# PROCESS FOR CLEANING AND PREPARATION OF METAL SURFACES PRIOR TO ELECTROPLATING

## 1.0 GENERAL :

This standard details the processes for the preparation of metal parts prior to electroplating, with particular reference to ferrous, copper and copper alloy parts.

**Note :**

Parts fabricated by riveting, spot welding, etc. where difficulty will be experienced in removing the entrapped electrolytes, should not be electroplated.

## 2.0 COMPLIANCE WITH NATIONAL STANDARDS :

There is no National Standard covering this process.

## 3.0 MATERIALS :

| Material | | CPS No,/IS No./Available From |
|---|---|---|
| 3.1 Sulphuric Acid (Technical) | : | AA 541 01 |
| 3.2 Nitric Acid | : | AA 541 02 |
| 3.3 Hydrochloric Acid (Technical) | : | AA 541 03 |
| 3.4 Chromic Acid-Electroplating Grade | : | AA 541 04 |
| 3.5 Caustic Soda (Technical) | : | AA 542 01 |
| 3.6 Potassium Cyanide For Electroplating | : | AA 556 09 |
| 3.7 Sodium Cyanide for Electroplating | : | AA 556 10 |
| 3.8 Trichloroethylene (Technical) | : | AA 567 06 |
| 3.9 Cleaner S-20 | : | M/S. Platewel Processes |
| 3.10 Cleaner SE-11 | : | Chemicals Ltd., Vadodara |
| 3.11 Cleaner ADA-1D | : | M/s. ACCI, Rishra Kolkata |
| 3.12 Metaclean ZX | : | M/s CMP Pvt.Ltd, Mumbai |
| Steelex K-20 | : | |
| 3.13 Inhibitor - 11 | : | M/s.Grauer & Weil (I) |
| 3.14 Pickle Aid Accelerator | : | Limited, Mumbai |
| 3.14.1 Acitex Accelerator | : | Artek sufir chemicals (P) Ltd. Mumbai |

| | | |
|---|---|---|
| 3.15 Pickle Aid Additive | : | M/s. Agromore Limited Bangalore |
| 3.16 Rodine - 50 | : | |
| 3.17 Rodine - 119 | : | |
| 3.18 Pickelwel-S | : | M/s Mascot Chemical Works, Bangalore. |
| 3.19 Remogal HDS | : | |
| 3.20 Pickelwel - H | : | |
| 3.21 Uniclean HD | : | M/s. Srinivasa Industrial Chemicals, Bangalore |
| 3.22 Surclean EC-504 | : | M/s. Grauer & Weil (I) Ltd., Mumbai |
| 3.23 Ginbond 808 | : | M/s. Artek Surfin Chemicals (P) Ltd., Mumbai |
| 3.24 Surfolin EC-54 | : | |
| 3.25 Surfolin EL-80 | : | |
| 3.26 Stainless Steel Anode | : | IS : 6911, Grade 07 Cr 18; Ni 19 |
| 3.27 Common salt | : | IS : 253 (Nacl 96% minimum) |

**4.0 EQUIPMENT :**

**4.1 Vapour degreasing plant :**

Any standard plant for the purpose

**4.2 Alkaline degreasing vat :**

Mild steel tank provided with suitable steam coils or electrical heating for heating the vat solution with thermostatic control.

**4.3 Electrolytic (Anodic) Degreasing Tank :**

Mild steel tank provided with suitable steam coils or electrical heating for heating the vat solution with thermostatic control and provided with anode and cathode bus bar.

**4.4 Acid pickling vats :**

Rubber / PVC / FRP / Lead lined M.S. Tank or PVC tank.

**4.5 Bright dip pickling vat :**

Stainless steel tank.

**4.6 Rinsing Vats :**

Rubber / PVC / FRP lined M.S. Tank.

**4.7 Cyanide dip vat :**

M.S.tank / Rubber lined / plastic lined / Enamel lined / Stone ware.

**5.0 COMPOSITION OF SOLUTIONS AND OPERATING CONDITIONS :**

**5.1 Alkaline Degreasing Solution :**

| Sl. No. | Material | Quantity g/litre | Tempera-ture $^0$C | Duration Time minutes (Recommeneded) | Current Density A/DM$^2$ | Voltage V |
|---|---|---|---|---|---|---|
| 1. | Cleaner S-20 | 30-50 | 90±5 | 10-12 | -- | -- |
| 2. | Cleaner SE-11 | 50-90 | 60-90 | 2-8 | -- | -- |
| 3. | Steelex K-20/ Metaclaen ZX | 45-75 | 90±5 | 1-5 | -- | -- |
| 4. | Cleaner ADA-1D | 30-50 | 90-95 | 1-2 | -- | -- |
| 5. | Uniclean HD | 50-100 | 80-90 | 10-15 | -- | -- |
| 6. | Remogal HDS | 20-30 | 60-65 | 3-5 | -- | -- |
| 7. | Surclean EC-504 and Sodiumhydroxide | 50-100 (m1/1) 20-60 | 65-70 -- | 2-5 -- | -- -- | -- -- |
| 8. | Surfolin EC-54 and Sodiumhydroxide | 50-100 (m1/1) 20-60 | 65-70 -- | 2-5 -- | -- -- | -- -- |
| 9. | Gin Bond 808 | 80-100 | 60-65 | 2-4 | 5-10 | 5-9 (Rack) 10-14 (Barrel) |
| 10. | Surfolin EL-80 | 80-100 | 60-65 | 2-4 | 5-10 | 5-9 (Rack) 10-14 (Barrel) |

**NOTE :**

**i)** The time duration (recommended) can vary with the condition of the job.

**ii)** In case jobs do not get cleaned then the solution shall be checked for pointage and rectified.

**5.1.1** The tank shall be filled with water to about two-thirds of its capacity and then the necessary quantity of material shall be added to the bath with stirring as per clause 5.1. After proper mixing, the solution shall be brought to the working level by adding more water with stirring and heated to the operating temperature.

**5.1.2 Analysis and replenishment of alkaline degreasing solution :**

The solution shall be analyzed at suitable intervals and deficiency if any, shall be replenished with required chemicals.
The concentration of bath solution shall be maintained as given below :

| Material | Pointage |
|---|---|
| Cleaner S.20 | 30-50 |
| Cleaner SE-11 | 50-100 |
| Steelex K-20 | 45-75 |
| Cleaner ADA 10 | 30-50 |
| Uniclean HD | 50-55 |
| Remogal HDS | 20 minimum for 5 ml sample |
| Surclean EC 504 OR Surfolin EC 54 | 50-155 |
| Gin Bond 808 OR surfolin EL 80 | 100 - 130 |

**5.2 Acid Pickling Solutions :**

**5.2.1 HCL Pickling Solution :**

| | | |
|---|---|---|
| Hydrochloric Acid | : | 400 - 500 ml/litre |
| Inhibitor - 11 | : | 2 to 6 ml/litre of the volume of the acid mixture |
| or | | |
| Rodine-50 | : | 0.1 to 0.5% of the acid used |
| or | | |
| Pickelwel-H | : | 0.25 to 0.5% of the acid used |
| Temperature | : | Shop temperature |
| Time | : | 2 to 10 minutes or as required |

The tank shall be filled with water to about two-thirds of its capacity and then the necessary quantity of hydrochloric acid shall be added to the water slowly with stirring. The required quantity of Inhibitor-II or Rodine-50 (mixed with some concentrated hydrochloric acid) or Pickelwel-H shall then be added to the acid mixture.

After all additions, the bath solution shall be brought to the working level by adding more water with stirring. The bath shall be operated at shop temperature.

**5.2.2 HCl Pickling Solution-For Heat Treated Ferrous Component/Annealed Oxide Pickling (Optional) :**

| | | |
|---|---|---|
| Hydrochloric Acid | : | 400 to 500 ml / litre |
| Pickle Aid Additive | : | 20 ml / litre |
| Pickle Aid Accelerator | : | 100 gm/litre |
| Temperature | : | Shop temperature |
| Time | : | 2 to 10 minutes or as required |

**5.2.3 Sulphuric Acid Pickling Solution :**

| | | |
|---|---|---|
| Sulphuric acid | : | 100 - 125 ml/litre |
| Rodine - 119 | : | 0.125 to 0.375% of the acid used |
| or | | |
| Pickelwel - S | : | 0.25 to 0.5% of the acid used |
| or | | |
| Inhibitor 11 | : | 2 - 6 ml/litre |
| Temperature | : | 60 - $70^0$ C |

The tank shall be filled with water to about two-thirds of its capacity and then the necessary quantity of sulphuric acid shall be added to the water slowly with stirring. The required quantity of Rodine - 119 (mixed with some concentrated sulphuric acid) or Pickelwel - S or inhibitor 11 shall be added to the acid mixture.

After all additions, the bath solution shall be brought to the working level by adding more water with constant stirring and heated to the operating temperature.

**5.2.4 Chromic-Sulphuric Acid Pickling Solution (For Heat treated / annealed Non-ferrous component)**

| | | |
|---|---|---|
| Chromic acid | : | 30 to 40 g / litre |
| Sulphuric acid | : | 50 to 70 ml / litre |
| Temperature | : | Shop temperature |
| Time | : | 1-2 minutes or as required |

The tank shall be filled with water to about two-thirds of its capacity and then the necessary quantity of sulphuric acid shall be added to the water slowly with stirring. The required quantity of chromic acid shall then be added to the acid mixture. After complete dissolution, the bath solution shall be brought to the working level by adding more water with constant stirring.
The bath shall be operated at shop temperature.

**5.3 Bright Dip Pickling Solution (Optional) :**

**5.3.1 Composition I : (Composition by Volume) :**
(For Ferrous Components)

| | | |
|---|---|---|
| Sulphuric acid | : | 1 part |
| Nitric acid | : | 1 part |
| Water | : | 1 part |
| Temperature | : | Shop temperature |
| Time | : | 10 secs to 1 minute or as required |

**5.3.2 Composition II : (Composition by Volume) :**
(For Non-Ferrous Components)

| | | |
|---|---|---|
| Sulphuric acid | : | 2 parts |
| Nitric acid | : | 1 part |
| Water | : | 1 part |
| Sodium Chloride (cl.3.27) | : | 1 to 1.5 g/litre |
| Temperature | : | Shop temperature |
| Time | : | 10 secs to 1 minute or as required |

**5.4 Cyanide Dip Solution for Ferrous Components :**

| | | |
|---|---|---|
| Sodium Cyanide | : | 80 to 100 g/litre |
| Water | : | To make up the volume |
| Temperature | : | Shop temperature |
| Time | : | 1-2 minutes or as required |

**5.5 Cyanide Dip Solution - for Non-ferrous components:**

| | | |
|---|---|---|
| Potassium Cyanide | : | 25 to 35 g / litre |
| Water | : | To make up the volume |
| Temperature | : | Shop temperature |
| Time | : | 1-2 minutes or as required |

Whenever required, the ferrous pickled components be given passivation dip in a solution with

| | | |
|---|---|---|
| Chromic Acid | : | 5 to 10 g / litre |
| Sulphuric Acid | : | 0.4 to 1 ml / litre |

**6.0 ANALYSIS AND REPLENISHMENT:**
(of acid pickling and cyanide dip solution)

The solution in clauses 5.2 to 5.5 (except 5.3) shall be analyzed regularly at suitable intervals and deficiency, if any, shall be replenished with the required chemicals. The concentration of bath solution shall be maintained as given in Cl 6.1.

**6.1 Maintenance of Acid Pickling and cyanide dip solution :**

The concentration of acid pickling and cyanide dip solutions shall be maintained as given below :

**6.1.1 HCL Pickling Solution** (Cl. 5.2.1 and 5.2.2)

Strength (Hydrochloric acid content) grams / litre 120 to 150

**6.1.2 Sulphuric Acid Pickling Solution** (Cl. 5.2.3)

Strength (Sulphuric acid content) grams / litre 180 to 220

**6.1.3 Chromic Sulphuric Acid Pickling Solution** (Cl.5.2.4)

Chromic acid grams / litre 30 to 40
strength (sulphuric Acid content) ml / litre 50 to 60

**6.1.4 Cyanide dip Solution (Ferrous)** (Cl. 5.4)

Sodium Cyanide content grams / litre 80 to 100

**6.1.5 Cyanide dip solution** (Copper and Copper Alloy) (Cl. 5.5)

Potassium Cyanide content grams / litre 25 to 35

**7.0 PROCESS FOR FERROUS PARTS :**

**7.1 Mechanical Cleaning :**

Where parts are heavily scaled, mechanical cleaning such as scratch brushing polishing or shot-blasting shall be resorted to. Care must be taken to avoid distortion of light gauge articles.

**7.2 Solvent Degreasing :**

Excess grease, oil or cutting lubricants shall be removed by means of a suitable organic solvent such a trichloroethylene.

**7.3 Degreasing :**

Parts shall be degreased by immersion in any one of the alkaline degreasing solutions mentioned at clause 5.1.

**7.4 Rinsing :**

After degreasing, the parts shall be rinsed in clean cold running water. The surface of the parts at this stage shall provide a continuous water film over it. A break in the water film indicates that the surface is not clean, in which case, the alkaline degreasing process shall be repeated.

**7.5 Pickling :**

If required, acid pickling may be done as per clauses 5.2.1, 5.2.3 and 5.2.4 till clean metallic surface is produced. Over pickling shall be avoided.

**7.6 Rinsing :**

After pickling, the parts shall be rinsed in clean cold running water.

**7.7 Electrolytic (Anodic) Cleaning :**

After rinsing the parts shall be degreased electrolytically in solution as mentioned in Clause 5.1 Sl.No. 9 or 10.

**7.8 Hot Water Rinse :**

After electrolytic (Anodic) cleaning parts shall be rinsed in Hot Water (50 - 60$^{0}$C)

**7.9 Cold Water Rinse :**

After hot water rinse parts shall be rinsed in cold running water.

The surface of the parts at this stage shall provide 9 continuous water film over it. A break in water film indicate that surface is not clean, in which case, the process shall be repeated.

**7.10 Bright Dip Pickling:**

The parts shall be dipped in bright dip solution at room temperature for few seconds till a uniform bright surface free from scale is obtained.

**7.11 Rinsing :**

After the bright dip, the parts shall be rinsed in clean cold running water.

**7.12 Cyanide Dip:**

Parts shall be dipped in sodium cyanide solution till stains are removed from the articles. Parts shall be rinsed in clean cold water if subsequent plating is not a cyanide one.

**7.13 Electroplating :**

Electroplating shall be done in line with the appropriate BHEL Standard.

**8.0 PROCESS FOR NON-FERROUS COMPONENTS:**

**8.1 Mechanical Cleaning :**

Where necessary, the parts shall be cleaned by scratch brushing polishing. Care must be taken to avoid distortion of light gauge articles.

**8.2 Solvent Degreasing :**

Excess grease, oil or cutting lubricants shall be removed by means of a suitable organic solvent such a trichloroethylene.

**8.3 Alkaline Degreasing :**

Parts shall be degreased by immersing in cleaner SE11 or Steelex K20 alkaline degreasing solutions mentioned at clause 5.1 till the parts are free from any oil or grease.

**8.4 Rinsing :**

After degreasing, the parts shall be rinsed in clean cold running water. The surface of the parts at this stage shall provide a continuous water film over it.

**8.5 Acid Pickling :**

**8.5.1 Hydrochloric Or Sulphuric Acid Pickling :**

If required, pickling may be done as per clauses 5.2.1, and 5.2.3 till clean metallic surface is produced. Over pickling shall be avoided.

**8.5.2 Chromic Sulphuric Acid pickling (optional) for Non - Ferrous:**

All surface residues formed during annealing, the parts shall be pickled by dipping in chromic sulphuric acid solution of following strength for a few minutes at shop temperature. Prolonged pickling shall be avoided, otherwise the surface will become etched and pitted.

Same composition as mentioned in clause No. 5.2.4.

**8.5.3 Rinsing :**

After pickling, the parts shall be rinsed in clean cold running water.

**8.6 Bright Dip Pickling:**

Parts shall be dipped in any one of the bright dip solutions mentioned at clause 5.3 at room temperature for a short duration till a uniform bright surface free from scale marks is obtained.

**8.7** After the bright dip, the parts shall be rinsed in clean cold running water.

**8.8 Cyanide Dip:**

Parts shall be dipped in potassium cyanide solution till stains are removed from the articles.

**8.9 Rinsing :**

Parts shall be rinsed in clean cold running water if subsequent plating is not a cyanide one.

**8.10 Electroplating :**

Parts shall be electroplated in line with the appropriate BHEL Standard.

**8.11 Optional Test:**

Passivation.

**9.0 INSPECTION :**

The surface shall be examined visually for bright and clean finish free from grease and rust.

**10.0 REFERRED STANDARDS (Latest Publications Including Amendments):**

| | | | |
|---|---|---|---|
| 1) AA 541 01 | 2) AA 541 02 | 3) AA 541 03 | |
| 4) AA 541 04 | 5) AA 54201 | 6) AA 556 09 | 7) AA 556 10 |
| 8) AA 567 06 | 9) IS : 253 | 10) IS : 6911 | |

# PROCESS FOR ELECTROPLATING TIN FROM ALKALINE BATH ON FERROUS AND NON-FERROUS METAL PARTS

## 1.0 GENERAL :

This standard details the process for Tin plating by Vat and Barrel process from an alkaline tin solution on articles of steel, copper and copper alloys to protect them against corrosion, to provide surface for soldering of electrical contacts & terminals and for masking during nitriding. Barrel process for smaller components and tank process for larger components shall be followed.

## 2.0 APPLICATION :

Used for bus-bar connections, spout connections, cable sockets, etc., of switchgear; hardware like nuts, bolts, connection cams of transformer; brush holder, cable glands, etc., of traction motors; clamp plates, support plates, etc., of capacitors; clamps, brackets, etc., of electronics.

## 3.0 COMPLIANCE WITH NATIONAL STANDARDS :

This Standard has reference to IS:1359-92 (Reaffirmed 2001): Electroplated coating Tin-Specification.

## 4.0 MATERIALS — AVAILABLE FROM

| | |
|---|---|
| Satin Tin Salt-721 | : M/S Platewel Processes & Chemicals Ltd., Baroda |
| Satin Tin Salt | : M/S Grauer & Weil (I) Ltd., Mumbai |
| Mutton Tallow (Optional) | : Having acid neutralization value of 2.3 to 6.6 mg of KOH/g of mutton tallow |
| Sodium Perborate | : IS:3598 |
| Hydrogen Peroxide -20 volume | : |
| Caustic Soda | : AA 54201 |
| Tin Anodes | : IS:2384 |
| Sodium Stannate | : IS:3026 |

**5.0 EQUIPMENT :**

**5.1 Plating Tank / Vat :**

The Tank/vat shall be made of mild steel. The vat shall be provided with an insulated frame on top fitted with insulators for holding the anode and cathode rods. The solution shall be heated by steam, gas or electrical heater..

**5.2 Barrel :**

The plating barrel shall be constructed of hard rubber, polypropylene, etc., and shall be so driven as to rotate at 10 to 15 rpm.

**5.3 Cold Water Rinsing Tank:**
Mild steel tank.

**5.4 Hot Water Rinsing Tank :**
Mild steel tank with heating arrangements.

**6.0 COMPOSITION OF ELECTROLYTE AND OPERATING INSTRUCTIONS :**

**6.1 Electrolyte (Bath Solution) And Operating Conditions :**

The electrolyte shall be of the following compositions and operating conditions as specified below :

| | | **SATIN TIN SALT-721** | **SATIN TIN SALT** |
|---|---|---|---|
| Salt for Vat Plating | : | 150 g/l | 110 g/l |
| Salt for Barrel Plating | : | 250 g/l | 200 g/l |
| Temperature | : | 60 - 70$^0$C | 60 - 80$^0$ C |
| Ratio of Anode to Cathode Area (Approximately) | : | 1:1 | 1:1 |
| Current density (for information only and not a controlling parameter) | : | 1.5 - 2.0 A/dm$^2$ (15-20 A/sq.ft) | 1.5 - 2.0 A/dm$^2$ (15-20 sq/ft) |
| Voltage for Vat | : | 2-6 V | 2-6 V |
| Voltage for Barrel | : | 10±2 V | 10±2 V |

**6.2 Preparation of Electrolyte :**

The vat/barrel shall be filled with water to about 2/3$^{rd}$ capacity and then heated to nearly 50$^0$C.

The required amount of tin salt shall be added to the water in small quantities with stirring.

After complete dissolution, the electrolyte shall be brought upto the working level by adding water and subsequently stirred thoroughly and heated to the operating temperature.

**6.3 Analysis of the Electrolyte :**

The electrolyte shall be analysed after initial make-up and subsequently at suitable intervals.

**The concentration of the electrolyte shall be maintained at the following limits :**

| | | | |
|---|---|---|---|
| Tin (Metal) | For vat plating | : | 30 - 40 g/litre |
| | For barrel plating | : | 50 - 60 g/litre |
| Free Caustic Soda (NaOH) | For vat plating | : | 8 - 16 g/litre |
| | For barrel plating | : | 20 - 30 g/litre |

**6.4** Temperature and voltage shall be recorded during plating.

**7.0 PROCESS OF PLATING:**

**7.1 Cleaning :**

All articles shall be properly cleaned as described in BHEL Standard AA 067 36 01 : Process for cleaning and preparation of metal surfaces prior to electroplating , except passivation. If required electrolytic cleaning can also be carried out additionally.

**7.2 Rinsing :**

All articles shall be rinsed thoroughly after cleaning to avoid contamination of the plating solution.

**7.3 Pre-heating (Optional):**

Before dipping in the plating bath all articles should be dipped in a hot water (80-90$^0$C) bath for pre-heating purpose.

**7.4 Plating :**

All articles shall be plated at the specified current density for a duration which will depend on the thickness of the deposit required.

**Note:** It shall be ensured that the anodes are never put in the solution before the vat/barrel is loaded and the current switched on. Likewise the anodes shall be removed before switching off the current after the plating is done.

**7.5 Cold Rinsing :**

After removal from the plating bath, all articles shall be rinsed thoroughly in cold running water till any trace of tin solution is removed.

**7.6 Hot Rinsing:**

Finally, all articles shall be rinsed in clean hot water at 80-90$^0$C and dried.

**7.7 Reflowing of Tin Deposit (Optional):**

Castings having surface impurities like cavities and blow holes, where removal of entrapped alkaline tin solution is not possible, shall be immersed in a mutton tallow bath maintained at $260\pm10^0$C for 2 to 10 seconds. After flow melting, the articles are quenched in a bath containing kerosene oil at the top and water at the bottom. The residual oil from the flow melted surface shall be removed by vapour degreasing or by dipping in trichloroethylene. The thickness range of coating that can be flow melted is 2.5 to 7.5 microns.

**8.0 HEAT TREATMENT :**

**8.1 Stress Relieving Before Plating :**

Severely cold-worked steels or parts made from steel of tensile strength of 100kgf/mm$^2$ or greater which have been ground or subjected to severe machining after tempering, shall normally be stress relieved by maintaining them at $200 \pm 10^0$C, for not less than one hour or, preferably, for 30 minutes at the highest temperature within the limits imposed by the tempering temperature.

**8.1.1** Some steels which have been carburized, flame-hardened or induction-hardened and subsequently ground would be impaired by the above treatment and shall instead be stress relieved at $140 \pm 10^0$C for not less than five hours.

**8.2 Heat Treatment After Plating (Optional):**

**8.2.1** Components subjected to critical fatigue or sustained loading stressed in service and made from severely cold-worked steels or from steels exceeding 100 kgf/mm$^2$ tensile strength shall be heat treated at $185 \pm 5^0$C for not less than two hours.

**8.2.2** Where the temperature of heat treatment in 8.2.1 would be harmful, for example, for some surface-hardened parts, a lower temperature for a longer time may be required.

**NOTE:**
When tin is plated on the article for soft soldering purposes, it may be flow melted at a temperature of 250 to $260^0$ C to overcome difficulties in soldering during long periods of storage.

**9.0 MAINTAINANCE OF ELECTROLYTE:**

**9.1** If the electrolyte is low in tin and caustic soda, then add tin salt according to the requirement

**9.2** To increase the tin content without affecting the caustic soda content, and addition of sodium stannate should be made.

**9.3** If the bath works sluggishly and the anodes are coated with a thick encrustation, it is an indication that the solution is deficient in free caustic soda. The deficiency shall be corrected by maintaining free caustic soda as per clause 6.3.

**9.4** If the deposit is rough, dark spongy, sodium perborate shall be added to the solution at the rate of 0.4 g/1 of solution. Alternatively, 20 volume Hydrogen Peroxide to the extent of 1.5 ml/litre of solution may be added.

**10.0 CARE OF ANODES :**

When working correctly the anodes are covered with a greenish yellow film the continuous maintenance of which is most important.

To obtain this film in the first instance, the vat/barrel shall be loaded with dummy cathodes (e.g. steel sheets). The current switched on and then the tin anodes shall be introduced on the one as each becomes filmed over. This is known as polarisation of anode. The current density necessary for this operation is about twice that normally used for plating. The formation of the film shall be at once apparent by the pale yellow brassy appearance of the anodes and shall also be indicated by a rapid fall in amperage and increase in voltage. As soon as the anodes are properly polarised in this manner, the current shall be reduced to normal and dummy cathodes replaced, one by one, with the articles to be plated. The batch shall be operated continuously for several hours, if possible, removing a number of articles at a time and replacing them with others before further unloading. In this way there will always be sufficient current passing to keep the anodes filmed the whole time they are in the vat/barrel.

At the end of day's work, anodes shall be taken out, current switched off and finally plated articles shall be removed. On commencing work again, the vat/barrel shall be loaded with articles current switched on and then anodes shall be introduced. If for any reason, the anodes lose their greenish yellow surface film and become a normal tin color they must be 'worked in' again as directed at the beginning of this clause until properly filmed over. It is important that the current be kept flowing continuously the whole time the anodes are in the vat/barrel in order to maintain the necessary film upon them. Failure to observe this precaution and keeping the anodes polarised will give rise to the formation of stannite (i.e. stannous tin) in solution and cause the plating to be dark and rough in texture.

**11.0 PRECAUTIONS :**

Solution shall be kept covered when not in use.

Any chemical that may be necessary to be added shall be dissolved in a part of the original solution before adding it to the vat/barrel. It shall be poured through a filter.

Any metal that may be deposited on any part of the vat/barrel shall be removed .

Any article that becomes lodged in any part of the vat / barrel shall be removed.

**12.0 INSPECTION AND QUALITY OF DEPOSIT :**

**12.1 Sampling :**

A sample from each batch of tank/barrel load shall be tested.

**12.2 Condition of Surface :**

The plated surface shall appear as a smooth and continuous film over the base metal and shall be free from defects such as pits, stains, cracks, blisters, unplated areas and other superficial blemishes visible to the unaided eye. The plated surface shall be matt white and free from nodules.

**12.3 Thickness of Deposit:**

Thickness of deposit shall be as per Appendix A of IS:1359.

**12.4 Adhesion Type Test (Cl 9.3, Appendix- C of IS:1359):**

The flaking and blistering of the coating shall be taken as evidence of unsatisfactory adhesion.

**12.5 Solderability test (Cl 9.5, Appendix-D of IS:1359):**

This test shall be carried out whenever specified on BHEL order.

The samples shall be considered solderable, if they show a uniform coating free from discontinuities of breaks visible to the unaided eye.

Samples of tin coating on copper and copper alloys shall be subjected to preliminary artificial ageing treatment as per clause D-3.1.

**13.0 REJECTION :**

If the samples taken do not comply with clauses 12.2 to 12.5 a further quantity not less than twice the number originally taken shall be subjected to these tests. If any one of these samples also fails, the whole batch shall be rejected.

**14.0 REFERRED STANDARDS (Latest Publications Including Amendments) :**

1) IS:1359 2) IS : 2384 3) IS : 3026 4) IS : 3598
5) AA 54201 6) AA 067 36 01

| | AMENDMENT -NOTIFICATION | AA 067 36 11 | REV. No. 03 |
|---|---|---|---|
| | | PAGE 1 OF 1 | |

## AA 067 36 11 : PROCESS FOR ELECTROPLATING BRIGHT TIN FORM ACID BATH ON FERROUS AND NON-FERROUS METAL PARTS

**PAGE 1 OF 6; Cl 4.0 MATERIAL:**
Activated carbon powder - pure mentioned at third line is modified as follows:

| MATERIAL | AVAILABLE FROM |
|---|---|
| Activated carbon pure<br>(for Electroplating) | 1) M/s Grauer & Weil (I) Ltd., Mumbai<br>2) M/s Artek surfin chemicals (P) Ltd., Mumbai |

**Please see Instructions on the reverse.**

| Ref : Cl. NO. 28.16.14 of 28th MOM of MRC(C) | Amd No. 01 | Approved MRC (C) | Issued CORP. R&D | Date 15.10.2000 | Cum.Sr.No. A 2869f |
|---|---|---|---|---|---|

| | AMENDMENT -NOTIFIFCATION | AA 067 36 11 | Rev. No. 03 |
|---|---|---|---|
| | | PAGE 1 OF 1 | |

## AA 067 36 11: PROCESS FOR ELECTROPLATING BRIGHT TIN FROM ACID BATH ON FERROUS & NON-FERROUS METAL PARTS

**Amendment 01 (Cum.Sl.No. 2869):**

The word 'FORM' mentioned in the title is corrected as **'FROM'.**

**Please see Instructions on the reverse.**

| Ref : Cl. 30.15.09 of MOM of MRC-C | Amd No. 02 | Approved MRC-C | Issued CORP. R&D | Date 15.12.2001 | Cum.Sr.No. A 3051 |
|---|---|---|---|---|---|

| | AMENDMENT -NOTIFICATION | AA 067 36 11 | Rev. No. 03 |
|---|---|---|---|
| | | PAGE 1 OF 1 | |

# AA 067 36 11: PROCESS FOR ELECTROPLATING BRIGHT TIN FROM ACID BATH ON FERROUS & NON-FERROUS METAL PARTS

**PAGE 1 OF 6; Cl 3.0 COMPLIANCE WITH NATIONAL STANDARDS**

**Year of IS reference is modified as follows:**

IS:1359-92 (Reaffirmed 2001)

**Please see Instructions on the reverse.**

| Ref : Cl; 31.11.14 of MOM of MRC-C | Amd No. 03 | Approved MRC- C | Issued CORP. R&D | Date 15.10.2002 | Cum.Sr.No. A 3165 |
|---|---|---|---|---|---|

# PROCESS FOR ELECTROPLATING BRIGHT TIN FROM ACID BATH ON FERROUS AND NON-FERROUS METAL PARTS

## 1.0 GENERAL:

This standard details the process for bright tin plating by vat or barrel from an acid tin solution on steel, copper & copper alloys to protect them against corrosion, to provide good surface for soldering and also to provide minimum contact resistance of joints and for masking during nitriding.

## 2.0 APPLICATION:

Used for bus-bar and spout connections, cables, sockets, connection cams, brush holder, cable glands, clamp plates, support plating clamps, brackets, hardware, etc.

## 3.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no National Standard covering this Standard. However, assistance has been derived from the following National Standard in respect of surface condition and quality of deposit.

IS:1359 : Electroplated Coatings Of Tin in Respect of Surface Condition & Quality of Deposit.

## 4.0 MATERIALS:

| Material | | IS No. / Available From |
|---|---|---|
| Sulphuric Acid (C.P. Grade) | : | IS : 266 |
| Tin Anodes | : | IS : 2384 |
| Activated Carbon Powder-Pure | : | IS : 8366 |
| Stannous Sulphate (Electroplating Grade) | : | M/s Grauer & Weil (I) Ltd and M/s Artek Surfin Chemicals (P) Ltd. Bombay |
| Tinbrite Make-up Brightner | : | M/s Grauer & Weil (I),Limited, Bombay. |
| Teknolume Carrier Additive | : | M/s Artek Surfin Chemicals (P) Ltd. Bombay. |

Tinbrite Maintenance Brightner : M/s Grauer & Weil (I) Ltd, Bombay.

Sediwell-Sn Purifier : M/s Grauer & Weil (I), Ltd, Bombay.

Teknolume Brightner : M/s Artek Surfin Chemicals (P) Ltd Bombay.

**5.0 EQUIPMENT:**

**5.1 Plating Tank:**

The tank shall be made of mild steel lined with rubber/PVC/FRP fitted with insulators for holding the anode and cathode rods and a cathode rod movement system.

**5.2 Plating Barrel:**

The plating barrel shall be made of hard rubber/polypropylene/ perspex and shall be so driven as to rotate at 10 to 15 r.p.m.

**5.3 Cold Water Rinsing Tank:**

Mild Steel tank lined with PVC/FRP/Rubber.

**5.4 Hot Water Rinsing Tank:**

Mild steel tank lined with PVC/FRP.

**5.5 Filter Pump:**

Standard filtration unit suitable for filtering acid solution.

**6.0 COMPOSITION OF ELECTROLYTE AND OPERATING INSTRUCTIONS :**

**6.1 Composition Of Electrolyte And Operating Conditions:**

| Parameter | For Vat | For Barrel |
|---|---|---|
| Stannous Sulphate, g/l (Grauer & Weil) | 40 - 60 | 25 - 35 |
| Stannous Sulphate, g/l (Artek Surfin) | 24 - 35 | 24 - 35 |
| Sulphuric Acid, ml/l | 80 - 100 | 95 - 110 |
| Tinbrite make-up brightner, ml/l | 30 - 40 | 30 - 40 |

| | | |
|---|---|---|
| Teknolume Carrier Additive m/l | 20-40 | 20-40 |
| Tinbrite maintenance brightner, ml/l | 3 - 4 | 4 - 6 |
| Teknolume Brightner, ml/l | 2 - 6 | 2 - 6 |
| Operating Temperature, °C | 20 - 35 | 20 - 35 |
| Current Density, A/dm$^2$ | 1 - 2.5 | 1 - 1.5 |
| Voltage, V | 1 - 3 | 4 - 6 |
| Agitation (Optional) | Cathode Rod movement | - |
| Filtration | Occasional | Occasional |
| Anode to Cathode ratio | 2:1 | - |

**6.2 Preparation Of Electrolyte:**

The vat/barrel shall be filled with cold water (preferably with demineralised water) to about two-thirds of its working level.

The required quantity of sulphuric acid shall be added very slowly to the bath with stirring.

The requisite amount of stannous sulphate shall then be added to this solution with stirring.

After complete dissolution, the electrolyte shall be brought upto the working level by adding water (preferably demineralised water) and subsequently stirred thoroughly.

The required quantity of make-up brightner and maintenance brightner shall then be added with thorough stirring.

**6.3 Maintenance Of The Electrolyte:**

The electrolyte shall be analysed after initial make-up and subsequently at suitable intervals to maintain the working concentration.

**6.3.1 Working Concentration:**

The concentration of the electrolyte shall be maintained at the following limits.

| | | For Vat | For Barrel |
|---|---|---|---|
| Metal content as Sn, g/l | : | 15 to 25 | 12 to 18 |
| Sulphuric acid as $H_2SO_4$, ml/l | | 70 to 100 | 80 to 120 |

**6.3.2 Replenishment:**

If the working concentration do not lie in the limits as mentioned in Cl.6.3.1, addition of stannous sulphate and sulphuric acid shall be made to raise the concentration of metal and acid respectively as per the deficiency of the bath.

In normal cases the addition of brightners shall be as follows for both vat & barrel.

| | |
|---|---|
| Teknolume Carrier Additive | 100 to 150 |
| or | |
| Tinbright Make-up Brightner, | 100 to 200 |
| or | |
| Tinbright Maintenance Brightner, | 200 to 400 |
| or | |
| Teknolume Brightner | 200 to 300 |

**6.3.3 Purification:**

**6.3.3.1 Removal Of Metallic Impurities:**

When objectionable amounts of metallic impurities are to be removed, electrolytic purification by using corrugated dummy cathode shall be employed at a low current density (0.3 Amp/$dm^2$).

**6.3.3.2 Removal Of Organic Impurities:**

When the electrolyte is not severely contaminated with the organic impurities, the solution shall be filtered by introducing a small amount of activated carbon powder packed within the filter. For severely contaminated organic impurities, the electrolyte shall be treated with activated carbon powder at the rate of 2-3 g/l and Sediwell-Sn purifier at the rate of 1-2 ml/l. After vigorous agitation, the mixture shall be allowed to settle for a few hours, preferably overnight, in a separate tank. Finally, the electrolyte shall be filtered into the plating tank. Sediwell-Sn purifier treatment will also remove the stannic oxide produced during the process and also in idle hours of the electrolyte.

**6.3.3.3** During carbon treatment brightners are partially removed. Therefore, brightners shall be added after carbon treatment as under.

| | |
|---|---|
| Teknolume Carrier Additive ml/l | |
| or | |
| Tinbright Make-up Brightner, ml/l | 10 - 15 |
| or | |
| Tinbright Maintenance Brightner, ml/l | |
| or | |
| Teknolume Brightner ml/l | 1 - 2 |

**7.0 PROCESS:**

**7.1 Cleaning:**

All articles shall be properly cleaned as described in the Corporate Standard AA 067 36 01: Process For Cleaning And Preparation Of Metal Surfaces Prior To Electroplating.

**7.2 Rinsing:**

All articles shall be rinsed thoroughly after cleaning in deionised water to avoid contamination of the plating solution.

**7.3 Acid Dipping:**

Before dipping in the plating bath all articles shall be dipped in 4 to 5% sulphuric acid (C.P.Grade) solution followed by a dip in deionised water.

**7.4 Plating:**

All articles shall be plated at specified current density for a duration which will depend on the thickness of the deposit required.

**Note:**

Articles made of steel, brass or other copper alloys shall not be directly plated with acid tin. An under coat of (3-5 microns) copper shall be given prior to tin plating on these alloys.

**7.5 Cold Rinsing:**

After removal from the plating bath, all articles shall be rinsed thoroughly in cold running water till all traces of plating solution are removed.

**7.6 Hot Rinsing:**

After cold rinsing, all articles shall be rinsed in hot water at 60-70°C.

**7.7 After Drying:**

Finally, all articles shall be dried in centrifugal drier or by hot air.

**8.0 PRECAUTIONS:**

**8.1** The electrolyte shall be kept covered when not in use to keep the bath free from dust and foreign matter.

**8.2** The anode shall be kept immersed in the electrolyte during idle hours to minimise oxidation of tin to stannic oxide, which is objectionable.

**8.3** Any article that becomes lodged in any part of barrel/vat shall be removed immediately.

**8.4** Ensure that the bath is 'alive' before loading the job into the plating vat.

**8.5** Any metal that may be deposited on any part of the vat/barrel shall be removed.

**9.0 INSPECTION AND QUALITY OF DEPOSIT:**

When tested in accordance with the test methods shown against each, the deposit shall conform to the norms specified below:

**9.1 Sampling:**

A minimum of 1% of each batch of vat/barrel load or part thereof shall be taken at random for testing.

**9.2 Condition Of Surface:**

The coating shall be uniformly bright, free from black patches, stains, pin holes, sponginess, blisters, uncovered areas and other superficial blemishes visible to the unaided eye.

**9.3 Thickness Of Deposit (IS:3203):**

The minimum Thickness shall be as specified on the purchase order or drawing.

**9.4 Adhesion (IS:1359):**

Flaking and blistering of the coating is not acceptable.

**9.5 Solderability (IS:1359):**

The actual soldering on the component may be done on shop floor and observations be made. If uniform coating free from breaks and discontinues when seen with unaided eye, sample be considered solderable.

**10.0 REJECTION:**

If the samples taken do not comply with clauses 9.2 to 9.5, a further quantity not less than twice the number originally taken shall be subjected to these tests. If any one of these samples also fails, the whole batch shall be rejected.

**11.0 REFERRED STANDARDS (Latest Publications Including Amendments) :**

1) IS : 266 2) IS : 1359 3) IS : 2384 4) IS : 3203

5) IS : 8306 6) AA 067 36 01

**Commodity (Prices are exclusive of GST)**

**Tin Slab**

SPOT -- NON-FERROUS METALS -- **TIN -- Tin Slab**

| Trading Date | Item | Variety(Wt.) | Centre | Price Range From | Price Range To |
|---|---|---|---|---|---|
| | TIN | Tin Slab1 Kg | MUMBAI | 3020.00 | 3020.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3000.00 | 3000.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3050.00 | 3050.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3025.00 | 3025.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3020.00 | 3020.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 2990.00 | 2990.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 2980.00 | 2980.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 2975.00 | 2975.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 2975.00 | 2975.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 2975.00 | 2975.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3025.00 | 3025.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3010.00 | 3010.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3000.00 | 3000.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3075.00 | 3075.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3025.00 | 3025.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3025.00 | 3025.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3050.00 | 3050.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3025.00 | 3025.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3025.00 | 3025.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3040.00 | 3040.00 |
| Dt. 03-01-22 03-01-2022 | TIN | Tin Slab1 Kg | MUMBAI | 3075.00 | 3075.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3075.00 | 3075.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3060.00 | 3060.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3060.00 | 3060.00 |
| | TIN | Tin Slab1 Kg | MUMBAI | 3055.00 | 3055.00 |

Top

# PROCEDURE FOR SILVER/TIN PLATING AND COATING PROTECTION

## INTRODUCTION:

This standard covers the procedure for Silver Plating / Tin coating protection on Aluminium / Copper material.

## PROCEDURE:

After clearance from inspecting agency, surface of the plated portion to be cleaned by using cotton cloth to remove dust, loose particles etc.

## PACKING:

1. Plated surface should be suitably covered with sulphur free adhesive sheet/tape/paper.
2. Sulphur free adhesive sheet/tape/paper shall be covered with cotton tape for providing cushion.
3. Cotton tape wrapped surface shall be covered with bubble sheet in double layer to avoid ingress of moisture and for providing cushion to plated surface (Fig-3A & 3B).
4. Edges of plated palms shall be covered with hard foam to avoid damage to edges during handling (Fig-4A & 4B).
5. Packed components shall be stored under covered shed.
6. Before dispatch of Bus Duct to site, proper packing of Silver / Tin plated surface shall be ensured.
7. If any damage is noticed in the packing, it shall be re-packed by the above given process.

**NOTE:** SL NO. 4 is applicable for silver plated busduct palms only and not for splice plates and flexible.

## REMOVAL OF PACKING:

At the time of erection of Bus Duct at site, all the packing must be removed from plated surface.

FIG-3A

FIG-3B

FIG-4A

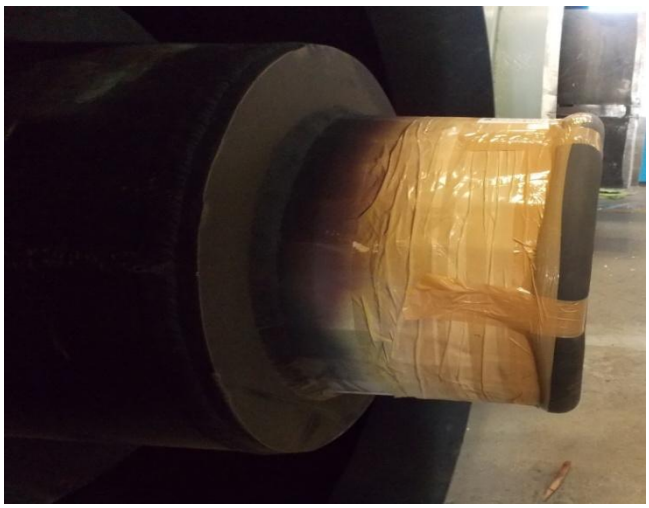


FIG-4B

# PQR CRITERIA

1. Bidder must have in house Facilities for Electro-Tinning as per Corp. Std. AA0673601 REV08 & AA0673611 REV03 as attached.

2. Bidder must have in house Testing Set Up for Electro Tinning as per attached QAP.

| CFP/Q&BE | BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR | | | |
|---|---|---|---|---|
| | **Quality Assurance Plan for Electro plating of Tin on Copper/ Al. & its Alloys.** | FINAL INSPECTION | VENDOR's WORK/ BHEL | Doc No.: QP/BD/EP-01, REV.No.: 00 DATE: 23.11.2020 Page 1 of 1 |

| Sl. No. | COMPONENT & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | M | C/N | | | | M | C | N | |
| 1. | Inspection of Electroplated Surface | a) Surface Finish. | B | V | 100% | 10% | BHEL Drg./ IS 1771 (General)/ IS 3203 (Thickness Measurement) SG 15605 (for Al.)/ AA 0673602 (for Cu.) | Same as Reference document | TC/OS | P | W | - | CHP (Insp. By BHEL/ TPIA at vendor's work) ***No. of Samples taken for witness is at the discretion of BHEL/IS** |
| | | b) Thickness of Plating. | B | I | 100% | *Sample | | | | P | W | - | |
| | | c) Adhesion. - Burnishing Test. | B | T | Sample | *Sample | | | | P | W | - | |

**Important Note:**

1) Vendor to strictly follow the process requirement stages as per Product Standard & reference documents as mentioned in above table).
2) Surveillance Process Inspection can be done by BHEL for any plating job in progress.
3) Cleaning/ Surface preparation/Buffing to be done effectively prior to plating as per Product Standard.
4) Packing of electroplated jobs shall be inspected at vendor's work Or at the time of receiving at BHEL works. Vendor to ensure packing protection during transit.
5) Packing of electroplated jobs shall be in line with latest packing scheme provided by BHEL.
6) QAP prepared on the basis of inputs received from Engineering Deptt. email dated 28th Aug'2020. Also, the acceptance of QAP Tests is given by Engineering vide Email dt 23rd Nov' 2020.

**LEGEND: -**

**CLASS**
A: CRITICAL
B: MAJOR

**TYPE OF CHECK**
V: VISUAL
I: MEASUREMENT
T: TEST

**AGENCY**
M: VENDOR / SUB CONTRACTOR
C: BHEL / BHEL NOMINATED INSPECTION AGENCY
N: CUSTOMER

**SCOPE**
P: PERFORMER
V: VERIFICATION
W: WITNESS
CHP: CUSTOMER HOLD POINT

**FORMAT OF RECORD**
TC: TEST CERTIFICATE
OS: OBSERVATION SHEET
Drg.: DRAWING

Budhiraja 23/11/2020

**Prepared & Checked by**

बुद्धिराजा
उप प्रबंधक (गुणता)
बी.एच.ई.एल., रुद्रपुर
उत्तराखण्ड -263153

BUDHIRAJA
Dy. Manager (Quality)
B.H.E.L., Rudrapur
Uttarakhand-263153

23/11/2020

**Approved by**

कपिल कुमार भारती
वरि. प्रबंधक (गुणता)
बी.एच.ई.एल., रुद्रपुर
उत्तराखण्ड -263153

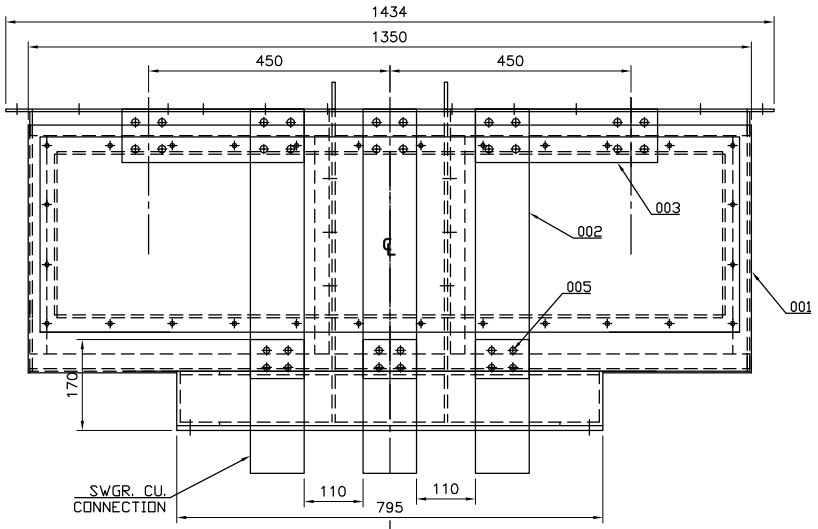
Kapil Kumar Bharti
Sr. Manager (Quality)
B.H.E.L., Rudrapur
Uttarakhand-263153

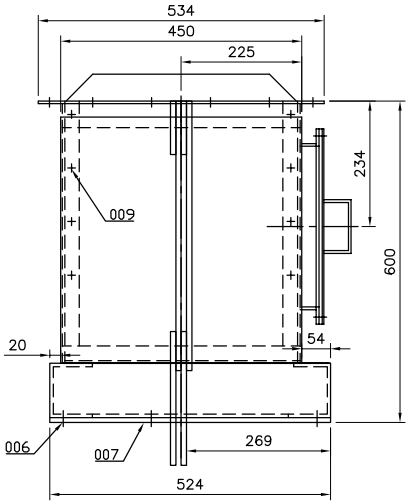
DRAWING NO. 32171911116

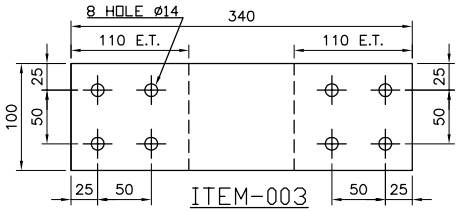
FIRST ANGLE PROJECTION

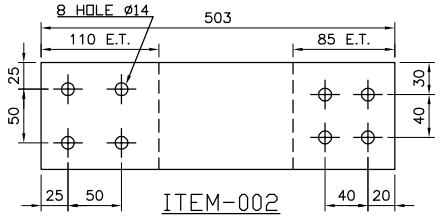
ALL DIMENSSIONS IN MILIMETER



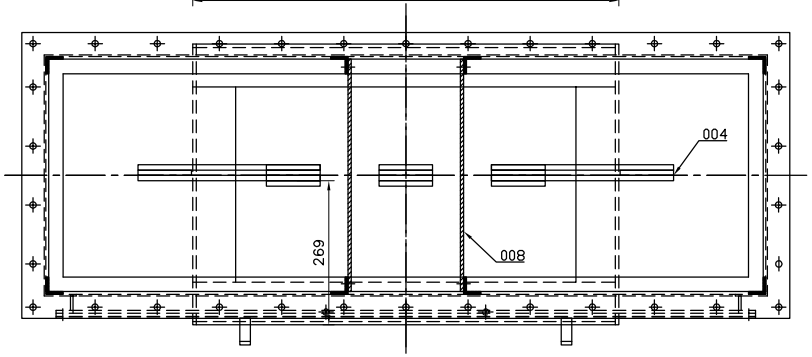


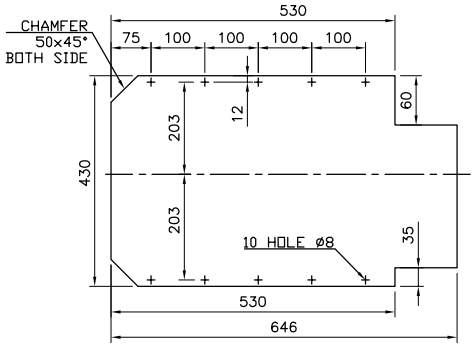




NOTE:–
1) FOR ASSY. TOLERANCES REF. STD. BD–25001T.
2) GENERAL & FINISH NOTES AS PER PROJECT MIS.
3) E.T. AREA OF IT.–002=514.56, IT.–003=606.56 & IT.–004=329.28 SQCM.
4) PAINT SHADE– RAL–7032

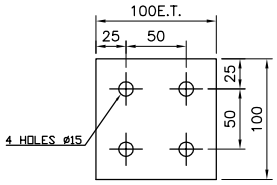



VAR–02

| VAR –– | VAR 00 | REMARKS | ITEM NO. | DESCRIPTION | DRAWING NO. | IT.NO. | MATL.CODE | WT. | GS |
|---|---|---|---|---|---|---|---|---|---|
| –– | 016 | | 009 | SCRU HEX A M6x25 STEEL–ZPP (SET) | | | | | |
| –– | 002 | | 008 | 4TK.x480x646 LG.FRP SHEET | SEE DETAIL | | | | |
| –– | 001 | SENT LOOSE | 007 | GASKET FOR SWGR. FLANGE | THIS DRG. SHEET 02 OF 02 | 003 | | | |
| –– | 014 | SENT LOOSE | 006 | SCRU HEX A M8x40–8.8 STEEL–ZPP (SET) | | | | – | |
| –– | 024 | SENT LOOSE | 005 | SCRU HEX A M12x100–8.8 STEEL–ZPP (SET) | | | | – | |
| –– | 003 | SENT LOOSE | 004 | COPPER PACKER 10Tkx100x100 | SEE DETAIL | | | 0.84 | |
| –– | 004 | SENT LOOSE | 003 | COPPER CONNECTION 10Tkx100x340 LG. | SEE DETAIL | | | 2.95 | |
| –– | 006 | SENT LOOSE | 002 | COPPER CONNECTION 10Tkx100x503 LG. | SEE DETAIL | | | 4.40 | |
| –– | 001 | | 001 | W. A. OF ENCLOSURE | THIS DRG SHEET 02 OF 02 | – | | 41.50 | |
| | | | | | | 01 | | – | |
| | | | | | | VAR. | MATL.SPCN. | QTY. | |




ITEM-008




ITEM-004

| REV. | DATE | ALTERD / CHEKED |
|---|---|---|
| 01 | 26.02.19 | S P S / SURAJ |

PAINT SHADE REVISED.

CUSTOMER: HPCL

PROJECT/PRODUCT: 1x75 MW HPCL VIZAG

भारत हैवी इलेक्ट्रिकल्स लिमिटेड – रुद्रपुर
BHARAT HEAVY ELECTRICALS LIMITED RUDRAPUR

| | NAME | SIGN. | DATE |
|---|---|---|---|
| DRN. | S P S | | – |
| CKD. | SURAJ | | – |
| APPD. | ARVIND NARAYAN | | – |

NO. OF VAR.

| DEPTT. | UNTOL.DIM.GR. | SCALE | WEIGHT–KG | REF.TO ASSY.DRG. | IT.NO. | NO.OF ITEM |
|---|---|---|---|---|---|---|
| BDE | C/M/F | – | – | – | – | |

TITLE: ASSY. OF SWGR HOOD

DRAWING NO. 32171911116 REV. 02

SHEET NO.– 01 NO.OF SHEETS– 02 SIZE– A3

## SPECIAL CONDTIONS OF CONTRCAT (SCC)

1. Component of Copper & Its Alloys shall be given by BHEL Rudrapur against material security (Minimum Security shall be Rs.1 Lakh)
2. Bidder has to do electro-tinning as per Corp. Standard AA0673601R08 & AA0673611 Rev 03.
3. Bidder has to lift material from BHEL Rudrapur and after tinning & Inspection same shall be returned to BHEL Rudrapur dully packed.
4. Each component shall be identifiable with drawing, Item/Variant & Project.
5. Sample Drawing Enclosed.
6. PVC Clause: PVC ratio shall be 1:0.5 (One is to Zero Point Five) i.e. for every increase/decrease by 1 % in the rates of TIN, there shall be corresponding increase/decrease by 0.5 % in the contract rates. Base rate for TIN is Rs. 3075/kg as per ET Intelligence circular dated 03.1.2022.
7. Delivery: Delivery within 21 days from receipt of material from BHEL Rudrapur (Job work)
8. Insurance Shall be done by BHEL Rudrapur as the raw material issued are property of BHEL
9. Inspection of Finished Material as per attached QAP: QP/BD/EP-01 Rev 00 Dt. 23.11.2020.
10. Packing Specification: Packing should be as per attached packing instruction no BHEL/PACK/SP/001 Rev01.

## ELECTROPLATING INSTRUCTIONS FOR BUSBARS & CONNECTIONS.

1. **GENERAL: -**
This standard facilitates the selection of Tin / Silver Plating procedure for all connections / bus bar of metal clad switchgear.

2. **APPLICATION: -**
Aluminium/Copper busbars, Connections, Droppers, Link plates, Earth connection and other similar items of metal clad switchgear type VM12, BVM12, VMN12, VN12(Kiosk), VM36.

3. **SELECTION CRITERIA: -**
All, busbars / connections mentioned above shall be electro-tin plated unless otherwise specifically called as silver plating in Drawing / PO / MID / Engg specification of Work Order.

4. **PLATING THICKNESS: -**
Unless otherwise stated in Drawing / PO / MID / Engg specification, Plating thickness shall be minimum 5 microns.

5. **QUALITY CHECKS AND ACCEPTANCE CRIETERIA OF MACHINED COPPER CONTACTS: -**
All the clauses called in SG 16054 shall be complied for machined copper contacts.

4. **ELECTRO PLATING PROCESS SPECIFICATIONS: -**

**Table-1**

| CONN. MATERIAL TO BE PLATED | PLATING | PROCESS SPECIFICATION |
|---|---|---|
| Aluminium | Tin | SG 15605 |
| | Silver | SG 15600 |
| Copper | Tin | AA 0673602 |
| | Silver | AA 0673613 |

5. **ACCEPTANCE CRITRERIA: -**
A. Plating thickness as per drawing/specification.
B. Adhesion test.
C. Anti-Tarnishing Test.
D. Packing and marking as per SG16054

Above test shall be performed as per relevant process specification specified in Table-1.

| REV. | 04 | PRINTS TO:- | | APPROVED – | | |
|---|---|---|---|---|---|---|
| ALTD. | BPC | Issued Online | | RKS | | |
| APD | SKP | | | PREPARED | ISSUED | DATE |
| DATE. | 21.3.14 | | | DB | RKJ | 17.03.00 |

## ELECTROPLATING OF TIN ON ALUMINIUM AND ITS ALLOYS

1. GENERAL: This standard details the process for plating Acid tin on aluminum and its alloys. It covers surface preparation and modified zincate treatment with a copper under-coat on aluminium surfaces normally used in electrical industry.

2. APPLICATION: Used for Bus Bars, Bus Duct Conductors, Bus Duct Flexible, Link plates, packers, Top and Bottom flanges of Switchgear equipments etc.

3. COMPLIANCE WITH NATIONAL STANDARDS: This specification has reference to following Indian standards regarding surface prepration and quality of deposits.

IS 2450 : 1963 Reaffirmed 1998 - Recommended practice for plating on Alluminium and its alloys.

IS 3203 : 1982 Reaffirmed 1998 - Method of testing local thickness of electroplated coatings.

IS 1359 : 1992 - Electroplated coatings of tin in respect of surface conditions and quality of deposit.

4. MATERIALS:

4.1 Trichloroethylene -(Technical) : AA 56706/IS: 245 Type 2

4.2 Chromium Trioxide(Electroplating Grade) : AA 54205/ IS: 330

4.3 Sulphuric Acid -(Technical) : AA 54101/ IS: 266

4.4 Sulphuric acid (c.p. grade) : IS : 266

4.5 Nitric Acid - (Technical) : AA 54102/ IS: 264

4.6 Caustic Soda -(Technical) : AA 54201/IS: 252

4.7 ZInc oxide -(Technical) : IS: 1880

4.8 Rochelle salt(Technical) : IS: 4846
(sodium -potassium Tartarate)

4.9 Ferric chloride -(Technical) : IS: 711
(FeCl3.12H2O)

4.9.0 Hydrofluoric Acid (40% purity)(Tech.A): IS: 10332

4.9.1 Acitek 707 : M/s Artek Surfin Chemicals Bombay

4.10 Coppele 160 (Rochelle Copper salt) : M/s platewel processes & chemicals Ltd, Vadodara

4.11 Rochelle Copper salt : M/s Grauer & weil (I) Ltd, Bombay

4.12 Sodium Cyanide : IS: 6358/ AA 55610

4.13 Copper Anode : IS: 2603
Oval shape preferred.

4.14 Tin anode : IS 2384

4.15 Aludegreaser : M/s Srinivasa Industrial Chemicals, Bangalore

4.15.1 Cleaner S-21 : M/s Platewel Processes & Chemical Ltd, Vadodara

4.16 Deoxidiser : M/s Srinivasa Industrial Chemicals Ltd Bangalore

4.17 Alzincate : -do-

4.18 Stannous Sulphate :(1) M/s Grauer & weil (I) Ltd. Mumbai.
(2) M/s Artek surfin Chemicals (P) Ltd. Mumbai.

4.19 Tin Brite Make up Brightner : M/S Grauer & Weil (I) Ltd, Mumbai

4.19.1 Tin Brite carrier additive: M/s Artek Surfin Chemicals(P) LTD Mumbai

4.20 Tin brite Maintenance Brightner :M/S Grauer and Weil (I) Ltd Mumbai

4.20.1 Teknolume Brightner : M/S Artek surfin chemical(P) Ltd Mumbai

4.21 Sediwell-Sn purifier : M/s Grauer & weil (I) Ltd Mumbai

4.22 Alzincate D - DO -

4.23 Activated carbon powder : M/s Grauer and Weil(P) Ltd Mumbai

OR

M/s C.M.P. Ltd., Mumbai

OR

M/s Sargbhai M Chemical Vadodarg

4.24 Lacquer (Resistance to Acid Alkali, Cyanede and Heat)

4.24.1 Stopping off lacquer : M/s IEL Ltd, Calcutta

OR

M/s Shalimar paints, Mumbai

4.24.2 Grey Marsing compound : M/s Phiroz Sethna, Mumbai

4.25 Ammonium Biflourede : IS : 13119

4.26 Alluminium wire : SG 10708

5. EQUIPMENT

5.1 Vapour Degreasing plant : Any standard plant for the purpose.

5.2 Alkaline Degreasing Tank : Mild steel Tank fitted with steam coils or Electrical Heater for heating the tank solution.

5.3 Acid cleaning Tank

5.3.1 Chromic-sulphuric Acid : Lead & PVC / FRP lined mild steel Tank fitted with heating arrangements.

5.3.2 Nitric-Hydrofluoric Acid Solution : PVC/PVC lined mild steel tank.

5.3.3 Nitric Acid solution : PVC / FRP/ Rubber lined mild steel Tank

5.3.4 Sulphuric acid dip solution : PVC/FRP/Lead,lined/mildsteel tank or PVC/poly propylene tank

5.3.5 For Deoxidiser solutions : PVC/FRP/rubber lined Mild Steel tank

5.4 Zincate Treatment Solution : Mild steel tank

5.5 Rinsing Tanks

5.5.1 For Rinsing After Alkali Degreasing/Electroplating : Mild steel tank

5.5.2 For Rinsing After Acid cleaning : PVC/PVC lined mild steel tank

5.6 Copper plating Tank : PVC or Rubber lined mild steel tank or plain mild steel tank

5.7 Tin plating tank : Mild steel tank lined with rubber/ PVC/FRP, fitted with insulators for holding the anode and cathode rods and cathode rod movement system.

5.8 Swilling tanks : PVC/Rubber/FRP/lined mild steel tanks

5.9 Hot water Rinsing tank : PVC/FRP lined mild steel Tank fitted with Heating arrangement

5.10 Portable filter pump : Standard filteration unit suitable for filteration plating solution

## 6. COMPOSITION/PREPARATION OF SOLUTIONS & OPERATING CONDITIONS

### 6.1 Alkaline Degreasing solution

Cleaner S-21 (clause 4.15.1) : 35 to 50 grams/litre

Water : To make up the volume

Temperature °C : 90 to 100

Immersion time in minutes : 5 to 10 OR as required

OR

Alu-degreaser : 200 to 250
(Clause. 4.15) ml/litre

Water : To make up the volume

Temperature deg C : 50-60 deg. C

Immersion time : 1 to 3 minutes OR as required

6.1.1 The tank shall be filled with clean cold water to about 2/3rd of its capacity and then the necessary quantities of S-21 clearer OR Aludegreaser shall be added to the bath with stirring. When the chemicals are dissolved and properly mixed, the solution shall be brought to the operating level by adding more water, and heated to the operating temperature.

6.2 Chromic-Sulphuric Acid pickling solution

Chromic Acid (Clause.4.2) gm/litre - 20 to 30

Sulphuric Acid (Clause.4.3) gm/litre - 140 to 150

Water To make up the volume

Temperature deg. C 60 to 70

Immersion time in minute 2 to 3 OR as required

6.2.1 The tank shall be filled with clean cold water to about 2/3rd of its capacity and then the necessary quantity of sulphuric acid shall be poured into the bath with constant stirring. When the acid is mixed then the chromic acid shall be added to the bath and properly mix, the the solution shall be brought to the operating level by adding more water, and then shall be heated to the operating temperature.

6.3 Nitric - Hydroflouric Acid pickling solution

| | |
|---|---|
| Nitric Acid (Clause. 4.5) | 750 ml |
| Hydroflouric Acid (Clause. 4.9) | 250 ml |
| Temperature | Shop temperature |
| Immersion time in minutes | 2 to 5 OR as required |
| OR | |
| Nitric acid (clause 4.5) ml/litre | 700 |
| Acitek 707 (clause 4.9.1) gram/litre | 60 to 120 |
| Temperature deg C | Shop temperature |
| Time in minutes | 2 to 3 OR as required |
| OR | |
| Nitric acid (clause 4.5)ml/litre | 700 to 750 |
| Ammonium Biflouride grams/litre (clause 4.25) | 100 to 120 |
| Temperature deg C | Shop temperature |
| Time in seconds | 10 to 20 OR as required |

6.3.1 The tank, shall be first filled with the required quantity of concentrated nitric acid and then the necessary quantity of hydrofluoric acid OR Acitek 707 (clause. 4.9.1) OR Ammonium Biflouride (clause. 4.25) shall be mixed in it with constant stirring.

6.4 De-oxidizing Solution (Solution A OR B may be used)

Solution – A

| | |
|---|---|
| Nitric Acid (Clause. 4.5) ml/litre | 500 to 750 |
| Water | To make up the volume |
| Temperature deg C | Shop temperature |
| Immersion Time in seconds | 15 to 30 OR as required |

Solution - B

Deoxidiser (Clause. 4.16) 2 parts

Water 1 part

Temperature deg C Shop temperature.

Time of immersion in seconds 30 to 60 OR as required

6.4.1 The tank shall be filled with clean cold water to about 1/3rd of its capacity. Then the necessary quantity of nitric acid or Deoxidiser as required shall be added to the tank with stirring and the solution shall be brought to the operating level by adding more water.

Note: Two Nos. of solution - A Bath or B Bath shall be prepared.

6.5 Zincate solution

6.5.1 composition and operating conditions
any one of three composition and operating condition as detailed below shall be used

| | Composition I | Composition II | Composition III |
|---|---|---|---|
| Caustic soda 300 to 500 (Clause.4.6) grams/litre | - | - | |
| Zinc oxide 100 grams/litre (Clause.4.7) | - | - | |
| Rochelle salt 10 grams/litre (Clause.4.8) | - | - | |
| Ferric chloride 1 gram/litre (Clause.4.9) | - | - | |
| | - | Alzincate (M/s Srinivasa) as supplied | Alzincate D (M/s Grauer & weil) as supplied |
| Water | To make up the volume | - | - |
| Temperature | Shop temperature. | Shop temperature | Shop temperature |
| Immersion time | 1 to 3 . minutes or as required | 15 to 60 seconds OR as required | 15 to 60 seconds OR as required |

6.5.2 For Composition I

The tank shall be filled with about 1/4th of its working capacity with clean water and then required quantity of Zinc oxide added with stirring so as to make a slurry of it.

Now tank again filled with clean water to 1/4th of its working capacity and required quantity of Sodium Hydroxide gradully added with stirring. Stir till Sodium Hydroxide is dissolved completely.

For quick dissolution of Chemicals Rochelle salt (Sodium-potassium tartarate) and Ferric Chloride in the required quantity shall be separately dissolved in water and then added in main bath.

The contents shall be thoroughly mixed and brought to operating level by adding more water.

For Composition II & III

The bath shall be brought to the operating level by Alzincate itself. No dilution is required.

6.5.3. In case, any air pockets/ blister is observed after plating then the zincate solution should be sent to the laboratory for chemical analysis and necessary replenishment shall be made on the basis of the test result.

6.6 Copper plating solution

6.6.1 Composition & Operating conditions

The electrolyte shall be made according to any one of the following composition

| | Composition-I (M/s G & W) | Composition-II (M/s Platewel) |
|---|---|---|
| Coppele 160 salt (gram/litre (Clause 4.10) | - | 150 |
| Rochelle Copper salt(gram/litre (clause. 4.11) | 150 | - |
| Water | To make up the volume | |
| Temperature | Shop Temperature. | Shop Temperature. |
| Current density A/sq.ft. | 1.0 to 20 | 1.0 to 20 |
| A/sq.dm. | 0.1 to 2 | 0.1 to 2 |
| Voltage V | 3 to 4.5 | 3 to 4 |
| Time | as per thickness requirement | |

6.6.2 Preparation of Electrolyte

6.2.1 The tank shall be half filled with demineralised water and heated to make it warm.

6.6.2.2 The calculated amount of copper salt as per the composition in clause 6.6 shall then be gradually added to the water with stirring.

6.6.2.3 The electrolyte shall be brought upto the desired level by adding more water and subsequently stirred thoroughly.

6.7 Sulphuric acid Dip Solution

6.7.1 Composition and operating condition

Suphuric acid (Clause.4.4) : 40 to 50 ml/litre

Water (dimenirelesed) : To make up the volume

Operating Temperature deg C : Shop temperature

Time in minutes : 1 to 2 minutes OR as required

6.8 Acid tin plating solution

6.8.1 Composition of Electrolyte and Operating Conditions

| | For Vat | For Barrel |
|---|---|---|
| Stannous Sulphate grams/litre (Grauer and weil) (Cl.4.18) | 40-60 | 25-35 |
| Stannous Sulphate grams/litre (Artek Surfin) (Cl.4.18) | 24-35 | 24-35 |
| Suphhuric Acid, ml/litre (Cl.4.4) | 80-100 | 95-110 |
| Tinbrite make-up brightner, ml/litre (Cl.4.19) | 30-40 | 30-40 |
| Teknolume Carrier Additive ml/litre (Cl.4.19.1) | 20-40 | 20-40 |
| Tinbrite maintenance (Cl.4.20) brightner, ml/l | 3-4 | 4-6 |
| Teknolume Brightner, ml/l (Cl.4.20.1) | 2-6 | 2-6 |
| Operating Temperature, deg C | 20-35 | 20-35 |
| Current Density, A/dm sq | 1-25 | 1-1.5 |
| Voltage, V | 1-3 | 4-6 |
| Agitation (Optional) | Cathode Rod movement | |
| filtration | Occasional | Occasional |
| Anode to Cathode ratio | 2:1 | - |

6.8.2 Preparation of Electrolyte

The vat/barrel shall be filled with with demineralised water) to about two-thirds of its working level.

The required quantity of sulphuric acid shall be added slowly to the bath with stirring.

The requisite amount of stannous sulphate shall then be added to this solution with stirring.

After complete dissolution, the electrolyte shall be brought upto the working level by adding demineralised water) and subsequemtly stirred thoroughly.
The required quantity of Make up Brightner and Maintenance brightner shall be added with thorough stirring.

7.0 Maintenances of bath solution / brightner

7.1 The solutions shall be analysed after initial makeup and subsequently at suitable intervals. The concentration of bath solution shall be maintained as given below.

7.2 Alkaline degreasing solution (clause. 6.1)
Cleaner S-21 Pointage 40 to 60
Aluo-degreaser Pointage 30 to 50

7.3 Chromic sulphuric Acid pickling (clause. 6.2)
Chromic acid 20 to 30 gms/litre.
Sulphuric Acid 135 to 150 ml/litre.

7.4 Deoxidizing solution (clause. 6.4)

Solution A
Strength (Nitric acid content) / grams/litre. 260 to 390
copper content – nil

Solution B
Pointage 20 to 30, Copper content - Nil

7.5 Zincate solution (clause. 6.5)
Caustic content 300 to 500 grams/litre

| 7.6 Copper plating solution (clause. 6.6) | Composition-I | Composition-II |
|---|---|---|
| Copper metal grams/litre | 15 to 17 | 18 to 20 |
| Free sodium cyanide grams/ litre | 5 to 7 | 6 to 8 |
| Rochelle salt grams/litre | 30 to 50 | 40 to 50 |

| 7.7 Tin plating solution cl.6.8 | For Vat | For Berrel |
|---|---|---|
| Tin Metal content grams/litre | 15-25 | 12-18 |
| Supphuric acid content ml/litre | 70-100 | 80-120 |

7.7.1 Replenishment :-

7.7.2 If the working concentration do not lie in the limits as mentioned in 7.7, addition of stannous sulphate and sulphuric acid shall be made to raise the concentration of metal and acid respectively as per the deficiency of the bath.

7.7.3 In normal cases the addition of brightners shall be as follows for both vat and barrel. ml / KAH

Teknolume Carrier Additive : 100 to 150
or
Tinbright Make-up Brightner, ml/KAH : 100 to 200

Tinbright Maintenance Brightner, ml/KAH : 200 to 400
or
Teknolume Brightner : 200 to 300

8.0 Purification :-

8.1 Removal of Metallic Impurities

When objectionable amounts of metallic impurities are to be removed, electrolytic purification by using corrugated dummy cathode shall be employed at a low current density (0.3 Amp / dm sq)

8.2 Removal of Organic Impurities

When the electrolyte is not severely contaminated with the organic impurities, the solution shall be filtered by introducing a small amount of activated carbon powder packed within the filter. For severely contaminated organic impurities, the electrolyte shall be treated with activated carbon powder at the rate of 2-3 g/l and Sediwell-Sn purifier at the rate of 1-2 ml/l. After vigorous agitation, the mixture shall be allowed to settle for a few hours, preferably overnight, in a separate tank. Finally, the electrolyte shall be filtered into the plating tank. Sediwell-Sn purifier treatment, will also remove the stannic oxide produced during the process and also in idle hours of the electrolyte.

8.3 During carbon treatment brightners are partially removed. therfore, brightners shall be added after carbon treatment as under :-

Teknolume Carrier Additive ml/1
or 10 - 15
Tinbright Make-up Brightner, ml/1

Tinbright Maintenance Brightner, ml/1
or 1 - 2
Teknolume Brightner ml/1

9.PROCESS:

9.1 Solvent Degreasing

Excess of oil / grease / cutting Lubricants shall be removed by means of suitable solvent such as trichlor-oethylene and dried in air subsequently. Preferably vapour degreasing process shall be followed.

9.2 Alkaline Degreasing

Parts shall be immersed in the degreasing solution as mentioned in clause 6.1.

9.3Rinsing

After Alkaline degreasing, the parts shall be rinsed in clean cold running water. The surface of the article at this stage shall provide a continuous water film over it. A break in water film indicates that the surface is not clean, in which case the Alkaline degreasing (clause. 6.1) shall be repeated.

9.4 Acid Cleaning /Pickling

9.4.1 Chromic-sulphuric acid Pickling

After rinsing the parts shall be dip in the chromic-sulphuric acid pickling solution (clause 6.2) to remove the oxide film and micro-constituents present on the metal surface.

9.4.2 Rinsing

9.4.3 Nitric-Hydrofluoric acid Pickling (optional)

In case of high silicon content, the article shall be pickled in the nitric-hydrofluoric acid pickling solution. as maintained in clause 6.3 under proper hood.

9.4.4 Rinsing

9.4.5 De-oxidizing

After pickling as mentioned either in clause 6.2 or 6.3 depending on the requirement, the parts shall be first rinsed in clean cold running water and then immersed indeoxidizing solution No.1, A or B as mentioned in clause 6.4, to remove any residual smut left on the surface.

9.5 Rinsing

After de-oxidizing the parts shall be rinsed in clean cold running water. Double rinsing is preferred.

9.6 First Zincate Treatment

After rinsing the parts shall be immersed in zincate solution (clause.6.5). The articles shall be gently stirred during the treatment.

NOTE :- For high silicon content cast alloys, the treatment time shall be reduced to 5 to 10 seconds only.

9.6.1 Rinsing

After the first Zincate treatment. The parts shall be rinsed in clean running water, double rinse is required.

9.6.2 Deoxidizing Solution No 2 (Zincate removal)

After rinsing the parts shall be dipped in Deoxidising solution No 2 as mentioned in Clause. 6.4 to remove loose zincate layer.

9.6.3 Rinsing

After deoxidising solution dip the parts shall be rinsed in clean cold running water. Double water rinse is required.

9.6.4 Second Zincate treatment

After rinsing, the parts shall be immediately dipped in the zincate solution as mentioned in clause 6.5.

9.6.5 Rinsing

After second zincate treatment, the article shall be rinsed in clean running water. Two successive rinses shall be given to remove the last traces of viscous zincate solution. A dip in running water followed by a spray is more effective.

10.0 Copper plating / strike

After water rinsing, a copper strike shall be given on the articles from copper plating bath (clause 6.6.1)

11.0 Rinsing

After copper plating all articles shall be thoroughly cleaned in running water.

12.0 Acid dipping

Before dipping in the plating bath all articles shall be dipped in 4 to 5% sulphuric acid (CL.6.7) solution followed by a dip in deionlsed water.

13.0 Plating

All articles shall be tin plated (as mentioned in cl.6.8) at specified current density for a duration which will depend on the thickness of the deposit required.

14.0 Cold rinsing

After removal from the tin plating bath all articles shall be rinsed thoroughly in cold running water till all traces of plating solution are removed.

15.0 Hot Rinsing

After cold ringsing, all articles shall be rinsed in hot water at 60-70 deg C.

16.0 Drying

Finally, all articles shall be dried in centrifugaal drier or by hot air.

17.0 Precautions

17.1 The electrolyte shall be kept covered when not in use to keep the bath free from dust and foreign matter.

17.2 The tin anode shall be kept immersed in the electrolyte during idle hours to minimise oxidation of in to stannic oxide, which is objectionable.

17.3 Any article that becomes lodged in any part of barrel/vat shall be removed immediately.

17.4 Ensure that the bath is 'alive' before loading the job into the plating vat.

17.5 Any metal that may be deposited on any part of the vat/barrel shall be removed.

17.6 Proper pre-trreatments are essential for getting a plating. Therefore, process parameters, whatever specified should be strictly followed.

17.7 In the plating of aluminium, racks OR wire should be made from pure aluminium of from the alloy similar to that being plated. The contact should be strong and sound.

17.8 Electrical contacts should invariably be established before putting the work in the electrolytes, so that immersion deposits formed by substitution process may not affect the adhesion of the subsequent electro-deposits.

17.9 A separate dilute nitric acid solution (Deoxidizing solution) should be used for cleaning treatment as followed in clause 9.6.2 after first zincate treatment.

17.10 If blisters are observed after Tin plating, then pretreatment cycles are to be checked and at the same time copper plating / strike bath is to be tested.

17.11 Any chemical which may be necessary for addition, shall then be added in the bath through a filter / Perforated Bucket.

17.12 Any metal that may be deposited on any part of the bath, shall be removed immediately.

18.0 Inspection and Quality of deposit

When tested in accordance with the test methods shown against each, the deposit shall conform to the norms specified. below :-

18.1 Sampling

A minimum of 1% of each batch of vat / Barrel, load OR part thereof shall be taken at random for testing with a minimum of 2 samples when the plated articles are big and can not be subjected to any of the specified test, a test panel of suitable size of the same basis metal shall be plated along with component under identical condition for the purpose of testing.

18.2 Condition of surface

The coating shall be uniformly bright free from black patches stains, pinholes, sponginess, blisters, uncovered areas and other Superficial blisters visible to unaided eyes.

18.3 Thickness of deposit (I.S. 3203)

The minimum thickness shall be as specified in purchase order OR drawing.

18.4 Adhesion (I.S. 1359)

Flaking and blestering of the coating is not acceptable.

18.5 Solderability (IS:1359)

The actual soldering on the component may be done on shop flooe and observations be made.The sample shall be considered solderable if they show a uniform coating free from discontinuities or breaks visible to the unaided eye.

18.16 Rejection

If the samples taken do not comply with clauses 18.2 to 18.4 a further quantity not less than twice the number originally taken shall be subjected to these tests. If any one of these samples also fails, the whole batch shall be rejected.

19.0 Safety measures are to be followed as detailed in AA0462801 (Safety precautions for Electroplating shops and Handling of Chemicals).