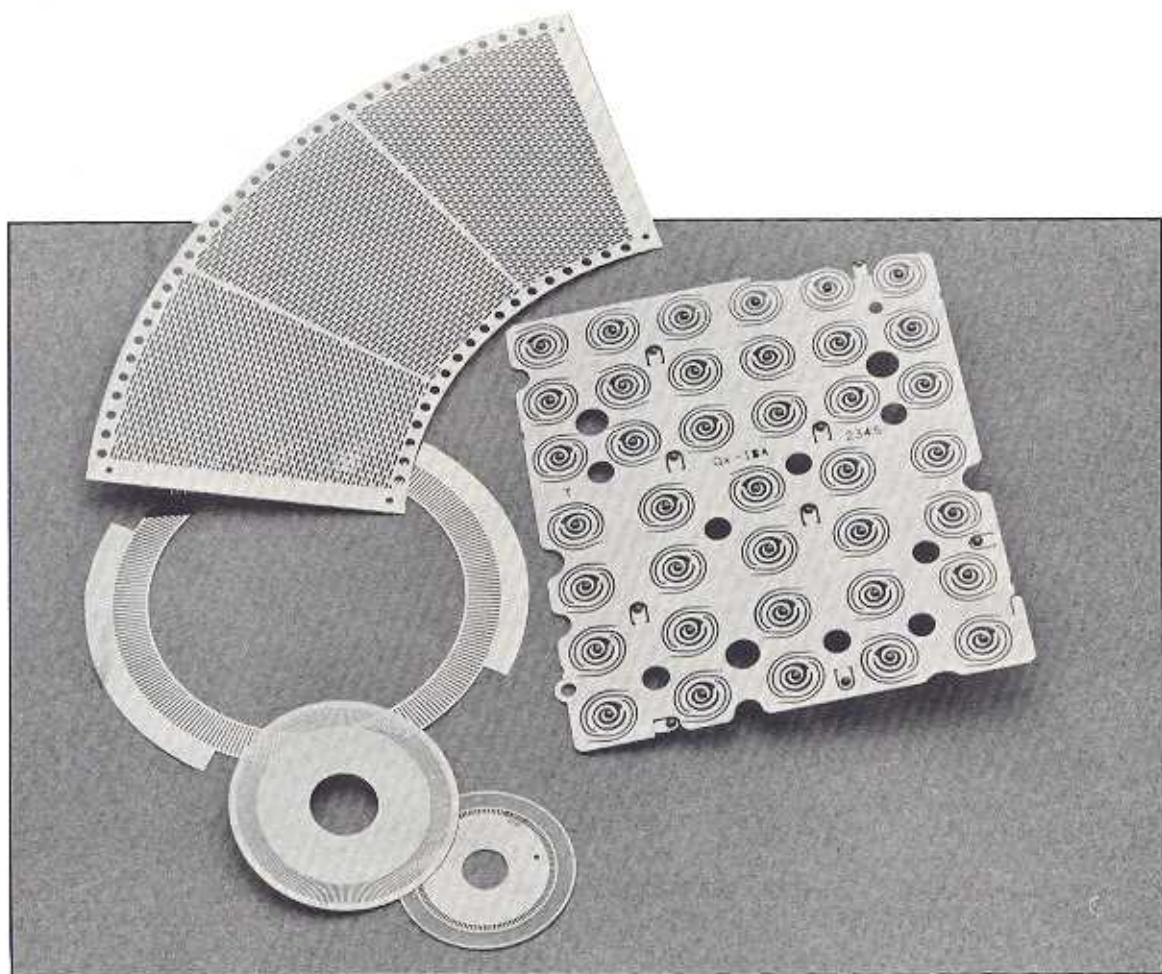


Electroformed Parts



METRIGRAPHICS



A DIVISION OF DYNAMICS RESEARCH CORPORATION

50 CONCORD STREET, WILMINGTON, MA 01887 • 978/658-6100 • Fax: 978/657-7765
800-261-2557 • E-Mail: metsales@drc.com • WEB: <http://www.drc.com>

CATALOG NO. M-3011-A

The Electroform Process With the Metrigratics Touch

The Electroforming Process—A Definition

In the basic electroforming process, an electrolytic bath is used to deposit nickel or other electroplatable metal onto a photographically-produced conductive patterned surface, such as glass or stainless steel. Once the plating material has been built up to the desired thickness, the electroformed part is stripped away from the master substrate, yielding high quality duplicates of the master. In contrast to the etched-metal process, electroforming permits quantity production—at low unit costs—with very high repeatability and excellent process control.

Metrigratics has developed some high refinements to electroforming technology. Through a patented process that employs glass masters for superior edge definition and dimensional control, Metrigratics can provide precision metal patterns with cross-section ratios up to 1:1 and resolutions over 2 million holes-per-square-inch.

Electroformed Parts—Why They are Superior to Etched Metal

Electroforming is an additive, not a subtractive, process, and herein lies electroform's superiority over etched metal techniques. The additive process produces superior edge definition with finer toleranced geometries. The cross-sections of an etched hole and an electroformed hole illustrate this. Theoretically, only metal which is exposed through a window in the photopolymer mask is chemically etched. In practice, etching occurs along a lateral path under the photopolymer as well as in the transverse direction. This limits the minimum opening diameter to 1.5 x the thickness of the metal. Etching from one side yields a hole which is funnel-shaped. An hour-glass shaped hole is achieved by etching from both sides.

When electroformed parts and etched-metal parts are applied to the same task, the electroformed part gives consistently higher precision performance and reliability.

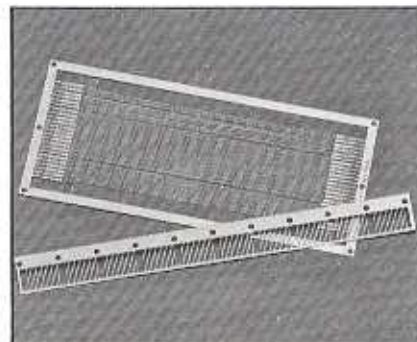
Precision insurance: if you want it, electroformed parts are a must for your application.

Electroformed Parts—How Do They Compare to Other Fabrication Methods?

- They are essentially insensitive to temperature or humidity.
- They have excellent light transmission when used in optical applications (encoders, aperture plates, slits, etc.).
- They have very low mass (weight or inertia).
- They are electrically conductive and essentially unbreakable.

Why Choose Metrigratics?

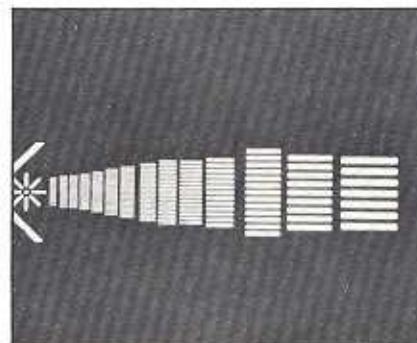
Metrigratics welcomes both prototype and production requests. We'll show you how we can use your artwork or ours to fabricate etched metal, electroformed metal, emulsion on film or glass, metal on glass or other substrate-based parts. We invite you to use, to your advantage, our thirty years of experience and knowledge in the precision photolithographics. We are the supplier who works with you.



Miscellaneous electroformed parts.

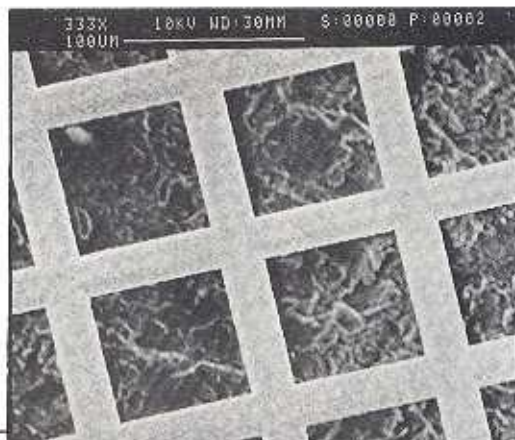


Special evaporation mask.



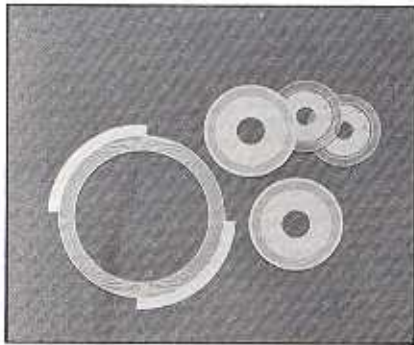
Resolution target with slots and bars from 1.2 mil to 0.1 mil and 0.7 mil center hole.

Electroformed Nickel Mesh—A Metrigratics Special Product

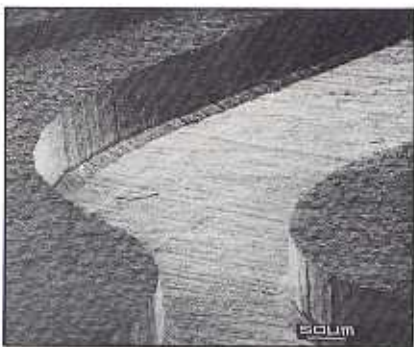


Nickel mesh with 250 1.5 mil lines per inch (62,500 holes per square inch).

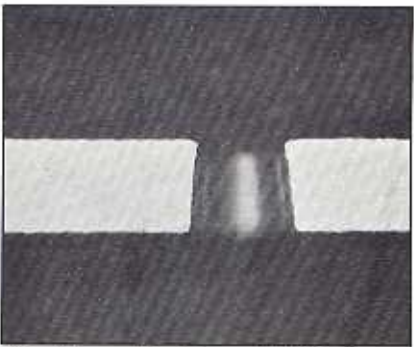
Fine mesh screen, originally created for direct view storage and video image tubes is a Metrigratics special product. Our patented process for plating directly to a glass base matrix whose surface has vacuum-deposited conductors, has earned us a recognition as a leading U.S. supplier. Our process ensures mesh of uniform quality and repeatability—mesh that is free of contaminants, has higher optical transmissions (75% at 750 LPI), and is capable of withstanding high temperatures. We have successfully fabricated test pieces of 10,000 LPI mesh, and we have created arrays of holes less than one micron in diameter. We welcome your inquiry for electroformed nickel mesh or other ultra-precision metal parts.



Incremental code discs.



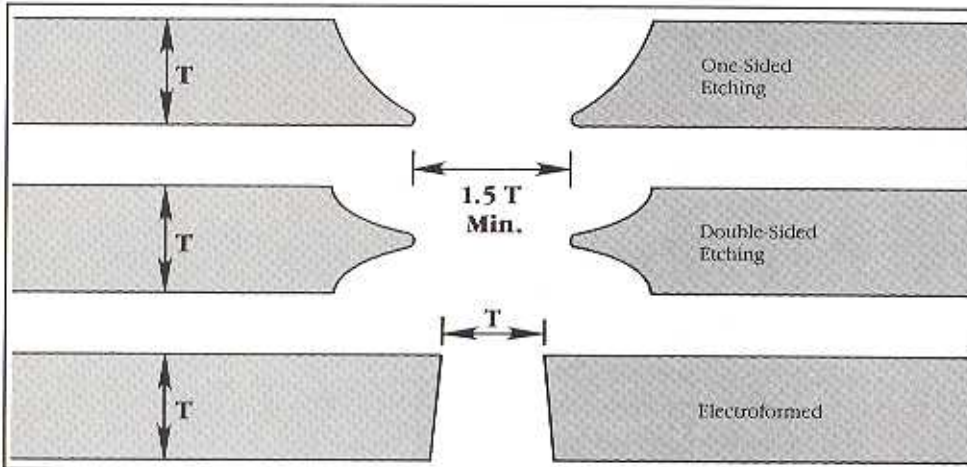
Curved electroformed conductors 3 mils thick x 3 mils wide on prepared substrate.



2.5 mil through-hole formed in 2.5 mil thick nickel.

A Comparison of Electroformed Parts vs. Etched Metal Parts

| | Electroformed | Etched Metal (50/50 Double Side) |
|--------------------------------|---|--|
| Metals available: | Nickel, Gold, Copper Other electro-plateable metals | Stainless steel Copper alloys, etc. |
| Part Thickness: | 0.0005–0.005" Typical (0.013–0.13mm) 0.00005 min.–0.010" max. (0.0013–0.254mm) | 0.0005–0.010" (0.013–0.254mm) |
| Minimum cross-section ratios: | 1.0 to 1 | 1.5 to 1 |
| Minimum landing or line width: | 1.3 x thickness Typical 1.0 x thickness Best | 1.5 x thickness or 0.00275" (0.070mm) |
| Minimum hole or slot size: | 0.0005" Typical (0.013mm) 0.00005" Best (0.0013mm) | 0.001" (0.025mm) |
| Other tolerances: | ±0.003" Typical (0.008mm) | ±0.001" (0.025mm) |
| Registration and Uniformity: | ±0.0003" Typical +0.0001" Best | ±0.002" Typical |
| DC Swing: | 5% Typical 3% Best | Not tested |
| Flatness: | 1" size or less 0.003"/inch >1" size 0.005"/inch | 0.005"/inch |
| Edge Definition: | Excellent | Fair |
| Repeatability: | Excellent | Fair |
| Maximum sheet size: | 8 1/2 x 8 1/2" (216 x 216mm) | 16 x 20" (406 x 508mm) |



Typical Cross-Sections

Incremental Code Discs M-3001-D
MetriForm™ II M-3010A
Precision Linear Scales M-3004-B
Resolution Targets M-3000C



METRIGRAPHICS

A DIVISION OF DYNAMICS RESEARCH CORPORATION
50 CONCORD STREET, WILMINGTON, MA 01887 • 978/658-6100 • Fax: 978/657-7765
800-261-2557 • E-Mail: metsales@drc.com • WEB: <http://www.drc.com>