



PRODUCT STANDARD

SWITCHGEAR ENGINEERING DIVISION

SG14610 Rev 04

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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 CRITERIA 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 CRITERIA: -**

- 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.

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AA 067 36 02

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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

Revisions :

Ref. CL31.11.5 of MOM of MRC (C)

APPROVED :

INTERPLANT MATERIAL RATIONALISATION
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**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 :

	<u>SATIN TIN SALT-721</u>	<u>SATIN TIN SALT</u>
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 2/3rd capacity and then heated to nearly 50⁰C.

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.



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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	For vat plating	:	8 - 16 g/litre
Soda (NaOH)	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°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°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 $260 \pm 10^\circ\text{C}$ 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 $200 \pm 10^\circ\text{C}$, 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 $140 \pm 10^\circ\text{C}$ 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 $185 \pm 5^\circ\text{C}$ 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°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.



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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/l 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 (CI 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 (CI 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 or 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



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ELECTROPLATING OF TIN ON ALUMINIUM AND ITS ALLOYS

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

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

IS 3203 : 1982 - Method of testing local thickness of
Reaffirmed 1998 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 : AA 54205/
Grade) 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

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			4.6	Caustic Soda -(Technical)	: AA 54201/IS: 252
			4.7	Zinc oxide -(Technical)	: IS: 1880
			4.8	Rochelle salt(Technical) (sodium -potassium Tartarate)	: IS: 4846
			4.9	Ferric chloride -(Technical) (FeCl3.12H2O)	: IS: 711
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.			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 Oval shape preferred.	: IS: 2603
			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 Mumb
			4.20	Tin brite Maintenance Brightner	:M/S Grauer and Weil (I) Ltd Mun
			4.20.1	Teknolume Brightner	: M/S Artek surfin chemical(P) Ltd Mumb



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- 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.

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.			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 5.3.4 Sulphuric acid dip solution : PVC/FRP/Lead,lined/mildsteel tank 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 Heating arrangement	



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5.10 Portable filter pump : Standard filtration unit suitable for filtration 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.



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6.3 Nitric - Hydrofluoric Acid pickling solution

Nitric Acid (Clause. 4.5) 750 ml

Hydrofluoric Acid 250 ml
(Clause. 4.9)

Temperature Shop temperature

Immersion time in minutes 2 to 5 OR as required
OR

Nitric acid (clause 4.5) ml/litre 700

Acitek 707 60 to 120
(clause 4.9.1) gram/litre

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 Bifluoride grams/litre 100 to 120
(clause 4.25)

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 Bifluoride (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



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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 Alzincate D
(M/s Srinivasa) (M/s Grauer
as supplied & weil
as supplied

Water To make up - -
the volume

Temperature Shop Shop Shop
temperature. temperature temperature

Immersion 1 to 3 . 15 to 60 seconds 15 to 60
time minutes OR seconds
or as required as required OR as required



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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 gradually 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 conditions

	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. A/sq.dm.	1.0 to 20 0.1 to 2	1.0 to 20 0.1 to 2
Voltage V	3 to 4.5	3 to 4
Time	as per thickness requirement	



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6.6.2 Preparation of Electrolyte

6.2.1 The tank shall be half filled with demineralised water and heated to 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

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

Water (demineralised) : 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
Sulphuric 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	-



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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 subsequently 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 Composition-I Composition-II
(clause. 6.6)

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



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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. therefore, brightners shall be added after carbon treatment as under :-

Teknolume Carrier Additive ml/l

or 10 - 15

Tinbright Make-up Brightner, ml/l

Tinbright Maintenance Brightner, ml/l

or 1 - 2

Teknolume Brightner ml/l



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9.PROCESS:

9.1 Solvent Degreasing

Excess of oil / grease / cutting Lubricants shall be removed by means of suitable solvent such as trichloroethylene 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.

9.3 Rinsing

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 in deoxidizing 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.



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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 deionised water.



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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 rinsing, all articles shall be rinsed in hot water at 60-70 de

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-treatments 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 or 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.



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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 blestoring of the coating is not acceptable.

18.5 Solderability (IS:1359)

The actual soldering on the component may be done on shop floor 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).