

	NOV SARA ENGINEERING SPECIFICATION		
	SECTION SES 26 – 736		
	REV NO "2"		ISSUE "A"
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## SILVER PALLADIUM/ELECTRO DEPOSIT /BRUSH PLATING COATING

Rev	Reason of Change	Date	Made By	Reviewed By	Approved By	Status
0	Initial release	20-11-2009	DPR	GJ	KCR	Released
1	Company name change from Nov Sara to Sara Sae	20-10-2011	RKS	DPR	KKD	Released
2	Plating thickness changed from 5-50 microns to 5-20 microns	24-05-2018	MN	AS	KKD	Released

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## **1.0 PURPOSE**

- 1.1** This specification defines the requirements for coating metal seals and ring gaskets and other components using any of the following: Silver Palladium, Electro Deposit Silver or Silver Brush Plating.
- 1.2** These coatings are for stainless steel and corrosion resistant alloys and are used to reduce friction and to prevent galling.

## **2.0 PREPARATION**

- 2.1** The following cleaning procedure should be used regardless of what coating is utilized. Any deviations to preparation, application or inspection must have prior approval from SARA SAE.
  - 2.1.1** Preliminary cleaning should be performed by washing with/within petroleum or chlorinated solvents generally operating at an elevated temperature. Solvents may be augmented by the use of heavy duty alkaline cleaning solutions. Vigorous brushing of all part surfaces is required to insure contaminant removal. Washing may be done by immersion, augmented by mechanical and or ultrasonic agitation.
  - 2.1.2** If deemed necessary, areas to be plated may be peened with glass bead media or fine aluminum oxide at 40 psi or less air pressure to dimple the surface, place the surface into net compressive residual stress, and remove burrs or surface irregularities which may induce galling. Coverage should be uniform and complete. 100% coverage should be verified on an Alien strip by visual observation with the aid of a 10X power magnifying lens. The Alien strip should be exposed to shot impingement using the same techniques used on the parts to be plated.
  - 2.1.3** Parts must be final cleaned in separate facilities from those used for preliminary cleaning to insure any contamination introduced during peening is removed. Parts should be blown off with dry air to remove any adhering contaminants.
  - 2.1.4** Immediately prior to plating, parts should receive final cleaning and be preheated above ambient to reduce the chance of vapor outgassing

## **3.0 APPLICATION AND INSPECTION OF SILVER-PALLADIUM**

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**3.1** Application and Inspection of Silver-Palladium should be performed in accordance with the following requirements:

- 3.1.1** The composition of the first charge to be evaporated should be pure Nickel (99.0% Nickel minimum) wire. The mass of the charge should be 20-40% of the mass of the Silver-Palladium charge.
- 3.1.2** The composition of the second charge to be evaporated should be an alloy strip or wire composed of 80% Silver and 20% Palladium ± 2% for each element. The alloy should be melted from commercially pure grades of each element containing (99.9% minimum) of the element. Alternately, strip or wire of each element may be used to make the charge.
- 3.1.3** The coating thickness should be between 8,000 and 25,000 Angstroms unless otherwise specified.
- 3.1.4** All parts should be visually inspected to assure the plating has fully covered the required area. The plating should be free of visual holidays, blisters, peeling, imperfections, or partially melted evaporated particles that may be detrimental to usage of the coating.
- 3.1.5** General adhesion of the finished plating shall be tested by attaching a section of Scotch Transparent Tape to the plated surface. Surface tested shall not exceed 120oF. Pull the tape off the surface. No plating material should be adhering to the tape. Intermediate layers may be tested on non-critical surfaces.

#### **4.0 APPLICATION AND INSPECTION OF ELECTRO DEPOSIT SILVER**

**4.1** Application and Inspection of Electro Deposit Silver should be performed in accordance with the following requirements:

- 4.1.1** After cleaning and prior to immersion in the plating solution, parts should be etched in a suitable solution such as ferric chloride-hydrochloric acid or sulfuric acid to promote adhesion.
- 4.1.2** Electrical contacts between the parts and power source should be made in such a manner as will ensure that neither chemical or immersion deposition nor electrical arcing or overheating will occur. If parts are to be plated completely, contact points should be located where specified or where agreed upon by purchaser and vendor. If parts are not required to be plated completely, contact points should be located in areas on which plating is not required or is optional.
- 4.1.3** Parts should be plated in the following sequence:

A) Nickel Strike

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### B) Silver Plate

- 4.1.3.1** Immerse components in nickel chloride solution and make cathodic. Deposit nickel to a thickness of about **0.0001 to 0.0002** inches
- 4.1.3.2** Cold water spray rinse.
- 4.1.3.3** Immerse in silver plating solution for the necessary time to deposit required thickness.
- 4.1.3.4** Cold water spray rinse.
- 4.1.3.5** Properties: The deposited silver conform to the following requirement:
- 4.1.3.6** Thickness shall be determined on representative parts or test panel in accordance with ASTM B487 or other method agreed upon by purchaser and vendor:
- 4.1.3.7** Plate thickness should be **0.0002 to 0.0008** inches (**5 to 20 microns**)..
- 4.1.3.8** Silver as plated should not be less than 99.9% pure. The process of plating should be controlled to produce this purity.
- 4.1.3.9** Silver plating should be sound, smooth and continuously bonded to the underlying metal. Parts should be free of detrimental blisters and indication of poor bond such as flaking or lifting of the plating.
- 4.1.3.10** General adhesion of the finished plating should be tested by attaching a section of Scotch Transparent Tape to the plated surface. The surface tested should not exceed 120oF. Pull the tape off the surface. No plating material should be adhering to the tape. Intermediate layers may be tested on non-critical surfaces.

## **5.0 APPLICATION AND INSPECTION OF BRUSH PLATING**

**5.1** Application and Inspection of Brush Plating should be performed in accordance with the following requirements:

- 5.1.1** Surfaces of parts to be plated should be smooth and free from blemishes, pits, tool marks, and other irregularities.
- 5.1.2** Electrical contacts between the parts and power source should be made to ensure that neither chemical or immersion deposition nor electrical arcing or overheating will occur.

- 5.1.3** Parts should only be processed by qualified operations for the specific plating solution/base material combination being processed.
- 5.1.4** The cathode speed and current density should be such that a shiny, yellow deposit occurs. A white, matte, powdery deposit occurs at excessive current densities. This type of appearance is unacceptable.
- 5.1.5** The plated parts should be rinsed thoroughly and dried immediately after plating.
- 5.1.6** The deposited silver should be uniform in thickness in the range of **0.001 to 0.002 maximum inches (25 to 50 microns)**.
- 5.1.7** Plating should be smooth, continuous and adherent to the base metal. Plating should be uniform in appearance, not coarsely crystalline, and free from pinholes, porosity, cracks, flakes, blisters, nodules, pits and other imperfections detrimental to performance of plating.
- 5.1.8** General adhesion of the finished plating should be tested by attaching a section of Scotch Transparent Tape to the plated surface. The surface tested should not exceed 120oF. Pull the tape off the surface. No plating material should be adhering to the tape. Intermediate layers may be tested on non-critical surfaces.

### **SILVER PLATING APPLICATION PARAMETERS**

- 4.1 The following procedure lists the basic processing parameters (reference GROWEL technical data sheet).
- 4.1.1 The surface of part shall be machined & surface finish should be as per drawing or specification.
- 4.1.2 Visually inspect parts to verify that all dirt, grease, oxide, scale & pitting or dents is removed. If part is not properly cleaned, return to 4.1.1.
- 4.1.3 **Silver plating make up:-**
- 4.1.3.1 **a) Strike Nickel Process:-**
- 4.1.3.3.1 Product: -Nickel chloride & Hydrochloride acid
- 4.1.3.3.2 Concentration: 200 gm / liter & 100 ml/liter
- 4.1.3.3.3 Temperature: 25-35 °C

4.1.3.3.4 Soak Time: 2 to 4 minutes, depending upon size of load, temperature, and strength of bath.

4.1.3.2 **b) Strike Silver Process:-**

4.1.3.4.1 Product: - Strike Silver Salt.

4.1.3.4.2 Concentration: 100-125 gm/liter

4.1.3.4.3 Temperature: Room Temperature

4.1.3.4.4 Soak Time: 1 to 2 minutes, depending upon size of load, temperature, and strength of bath.

4.1.3.3 **c) Bright Silver Process:-**

4.1.3.4.5 Product: - Bright Silver Salt.

4.1.3.4.6 Concentration: 200-250 gm/liter

4.1.3.4.7 Temperature: Room Temperature

4.1.3.4.8 Soak Time: 10 to 12 minutes, depending upon size of load, temperature, and strength of bath.

4.1.6 **Equipment:** - Mild steel tanks lined with plastic or hard rubber is suitable. Cooling arrangement is recommended for barrel plating tanks to maintain the temperature below 28 °C.