



## WARNING !!!

PLEASE BE ADVISED THAT KOCOUR 110 VOLT HULL CELLS ARE ONLY RATED FOR USE WITH 110 VOLT AC POWER SUPPLY. DAMAGE TO THE HULL CELL AND/OR FIRE CAN OCCUR!

220 VOLT HULL CELLS ARE AVAILABLE!

## OPERATING INSTRUCTIONS FOR TCCG & TCACG 267 & 1000 ML HEATED HULL CELLS (110 VOLT)

The heated hull cell provides a simple, accurate method for making plating tests on any baths, such as bright nickel, high speed copper, tin, etc. which require an elevated operating temperature. The hull cell is equipped with a thermostatically controlled circuit guard heater which will maintain the bath temperature to a maximum of 150E. **To avoid damage to the hull cell do not exceed 150EF.** The standard hull cell is not equipped with a heating element and operates at room temperature without the need to preheat the solution. Hexavalent chromium plating solutions cause the Lucite™ hull cells to craze and eventually leak. **Do not use Lucite™ cells with Chrome solutions.** A porcelain hull cell is recommended for use with hexavalent chromium solutions.

### (A) OPERATING PROCEDURE:

1. Analyze all plating solution components (e.g., metals, chlorides, boric acid, specific gravity, pH, etc.) and make adjustments as required.

**NOTE:** If preheating the solution is not required, withdraw a sample to be tested and transfer directly into the hull cell to the red scribed line. Then proceed to Step #5.

### WARNING: DO NOT LEAVE UNATTENDED OR OPERATE WITHOUT LIQUID.

2. Withdraw approximately 1500 ml of the solution to be tested and transfer into a 2000 ml beaker. Place the beaker on a heat source and then preheat the solution to the proper operating temperature. (Periodically check the temperature with the thermometer).
3. After reaching the desired temperature, remove beaker from heat source and fill hull cell with the preheated solution to the red scribed line in either the 267 ml or 1000 ml hull cell.
4. Plug the heater into the short jumper connector cord and slide the boot cover over the connection. Plug in the power cord and turn the control knob fully clockwise, the red indicator light should now be on. When the desired temperature is reached slowly turn the control knob counterclockwise until the light goes off. This will turn off the heater element and maintain the preheated solution temperature within  $\pm 5^{\circ}\text{F}$  of the desired operating range. The heating element will cycle on and off at this "set-point" to maintain the desired temperature range. (Periodically check the temperature with the thermometer).

5. If agitation is required, use either the air or mechanical system. Use the system that duplicates your production process.
6. Using the chart listed below as a guide, select the proper anode and connect it to the red lead (+) from the rectifier. Again, using the chart, select the proper cathode, clean according to the instructions on the package, then connect it to the black lead (-) from the rectifier. (see Figure 1 on page 5.)

**NOTE:** The Kocour rectifier model 5C for the 267ml hull cell or the model 15A for the 1000ml hull cell are the recommended power sources. Do not use rectifiers with greater than 3% ripple.

SOLUTION	AGITATION	ANODE	CATHODE	AMPERAGE		PLATING TIME (min.)
				267 ML	1000 ML	
ACID COPPER	AIR	PHOS. COPPER	COPPER	3	5	5
PYRO COPPER	AIR	COPPER	COPPER	2	3	5
CYANIDE COPPER		COPPER	COPPER	2	3	5
CADMIUM RACK		CADMIUM	STEEL	2	3	5
CADMIUM BARREL		CADMIUM	STEEL	1	3	5
ACID ZINC RACK	AIR or MECH.	ZINC	STEEL	3	3	5
ACID ZINC BARREL		ZINC	STEEL	1	3	5
ALKALINE ZINC RACK		ZINC	STEEL	3	3	5
ALKALINE ZINC BARREL		ZINC	STEEL	1	3	5
CYANIDE ZINC		ZINC	STEEL	2	3	5
CHROMIUM		LEAD	STEEL	5	5	4
NICKEL (ALL)	AIR or MECH.	NICKEL	BRASS	2	3	5
ACID TIN RACK	MECH.	TIN	STEEL	2	5	5
ACID TIN BARREL		TIN	STEEL	1	---	5
SILVER	MECH.	SILVER	COPPER	0.75	---	5
GOLD		PT. TITANIUM	NICKEL plated BRASS	0.25	---	1
BRASS		BRASS	STEEL	1	---	5
LEAD		LEAD	COPPER or STEEL	2	3	5

7. Plate the panel for the specific time and amperage recommended by the plating process supplier or use the general plating times and amperages listed above.
8. After plating, remove the panel and rinse thoroughly with water, then dry. Use the plastic hull cell scale (or Figure 2 on page 5) to determine the current density at various points along the plated panel.
9. If any additions are required, calculate the amount from the chart below:  
  
2 gm/267 mL Hull Cell = 1 oz./gal. = 6.25 lbs./100 gal.  
2 mL/267 mL Hull Cell = 0.96 fl. oz./gal. = 6 pints./100 gal.  
4 gm/534 mL Hull Cell = 1 oz./gal. = 6.25 lbs./100 gal.  
4 mL/534 mL Hull Cell = 0.96 fl. oz./gal. = 6 pints./100 gal.  
7.5 gm/1000 mL Hull Cell = 1 oz./gal. = 6.25 lbs./100 gal.  
7.5 mL/1000 mL Hull Cell = 1 fl. oz./gal. = 6.25 pints./100 gal.
10. After testing is completed, unplug heater and allow heating element to cool before removing solution.

#### **(B) MAINTENANCE:**

1. **ELECTRICAL HAZARD. Unplug power cord before cleaning.** Clean hull cell thoroughly with water when testing various solutions or after additions have been made. Residues left in the cell can affect results.
2. It is strongly recommended to use different hull cells for different solutions. This reduces the risk for contamination of the plating solution.
3. **The hull cell is not waterproof. To avoid damaging the heating element and thermostat, DO NOT IMMERSE IN WATER.**

#### **(C) ELECTROLYTIC PURIFICATION OF BATHS:**

It is frequently necessary to electrolyze plating baths to remove metallic impurities. The manner in which this is accomplished in the hull cell is to electrolyze the bath sample at low current density with the anode and cathode parallel, i.e., the cathode plate adjacent to the longest side of the hull cell, with the anode opposite.<sup>1</sup> Agitation may be used if desired. The amount of electrolysis required to give a good test plate in the regular manner can then be translated to the plating tank.

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<sup>1</sup>

Sedusky and Mohler, January, 1947 – *Metal Finishing*

As an example, 5 amperes per ft<sup>2</sup> on the plate (3.938" long by 2" deep (immersed)), calculates as:

$$\frac{3.938 \text{ in} \times 2 \text{ in} \times 5 \text{ amp/ft}^2}{144 \text{ in}^2/\text{ft}^2} = 0.27 \text{ ampere through the hull cell.}$$

If 20 minutes electrolysis removes the impurity satisfactorily, the total electrolysis is 20 min. x 0.27 amp = 5.4 ampere-minutes. Therefore, since 3,785 ml. equals one gallon, 5.4 ampere-minutes for 267 ml calculates as follows:

$$\frac{3,785 \text{ ml}}{267 \text{ ml}} \times \frac{5.4 \text{ amp-min}}{60 \text{ min/hr}} = 1.27 \text{ ampere-hours per gal of plating bath.}$$

**(D) PROPRIETARY PROCESSES:**

When using hull cell control on proprietary plating baths, it is usually advisable to contact the manufacturer of the particular process for their recommendations. These recommendations may suggest a change in the amperage or time of the hull cell test in order to better illustrate the bath parameters to be controlled. Some processes also use special addition agents, which have a pronounced effect on appearance of the hull cell panel.

FIGURE 1 METHODS OF TESTING (top view)

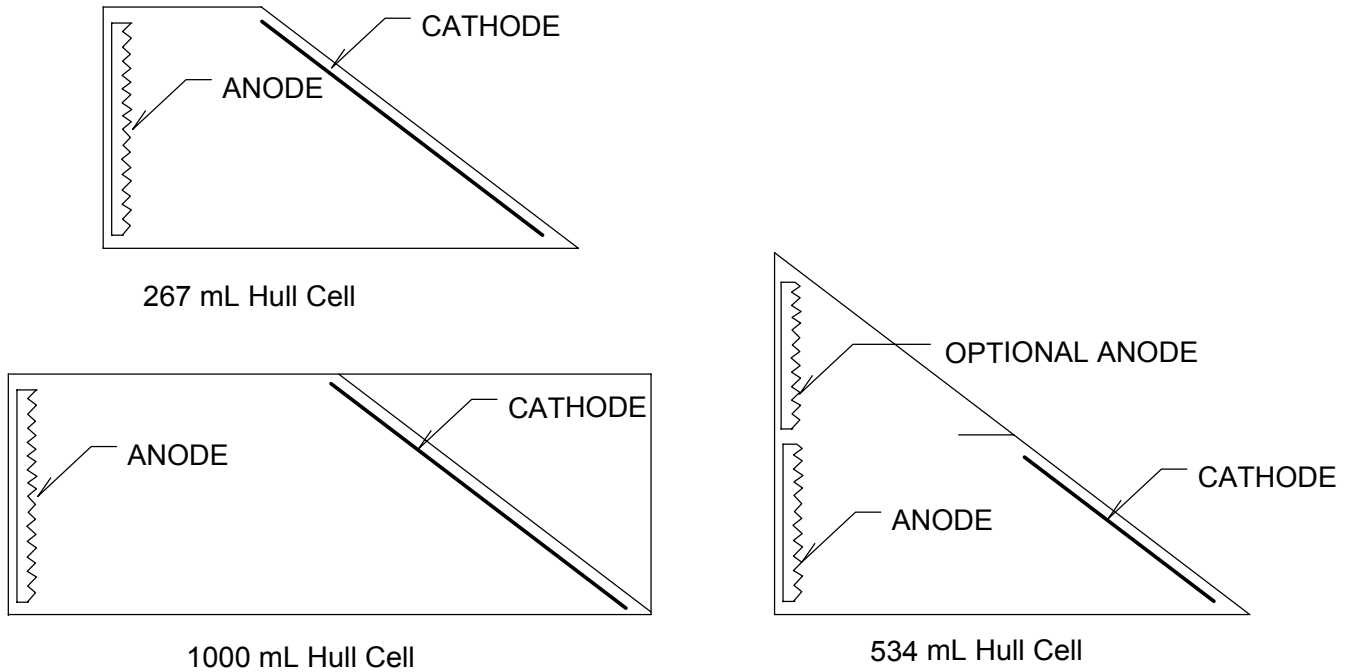


FIGURE 2 CURRENT DENSITY in AMPHERES per SQUARE FOOT

		PANEL EDGE													
1 AMP		40	30	25	20	15	12	10	8	6	4	3	2	1	0.5
2 AMPS		80	60	50	40	30	24	20	16	12	8	6	4	2	1
	↑ TOTAL CURRENT ↓														
3 AMPS		120	90	75	60	45	36	30	24	18	12	9	6	3	1.5
5 AMPS		200	150	125	100	75	60	50	40	30	20	15	10	5	2.5
		PANEL EDGE													
3 AMPS		90	60	45	36	30	24	18	15	12	9	6	3	0.6	
5 AMPS		150	100	75	60	50	40	30	25	20	15	10	5	1	