immediately with plenty of cold water and seek medical attention immediately.

Store components in their original containers. Keep away from direct sunlight and temperature extremes. Protect from freezing.

## WASTE TREATMENT

- Consult with federal, state, and local authorities for regulations regarding disposal of solutions.

The spent IG300 bath contains gold, nickel and copper salts. The spent bath should be reclaimed to recover remaining gold metal. Consult with FCT Water Treatment personnel for more details.

## MISCELLANEOUS

- Components are available in 1 gallon, 5 gallon, 55 gallon drums.