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| C:\Users\gwakefield\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\KOF5O2AM\DowKey Logo (002).png | **Process specification** | **PS-1** |

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| **REVISIONS** | | | | | | | |
| **Rev** | **Change Description** | | | **Release Date** | **Approvals** | | |
| **Eng.** | **Q.A.** | **Test/MFG** |
| P | Revised per ECO 7100 | | | 4/08/02 J.S. | -- see below -- | | |
| R | Per ECO 7782, Added Paragraphs 2.2.4, 2.4.3, and 2.5.3 Revised Paragraphs 2.5.1 and 2.5.2 | | | 12/21/04 | G.N. | S.E. | R.G. |
| T | Revised per ECO 8569 | | | K.R  11/27/06. | G.N. | N.S. | R.G. |
| U | Revised per ECO 8981 (Administrative Changes) | | | K.R.  4/30/07 | R.S. | N.S. | S.O. |
| V | Revised per ECO 9600 (Paragraph 2.5 to comply with  MIL-DTL-5541.) | | | K.R.  5/26/09 | G.N. 5/26/09 | S.L. 5/26/09 | R.G. 5/26/09 |
| W | Revised per ECO 9937 (Paragraph 2.4.3, Low PIM Application) | | | K.R.  10/44/10 | G.N. 9/30/10 | A.A. 9/30/10 | J.L. 10/04/10 |
| Y | Added Gold Plating inspection Requirements | | | K.R.  3/14/11 | G.N. 3/14/11 | S.L. 3/14/11 | J.L. 3/14/11 |
| AA | Added Low PIM plating specs (Paragraphs 2.1.4, 2.1.5, 2.1.6, and 2.2.5. Revised 2.4.3. Added Post Bake Requirements Paragraph 1.5.) | | | KR  2/6/13 | GN 1/31/13 | SL 2/5/13 | JW  2/6/13 |
| AB | Removed reference to IPA in paragraph 1.4.2.6 and added paragraph 2.4.4. | | | KR  9/19/14 | GN 9/19/14 | GW 9/1914 | JL  9/19/14 |
| AC | Revise Per Current Plating Specifications | | | KR  2/4/16 | GN 2/2/16 | GW 2/4/16 | PJ 2/4/16 |
| AD | Revise Electroless Nickel Plating of Aluminum, 2.2.1 | | | KR  12/20/16 | GN 12/19/16 | SL 12/19/16 | RG 12/20/16 |
| AE | Remove solderability requirement from para 2.2.1 and add paragraph 2.2.6 with solderability requirement | | | SL  7/08/20 | GN 7/07/20 | SL 7/08/20 | DL 7/08/20 |
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| **Approval Signatures:** | | **Date:** | **APPROVED PLATING PROCESS SPECIFICATION** | | | | |
| Prepared By:  J. SPENCER | | 04/03/02 |
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# **General Requirements**

## Scope

This specification defines the standard finishes used by Dow-Key Microwave. These finishes must be applied as specified unless otherwise noted on the purchase order and / or drawing. Parts processed in accordance with this specification are used in precision electromechanical devices and the finishes must be of extremely high quality. Any questions or concerns about achieving a high quality finish must be brought to the attention of Dow-Key Microwave Engineering before processing the parts.

## Supplier Quality Requirements

### Certificate of Conformance

The supplier must provide a certificate of conformance stating full compliance to the requirements of the purchase order, the drawing and revision letter and this specification including revision letter and applicable paragraph.

## Inspection and Test

The supplier is responsible for all inspections and tests listed within the specification stated on the purchase order and / or drawing.

## Inspection criterion for Gold plated contacts.

### Applicability

Requirements specified herein are applicable to the make and break contacting surfaces of parts that are Gold plated for the specific purpose of providing low resistance electrical connections (< 2 milliohms). Examples of such parts include:

#### RF reeds / RF blades

#### RF connector center conductors (both ends)

#### Indicator circuit leafs, blades, contacts and wires

### Requirements

The make and break contacting surfaces of Gold plated parts must meet the following requirements:

#### Geometry must be in accordance with drawing requirements.

#### Plating must be in accordance with drawing requirements.

#### Surface finish must be in accordance with drawing requirements.

#### Edge conditions and burr removal must be in accordance with drawing requirements.

#### Plating must not show evidence of blisters, cracks, nodules, voids, chips and/or peeling at up to 10X magnification.

#### Surface finish must not show evidence of contamination and/or discoloration at up to 10X magnification, which cannot be readily removed.

* + - 1. Packaging must be sufficient to preclude contamination and/or damage during handling, transit and storage.

### Exceptions

These requirements do not apply to the surfaces of Gold plated parts that are intended for crimp or solder connections.

## Standard Post Bake Requirements

**This note applies to any part that is Dow-Key Microwave design.**

All metallic parts that are plated with Gold, Silver, Copper, electroless Nickel and/or electro-deposited Nickel, individually or in any combination, shall be subjected to a post plating bake process unless otherwise specified. Bake temperature and duration for the various material combinations are specified in Table 1.

|  |  |  |  |
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| **Table 1: Post Plating Bake Requirements** | | | |
| Finish | Base Material | Bake Temperature | Bake Duration |
| Individually or in any combination of Gold, Silver, Copper, Electro less Nickel and/or Electro-deposited Nickel | Aluminum | 250 ± 10°F | 60 to 90 minutes |
| Copper/Brass | 300 ± 10°F | 60 to 90 minutes |
| Iron/Steel  Iron/Steel over Rc40 | 350 ± 15°F  375 ± 10°F | 60 to 90 minutes |

**Note:** The supplier’s certification of conformance shall state the post plating bake times, and temperature.

# **Finish Processes**

## Gold Plate

### Copper Beryllium Alloys – RF Connector Center Pins

Gold Plate per ASTM B488, Type I, Grade C, .00010 / .00015 thick over Nickel Plate per SAE-AMS-QQ-N-290, Class 1, .00005 / .00015 thick over Copper Flash (Optional) per SAE AMS 2418, .00001 / .00005 thick. Total plating thickness .00016 / .00035. No Gold Brighteners Permitted.

**Note: To control the porosity of the gold plating, the current density of the plating bath must be limited to 1.5 amperes per square foot maximum for the type I gold.**

### Copper Beryllium Alloys – RF Blades

Gold Plate per ASTM B488, Type III, Grade A, .00005 / .00010 thick over Gold Plate per ASTM B488, Type I, Grade C, .00005 / .00010 thick over Nickel Plate per SAE-AMS-QQ-N-290, Class 1, .00005 / .00015 thick over Copper Flash (Optional) per SAE AMS 2418, .00001 / .00005 thick. Total plating thickness .00016 / .00040. No Gold Brighteners Permitted.

**Note: To control the porosity of the gold plating, the current density of the plating bath must be limited to 1.5 amperes per square foot maximum for the type I gold and 0.5 amperes per square foot maximum for the type III gold.**

### Aluminum Alloys

Gold Plate per ASTM B488, Type I, Grade C, .00010 / .00015 thick over Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00020 / .00030 thick over Zincate (double dip) per ASTM B253. The total plating thickness is .00030 / .00045.

### Copper Beryllium Alloys – Specialty Plating, Low PIM

RF Connector Shells and Center Pins

Gold Plate per ASTM B488, Type I, Grade C, .00010 / .00015 thick over Nonmagnetic Electroless Nickel Plating (no Electrolytic Nickel Plating or Strike allowed) per ASTM-B733, Type V, Class 5, .00005/.00010 thick. The Electroless Nickel plating bath composition, PH, temperature of the solution, and bath age must be controlled to achieve Phosphorus content 11.2% - 12.5%.

**Notes:**

In order to achieve optimum nonmagnetic properties of the Nickel plating the following plating bath controls are recommended:

* Plating Phosphorus Content 12% - 12.5% should be targeted in order to ensure nonmagnetic plating properties
* Plating Bath PH Range - 4.6 – 4.8
* Plating Bath Temperature - 87⁰C±0.5C⁰

### Copper Beryllium – RF Blades, Specialty Plating, Low PIM

Gold Plate per ASTM B488, Type III, Grade A, .00005 / .00010 thick over Gold Plate per ASTM B488, Type I, Grade C, .00005 / .00010 thick over Nonmagnetic Electroless Nickel Plating (no Electrolytic Nickel Plating or Strike allowed) per ASTM-B733, Type V, Class 5, .00005/.00010 thick. The Electroless Nickel plating bath composition, PH, temperature of the solution, and bath age must be controlled to achieve Phosphorus content 11.2% - 12.5%.

**Notes:**

In order to achieve optimum nonmagnetic properties of the Nickel plating the following plating bath controls are recommended:

* Plating Phosphorus Content 12% - 12.5% should be targeted in order to ensure nonmagnetic plating properties
* Plating Bath PH Range - 4.6 – 4.8
* Plating Bath Temperature - 87 ± 0.5 ⁰C

### Aluminum Alloys – Specialty Plating, Low PIM

Gold Plate per ASTM B488, Type I, Grade C, .00010 / .00015 thick over Nonmagnetic Electroless Nickel Plating (no Electrolytic Nickel Plating or Strike allowed) per ASTM-B733, Type V, .00005/.00010 thick. The Electroless Nickel plating bath composition, PH, temperature of the solution, and bath age must be controlled to achieve Phosphorus content 11.2% - 12.5%.

**Notes:**

In order to achieve optimum nonmagnetic properties of the Nickel plating the following plating bath controls are recommended:

* Plating Phosphorus Content 12% - 12.5% should be targeted in order to ensure nonmagnetic plating properties
* Plating Bath PH Range - 4.6 – 4.8
* Plating Bath Temperature - 87 ± 0.5 ⁰C

## Electroless Nickel Plate

### Aluminum Alloys

Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00045 / .00055 thick over Zincate (double dip) per ASTM B253.

### Magnetic Iron / Low Carbon Steel Alloys

Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00020 / .00030 thick.

### Copper Alloys

Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00045 / .00055 thick.

### Aluminum Alloy

Applications requiring nonmagnetic nickel for optimum insertion loss.

Electroless Nickel Plate with High Phosphorus (Greater than 11.2%) Non Magnetic Properties per ASTM-B733, TYPE V, .00045 / .00055 thick over Zincate (double dip) per ASTM B253. No electrolytic Nickel plating or strike allowed.

### Aluminum Alloy - Specialty Plating, Low PIM

Electroless Nickel Plate with High Phosphorus (Greater than 11.2%) Non Magnetic Properties (no Electrolytic Nickel Plating or Strike allowed) per ASTM-B733, Type V, .00005/.00010 thick. The Electroless Nickel plating bath composition, PH, temperature of the solution, and bath age must be controlled to achieve Phosphorus content 11.2% - 12.5%.

**Notes:**

In order to achieve optimum nonmagnetic properties of the Nickel plating the following plating bath controls are recommended:

* Plating Phosphorus Content 12% - 12.5% should be targeted in order to ensure nonmagnetic plating properties
* Plating Bath PH Range - 4.6 – 4.8
* Plating Bath Temperature - 87 ± 0.5 ⁰C

### Aluminum Alloys – Requiring Soldering

Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00045 / .00055 thick over Zincate (double dip) per ASTM B253.

Surfaces shall meet solderability requirements per MIL-STD-202, method 208H

Composition of plating must comply with RoHS requirements per Directive 2011/65/EU

## Nickel Plate

### Magnetic Iron / Low Carbon Steel Alloys

Nickel Plate per SAE-QQ-N-290, Class 1, Form SB, .00020 / .00030 thick.

### Magnetic Iron / Low Carbon Steel Alloy - Applications requiring ductile (soft) finish.

Nickel Plate per SAE-QQ-N-290, Class 1, Form SD, .00020 / .00030 thick.

## Silver Plate

### Copper Alloys

Silver Plate per ASTM B700, Type II, Grade D, Class S, .00030 / .00040 thick over Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00005 / .00015 thick over Copper Flash per SAE AMS 2418, .00001 / .00005 thick. Total plating thickness .00036 / .00060.

### Aluminum Alloys

Silver Plate per ASTM B700, Type II, Grade D, Class S, .00030 / .00040 thick over Electroless Nickel Plate per SAE AMS 2404 (Low Phosphorus 2% to 8%), .00005 / .00015 thick over Zincate (double dip) per ASTM B253. Total plating thickness .00035 / .00055.

### Aluminum Alloys – Specialty Plating, Low PIM

Silver Plate per ASTM B700, Type II, Grade D, Class S, .00030 / .00040 thick over Electroless Nickel Plate with High Phosphorus (Greater than 11.2%) Non Magnetic Properties (no Electrolytic Nickel Plating or Strike allowed) per ASTM B733, Type V, .00005/.00010 thick. The Electroless Nickel plating bath composition, PH, temperature of the solution, and bath age must be controlled to achieve Phosphorus content 11.2% - 12.5%.

**Notes:**

In order to achieve optimum nonmagnetic properties of the Nickel plating the following plating bath controls are recommended:

* Plating Phosphorus Content 12% - 12.5% should be targeted in order to ensure nonmagnetic plating properties
* Plating Bath PH Range - 4.6 – 4.8
* Plating Bath Temperature - 87 ± 0.5 ⁰C

### Aluminum Alloys

Applications requiring nonmagnetic nickel for optimum insertion loss.

Silver Plate per ASTM B700, Type II, Grade D, Class S, .00030 / .00040 thick over Electroless Nickel Plate with High Phosphorus (Greater than 11.2%) Non Magnetic Properties per ASTM-B733, Type V, .00005/.00015 thick over Zincate (double dip) per ASTM B253. Total plating thickness .00035 / .00055.

## Chemical Conversion Coat

### Aluminum Alloys - Electrical applications requiring low resistance

Chemical Conversion Coat per MIL-DTL-5541, Type I, Class 3 (Gold).

### Aluminum Alloys – Non-Electrical applications

Chemical Conversion Coat per MIL-DTL-5541, Type I, Class 1A (Gold).

### Aluminum Alloys – Special applications requiring a clear finish.

Chemical Conversion Coat per MIL-DTL-5541, Type I, Class 3 (Clear).

### Aluminum Alloys – Special applications requiring ROHS Compliance.

Chemical Conversion Coat per MIL-DTL-5541, Type II, Class 1A (Clear).

## Passivation

### Stainless Steel Alloys

Passivate per ASTM A967, SAE AMS 2700, or equivalent.

## Hard Anodize

### Aluminum Alloys

Anodize per Mil-A-8625, Type III, Class 1, .0020 / .0025 thick. (Hard Anodize, non-dyed)

## Tin Plate

### Copper / Copper Alloys

Tin Plate per ASTM-B545 .00020/.00030 thick, Bright Finish, Solderability required.

### Deleted

## Zinc Plate

### Magnetic Iron / Low Carbon Steel Alloys

Zinc Plate per ASTM B633, Type II, .00020 / .00030 thick.

# **Dry Film Lubrication Processes**

## Dicronite Process – Tungsten Disulfide

Dry Film Lubricate per Dicronite DL-5 process.

Suggested Source:

Dicronite Drylube/Rotary Company

816 East Edna Place

Covina, CA 91723

(626) 967-3729

## Microseal Process – Tungsten Disulfide

Dry Film Lubricate per Microseal 300-1 process.

Suggested Source:

EM Coating Solutions

6940 Farmdale Avenue

North Hollywood, CA 91605

(818) 983-1952

# **Insulation Processes**

## Aluminum Alloy Coil Bobbins – Low Friction Solenoid Applications

Hardtuf X20 Anodize per Mil-A-63576, .0018 / .0020 thick.

Suggested Source:

Tiodize

15701 Industry Lane

Huntington Beach, CA 92649

714-902-0511

[www.tiodize.com](http://www.tiodize.com)