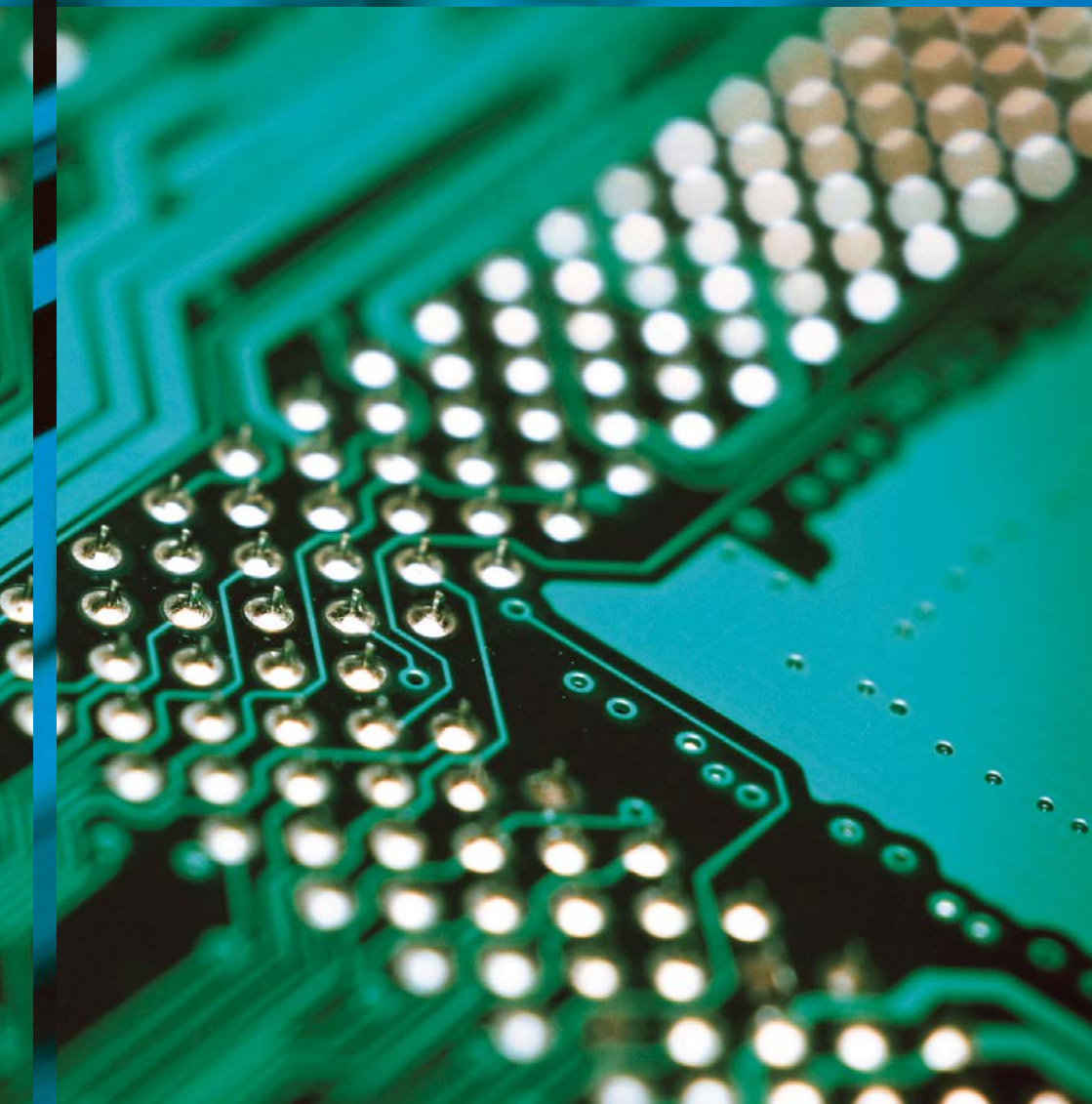
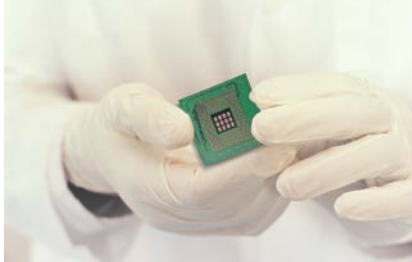


Plating on Plastics and  
Metal Finishing Technologies

# Process Directory





## **The Convergence of Materials and Innovation**

Dow Electronic Materials is a world leader in developing innovative material solutions for the electronic and optoelectronic industries. Focused on the circuit board, semiconductor and advanced packaging industries, our products, technologies and solutions are vital elements in creating and producing electronic devices. Everyday, we bring inspiration, science, technology and innovation together for people around the globe. We drive the convergence of materials and innovation.

At Dow Electronic Materials we are committed to using the breadth of our portfolio, the talent of our people, and our unparalleled ability to serve customers regardless of geography. We respond quickly to the most demanding challenges, bringing you dynamic technologies and products, exactly when and where you need them.

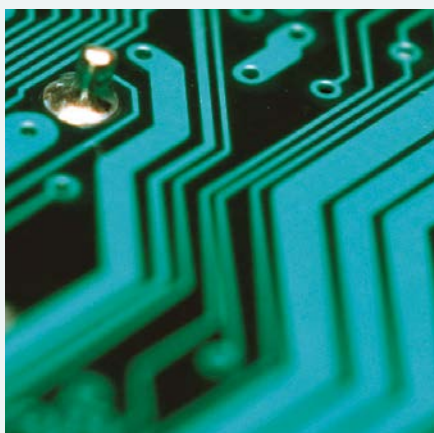
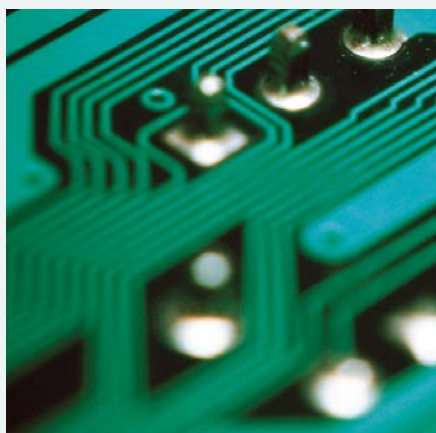
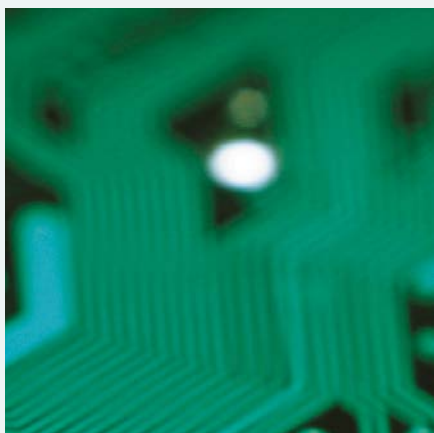
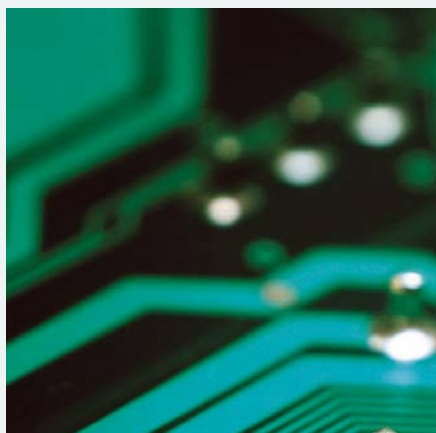
## **Plating on Plastics and Metal Finishing Technologies**

### **Linking Innovation to Performance**

Plating on Plastics and Metal Finishing Technologies delivers integrated materials and surface finishing processes for use in electronics, optoelectronics and industrial applications worldwide. Our processes provide essential functionality to the end-use markets we serve, including reliable interconnects for electronic packaging, EMI shielding of electronic devices, cost-effective optoelectronic components, corrosion resistance of industrial articles, and decorative treatments for metal and plastic surfaces. By investing in innovative technologies, leveraging global operations and providing outstanding service, we link innovation to performance every day around the world.

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# Plating on Plastics–Decorative

Process	Process Name	Description
Pre-etch	Cleaner PM-900 Conditioner PM-920 Conditioner PM-921	<ul style="list-style-type: none"> <li>Removes soils and aids in wetting of plastic surfaces</li> <li>Conditioner for ABS plastic</li> <li>Conditioner for ABS/PC and other thermoplastics</li> </ul>
Chrome Etch	Etch Additive PM-941-A-2	<ul style="list-style-type: none"> <li>Etch wetter</li> </ul>
Neutralizer	Neutralizer PM-954	<ul style="list-style-type: none"> <li>Chrome neutralizer</li> </ul>
Catalyst	CATAPOSIT™ PM-957 CATAPOSIT™ PM-959 Catalyst	<ul style="list-style-type: none"> <li>Standard Pd activator, colloidal</li> </ul>
Accelerator	Accelerator PM-964  Accelerator PM-960	<ul style="list-style-type: none"> <li>Salt-based accelerator, preferred for high volume applications</li> <li>Liquid accelerator</li> </ul>
Electroless	NIPOSIT™ PM-980  NIPOSIT™ PM-988  CIRCUPOSIT™ Electroless Copper	<ul style="list-style-type: none"> <li>Low-temperature EN, low thickness, metallization for POP</li> <li>Ammonia-, Pb-, Cd-free, low-temperature EN for POP</li> <li>EDTA-based electroless copper for POP</li> </ul>
Semi-bright Nickel	NICKEL GLEAM™ SB 200	<ul style="list-style-type: none"> <li>Undercoat for duplex nickel, high levelling and ductility</li> </ul>
Bright Nickel	NICKEL GLEAM™ BR 220	<ul style="list-style-type: none"> <li>Bright nickel, exceptional brightness and levelling</li> </ul>
Chrome Plate	CHROME GLEAM™ 3C  CHROME GLEAM™ 3C Jet	<ul style="list-style-type: none"> <li>Trivalent chromium plating process</li> <li>Black trivalent chromium plating process</li> </ul>

## Plating on Plastics–Functional

Process	Process Name	Description
Etch	Conditioner PM-925  CIRCUPOSIT™ MLB Promoter 3308	<ul style="list-style-type: none"> <li>Alkaline conditioner/etch for liquid crystal polymers (LCP)</li> <li>Permanganate etch, used after PM-925 for polyetherimides (ULTEM)</li> </ul>
Neutralizer	CIRCUPOSIT™ Neutralizer 3313 CIRCUPOSIT™ Neutralizer PM-954	<ul style="list-style-type: none"> <li>Acidic neutralizer permanganate and PM-925</li> <li>Chrome neutralizer</li> </ul>
Promoter	Cleaner-Conditioner 231	<ul style="list-style-type: none"> <li>Alkaline catalyst promoter</li> </ul>
Catalyst	CATAPOSIT™ PM-957 CATAPOSIT™ PM-959	<ul style="list-style-type: none"> <li>Standard Pd activator, colloidal</li> </ul>
Accelerator	Accelerator PM-960 Accelerator PM-964	<ul style="list-style-type: none"> <li>Liquid accelerator</li> <li>Salt-based accelerator, preferred for high-volume applications</li> </ul>
Electroless Copper	CIRCUPOSIT™ 71 CIRCUPOSIT™ Electroless Copper	<ul style="list-style-type: none"> <li>Full-build electroless copper</li> <li>Uniform, bright electroless copper</li> </ul>
Activator	Activator 472	<ul style="list-style-type: none"> <li>Ionic palladium activator, activation of copper for electroless nickel</li> </ul>
Electroless Nickel	DURAPOSIT™ MF 1110	<ul style="list-style-type: none"> <li>Ammonia-, lead- and cadmium-free electroless nickel</li> </ul>

## Passive Components

Process	Process Name	Description
Nickel Plate	NIKAL™ PC-3 NIKAL™ MP-200	<ul style="list-style-type: none"> <li>Semi bright finish</li> <li>Matte finish</li> </ul>
Tin Plate	SOLDERON™ SG-J	<ul style="list-style-type: none"> <li>Sulfonic acid-based for pH sensitive devices. Excellent wetting speeds</li> </ul>
Tin/Solder Plate	SOLDERON™ LG	<ul style="list-style-type: none"> <li>MSA pure tin or lead alloy process for pH sensitive devices</li> </ul>
Post-treatment	NEUTRA RINSE™ 80 CERMETEC™ NO TARN™ Sn2	<ul style="list-style-type: none"> <li>Neutralizes acid film</li> <li>Rinse aid</li> <li>Tin anti-tarnish</li> </ul>

## Metal Finishing

Process	Process Name	Description
Tin/Solder Plate	SOLDERON™ RONASTAN™ EC TINGLO CULMO™	<ul style="list-style-type: none"> <li>Matte tin, tin/lead, MSA</li> <li>Matte tin, sulfate-based</li> <li>Bright tin, sulfate-based</li> </ul>
Silver Plate	SILVER GLO™ 3K  SILVER GLO™ 3K BP  SILVERON™ GT-101	<ul style="list-style-type: none"> <li>Cyanide silver, electronic applications</li> <li>Cyanide-based, bright decorative</li> <li>Bright or semi-bright, non cyanide silver</li> </ul>
Cadmium	KADIZID™	<ul style="list-style-type: none"> <li>Acid-based cadmium</li> </ul>
Post-treatment	NO TARN™ Sn2 Anti-Tarnish 7130 CERMETEC™	<ul style="list-style-type: none"> <li>Tin anti-tarnish</li> <li>Copper anti-tarnish</li> <li>Rinse aid</li> </ul>

# Wire Plating

Process	Process Name	Description
Cleaner	RONACLEAN™ E950 LF	<ul style="list-style-type: none"> <li>• Low foaming</li> </ul>
Activator	10–20% SOLDERON™ Acid HC	
Tin/Solder Plate	SOLDERON™ MHS-W  SOLDERON™ BTD	<ul style="list-style-type: none"> <li>• Matte, tin, tin/lead alloy, MSA</li> <li>• Bright, tin, tin/lead, MSA</li> </ul>
Auxiliary Products	SOLDER STRIP™ 8T  LRSE 557 Support Electrolyte  SOLDERON™ SD Antifoam SOLDERON™ RD Concentrate	<ul style="list-style-type: none"> <li>• Non-nitric-based tin/solder stripper</li> <li>• Support electrolyte for the CVS</li> <li>• Antifoam</li> <li>• Antioxidant</li> </ul>



# Lead Frame Plating

Process	Process Name	Description
Cleaner	RONACLEAN™ GP300-LF RONACLEAN™ NP 200	<ul style="list-style-type: none"> <li>All purpose cleaner</li> <li>All purpose, low COD cleaner</li> </ul>
Activator/Descaler	ACTRONAL™ 660	<ul style="list-style-type: none"> <li>Copper descaler</li> </ul>
Copper Plate	COPPER GLEAM™ RG-11	<ul style="list-style-type: none"> <li>Bright acid copper</li> </ul>
Nickel Plate	NIKAL™ PC-3 NIKAL™ MP 200	<ul style="list-style-type: none"> <li>Semi bright finish</li> <li>Matte finish</li> </ul>
Tin/Solder Plate	SOLDERON™ SC  SOLDERON™ ST-380	<ul style="list-style-type: none"> <li>Matte, tin/lead alloy, MSA</li> <li>Whisker mitigated pure tin</li> </ul>
Palladium	PALLADURE™ 200	<ul style="list-style-type: none"> <li>Chloride-based, pure palladium</li> </ul>
Post-treatment	CERMETEC™ NO TARN™ Sn2 Anti-Tarnish 7130	<ul style="list-style-type: none"> <li>Rinse Aid</li> <li>Tin anti-tarnish</li> <li>Copper anti-tarnish</li> </ul>
Auxiliary Products	SOLDER STRIP™ 8T  LRSE 557 Support Electrolyte  SOLDERON™ SD Antifoam SOLDERON™ RD Concentrate	<ul style="list-style-type: none"> <li>Non-nitric-based tin/solder stripper</li> <li>Support electrolyte for the CVS</li> <li>Antifoam</li> <li>Antioxidant, used in all SOLDERON™ processes except the ST-380</li> </ul>

## Barrel/Vibratory–Electronics

Process	Process Name	Description
Cleaner	RONACLEAN™ NP 200	<ul style="list-style-type: none"> <li>All purpose, low COD cleaner</li> </ul>
	RONACLEAN™ E 950 LF	<ul style="list-style-type: none"> <li>All purpose cleaner</li> </ul>
Activator/Descaler	ACTRONAL™ 660	<ul style="list-style-type: none"> <li>Copper descaler</li> </ul>
	PREPOSIT™ Etch 748	<ul style="list-style-type: none"> <li>Copper descaler</li> </ul>
Copper Plate	COPPER GLEAM™ RG-11	<ul style="list-style-type: none"> <li>Bright acid copper</li> </ul>
Nickel Plate	NIKAL™ PC-3	<ul style="list-style-type: none"> <li>Semi bright finish</li> </ul>
	NIKAL™ MP-200	<ul style="list-style-type: none"> <li>Matte finish</li> </ul>
Nickel Activator	RONATAB™ Acid Activator PC-1	<ul style="list-style-type: none"> <li>Nickel activator</li> </ul>
Palladium	PALLADURE™ 200	<ul style="list-style-type: none"> <li>Chloride-based, pure palladium</li> </ul>
Gold Strike	AURALL™ 364-A	<ul style="list-style-type: none"> <li>Pure gold strike</li> </ul>
	RONOVEL™/AUROSPEED™ Strike	<ul style="list-style-type: none"> <li>Hard gold strike</li> </ul>
	RONOVEL™ CM	<ul style="list-style-type: none"> <li>Cobalt-hardened, oxalate-free, acid gold, contains range extender for improved thickness distribution</li> </ul>
	RONOVEL™ N	<ul style="list-style-type: none"> <li>Nickel-hardened, acid gold, contains range extender for improved thickness distribution</li> </ul>
	AURONAL™ BGA	<ul style="list-style-type: none"> <li>Pure gold, lead-based brightener</li> </ul>
	AURALL™ 305 & 305 M	<ul style="list-style-type: none"> <li>Pure gold, arsenic brightener</li> </ul>

# Barrel/Vibratory–Electronics

Process	Process Name	Description
Tin/Solder Plate	SOLDERON™ PC RONASTAN™ EC  TINGLO CULMO™  SOLDERON™ ST-200	<ul style="list-style-type: none"> <li>• Matte, tin/lead alloy, MSA</li> <li>• Matte, pure tin, sulfate-based</li> <li>• Bright, pure tin, sulfate-based</li> <li>• Matte, pure tin whisker resistant, over nickel, MSA</li> </ul>
Silver Plate	SILVER GLO™ 3K SILVERON™ GT-101	<ul style="list-style-type: none"> <li>• Semi bright silver</li> <li>• Bright, non cyanide silver</li> </ul>
Post-treatment	NO TARN™ Sn2 NEUTRA RINSE™ 80  CERMETEC™ Anti-Tarnish 7130	<ul style="list-style-type: none"> <li>• Tin anti-tarnish</li> <li>• Neutralizes acid film, from tin plating</li> <li>• Rinse aid</li> <li>• Copper anti-tarnish</li> </ul>
Auxiliary Products	SOLDER STRIP™ 8T  LRSE 557 Support Electrolyte  SOLDERON™ SD Antifoam SOLDERON™ RD Concentrate  SOLDERON™ AO-52  SUPER STRIP 300	<ul style="list-style-type: none"> <li>• Non-nitric-based tin/solder stripper</li> <li>• Support electrolyte for the CVS</li> <li>• Antifoam</li> <li>• Antioxidant, used in all SOLDERON™ processes except the ST-380</li> <li>• Alternate antioxidant, used in the SOLDERON™ ST-200 process</li> <li>• Gold stripper</li> </ul>

# Reel to Reel

Process	Process Name	Process Description
Cleaner	RONACLEAN™ E950 LF RONACLEAN™ NP 200	<ul style="list-style-type: none"> <li>• All-purpose cleaner</li> <li>• All-purpose, low COD cleaner</li> </ul>
Activator/Descaler	ACTRONAL™ 660 PREPOSIT™ 748 Etch	<ul style="list-style-type: none"> <li>• Copper descaler</li> <li>• Potassium mono persulfate</li> </ul>
Copper Plate	COPPER GLEAM™ RG-11	<ul style="list-style-type: none"> <li>• Bright, high speed acid copper</li> </ul>
Nickel Plate	NIKAL™ PC-3 NIKAL™ MP-200	<ul style="list-style-type: none"> <li>• Semi bright finish</li> <li>• Matte finish</li> </ul>
Activator	RONATAB™ PC-1	<ul style="list-style-type: none"> <li>• Nickel activator</li> </ul>
Gold Strike	AURALL™ 364 -A RONOVEL™ Strike AUROSPEED™ Strike	<ul style="list-style-type: none"> <li>• Pure gold strike</li> <li>• Hard gold strike</li> <li>• Hard gold strike – no range extender</li> </ul>
Gold	RONOVEL™ CM  RONOVEL™ N  AURONAL™ BGA	<ul style="list-style-type: none"> <li>• Cobalt-hardened, oxalate-free, acid gold, contains range extender for improved plating distribution</li> <li>• Nickel-hardened, acid gold, contains range extender for improved plating distribution</li> <li>• Pure gold, non oxidizing, lead-based brightener</li> </ul>

# Reel to Reel

Process	Process Name	Description
Palladium	PALLADURE™ 200	<ul style="list-style-type: none"> <li>Chloride-based, pure palladium</li> </ul>
	PALLAMET™ 500	<ul style="list-style-type: none"> <li>Sulfate-based, palladium/nickel</li> </ul>
	PALLAMET™ 600	<ul style="list-style-type: none"> <li>Low ammonia sulfate-based palladium/nickel</li> </ul>
Silver	SILVERON™ GT 101	<ul style="list-style-type: none"> <li>Non cyanide bright and semi-bright</li> </ul>
	SILVER GLO™ 3K	<ul style="list-style-type: none"> <li>Semi-bright cyanide based</li> </ul>
Tin/Solder Plate	SOLDERON™ SC	<ul style="list-style-type: none"> <li>Matte, tin/lead alloy, MSA</li> </ul>
	SOLDERON™ ST-200	<ul style="list-style-type: none"> <li>Matte, pure tin whisker resistant, over nickel, MSA</li> </ul>
	SOLDERON™ BHT 350	<ul style="list-style-type: none"> <li>Bright whisker mitigated</li> </ul>
	SOLDERON™ BHT-90	<ul style="list-style-type: none"> <li>Bright 90/10, MSA</li> </ul>
	SOLDERON™ BT100	<ul style="list-style-type: none"> <li>Bright tin MSA</li> </ul>
Post-treatment	NEUTRA RINSE™ 80	<ul style="list-style-type: none"> <li>Neutralizes acid film, from tin plate</li> </ul>
	CERMETEC™	<ul style="list-style-type: none"> <li>Rinse aid</li> </ul>
Auxiliary Products	SOLDER STRIP™ 8T	<ul style="list-style-type: none"> <li>Non-nitric-based tin/solder stripper</li> </ul>
	LRSE 557 Support Electrolyte	<ul style="list-style-type: none"> <li>Support electrolyte for the CVS</li> </ul>
	SOLDERON™ SD Antifoam	<ul style="list-style-type: none"> <li>Antifoam</li> </ul>
	SOLDERON™ RD Concentrate	<ul style="list-style-type: none"> <li>Antioxidant, used in all SOLDERON™ processes except the ST-380</li> </ul>
	SOLDERON™ AO-52	<ul style="list-style-type: none"> <li>Alternate antioxidant, used in the SOLDERON™ ST-200 process</li> </ul>
	SUPER STRIP 300	<ul style="list-style-type: none"> <li>Gold stripper</li> </ul>

# Conversion Tables

To convert from a unit in the column at the left to a related unit, multiply by the factor in the appropriate right hand column. For example, to convert inches to meters multiply by 0.0254.

## Length

Units	Centimeters	Meters	Kilometers	Inches	Feet
Centimeters	1	0.01	0.00001	0.3937	0.03281
Meters	100	1	0.001	39.37	3.281
Kilometers	100,000	1000	1	39400	3281
Inches	2.54	0.0254	$2.54 \times 10^{-5}$	1	0.08333
Feet	30.48	0.3048	0.000305	12	1

1 angstrom =  $1 \times 10^{-4}$  microns =  $1 \times 10^{-8}$  cm =  $3.937 \times 10^{-9}$  inches

1 mile = 1.609 km = 1760 yd = 1.151 nautical mile

1 meter = 1.094 yd

## Mass & Weight

Units	Grams	Kilograms	Grain (Avoir.)	Ounce (Avoir.)	Lb. (Avoir.)
Gram	1	0.001	15.43	0.03527	0.0022
Kilogram	1000	1	15432	35.27	2.205
Grain (Avoir.)	0.06480	$6.48 \times 10^{-5}$	1	0.00229	0.000143
Ounce (Avoir.)	28.35	0.02835	437.5	1	0.0625
Lb. (Avoir.)	453.6	0.4536	7000	16	1

## Volume & Capacity

Units	Cubic CM	Liters	Cubic Inches	Fluid Ounces (U.S.)	Gallon (U.S.)
Cubic cm	1	0.001	0.06102	0.03381	0.000264
Liter	1000	1	61.02	33.81	0.2642
Cubic inches	16.39	0.01639	1	0.5541	0.00433
Cubic ft.	28300	28.32	1728	957.5	7.481
Cubic yd.	765000	764.5	46700	25900	202.0
Fl. oz. (U.S.)	29.57	0.02957	1.805	1	0.00781
Fl. pt. (U.S.)	473.2	0.4732	28.88	16	0.1250
Fl. quart (U.S.)	946.4	0.9464	57.75	32	0.25
Gallon (U.S.)	3785	3.785	231.0	128	1

1 gal. (Imperial) = 1.20094 gal. (U.S.)

## Density

Units	Sq. Cm	Sq. Meters	Sq. Inches	Sq. Ft.
Sq. centimeters	1	0.0001	0.1550	0.00108
Sq. meters	10000	1	1550	10.76
Sq. inches	6.452	0.000645	1	0.00694
Sq. ft.	929	0.0929	144	1

1 cubic ft. water at 60°F = 62.37 lb. 1 gram/cu cm = 62.37 lb./cu ft.

1 gal. Water at 62°F = 8.337 lb. 1 lb./cu ft. = 0.1337 lb./gal.

## Atomic Weights

Name	Symbol	Atomic Number	Atomic Weight
Actinium	Ac	89	(227)
Aluminum	Al	13	26.9815
Americium	Am	95	(243)
Antimony	Sb	51	121.75
Argon	Ar	18	39.948
Arsenic	As	33	74.9216
Astatine	At	85	(210)
Barium	Ba	56	137.34
Berkelium	Bk	97	(247)
Beryllium	Be	4	9.0122
Bismuth	Bi	83	208.980
Boron	B	5	10.811
Bromine	Br	35	79.909
Cadmium	Cd	48	112.40
Calcium	Ca	20	40.08
Californium	Cf	98	(251)
Carbon	C	6	12.0111
Cerium	Ce	58	140.12
Cesium	Cs	55	132.905
Chlorine	Cl	17	35.453
Chromium	Cr	24	51.996
Cobalt	Co	27	56.933
Columbium	Cb	(See Niobium)	
Copper	Cu	29	63.54
Curium	Cm	96	(247)
Dysprosium	Dy	66	162.50
Einsteinium	Es	99	(254)

Based on Atomic Mass of  $^{12}\text{C} = 12$



Name	Symbol	Atomic Number	Atomic Weight
Erbium	Er	68	167.26
Europium	Eu	63	151.96
Fermium	Fm	100	(253)
Fluorine	F	9	18.9984
Francium	Fr	87	(223)
Gadolinium	Gd	64	157.25
Gallium	Ga	31	69.72
Germanium	Ge	32	72.59
Gold	Au	79	196.967
Hafnium	Hf	72	178.49
Helium	He	2	4.0026
Holmium	Ho	67	164.930
Hydrogen	H	1	1.00797
Indium	In	49	114.82
Iodine	Ir	77	192.2
Iron	Fe	26	55.847
Krypton	Kr	36	83.80
Lanthanum	La	57	138.91
Lawrencium**	Lw	103	(257)
Lead	Pb	82	207.19
Lithium	Li	3	6.939
Lutetium	Lu	71	174.97
Magnesium	Mg	12	24.312
Manganese	Mn	25	54.938
Mendelevium	Md	101	(256)
Mercury	Hg	80	200.59
Molybdenum	Mo	42	95.9

## Atomic Weights - continued

Name	Symbol	Atomic Number	Atomic Weight
Neodymium	Nd	60	144.24
Neon	Ne	10	20.183
Neptunium	Np	93	(237)
Nickel	Ni	28	58.71
Niobium	Nb	41	92.906
Nitrogen	N	7	14.0067
Nobelium	No	102	(254)
Osmium	Os	76	190.2
Oxygen	O	8	15.9994
Palladium	Pd	46	106.4
Phosphorus	P	15	30.9738
Platinum	Pt	78	195.09
Plutonium	Pu	94	(242)
Polonium	Po	84	(210)
Potassium	K	19	39.102
Praseodymium	Pr	59	140.907
Promethium	Pm	61	(147)
Protactinium	Pa	91	(231)
Radium	Ra	88	(226)
Radon	Rn	86	(222)
Rhenium	Re	75	186.2
Rhodium	Rh	45	102.905
Rubidium	Rb	37	85.47
Ruthenium	Ru	44	101.07
Samarium	Sm	62	150.35
Scandium	Sc	21	44.956
Selenium	Se	34	78.96

Based on Atomic Mass of  $^{12}\text{C} = 12$

Name	Symbol	Atomic Number	Atomic Weight
Silicon	Si	14	28.086
Silver	Ag	47	107.870
Sodium	Na	11	22.9898
Strontium	Sr	38	87.62
Sulfur	S	16	32.064
Tantalum	Ta	73	180.948
Technetium	Tc	43	(99)
Tellurium	Te	52	127.60
Terbium	Tb	65	158.924
Thallium	Tl	81	204.37
Thorium	Th	90	232.038
Thulium	Tm	69	168.934
Tin	Sn	50	118.69
Titanium	Ti	22	47.90
Tungsten	W	74	183.84
Uranium	U	92	238.04
Vanadium	V	23	50.942
Wolfram	W	(See Tungsten)	
Xenon	Xe	54	131.30
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.905
Zinc	Zn	30	65.37
Zirconium	Zr	40	91.22

\*Value in parenthesis ( ) indicates most stable or best know isotope

\*\*Proposed – not officially accepted

## Metal Content of Plating Salts

Technical Name of Salt	Chemical Formula	Percent Metal
Antimony trichloride	$\text{SbCl}_3$	53.4
Cadmium cyanide	$\text{Cd}(\text{CN})_2$	68.3
Cadmium oxide	$\text{CdO}$	87.5
Chromic acid	$\text{CrO}_3$	52.0
Cobalt sulfate (anhydrous)	$\text{CoSO}_4$	38.0
Cobalt sulfate, crystal	$\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$	21.0
Copper carbonate (basic)	$\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$	57.5
Copper chloride (ic)	$\text{CuCl}_2$	47.3
Copper cyanide	$\text{CuCN}$	71.0
Copper sulfate (ic), crystal	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	25.5
Ferrous chloride, crystal	$\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$	28.1
Ferrous ammonium sulfate	$\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot \text{H}_2\text{O}$	14.2
Gold chloride (ic)	$\text{AuCl}_3$	64.9
Gold chloride (ic), crystals	$\text{AuCl}_3 \cdot 2\text{H}_2\text{O}$	58.1
Gold chloride (ous)	$\text{AuCl}$	84.7
Gold cyanide (ous)	$\text{AuCN}$	88.3
Gold potassium cyanide	$\text{KAu}(\text{CN})_2$	68.3*
Gold potassium cyanide, crystal	$\text{KAu}(\text{CN})_2 \cdot 2\text{H}_2\text{O}$	60.8
Gold sodium cyanide	$\text{NaAu}(\text{CN})_2$	72.5
Lead carbonate (basic)	$\text{Pb}(\text{OH})_2 \cdot 2\text{PbCO}_3$	80.1
Mercuric chloride	$\text{HgCl}_2$	73.8
Mercuric cyanide	$\text{Hg}(\text{CN})_2$	79.4
Mercuric nitrate	$\text{Hg}(\text{NO}_3)_2$	61.8
Mercuric nitrate, crystal	$\text{Hg}(\text{NO}_3)_2 \cdot \text{H}_2\text{O}$	58.6

Technical Name of Salt	Chemical Formula	Percent Metal
Nickel ammonium sulfate (double nickel salts)	$\text{NiSO}_4(\text{NH}_4)_2\text{SO}_4 \bullet 6\text{H}_2\text{O}$	14.9
Nickel carbonate (basic)	$2\text{NiCO}_3 \cdot 3\text{Ni}(\text{OH})_2 \bullet 4\text{H}_2\text{O}$	50.0
Nickel chloride, crystal	$\text{NiCl}_2 \bullet 6\text{H}_2\text{O}$	24.7
Nickel sulfamate	$\text{Ni}(\text{NH}_2\text{SO}_3)_2$	23.4
Nickel sulfate (single nickel salt)	$\text{NiSO}_4 \bullet 6\text{H}_2\text{O}$	22.3
Palladium chloride	$\text{PdCl}_2$	60.0
Platinum chloride, crystal	$\text{H}_2\text{PtCl}_6 \bullet 6\text{H}_2\text{O}$	37.7
Rhodium phosphate, crystal	$\text{RhPO}_4 \bullet 3\text{H}_2\text{O}$	29.9
Rhodium sulfate, crystal	$\text{Rh}_2(\text{SO}_4)_3 \bullet 12\text{H}_2\text{O}$	29.0
Silver chloride	$\text{AgCl}$	75.3
Silver cyanide	$\text{AgCN}$	80.5
Silver potassium cyanide	$\text{KAg}(\text{CN})_2$	54.2
Silver sodium cyanide	$\text{NaAg}(\text{CN})_2$	59.0
Silver nitrate	$\text{AgNO}_3$	63.5
Sodium stannate, crystal	$\text{Na}_2\text{SnO}_3 \bullet 3\text{H}_2\text{O}$	44.5
Tin chloride (ous), crystal	$\text{SnCl}_2 \bullet 2\text{H}_2\text{O}$	52.6
Tin sulfate (ous)	$\text{SnSO}_4$	55.3
Tungstic acid	$\text{H}_2\text{WO}_4$	73.6
Tungstic oxide	$\text{WO}_3$	79.3
Zinc cyanide	$\text{Zn}(\text{CN})_2$	55.7
Zinc oxide	$\text{ZnO}$	80.3
Zinc sulfate, crystal	$\text{ZnSO}_4 \bullet 7\text{H}_2\text{O}$	22.7
*Technically salts may contain appreciably less, and gold content is usually stated on container		

## Concentrations of Common Acids and Bases

Name	Weight (%)	Specific Gravity (g/cc)	Normality
Acetic acid	99%	1.05	17.5
Ammonium hydroxide	30%	0.90	14.8
Formic acid	90%	1.21	22.15
Hydrochloric acid	35%	1.18	12
Hydrofluoric acid	48%	1.15	28.9
Methanesulfonic acid	70%	1.35	9.8
Nitric acid	67%	1.41	15
Phosphoric acid	75%	1.585	39
	85%	1.694	44.1
Solderon acid	50% methanesulfonic	1.25	6.9
Sulfuric acid	93%	1.84	36

$^{\circ}\text{F} = (^{\circ}\text{C}) (9/5) + 32$

$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$

$\text{cu ft.} \times 7.48 = \text{gal.}$

$\text{gm/l} \times 0.134 = \text{oz./gal.}$

$\text{oz./gal.} \times 7.5 = \text{gm/liter}$

$\text{gal.} \times 3785 = \text{ml}$

$\text{lb.} \times 453.6 = \text{gm}$

$\text{A/sq. ft.} \times 0.108 = \text{A/sq. dm}$

$1080 \times \text{Thickness in mils.} = \text{ASF}$

$\frac{\text{Plating Time (min.)}}{\text{ASF}}$

**Plating Time**

1 Amp	15 minutes
1.5 Amps	10 minutes
2 Amps	7.5 minutes
3 Amps	5 minutes
5 Amps	3 minutes

Amps/sq. ft.—267 ml or 534 ml Hull Cell

2 gm/267 ml Hull Cell = 1 oz./gal. = 6.25 lbs./100 gal. =

7.5 gm/liter

2 ml/267 ml Hull Cell = 0.96 fl. oz./gal. = 6 pts./100 gal.

1 Amp4	PANEL										03	EDGE												
	03	02	52	01	51	21	08	64	32	10		.5	60	45	37	30	23	18	15	12	96	4.53	1.5	.75
1.5 Amps	80	60	50	40	30	24	20	16	12	86	42	1	1	1	1	1	1	1	1	1	1	1	1	
2 Amps	1209	07	56	04	53	63	02	41	81	29	63	15	15	15	15	15	15	15	15	15	15	15	15	
3 Amps	2001	50	1251	00	75	60	50	40	30	20	15	10	5	5	5	5	5	5	5	5	5	5	5	
5 Amps	TOTAL CURRENT																							

**HULL CELL SCALE**

**Hull Cell Scale**



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