

			PRODUCT STANDARD SWITCHGEAR ENGINEERING DIVISION		SG 15600 REV.04			
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		<u>ELECTROPLATING OF SILVER ON ALUMINIUM AND ITS ALLOYS</u>						
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.		1. <u>GENERAL:</u> This standard details the process for plating silver on aluminum and its alloys. It covers surface preparation and modified zincate treatment required prior to electroplating silver with a copper under-coat on aluminium surfaces both in the wrought and cast forms normally used in electrical industry.						
		2. <u>APPLICATION:</u> Used for Bus Bars, Bus Duct Conductors, Bus Duct Flexible, Link plates, packers, Top and Bottom flanges of Switchgear equipments etc.						
		3. <u>COMPLIANCE:</u> This specification has reference to following WITH NATIONAL STANDARDS Indian standards regarding surface preparation and quality of deposits.						
		IS 2450 : 1963 - Recommended practice for plating on Reaffirmed 1992 Alluminium and its alloys.						
		IS 3203 : 1982 - Method of testing local thickness of Reaffirmed 1992 electroplated coatings.						
		IS 1771 : 1986 - Electroplated coatings of Silver and Reaffirmed 1991 Silver Alloys for general engineering purposes.						
		IS 6012 : 1992 - Method of coating thickness by eddy current.						
		4. <u>MATERIALS:</u>						
		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 Nitric Acid - (Technical) : AA 54102/ IS: 264								
		REV.	04	PRINTS TO :-		APPROVED –		
		ALTD.	AD	SWM(P)		RKS		
		APPD.	NB	QCX				
		DATE.	07.12.15			PREPARED	ISSUED	DATE
						MAS	RKJ	7.1.95

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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.		4.5 Caustic Soda -(Technical) : AA 54201/IS: 252		
		4.6 Zinc oxide -(Technical) : IS: 1880		
		4.7 Rochelle salt(Technical) : IS: 4846 (sodium -potassium Tartarate)		
		4.8 Ferric chloride -(Technical) : IS: 711 (FeCl3.12H2O)		
		4.9 Hydrofluoric Acid (40% purity)(Tech.A): IS: 10332		
		4.9.1 Acitek 707 : M/s Artek Surfin Chemicals Bombay		
		4.10 Coppele 160 (Rochelle : M/s platewel processes & Copper salt) 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 (99.9% pure) - : IS: 2603 Oval shape preferred.		
		4.14 Aludegreaser : M/s Srinivasa Industrial Chemicals, Bangalore		
		4.14.1 Cleaner S-21 : M/s Platewel Processes & Chemical Ltd, Vadodara		
		4.15 Deoxidiser : M/s Srinivasa Industrial Chemicals Ltd Bangalore		
		4.16 Alzincate : -do-		
		4.17 Silvernix' Bright silver salt : M/s Grauer & weil (I) Ltd. Bombay.		
		4.17.1 Argomax Bright Silver Salt : M/S Artek surfin Chemicals Ltd Bombay		
		4.18 Silver potassium cyanide (54% Silver) : I.S.6267:90		
		4.19 Argomax Strike Silver Salt : M/s Artek Surfin Chemicals LTD Bombay		
	4.19.1 Strike Silver Salt : M/S Grauer and Weil (I) Ltd Bombay			
	4.19.2 Strik Sil 610 Salt : M/S Platewel processes and Chemical Ltd Vadodara			

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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.	4.20 Silvernix' Make-up Brightener	: M/s Grauer & weil (I) Ltd Bombay
			4.21 Silvernix' standard Brightener	: M/s Grauer & weil (I) Ltd Bombay
			4.22 Silchrome	: M/s Grauer & weil (I) Ltd Bombay
			4.23 Alzincate D	: -do-
			4.24 Potassium Cyanide	: IS: 6358/AA 55609
			4.25 Silver Anode	: IS: 1959
			4.26 Stainless Steel Anode	: IS:6911, Gr.07 Cr18, Ni9
			4.27 Stopping off Lacquer (Resistant to acid, alkali, cyanide and heat)	: M/s Shalimar paints, Bombay OR I.E.L. Ltd, Calcutta
			4.27.1 Grey Masking compound	: M/s Phiroz Sethna Bombay
			4.28 Activated carbon powder	: M/s Grauer & weil (I) Ltd. Bombay or M/s C.M.P. Ltd Bombay or M/s Sharabhai M. Chemicals, Baroda.
			4.29 Ammonium Biflourede	: IS : 13119
			<u>5. EQUIPMENT</u>	
			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	For chromic-sulphuric Acid Soln	: Lead & PVC / FRP lined mild steel Tank fitted with heating arrangements.
		5.3.2	For Nitric-Hydrofluoric Acid Solution	: PVC/PVC lined mild steel tank.
		5.3.3	For Nitric Acid solution	: PVC / FRP Rubber lined mild steel Tank
		5.3.4	For Deoxidiser solutions	: -do-
		5.4	Zincate Treatment Tank	: 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	Potassium Cyanide dip tank	: Mild steel tank
		5.8	Silver strike tank	: FRP / PVC / Rubber lined mild steel tank
		5.9	Silver plating tank	: FRP / PVC / Rubber lined mild steel tank
		5.10	Swilling tanks	: PVC / Rubber lined mild steel tanks
		5.11	Anti-tarnishing treatment Tank	: PVC/Rubber lined mild steel Tank
		5.12	Portable filter pump	: Any suitable filtration pump.

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		6. COMPOSITION/PREPARATION OF SOLUTIONS & OPERATING CONDITIONS		
		6.1 Alkaline Degreasing solution		
		Cleaner S-21 (clause 4.14.1) : 35 to 50 grams/litre		
		Water : To make up the volume		
		Temperature : 90 to 102 deg. C		
		Immersion time : 5 to 10 minutes OR as required		
		OR		
		Alu-degreaser : 200 to 250 ml/litre (Clause. 4.14)		
		Water :		
		Temperature : 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) - 20 to 30 gm/litre		
		Sulphuric Acid (Clause.4.3) - 140 to 150 gm/litre		
		Water - To make up the volume		
		Temperature deg. C - 60-70		
		Immersion time - 2 to 3 minutes 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 after proper mixing, 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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		<u>6.3 Nitric - Hydroflouric Acid pickling solution</u>		
		Nitric Acid (Clause. 4.4) - 750 ml/litre		
		Hydroflouric Acid (Clause. 4.9) - 250 ml/litre		
		Temperature - Shop temperature		
		Immersion time - 2 to 5 minutes OR as required		
		OR		
		Nitric acid (clause 4.4) - 700 ml/litre		
		Acitek 707 (clause 4.9.1) - 60 to 120 gram/litre		
		Temperature - Shop temperature		
		Time - 2 to 3 minutes OR as required		
		OR		
		Nitric acid (clause 4.4) - 700 to 750 ml/litre		
		Ammonium Biflouride (clause 4.32) - 100 to 120 grams/litre		
		Temperature - Shop temperature		
		Time - 10 to 20 Seconds OR as required		
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		6.4		De-oxidizing Solution (Solution A OR B may be used)
		Solution - A		
		Nitric Acid (Clause. 4.4) 500 to 750 ml/litre		
		Water - To make up the volume		
		Temperature - Shop temperature		
		Immersion Time - 15 to 30 seconds OR as required		

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		<u>Solution - B</u>					
		Deoxidiser (Clause. 4.15) - 2 parts					
		Water - 1 part					
		Temperature - Shop temperature.					
		Time of immersion - 30 to 60 secs OR as required					
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		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.4.5) grams/litre - -					
		Zinc oxide 100 grams/litre (Clause.4.6) - -					
		Rochelle salt 10 grams/litre (Clause.4.7) - -					
		Ferric chloride 1 gram/litre (Clause.4.8) - -					
		- 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 . 15 to 60 seconds OR as required 15 to 60 seconds OR as required					

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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.		<u>6.5.2 For Composition I</u>																											
		The tank shall be filled with about 1/4th of its work- ing 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. <u>For Composition II & III</u> 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 plat- ing then the zincate solution should be sent to the labo- ratory 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 <table><thead><tr><th></th><th>Composition-I (M/s G & W)</th><th>Composition-II (M/s Platewel)</th></tr></thead><tbody><tr><td>Coppele 160 salt (g/l) (Clause 4.10)</td><td>-</td><td>150</td></tr><tr><td>Rochelle Copper salt (g/l) (clause. 4.11)</td><td>150</td><td>-</td></tr><tr><td>Water</td><td colspan="2">To make up the volume</td></tr><tr><td>Temperature</td><td>Shop Temperature.</td><td>Shop Temperature.</td></tr><tr><td>Current density A/sq.ft. A/sq.dm.</td><td>1.0 to 20 0.1 to 2</td><td>1.0 to 20 0.1 to 2</td></tr><tr><td>Voltage V</td><td>3 to 4.5</td><td>3 to 4</td></tr><tr><td>Time</td><td colspan="2">as per thickness requirement</td></tr></tbody></table>					Composition-I (M/s G & W)	Composition-II (M/s Platewel)	Coppele 160 salt (g/l) (Clause 4.10)	-	150	Rochelle Copper salt (g/l) (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	
			Composition-I (M/s G & W)	Composition-II (M/s Platewel)																									
		Coppele 160 salt (g/l) (Clause 4.10)	-	150																									
		Rochelle Copper salt (g/l) (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				
		6.6.2.1 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.				
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.		6.7 Potassium Cyanide Dip Solution				
		6.7.1 <u>Composition and operating condition</u>				
		Potassium cyanide (Clause.4.24) : 40 to 50 gms/litre				
		Water (distilled) : To make up the volume				
		Operating Temperature : Shop temperature				
		Time : 1 to 2 minutes OR as required				
		6.8 <u>Silver strike solution</u>				
		6.8.1 Composition and Operating Conditions				
		Any one of the three composition and operating conditions as detailed below, shall be used.				
		Composition-I Composition-II Composition-III (M/s G & W) (M/s Platewel) (M/s Artek Surferin)				
		'Strike' silver-salt (grams/litre) (Clause.4.19.1)	75	-	-	
		'Striksil-610 Salt' (Clause.4.19.2) (grams/litre)	-	50	-	
		Argomax Strike silver Salt (clause.4.19)	-	-	100	
		Water	To make up the volume			
		Operating Temperature	Shop temperature	Shop. temperature	Shop temperature	
		Current Density Ampere/dm2	0.1 to 0.2	0.1 to 0.2	0.1 to 0.2	
		Voltage(volt)	0.75 to 1.5	2 to 4	0.5 to 1.0	
		Treatment time(seconds)	30 to 45 OR as required	30 to 45 OR as required	30 to 60 OR as required	

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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.	Composition-I Composition-II Composition-III (M/s G & W) (M/s Platewel) (M/s Artek Surferin) Anode Silver/Stain- Silver/Stainless Silver/ less Steel Steel Stainless Steel				
	6.8.2 Preparation of strike solution				
	6.8.2.1 The tank shall be half filled with D.M. water. The required amount of salt shall be added with stirring.				
	6.8.2.2 After complete dissolution, the solution shall be brought upto the working level by adding water.				
	6.8.2.3 Analysis of Electrolyte				
	The Silver metal content after initial make up, analysed and shall be minimum				
	2 grams/Litre for composition II (clause 6.8.1)				
	3 grams/Litre for composition I and III (clause 6.8.1)				
	6.9 Silver plating solution				
	6.9.1 composition and operating conditions				
Any one of the two composition and operating conditions as detailed below, shall be used.					
Composition-I Composition-II (M/S G & W) (M/S Artek surfin)					
'Silvernix' Bright silver Salt (gms/litre(Clause.4.17)) 200 -					
Argomax Bright Silver Salt (clause 4.17.1) - 200					
Silvernix Makeup Brightner (ml/L) (clause. 4.20) 30 30					
Water - To make up the volume -					
Operating Temperature : Shop temperature Shop temperature					
Anode Silver Silver					
Anode/Cathode Ratio 1:1 1:1					
Current Density :					
Ampere/sq.dm 0.5 to 0.8 0.5 to 0.8					
Voltage (volt) 1 to 1.5 1 to 1.5					

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		Composition-I Composition-II (M/S G & W) (M/S Artek surfín)			
		pH of solution 12.0 to 12.5 12.2 to 12.5			
		Agitation(Optional) - Cathode Rod Movement -			
		Time - as per thickness requirement -			
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		6.9.2.1 The tank shall be filled with luke warm demineralised water to 1/3 to 1/2 of the required volume and calculated amount of salt as per clause 6.9.1 shall be added with stirring.			
		6.9.2.2 After complete dissolution Activated carbon powder (clause 4.28) shall be added at the rate of 2 to 3 grams per litre of electrolyte and stirred for 3 to 4 hours. The solution is allowed to settle over night. Filter the solution.			
		6.9.2.3 After filtration the calculated amount of Make up Brighter (as per clause 4.20) shall be added, solution stirred thoroughly and made up to working volume by demineralised water.			
		<u>6.9.3.0 Analysis of Electrolyte</u>			
		6.9.3.1 The electrdyte, as prepared above shall be analysed after initial make up and subsequently at suitable intervals. The silver Metal content after initial make up shall be Minimum 30 grams / litre.			
		<u>6.10 Anti-tarnishing solution</u>			
		<u>6.10.1 Composition and operating condition:</u>			
		Silchrome (clause.4.22) - 200 to 250 ml/litre			
		Water - To make up the volume -			
		Operating Temperature Shop temperature.			
		Current Density			
		Ampere/ sq.dm - 1 to 4.5			
		Voltage (volt) - 3 to 7			
		pH of solution - 8 to 9			
		Treatment Time(minutes) - 2 to 5			
		Anode - Stainless steel			
		Anode-Cathode ratio - 1:1			
		<u>6.10.2 Preparation of Anti-tarnishing solution</u>			
		6.10.2.1 The tank shall be half filled with water.			

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		6.10.2.2 The required amount of salts as given in clause 6.10.1 shall then be added simultaneously with stirring.			
		6.10.2.3 After complete dissolution, the solution shall be brought upto the working level by adding water and subsequently stirred thoroughly.			
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		7.0 The solutions shall be analysed after initial makeup and subsequently at suitable intervals. The concentration of bath solutions shall be maintained as given below.			
		7.1 Alkaline degreasing solution (clause. 6.1) <u>Cleaner S-21</u> Pointage 40 to 60 <u>Aluo-degreaser</u> Pointage 30 to 50			
		7.2 <u>Chromic sulphuric Acid pickling (clause. 6.2)</u> Chromic acid 20 to 30 gms/Litre. Sulphuric Acid 135 to 150 ml./Litre.			
		7.3 <u>Deoxidizing solution (clause.6.4)</u> <u>Solution A</u> Strength (Nitric acid content) /grams/litre. 260 to 390 copper content - Nil <u>Solution B</u> Pointage 20 to 30 Copper content - Nil			
		7.4 <u>Zincate solution (clause. 6.5)</u> caustic content 300 to 525 grams/litre			
		7.5 <u>Copper plating solution Composition-I Composition-II (clause.6.6)</u> Copper metal grams/litre 15 to 17 18 to 20 Free sodium cyanide grams/ 5 to 7 6 to 8 litre Rochelle salt grams/llitre 30 to 50 40 to 50			
		7.6 <u>Potassium cyanide dip solution (clause.6.7)</u> Potassium cyanide content grams/litre. 40 to 50			
		7.7 <u>Silver strike solution (clause.6.8)</u> Silver as metal grams/litre 3 to 4 Free potassium cyanide grams/litre 90 to 130			

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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.		<u>7.8 Silver plating solution (clause.6.9)</u> Silver as metal grams/litre. 40 to 45 Free potassium cyanide grams/litre. 100 to 140 <u>7.9 Brightner addition</u> Silverrux standard Brightner (clause 4.21) 500 to 1000 ml/1000 Ampere hour <u>7.10 Antitarnishing solution (clause. 6.10)</u> Pointage 20 to 25 PH 8 to 9 8. PROCESS: <u>8.1 Solvent Degreasing</u> The surface of the article shall be degreased by vapour degreasing OR excess grease, oil or cutting lubricants shall be removed by means of suitable solvent such as trichloroethylene and dried in air subsequently . <u>8.2 Alkaline Degreasing</u> Parts shall be immersed in the degreasing solution as mentioned in clause 6.1 till, free from any oil or grease. <u>8.3 Rinsing</u> 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. 8.2) shall be repeated. <u>8.4 Acid Cleaning /Pickling</u> <u>8.4.1 Chromic-sulphuric acid Pickling</u> 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. <u>8.4.2 Rinsing</u> <u>8.4.3 Nitric-Hydrofluoric acid Pickling (optional)</u> 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. 8.4.4 Rinsing		

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		<u>8.4.5 De-oxidizing</u> After pickling as mentioned either in clause 8.4.1 or 8.4.2 depending on the requirement, the parts shall be first rinsed in clean cold running water and then immersed in eoxidizing solution No.1, A or B as mentioned in clause 6.4, to remove and residual smut left on the surface.		
		<u>8.5 Rinsing</u> After de-oxidizing the parts shall be rinsed in clean cold running water. Double rinsing is preferred.		
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	<u>8.6.1 Rinsing</u> After the first Zincate treatment. The parts shall be rinsed in clean running water, double rinse is required.			
	<u>8.6.2 Deoxidizing Solution No 2 (Zincate removal)</u> After rinsing the parts shall be dipped in Deoxidising solution No 2 as mentioned in Clause. 6.4 to remove loose zincatelayer.			
	<u>8.6.3 Rinsing</u> After deoxidising solution dip the double parts shall be rinsed in clean cold running water. Double water rinse is required.			
	<u>8.6.4 Second Zincate treatment</u> After rinsing, the parts shall be immediately dipped in the zincate solution as mentioned in clause 6.5.			
	<u>8.6.5 Water Rinsing</u> 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.			
	<u>8.7 Electroplating</u>			

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		<u>8.7.1 Copper plating/Strike</u> After the water rinsing, a copper strike/plating shall be given on the article from the copper plating bath (clause 6.6.1)		
		<u>8.7.2 Rinsing</u> After copper plating the parts shall be swilled in clean cold running water.		
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		<u>8.8 Silver striking</u> It shall be ensured that the current is on before articles are introduced into the bath. Plating shall be done until articles are completely covered with silver. Articles shall then be transferred directly to the silver plating bath without swilling.		
		<u>8.9 Silver plating</u> It shall be ensured that current is on before articles are immersed in the silver plating bath (clause. 6.9). The articles shall be electroplated at the specified current densities for a duration which will depend on the thickness of the deposit required.		
		<u>8.10 Dragout</u> After removal from the tank, the parts shall be rinsed in dragout tank till all the traces of plating solution are removed.		
		<u>8.11 Rinsing</u> After removing from dragout tank the parts shall be thoroughly rinsed in clean cold running water.		
		<u>8.12 Hot rinsing -</u> After rinsing in cold running water the parts shall be rinsed thoroughly in Hot water.		
		<u>8.13 Anti-tarnishing</u> Parts shall be treated in antitarnishing solution as mentioned in (clause.6.10)		
		<u>8.14 Rinsing</u> After removal from antitarnishing bath the parts shall be rinsed in clean cold running water till all the traces of antitarnishing solution are removed. Finally the parts shall be air dried.		

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		<u>8.15.0 Lacquering</u> Surface which do not require silver plating, may be protected by chlorinated rubber based lacquer. After Acid cleaning / pickling (clause 8.4 to 8.4.3) and rinsing (clause 8.4.4) 8.15.1 After the end of the process of plating the lacquar is removed with suitable solvent e.g. trichlaoroethylene.		
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.		<u>9. PRECAUTIONS :</u> 9.1 Proper pre-treatments are essential for getting a good plating. Therefore, process parameters, whatever specified should be strictly followed. 9.2 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. 9.3 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. 9.4 A separate dilute nitric acid solution (Deoxidizing solution) should be used for cleaning treatment as followed in clause 8.6.2 after first zincate treatment. 9.5 If blisters are observed after silver plating, then pre-treatment cycles are to be checked and at the same time copper plating/ strike bath is to be tested. 9.6 Any chemical which may be necessary for addition, shall then be added in the bath through a filter/Perforated Bucket. 9.7 Any metal that may be deposited on any part of the bath, shall be removed immediately.		
		<u>9.8 Care of Anodes</u> 9.8.1 Ratio of anode to cathode surface shall not be less than 1. 9.8.2 Anodes shall be removed from the silver strike and silver plating vats when they are not operating, to prevent attack by the solution. 9.8.3 Stainless steel inverted 'V' shaped anode hooks only shall be used to suspend anodes from the Bus bar. 9.9 Wires used for suspending parts or electroplating and components which may accidently drop into the vat shall be removed at once to prevent contamination by their dissolution		

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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.		9.10 Soluble organic impurities shall be removed by activated carbon treatment. Activated carbon 2 to 3 g/litre shall be added to the solution and the solution shall be thoroughly stirred for 3 to 4 hours and then filtered. This process shall be carried out in a separate bath. Alternatively, activated carbon shall be loosely packed in the filter unit of the filter pump and the solution shall be filtered through several times. Note: 1) After each carbon treatment makeup brightener is to be added at the rate of 100 ml/1 no gram of carbon used. 2) The dragout solution shall be used for make-up of working volume of the silver plating bath whenever required. <u>9.12 Filtration</u> To get uniform results, continuous filtration of the bath shall be carried out. If continuous filtration is not possible, periodic filtration shall be done. 10. INSPECTION & QUALITY OF DEPOSITS: <u>10.1 Sampling</u> A minimum of 1% of each batch or bath load shall be taken at random for testing with a minimum of 3 samples. <u>10.1.1 For big components</u> When plated articles/components are big and can not be subjected to any of the specified tests, a test pannel of suitable size of the same basis metal shall be plated along with component under identical condition for the purpose of testing. <u>10.2 Condition of Surface</u> The plated surface shall be smooth and free from defects such as stains, blisters, exfoliations, unplated portions, nodules and cracks. <u>10.3 Thickness (I.S. 3203)</u> The minimum thickness shall be as specified on drawing OR purchase order		

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		<u>10.4 Adhesion (I.S. 1771)</u> The flaking and blistering of Coating shall be taken as evidence of unsatisfactory adhesion. <u>10.5 Soldering Test</u> A strip of 24 S.W.G. tinned mild steel 9.5 mm wide x 75 mm length. (approx.) shall be soldered on the flat side to the plated surface. The soldering heat shall not produce blistering on the coating. The actual soldering on the component may be done on the shop floor. <u>10.6 Anti-tarnishing test (IS1771)</u> SHALL NOT SHOW BLACK OR BROWN COLOUR. <u>10.7 Rejection</u> If the sample taken does not comply with to as laid in clause 10 to 10.6 a further quantity not less than twice the number original taken, shall be subjected to the tests in which failure occurred. If this sample also fails, the whole batch shall be rejected. 11.0 Safety measures are to be followed as detailed in AA0462801.		
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