

metalphoto®

Design Guide

For high performance anodized aluminum identification plates including **bar code labels** and **UID plates**.



**Because durability
really matters**

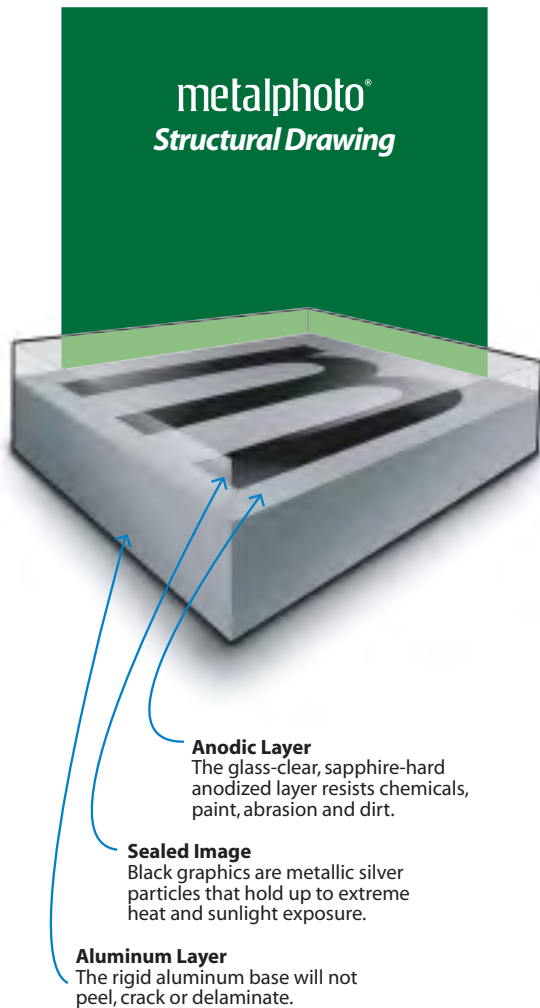


Table of Contents

Introduction	1
Metalphoto Structural Drawing (Figure 1)	1
Metalphoto Performance Characteristics (Figure 2)	2
Government and Industry Specifications (Figure 3)	3
1.0 - Scope	4
2.0 - Material Designation	4
3.0 - Reference Documents/Web Sites	4
4.0 - Aluminum Substrate Characteristics	4
4.1 - Thicknesses/Finishes/Tempers	4
5.0 - Design Application/Guidelines	4
5.1 - Finish Choice	4
5.2 - Thickness Choice	4
5.3 - Thickness/Finish Availability	5
5.4 - Temper Choice	5
5.5 - Grain Direction	5
5.6 - Color	5
5.7 - Edge and Hole Treatment	5
5.8 - Applications with Special Durability Requirements	5
6.0 - Fabrication	5
6.1 - Tolerances	5
7.0 - Fastening Methods	6
8.0 - Variable Copy	6
9.0 - Quality Control	6
10.0 - UID Labels	6
10.1 - UID Overview	6
10.2 - UID Substrate Choice	7
10.3 - UID Data Matrix Codes	7
10.4 - UID Label Layout	7
11.0 - Verifying UID Labels	8
12.0 - Sample UID Label Drawing/Sample	8
Metalphoto Information and Durability	9
Abrasion Resistance	10
Acid Resistance	11
Weathering Resistance	11
Salt Spray Resistance	11
Heat Resistance	12
Cleaning Solution Resistance	12
Notes	13

Metalphoto is a registered trademark of Horizons Incorporated.

Identification Plates introduction



(figure 1)

Virtually every new product and assembly has a requirement to carry some identifying or other information. This requirement is usually fulfilled by attaching a plate or label to the product or assembly or by marking directly on its surface. Attached plates are known as identification plates, nameplates, tags, labels and placards among others.

This manual discusses issues relevant to the design of identification plates made of high performance anodized, photosensitized aluminum, hereinafter referred to as **Metalphoto[®]**.

Identification plates made of **Metalphoto** are clearly differentiated from those produced on other substrates in two important ways - first, **Metalphoto** identification plates are defined as the **most durable of aluminum identification plates** by GPI, the National Association of Graphic and Product Identification Manufacturers, Inc. Second, they offer the **highest graphic resolution** capability of any metallic substrate.

Physical characteristics of **Metalphoto** identification plates include an impervious, clear anodic surface and photographically produced silver metal graphics. This combination of features provides maximum sunlight and heat resistance and superior abrasion and chemical resistance.

Proper design of an identification plate requires attention to many details and options. This manual will help to guide you through some of the most important of those as they pertain to your application. Within this guide the word "shall" indicates a requirement and the word "should" indicates a recommendation.

Additional information available at
www.Metalphoto.com

Metalphoto performance

characteristics

20 Year Outdoor Durable
Resistant to Sunlight, Wind, Water and Saltwater
Withstands Chemicals, Fire, Rust and Abrasion

More detailed information available at www.Metalphoto.com

Characteristic	Result
Abrasion Resistance	No pronounced image loss, degradation or reduced readability after 7000 cycles of an abrading wheel.
Acid Corrosion	No deterioration or image degradation after 24 hours in 3% nitric acid.
Heat Resistance	No legibility loss or degradation when subjected to 1000°F.
Salt Spray Corrosion	No deleterious effect after a 720-hour salt spray (fog) test. 2,6 "very good" corrosion resistance after 113 days seawater exposure.
Accelerated Light and Weather Resistance	No pronounced deterioration of legibility after 400-hour carbon arc weatherometer exposure.
Accelerated Oxygen Aging	No discoloration or fading after 96 hours/300 psi/70°C oxygen bomb aging.
Stain Resistance	No black fading when plates are exposed to tincture of iodine.
Cleaning Resistance	No deleterious effect when tested with alkaline cleaners (MIL-C-87937 or equivalent) for aircraft surfaces.
Low Temperature Resistance	No deleterious effects or image fade after 1 hour at -50°F. No impairment of legibility upon exposure at -67°F.
Organic Solvent Resistance	No softening, staining or noticeable fade after 24-hour exposure to: JP-4 fuel, gasoline, mineral spirits, methyl ethyl ketone, turpentine, turbine and jet fuel, kerosene, xylol, acetone, toluol, heptane, trichlorethylene, MIL-H-5606 hydraulic fluid and MIL-L-7808 jet engine oil.
Fungus Resistance	Visual reading of "0" per ASTM-G21.
Thermal Shock	No deterioration after 3 cycles between -65°C and 125°C.
Moisture Resistance	No deterioration after 10 humidity cycles per MIL-STD-202, method 106.

(figure 2)

Metalphoto meets or exceeds Government & Industry specifications

Industry Specifications & Studies

Boeing Commercial Aircraft Company

Boeing Process Specification BAC5875
Fabrication of Aluminum Markers, Instrument Panels, Drawer Front Panels and Fabrication of Metal and Plastic Appliques

Lockheed Martin

Fabrication of UID Nameplates of Aircraft Items
LMA-PN010

Honeywell, Inc.

Satellite Systems Operations
Metalphoto approved for use on Space Station
Memorandum A3-J024-M-9501786
Laboratory Case 161311

SAE Technical Paper Series 2000-01-2437

Special requirements for Crew Interface Labels on the International Space Station
Stephen Gray & Fernando Ramos - Boeing

UL & CSA

Underwriter Laboratories

Marking and Labeling Systems PGDQ2
Marking and Labeling System Material
Component PGGU2.MH26206

U.S. Government Specifications & Studies

Department of Defense

Commercial Item Description
A-A-50271 Class 2-Composition C

Department of Defense

MIL-A-8625F
Anodic Coatings for Aluminum & Aluminum Alloys
Type II Class 1 (unprocessed or clear)
Class 2 (processed)

Department of Defense

MIL-STD-13231
Standard Practice
Marking of Electronic Items

Department of Defense

MIL-DTL-15024F
Identification of Equipment
Type G - Foil - Type H - Plate

Department of Defense

MIL-STD-130M
Identification Marking of U.S. Military Property

Department of Defense

MIL-P-19834B
General Specification for Plates
Identification or Instruction, Metal Foil,
Adhesive Backed

Department of Navy

Laboratory evaluation of label plate materials and attachment methods considered for use on LPD-17 CARDIVNSWC-TR-62-00-05 June 2000

NASA, Johnson Space Center, Texas

Space Station Inventory Label Specification - SSP 50007

United States Federal Government

Federal Specification GGP-455B(3)
Type I (Grade A&B) Class 1 or 2

(figure 3)

design considerations

for Metalphoto

1.0 Scope

This document describes the design and application considerations for product identification using high performance silver halide photosensitive anodized aluminum (**Metalphoto**).

2.0 Material Designation

Material shall be **Metalphoto** (specify thickness and finish). Black images shall be silver (Ag) metal compounds sealed within the anodic layer. Additional selective or background colors shall be sealed in the anodic layer.

Note - Please see section 5.8 "Applications with Special Durability Requirements" for additional information.

3.0 Reference Documents/Web Sites

Reference documents are available at www.Metalphoto.com

4.0 Aluminum Substrate Characteristics

The material surface is totally anodized 1100 series alloy with all graphics (black or colors) imbedded in the impervious clear and sapphire-hard anodic layer.

4.1 Thicknesses/Finishes/Tempers

A variety of thicknesses and finishes are available in our standard tempers. Zero temper, also known as dead soft is only available in satin finish .005" and .012" thick. A table of thicknesses and finishes are available on page 9.

5.0 Design/Application Guidelines

5.1 Finish Choice

5.1.1 Satin Finish is a semi-gloss, medium reflectance finish. This attractive finish is widely specified for identification plate and panel front applications.

5.1.2 Matte Finish (preferred finish for bar code labels) offers a nonreflective surface with a dull or frosted appearance. This finish is widely specified where a non-glare surface is desirable.

5.1.3 Gloss Finish is ideal for identification plate applications where a lustrous finish is desired.

5.1.4 #4 Finish is a coarse brushed finish with directional scratch lines. This finish resembles #4 stainless steel in appearance.

5.2 Thickness Choice

All thicknesses of **Metalphoto** provide silver metal graphics imbedded in a sapphire-hard, impervious anodized layer. For this reason, all thicknesses offer high durability to abrasion, chemicals and sunlight. Additionally, all thicknesses offer photographically precise graphic reproduction characteristics.

5.2.1 Thin Gauge Materials are ideal for applications requiring a low profile identification plate. Thin gauge materials work well with a variety of adhesives and can be less costly than thicker gauge materials.

5.2.2 Thick Gauge Materials may be attached with adhesive or fasteners. Thick gauge materials are recommended for applications requiring mechanical fasteners and/or when environmental conditions or stress demand greater material integrity.

5.3 Thickness/Finish Availability Table

See page 9.

5.4 Temper Choice

Temper shall **not** be specified except when the application requires a zero temper material. Zero temper materials are available only in satin finish .005" and .012" thicknesses. Zero temper materials are chosen when the identification plate is to be attached to a curved surface and the preferred mounting method is by adhesive.

Zero temper material has no "memory" or tendency to curve back to its original shape. This is advantageous in preventing the identification plate from lifting or peeling off after assembly.

5.5 Grain Direction

The grain direction of the material is visible on all finishes. It is more prominent on satin and #4 finishes. The grain direction shall be specified to be in the same direction for parts that are to be butted when mounted. The grain direction should run parallel with type.

Grain direction shall not be specified when it is inconsequential as it may adversely affect the manufacturing yield and nameplate cost.

5.6 Color

The most frequently used color combination is black and silver (natural aluminum). Colors other than black may be added, but are not recommended for bar code labels.

Exact color matches are not possible with anodized aluminum substrates. As such, colors imbedded in anodic layers must be approximations. Colors may be specified as approximations to the extent that they fall within a standard **Metalphoto** color range.

Colors other than black shall not be specified for outdoor use unless protected from the fading effects of sunlight. Black, Sunfast Gold and Classic Gold may be used outdoors.

5.7 Edge and Hole Treatment

Fabricated edges may be colored by painting or tinted by reanodizing. Reanodizing or chemical filming (anodyne) may be used to treat holes and edges of **Metalphoto** identification plates, providing the anodized surface of the identification plate is protected with a mask.

5.8 Applications with Special Durability Requirements

Although graphics made of silver metal are exceptionally durable, certain applications require additional conditioning of the nameplate during its manufacturing.

When the application requires the nameplate be exposed to heat up to 750°F for short periods of time and/or requires extended outdoor life in direct sunlight, then **Image Intensification** shall be part of the material callout.

6.0 Fabrication

Metalphoto is easy to fabricate using standard sheet metal fabrication methods. For example, thin gauge materials may be steel rule die cut, punched with blanking dies or sheared. Thick gauge materials may be punched, sheared, drilled or machined as the application demands. It should be noted that **Metalphoto** identification plates are imaged first so drawings should include appropriate cut marks or targets.

6.1 Tolerances

Outside, hole, hole to hole and hole edge dimension tolerances are a function of the requirements of the application and tool capability. Any standard sheet metal tolerances required can be achieved.

Please note - Tight tolerances result in higher nameplate costs. Tolerances required for other precision components may be unnecessary for the fabrication of the average identification plate.

7.0 Fastening Methods

Identification plates may be fastened with any of a variety of adhesives or mechanical fasteners. The fastening method chosen will depend upon the surface to be attached to, the thickness of the identification plate and the degree of performance required.

The fastening method is a critical component of the identification plate design.

3M #467MP and 3M #468MP Transfer Tapes have traditionally been used for attachment to metal or wood. 3M #9472LE is recommended for low surface energy applications, such as affixing plates to powder coated or plastic items.

If plates are to be used in a marine environment, choose an adhesive such as 3M VHB5925 or Saint Gobain Normount V9000 that offers a barrier against galvanic reaction.

Additional information about transfer adhesives may be found at Horizons' website: www.Metalphoto.com.

Mechanical fasteners are usually specified for plates .032" or thicker.

8.0 Variable Copy

Identification plate design often requires inclusion of variable copy. That is, information that changes on every nameplate. Examples of variable copy are serial numbers, item numbers and bar codes. Variable copy may or may not be sequential.

Mechanical marking methods for variable information (stamping, typing, scribing, engraving) are slow, often costly and subject to human error regardless of the substrate to be marked. Although mechanical marking methods may be used to mark **Metalphoto** identification plates, these methods break the **Metalphoto** anodic layer and result in exposed raw aluminum in the marked area. This may reduce the permanency of the plate and forfeit some of the durability characteristics previously described.

An ideal solution to variable marking is available with the **Metalphoto** substrate. **Metalphoto** graphics are produced photographically, a technique which allows the addition of variable information during rather than after the manufacturing process.

8.0 ...Continued

Designating that variable information shall be imaged photographically and sealed in the anodic layer insures the permanency of the information and reduces the cost of the identification plate.

Metalphoto imaging technologies allow variable information to be added economically in the quantities from a few to many thousands.

9.0 Quality Control

Metalphoto plates offer high performance due to both material and process used to produce the finished plate. Other substrates may be similar in appearance to **Metalphoto**, but lack the same high performance characteristics. Some simple tests will help to verify the authenticity of a **Metalphoto** plate.

Permascope may be used to further verify an anodic layer in both image and non-image areas.

An image trapped in the anodic layer will show no effect from a rubbing with steel wool or immersion in alcohol for 72 hours.

These tests will help to eliminate some similar looking substrates, but do not guarantee the material to be **Metalphoto**.

Unique Identification for the Department of Defense (UID)

10.0

10.1 Overview

The DOD has established item-marking criteria for identification of items of military property produced, stocked, stored and issued by or for the Department of Defense.

The guiding document for this requirement is Mil-Std-130M that states,

"Direct identification marking and identification plates, identification bands, identification tags, or identification labels used shall be as permanent as the normal life expectancy of the item and capable of withstanding environmental tests and cleaning procedures."

10.2 Substrate Choice

Metalphoto is an ideal label substrate to meet the DOD requirement. Most items to be marked are used in challenging environments. With **Metalphoto**, the image is permanently sealed within the anodic layer of the plate. **Metalphoto** labels have a smooth, cleanable, fully anodized surface so grease and dirt can be easily removed. Since the entire imaged surface of **Metalphoto** plates is anodized, there is also less chance for abrasion or corrosion to cause scan errors.

Metalphoto has significant advantages over engraved or etched black anodized aluminum plates where the surface of the plate must be converted or broken in order to create the image. Engraved or etched portions on the plate are raw aluminum, which is susceptible to abrasion, corrosion and dirt accumulation.

Metalphoto images are produced photographically, which makes them ideal for the DOD application, where plates carry variable data. **Metalphoto**'s high resolution makes it especially useful where label space is limited.

10.3 Data Matrix Codes (2D Code)

The Data Matrix Code is a machine-readable code capable of holding far more data than traditional codes, such as Code 128 or Code 39. A Data Matrix Code is required on every UID label.

10.4 Label Layout

Under Mil-STD-130, the preferred layout for UID labels includes linear bar codes combined with human readable data and a Data Matrix Code. Alternate layouts require data matrix with human readable, or where space is extremely limited, Data Matrix Code only. (See figure 4)

MIL-STD-130M

Here are some examples of Construct #1

Preferred Layout
*Data Matrix,
linear bar codes
and human readable*



Alternate Layout
*(Limited Space) Data
Matrix and
human readable*



Alternate Layout
*(Severely limited
space)*



Here are some examples of Construct #2

Preferred Layout
*Data Matrix,
linear bar codes
and human readable*



Alternate Layout
*(Limited Space) Data
Matrix and
human readable*



Alternate Layout
*(Severely limited
space)*



(figure 4)

See pages 27-37 of MIL-STD-130M for specific formatting guidelines

11.0 Verifying UID Labels

Verification is the process of verifying the quality of a Data Matrix code. Several parameters are measured to reach an overall grade level (quality level). Specially designed verification equipment is required. A scanner will not provide verification results.

Verification equipment must be carefully calibrated to insure accurate readings.

MIL-STD-130M recognizes that metallic surfaces are more difficult to verify due to lower print contrast and modulation readings. **Metalphoto Matte** finish UID labels consistently verify at 3.0 or higher, in accordance with Section 5.2.7.1.1 (linear) and 5.2.7.2.2 (2D) of MIL-STD-130M. **Metalphoto satin** finish may be used when UID plates utilize alternate layouts (no linear code) as illustrated in Figure 4.

12.0 Sample UID Label Drawing

NOTES:

1. MATERIAL:
 .020" THK METALPHOTO ANODIZED ALUMINUM. GRAPHICS SHALL BE PHOTSENSITIVE SILVER COMPOUNDS SEALED INTO THE ANODIC LAYER.

2. COLOR:
 ALL GRAPHICS BLACK ON NATURAL ALUMINUM BACKGROUND OR REVERSE.

3. FINISH:
 MATTE FINISH ALUMINUM. PLATE SHALL BE INTENSIFIED PRIOR TO SEALING.

4. SOURCE:
 LOCAL METALPHOTO SUPPLIER.

5. INCLUDE LINEAR BAR CODE AND DATA MATRIX IN ACCORDANCE WITH MIL-STD-130M CONSTRUCT 2 FORMAT 06.

<i>Horizons Incorporated</i>		
SCALE: FULL	APPROVED BY: <i>Randal Graves</i>	DRAWN BY
DATE: 1-10-07		REVISED
MATERIAL: METALPHOTO (SEE NOTES)		
NAMEPLATE - CABINET		DRAWING NO. 02811

Metalphoto info & durability

Finishes, Sizes & Thicknesses



Matte

Non-reflective with dull finish



Satin

Semi-gloss medium reflective material



#4

Brushed to resemble a stainless steel finish



Gloss

Highly reflective mirror-like

Sizes

8" x 10", 10" x 12"
12" x 20", 20" x 24"
20" x 40", 24" x 40"

8" x 10", 10" x 12"
12" x 20", 20" x 24"
20" x 20", 20" x 40"
24" x 40"

10" x 12", 12" x 20"
20" x 24", 24" x 40"

10" x 12", 12" x 20"

Thicknesses

.003", .005", .008"
.012", .020", .032"
.039", .063", .090"
.125"

.003", .005", .008"
.012", .020", .032"
.039", .063", .090"
.125"

.032", .063"
.090", .125"

.020"

Durability

Test Conditions		Finished Plate Characteristics				
Results Key Excellent Acceptable Not Recommended		Black & Aluminum Image Intensified	Black on Gold* Background Image Intensified	Black & Aluminum Not Image Intensified	Black on Gold* Background Not Image Intensified	Additional Background or Selective Colors
Abrasion Resistance - Taber abraser with CS17 wheel, 1000 gram load for 7000 cycles.		●	●	●	●	●
Solvent/Fuel Resistance - Extended immersion in alcohol, kerosene, JP-4 jet fuel, hydraulic fluid, MEK and other organic solvents at room temperature.		●	●	●	●	●
Temperature Resistance - Oven tested for one hour	between 400°F and 750°F	●	●	●	●	○
	between 750°F and 1000°F	●	●	●	●	○
Ultraviolet Light Resistance - 400 hour weatherometer test. Recognized equivalent of 20 years outdoor exposure.		●	●	●	●	○
Salt Spray/Immersion Resistance	Salt spray testing with a 5% NaCl solution at 90°F for 700 hours.	●	○	●	○	●
	Immersed plates in sea water at ambient temperature for an extended period of time avoiding galvanic coupling.	●	○	●	○	●
Chemical Resistance	Acid - 24 hour immersion at room temperature in 3% solutions of nitric acid, sulfuric acid and ferric chloride.	●	●	●	●	●
	Base - 24 hour immersion at room temperature in 3% solution of Clorox.	●	●	●	●	●
	Base - 24-hour immersion at room temperature in 3% solutions of sodium or ammonium hydroxide.	○	○	○	○	○

Note - Users must test Metalphoto in the specific environment anticipated. Metalphoto does not warrant performance of its materials in any environment.
*Includes Sunfast and Classic Gold Products.

(figure 5)

Because durability really matters, MIL-STD-130M (Department of Defense Standard Practice – Identification Marking of U.S. Military Property) requires that “Identification plates be as permanent as the normal life expectancy of the item and be capable of withstanding the environmental tests and cleaning procedures specified for the item to which it is affixed.”

Where equipment will be used in benign environments, plastic or even paper labels may suffice. In harsh environments, more durable substrates will be required. When choosing a metal label, remember that both the quality of the substrate and the printing method affect performance. Printing methods such as engraving or etching alter the substrate and reduce performance. **Metalphoto** has over 50 years of proven field experience.

Label Performance

Label Performance is affected by the substrate choice, the printing method, and the method of attachment

	Environment			
	Benign	Moderate	Demanding/ Harsh	Extreme
Paper ¹	██████████	██████████	██████████	██████████
Plastic ¹	██████████	██████████	██████████	██████████
Black Anodized ²	██████████	██████████	██████████	██████████
Metalphoto ³	██████████	██████████	██████████	██████████
Stainless Steel ⁴	██████████	██████████	██████████	██████████

¹Thermally printed paper or plastic

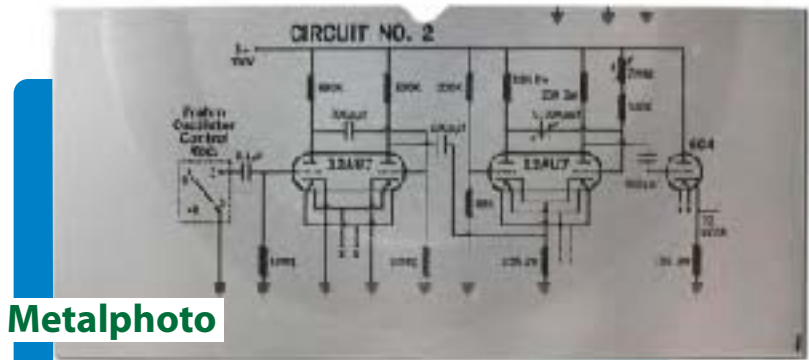
²Etched or engraved black anodized

³Image-intensified Metalphoto

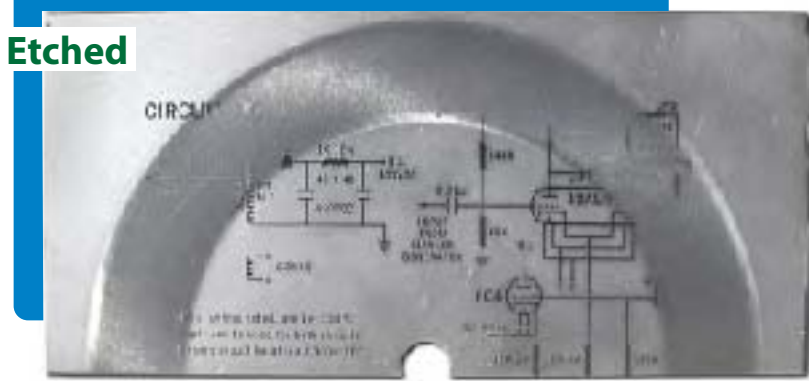
⁴Thermally-bonded ceramic on stainless steel

additional information abrasion resistance

These samples were tested identically on a Taber Abraser, 1,000 gram total load, 7,000 cycles, CS-17 wheel.



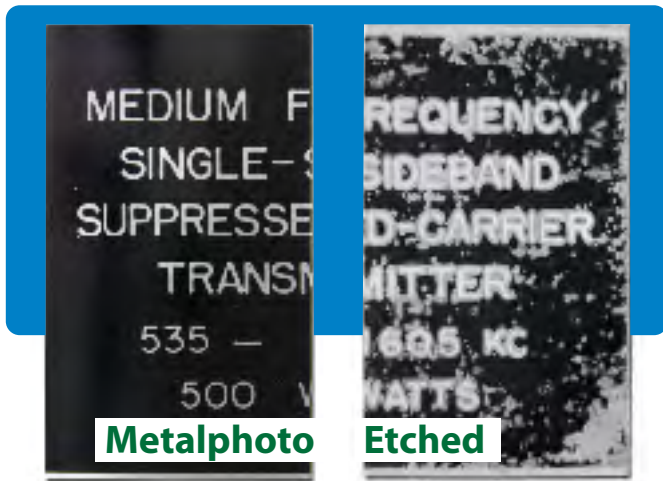
Metalphoto



Etched

additional information
acid resistance

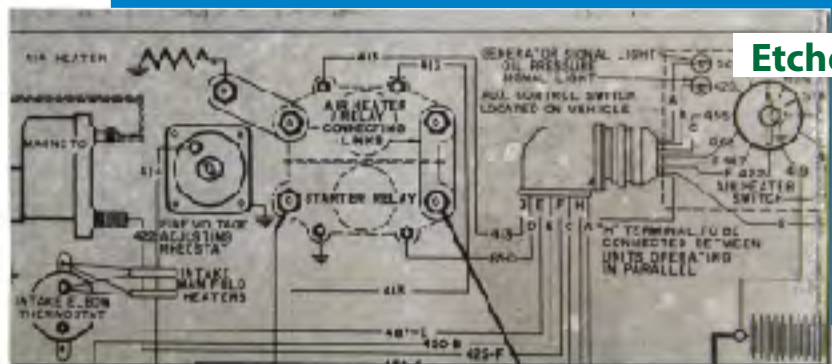
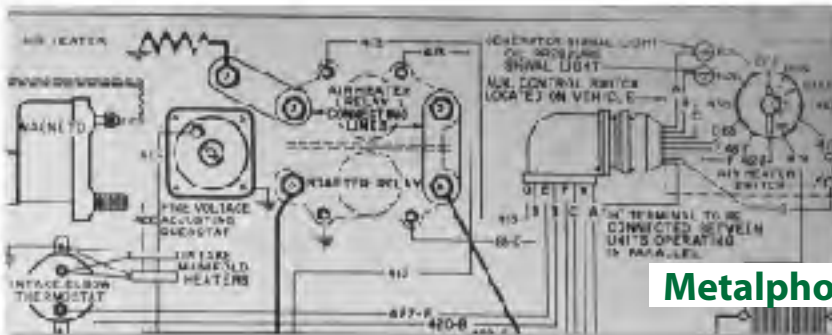
additional information
weathering resistance



Specimens were immersed simultaneously for 72 hrs. in a solution of dilute nitric acid (3.5% solution).

Specimens were exposed simultaneously for 180 days to outdoor weather conditions.

additional information
salt spray corrosion resistance



250 hrs., 5% NaCl salt spray test as set in Federal Specification QQM-151A. Both specimens were tested simultaneously.

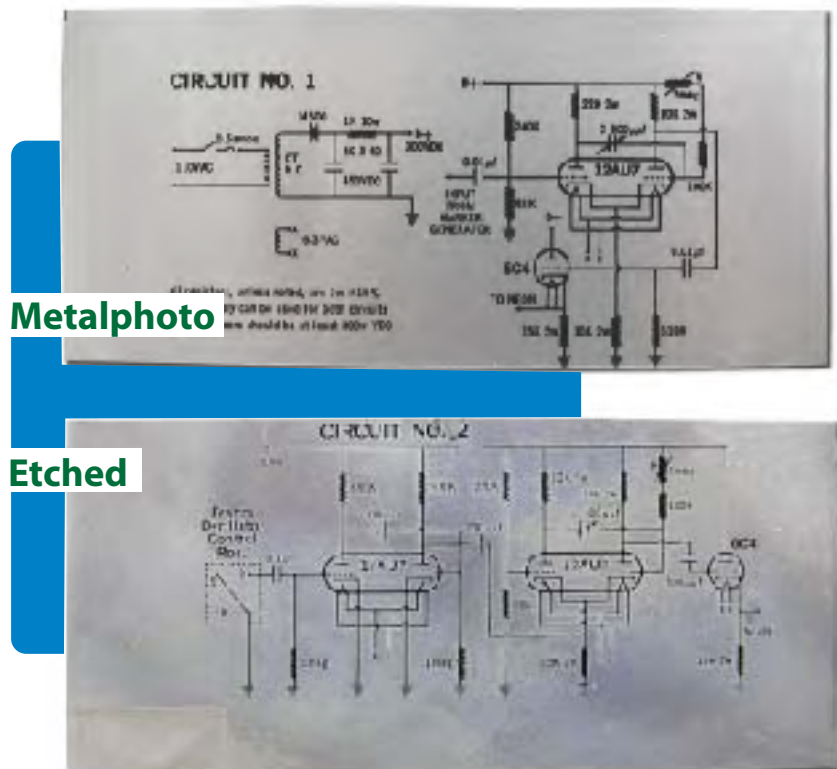
additional information **heat resistance**



Specimens were heated simultaneously to a temperature of 1,000°F., one minute in a laboratory muffle type furnace. When cool, each sample was heated with a propane torch in a localized area until the aluminum melted.

additional information **cleaning solution resistance**

Specimens were immersed simultaneously in 1% water solution of Solilax for 72 hrs..



metalphoto[®]

Design Guide

For high performance anodized aluminum identification plates including **bar code labels** and **UID plates**.

contact ***information***

Technical Support

Horizons Imaging Systems Group is dedicated to providing the highest level of quality and service possible. If you have questions, please contact Horizons ISG customer service at

800 - 482 - 7758

216 - 475 - 0555

Horizons Incorporated

18531 South Miles Road
Cleveland, Ohio 44128

www.Metalphoto.com