



Product Data Sheet

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PRODUCT #: N5115, N5112 & N5100

CIRCUTEK C-777

Colloidal Palladium Activator

DESCRIPTION:

Low acid activator system used to catalyze non-metallic surfaces for the subsequent metallization by electroless copper. ***CIRCUTEK C-777*** is primarily used in the fabrication of printed circuit boards but can also be used in any application where the metallization of a non-conductor is desired.

A pre-dip solution is necessary to pre condition the substrate and to minimize drag-in of water into the ***CIRCUTEK C-777***. Make up the pre-dip solution according to instructions below, or use ***CIRCUTEK PD-776*** liquid.

CIRCUTEK PD-776S is also used in the preparation of ***CIRCUTEK C-777***.

BENEFITS:

- **Stable, long-lasting solution**
- **Low acid for reduced pink ring**

EQUIPMENT:

Tanks should be constructed of polyethylene, polypropylene or PVC. Racks should be constructed of 304 or 316 stainless steel, polypropylene, PVC or Teflon coated wire. Heater should be made of quartz or Teflon[®].

Filtration of the ***CIRCUTEK C-777*** solution is recommended. Use filters of polypropylene or dynel (5-10 micron filter porosity). The turn-over rate should be 3-5 times per 8 hours.

DO NOT introduce air into the system.

MAKE-UP / OPERATING INSTRUCTIONS:

Make-up of CIRCUTEK PD-776 Pre-Dip:

<i>CIRCUTEK PD-776S</i>	2.0 lbs/gal
37% Hydrochloric Acid:	2 - 5 % by volume
Deionized Water:	Balance
Temperature:	70 - 90°F
Immersion Time:	1 - 3 minutes
Agitation:	Work bar agitation

Procedure:

1. Fill tank half full with deionized water.
2. Add the required amount of ***CIRCUTEK PD-776S*** and mix until completely dissolved.
3. Slowly add the required amount of hydrochloric acid and mix well.
4. Adjust to final volume with deionized water.

OR use ***CIRCUTEK PD-776*** liquid pre-dip as supplied.

Make-up of CIRCUTEK C-777 working bath:

CIRCUTEK C-777	2 - 3% by volume
CIRCUTEK PD-776S	2.0 lbs/gal
37% Reagent Grade Hydrochloric Acid:	2 - 5% by volume
Deionized Water:	Balance
Temperature:	80 - 95°F
Immersion Time:	4 - 6 minutes
Agitation:	Work bar agitation
Vibration:	Recommended for small hole processing

Procedure:

1. Fill tank ½ full with deionized water.
2. Add the required amount of **CIRCUTEK PD-776S** and mix until completely dissolved.
3. Slowly add the hydrochloric acid.
4. Add the required amount of **CIRCUTEK C-777** catalyst.
5. Bring the solution up to volume with deionized water. Mix well.

OR fill tank with **CIRCUTEK PD-776** liquid. Add required amount of **CIRCUTEK C-777** catalyst, and mix well.

CONTROL

PARAMETERS:

To achieve optimum results the baths should be maintained at these concentrations.

<u>CIRCUTEK PD-776 Pre-Dip:</u>	OPTIMUM	RANGE
Acid Concentration:	0.4N	0.2 - 0.6N
Chloride Concentration:	4.35N	4.0 - 4.70N
Specific Gravity:	Above 1.14	

To maintain the specific gravity, replenish the bath according to the following schedule using **Circutek PD-776S** salt.

<u>Specific Gravity</u>	<u>PD-776S Addition</u>
1.136	-
1.129	2.7 oz/gal
1.118	5.4 oz/gal

<u>CIRCUTEK C-777:</u>	OPTIMUM	RANGE
CIRCUTEK C-777	2.5% by volume	2-3% by volume
Acid Concentration:	0.4N	0.2 - 0.6N
Chloride Concentration:	4.35N	4.0 - 4.70N
Stannous Chloride (SnCl₂):	13 g/l	10 - 16 g/l

Note: The desmear and electroless copper deposition process is laminate-specific. Parameters specified in RBP supplied operating guides for particular installations always supersede the parameters listed above.

This product should be used only for its intended purpose. The information stated above is based on our laboratory tests and experience, and is accurate to the best of our knowledge. Since actual use is beyond our control, the recommendations or suggestions are made without warranty, expressed or implied.

Analysis procedures for CIRCUTEK PD-776

Determination of Acid Normality in CIRCUTEK PD-776 Pre-Dip

- Equipment:** 5 ml pipette 250 ml Erlenmeyer flask
50 ml burette 50 ml graduated cylinder
- Reagents:** 0.1N Sodium Hydroxide (NaOH) – Commercially available from chemical supplier.
Phenolphthalein Indicator – Dissolve 0.10 g of phenolphthalein into 100 ml of ethanol.
- Procedure:**
1. Pipette 5 ml of a working bath into a 250 ml Erlenmeyer flask.
 2. Add 50 ml of deionized water and 3 - 5 drops of phenolphthalein indicator.
 3. Titrate with 0.1N sodium hydroxide to a pink endpoint.
- Calculation:** $\text{ml NaOH} \times N \text{ NaOH} \times 0.2 = \text{Acid Normality}$
- Maintenance:** To raise the acid normality by 0.1N, add 30 ml of 37% reagent grade hydrochloric acid per gallon of working solution.

Determination of Chloride Normality in CIRCUTEK PD-776 Pre-Dip

- Equipment:** 5 ml pipette 100 ml volumetric flask
10 ml pipette 250 ml Erlenmeyer flask
50 ml burette 50 ml graduated cylinder
Balance
- Reagents:** 0.1N Silver Nitrate (AgNO₃) – Commercially available from chemical supplier.
Dichlorofluorescein Indicator – Dissolve 0.1 g of 2', 7' – dichlorofluorescein into 100 ml of ethanol.
Dextrin – Commercially available from chemical supplier.
Calcium Carbonate, reagent grade – Commercially available from chemical supplier.
- Procedure:**
1. Pipette 5 ml of a working bath into a 100 ml volumetric flask. Dilute to the mark with deionized water. Mix well.
 2. Pipette 10 ml of the diluted sample into a 250 ml Erlenmeyer flask.
 3. Add 100 ml of deionized water.
 4. Add 0.5 g of dextrin powder.
 5. Add 5 g of calcium carbonate.
 6. Add 5 – 10 drops of dichlorofluorescein indicator.
 7. Titrate with 0.1N silver nitrate to a pink endpoint.

Calculation: $\text{ml AgNO}_3 \times N \text{ AgNO}_3 \times 2 = \text{Chloride Normality}$

Maintenance: To raise the chloride normality by 0.1N, add 20 grams/gal. Of *CIRCUTEK PD-776S* salt or 85 ml/gal of *PD-776*.

Determination of Copper Concentration in CIRCUTEK PD-776 Pre-Dip

Equipment: 20 ml pipette 250 ml Erlenmeyer flask
50 ml burette 50 ml graduated cylinder

Reagents: 0.05M EDTA – Commercially available from chemical supplier.

PAN Indicator – Dissolve 0.1 g of 4 - (2-pyridylazo)- resorcinol into 100 ml of ethanol.

pH 10 Buffer – Dissolve 54.0 g of ammonium chloride into 500 ml of deionized water. Add to that 350 ml of ammonium hydroxide and dilute to a volume of 1 liter.

Procedure:

1. Pipette 20 ml of working bath into a 250 ml Erlenmeyer flask
2. Add 100 ml of deionized water.
3. Add 20 ml of pH 10 buffer solution and 10 drops of PAN indicator.
4. Titrate with 0.05M EDTA to yellow endpoint.

Calculation:

$\text{ml EDTA} \times N \text{ EDTA} \times 3.18 = \text{g/l copper metal}$

Analysis procedures for CIRCUTEK C-777 Catalyst

Determination of CIRCUTEK C-777

Colorimetric Procedure:

1. Pipette 30 ml of *CIRCUTEK C-777* concentrate into a 1000 ml volumetric flask.
2. Add 225 g of *CIRCUTEK PD-776S* and 20 ml of reagent grade hydrochloric acid. Dilute to a volume of 1 liter and mix well. This solution represents a *CIRCUTEK C-777* working bath at 3.0%.
3. Pipette 50, 45, 40, 35, 30 and 25 ml samples of the 3.0% standard into six 100 ml volumetric flasks.
4. Dilute to the mark with 25% (by volume) reagent grade hydrochloric acid. Mix well. These standards represent 3.0%, 2.7%, 2.4%, 2.1%, 1.8% and 1.5% of the *CIRCUTEK C-777* working bath.
5. Pour the standard into 2 ounce glass bottles and label. The bottles should be filled to the top to prevent oxidation of stannous chloride.
6. To determine the concentration of a 3% working bath, pipette 40 ml of working solution into a 2 ounce glass bottle, add 40 ml of 25% hydrochloric acid. Mix well. Compare the color of the resulting solution with the color standards.
7. To determine the concentration of a 6% working bath, mix 20 ml of working solution with 60 ml of 25% hydrochloric acid and compare with color standards. Multiply the result of the color standard comparison by two to give the correct concentration.

Photometric Procedure:

1. Pipette 30 ml of *CIRCUTEK C-777* concentrate into a 1000 ml volumetric flask.
2. Add 225 g of *CIRCUTEK PD-776S* and 20 ml of hydrochloric acid. Dilute to a volume of 1 liter and mix well.
3. Pipette 25, 20, 15, 10 and 5 ml samples of the standard solution prepared in step 2 into five 100 ml volumetric flasks. Dilute to the mark with 25% (by volume) reagent grade hydrochloric acid. Mix well. These standards represent 5.0%, 4.0%, 3.0%, 2.0% and 1.0% of the *CIRCUTEK C-777* working bath.
4. Using a variable wavelength colorimeter set at 450 nm, read the absorbances for the different concentration of activator using 25% hydrochloric acid to zero the instrument.
5. Plot the absorbances versus concentrations on standard graph paper.
6. To determine the concentration of the *CIRCUTEK C-777* working solution, pipette 15 ml of the bath into a 100 ml volumetric flask. Dilute to the mark with 25% hydrochloric acid and mix well.
7. Read the absorbance of the sample and determine the percent concentration from the graph.

Determination of Stannous Chloride in C-777

Equipment: 10 ml pipette 500 ml Erlenmeyer flask
50 ml burette 50 ml graduated cylinder
Balance

Reagents: 0.1N Iodine (I₂) – Standard solutions are commercially available from chemical supplier.

25% Hydrochloric Acid – Dilute 250 ml of concentrated hydrochloric acid to a volume of 1 liter with deionized water.

Starch Indicator – Commercially available from chemical supplier.

Procedure:

1. Pipette 10 ml of a working bath into a 500 ml Erlenmeyer flask.
2. Add 75 ml of 25% hydrochloric acid.
3. Add 75 ml of deionized water.
4. Add 0.5 - 1 g of starch indicator.
5. Titrate with 0.1N iodine to a blue-black endpoint.

Calculation: ml of I₂ X N of I₂ X 9.48 = g/l SnCl₂

Maintenance: To raise the stannous chloride concentration by 1g/l, add 3.785 g/gal. Dissolve the required amount of stannous chloride into a 5% hydrochloric acid solution and add the mixture to the working bath.

Note: Do not make stannous chloride adds during production. Make stannous chloride adds at the end of a production day.

Determination of Chloride Normality in C-777

Equipment: 5 ml pipette 100 ml volumetric flask
10 ml pipette 250 ml Erlenmeyer flask
50 ml burette 50 ml graduated cylinder
Balance

Reagents: 0.1N Silver Nitrate (AgNO_3) – Commercially available from chemical supplier.

Dichlorofluorescein Indicator – Dissolve 0.1 g of 2', 7'-dichlorofluorescein into 100 mls of ethanol.

Dextrin – Commercially available from chemical supplier.

Calcium Carbonate, reagent grade – Commercially available from chemical supplier.

Hydrogen Peroxide – Commercially available from chemical supplier.

Procedure:

1. Pipette 5 ml of a working bath into a 100 ml volumetric flask. Add 8 - 10 drops of hydrogen peroxide and mix well. The solution should be amber in color. Fill to the volume with deionized water and mix well.
2. Pipette 10 ml of the diluted sample into a 250 ml Erlenmeyer flask.
3. Add 100 ml of deionized water.
4. Add 0.5 g of dextrin powder.
5. Add 5 g of calcium carbonate.
6. Add 5 - 10 drops of dichlorofluorescein indicator.
7. Titrate with 0.1N silver nitrate to a pink endpoint.

Calculation: $\text{ml AgNO}_3 \times N \text{ AgNO}_3 \times 2 = \text{Chloride Normality}$

Maintenance: To raise the chloride normality by 0.1N, add 20 grams of **CIRCUTEK PD-776S** salt or 85 mls/gal. of **CIRCUTEK PD-776** per gallon of working solution.

Determination of Acid Normality in C-777

Equipment: 5 ml pipette 100 ml volumetric flask
10 ml pipette 250 ml Erlenmeyer flask
50 ml burette 50 ml graduated cylinder

Reagents: 0.1N Sodium Hydroxide (NaOH) – Commercially available from chemical supplier.

Phenolphthalein Indicator – Dissolve 0.1 grams of phenolphthalein into 100 ml of ethanol.

Hydrogen Peroxide – Commercially available from chemical supplier.

Procedure:

1. Pipette 5 ml of a working bath into a 100 ml volumetric flask. Add 8 - 10 drops of hydrogen peroxide and mix well. The solution should be amber in color. Fill to the volume with deionized water and mix well.
2. Pipette 10 ml of the diluted sample into a 250 ml Erlenmeyer flask.
3. Add 100 ml of deionized water.
4. Add 3 - 5 drops of phenolphthalein indicator.
5. Titrate with 0.1N NaOH to a pink endpoint.

Calculation: ml NaOH X N NaOH X 2 = Acid Normality

Maintenance: To raise the acid normality by 0.1N, add 30 ml of 37% reagent grade hydrochloric acid per gallon of working solution.

BATH LIFE: *CIRCUTEK C-777* activator should be replaced when the copper concentration exceeds 1.0 g/l, or after 12 months of production.

CIRCUTEK C-776 pre-dip should be replaced when the copper concentration exceeds 0.5 g/l or when 500 SSF/gal. of boards have been processed.

CAUTIONS: *CIRCUTEK PD-776S* is a non-hazardous solid. Normal caution, such as safety glasses, rubber gloves, etc. should be exercised during handling.

CIRCUTEK C-777 catalyst is a strongly acidic concentrate. Avoid skin, oral and eye contact. Avoid breathing vapors. When handling the liquid concentrate wear goggles and protective clothing. In case of contact flush exposed areas immediately with cold water. Consult a physician in case of injury.

WASTE DISPOSAL: *CIRCUTEK PD-776S* should be neutralized to precipitate metals. Dispose of sludge according to state and local regulations.

CIRCUTEK C-777 catalyst should be adjusted to a pH of 8 to 9 with 25% by weight sodium hydroxide. USE EXTREME CAUTION! This reaction generates heat and may become violent if the sodium hydroxide is not added slowly. The precipitate contains palladium which may be reclaimed.