ANNEXURE-A

PRE-QUALIFYING REQUIREMENTS FOR PURCHASE INDENT 20220255 DT. 04.08.2022 FOR FRAMEWORK AGREEMENT OF SILVER PLATING ON ALUMINIUM & COPPER COMPONENTS, CONDUCTORS INCLUDING BLANKING PLATES & PALMS

Sl. No.	PRE-QUALIFYING REQUIREMENTS	DETAIL DESCRIPTION
01	**Size, Type & Weight of Job**	**Job Type**- Octagon, Square, Flat, Rectangular, L, Z & U type or as per design. **Size of Job:** Height- 4000 mm(Max.), Width- 1000 mm (Max.), Depth- 1000 mm (Max.) **Weight of Job:** More than 100 Kg. **Note: - For palm involving multiple sides (like octagon, square shape etc.), BHEL will be free to ask for plating on only one side (on selective portion) of the palm. In that case, vendor will have to make suitable masking arrangement with no extra cost implication to BHEL.**
02	**Technical requirement**	1. Bidder shall have silver plating processing plant as per BHEL standard SG14610 R04, SG15600 R04 & AA0673613 R04. 2. Bidder shall have overhead crane and transporter facility with process time control system to maintain the process parameter (like voltage, current and temperature) and to meet the required quality as per BHEL standard. 3. Bidder shall have at least 2 years' experience (with documental proof) in silver plating on electrical grade aluminium alloy conductors and bus bars, to ensure required quality as per BHEL standard, as it is a specialized and expensive process for very high current carrying electrical application (up to 26000 Amps. at working temperature of 85°C). 4. The technical offer of new bidder other than BHEL PMD vendor, who is not listed with BHEL, shall be reviewed as per BHEL standard. The expert team of BHEL will visit their plant to examine the silver plating facilities as per SG14610 R04, SG15600 R04 & AA0673613 R04. Failing to meet the standard requirement will be liable for rejection of offer technically.
03	**Testing Facilities**	Bidder shall have testing facilities for i. Chemical composition analysis as per product standard SG14610 R04, SG15600 R04 & AA0673613 R04. ii. Thickness measurement iii. Anti-tarnishing iv. Adhesion v. Salt spray & vi. Humidity test etc.

ANNEXURE-B

TECHNO-COMMERCIAL TERMS AND CONDITIONS FOR PURCHASE INDENT 20220255 DT. 04.08.2022 FOR FRAMEWORK AGREEMENT OF SILVER PLATING ON ALUMINIUM & COPPER COMPONENTS, CONDUCTORS INCLUDING BLANKING PLATES & PALMS

Sl. No.	TECHINCAL TERMS	DETAIL DESCRIPTION
01	**Price Basis**	Rate shall be quoted for entering into framework agreement for One Year. Rate to be quoted on Price Variation Clause for silver. Multiples Orders shall be placed during validity period of this agreement on finalized rates.
02	**Delivery Destination**	Rate shall be quoted on F.O.R. BHEL Rudrapur basis. (Jobs shall be lifted by the bidder from BHEL-Rudrapur and shall be delivered back to BHEL Rudrapur after Silver Plating duly packed).
03	**Delivery requirement**	Delivery time shall be within 21 days from receipt of raw material (Al/Cu) from BHEL Rudrapur (under GST Job Work norms) after placement of purchase order.
04	**PVC Clause**	Rates shall be subject to Price Variation Clause (PVC) at the base rate of Silver (99.9% purity) @ Rs. 57,600/- As per Mumbai Bullion market (Ready) date 03.08.2022. For any change in this rate, the silver closing rate of Mumbai Bullion market on the 1st working day of the calendar month as published on ET-INTELLIGENCE shall be effective for supplies till the end of that month in which the plated components are to be supplied to BHEL/BHEL's fabricators.
05	**PVC Ratio & Formula**	**PVC ratio shall be 1:0.7.** i.e. A change in base rate of silver shall impact 70% change in finalized basic rate of silver plating. Price Variation Formula: - **S=SF*{1+70%*(SI-SB)/SB}** Where, S = Applicable Rate of Silver Plating at the time of invoicing, SF = Applicable Rate of Silver Plating finalised in the NIT, SI = Applicable Base rate of Silver at the time of invoicing, SB = Applicable Base rate of Silver as per NIT,
06	**Test Certificate**	TC as per specification shall be submitted along with material.

<table>
<tr><td>07</td><td>Silver plating procedure/Inspection procedure/Packing</td><td>As per attached Product Standard SG14610 R04, SG15600 R04 & AA0673613 R04 and drg. No.- 45410001025 /Packing instructions as per BHE/Pack/SP/001 REV02.
- Quality assurance plan: QAP/BD/164/R02 (Copy attached)
- Composition of components to AA12329
- The chemical composition of material when analyzed in accordance with IS:504
- Method of chemical analysis of Aluminium and its alloys shall be as follows:
<table><tr><th>Elements</th><th>Min.</th><th>Percent Max.</th></tr><tr><td>Magnesium</td><td>0.4</td><td>0.90</td></tr><tr><td>Silicon</td><td>0.4</td><td>0.90</td></tr><tr><td>Manganese</td><td>0.4</td><td>0.90</td></tr><tr><td>Copper</td><td>0.4</td><td>0.90</td></tr><tr><td>Iron</td><td>0.4</td><td>0.90</td></tr><tr><td>Aluminium</td><td>Remainder</td><td></td></tr></table></td></tr>
<tr><td>08</td><td>Inspection</td><td>100% inspection shall be done by BHEL/BHEL's representative before dispatch.</td></tr>
<tr><td>09</td><td>Important IS</td><td>IS:1959 (Silver Anode)
IS:3203(Thickness)
IS: 1771(Adhesion/Tarnish Resistance test)
For all other required IS details vide Product standard SG15600 REV.04</td></tr>
<tr><td>10</td><td>Distribution Clause</td><td>Distribution shall be done as per below matrix as applicable: -
<table><tr><th>Distribution Matrix</th><th>L1</th><th>L2</th></tr><tr><td>02 lowest acceptable bidders</td><td>60%</td><td>40%</td></tr><tr><td>01 lowest bidder</td><td>100%</td><td>-</td></tr></table></td></tr>
<tr><td>11</td><td>Quantity variation</td><td>All the quantities in the enquiry are tentative being framework agreement and BHEL shall have no commitment for exact ordering. Supplier shall be prepared to accept orders of reduced quantities without any implication.</td></tr>
<tr><td>12</td><td>Insurance of BHEL issued material</td><td>Being Job Work contract, semi-finished / finished material shall be issued to sub-contractor for Silver Plating.
As the material being issued is sole property of BHEL, Insurance shall be done by BHEL for every consignment under prevailing Insurance Policy.</td></tr>
</table>

Bidder's Sign & Seal

Commodity (Prices are exclusive of GST)

Ready

SPOT -- BULLION -- SILVER -- Ready

Trading Date	Item	Variety(Wt.)	Centre	Price Range From	Price Range To
05-07-2022	SILVER	Ready1 Kg	MUMBAI	58650.00	58650.00
06-07-2022	SILVER	Ready1 Kg	MUMBAI	56100.00	56100.00
07-07-2022	SILVER	Ready1 Kg	MUMBAI	56600.00	56600.00
08-07-2022	SILVER	Ready1 Kg	MUMBAI	56700.00	56700.00
09-07-2022	SILVER	Ready1 Kg	MUMBAI	57100.00	57100.00
11-07-2022	SILVER	Ready1 Kg	MUMBAI	57000.00	57000.00
12-07-2022	SILVER	Ready1 Kg	MUMBAI	56200.00	56200.00
13-07-2022	SILVER	Ready1 Kg	MUMBAI	56400.00	56400.00
14-07-2022	SILVER	Ready1 Kg	MUMBAI	56200.00	56200.00
15-07-2022	SILVER	Ready1 Kg	MUMBAI	54600.00	54600.00
16-07-2022	SILVER	Ready1 Kg	MUMBAI	55600.00	55600.00
18-07-2022	SILVER	Ready1 Kg	MUMBAI	56200.00	56200.00
19-07-2022	SILVER	Ready1 Kg	MUMBAI	55900.00	55900.00
20-07-2022	SILVER	Ready1 Kg	MUMBAI	55300.00	55300.00
21-07-2022	SILVER	Ready1 Kg	MUMBAI	54200.00	54200.00
22-07-2022	SILVER	Ready1 Kg	MUMBAI	55000.00	55000.00
23-07-2022	SILVER	Ready1 Kg	MUMBAI	55100.00	55100.00
25-07-2022	SILVER	Ready1 Kg	MUMBAI	55000.00	55000.00
26-07-2022	SILVER	Ready1 Kg	MUMBAI	54500.00	54500.00
27-07-2022	SILVER	Ready1 Kg	MUMBAI	55100.00	55100.00
28-07-2022	SILVER	Ready1 Kg	MUMBAI	56200.00	56200.00
29-07-2022	SILVER	Ready1 Kg	MUMBAI	57700.00	57700.00
30-07-2022	SILVER	Ready1 Kg	MUMBAI	58350.00	58350.00
01-08-2022	SILVER	Ready1 Kg	MUMBAI	58600.00	58600.00
02-08-2022	SILVER	Ready1 Kg	MUMBAI	58200.00	58200.00
03-08-2022	SILVER	Ready1 Kg	MUMBAI	57600.00	57600.00

Top

Copyright © 2020 Bennett, Coleman & Co Ltd. All rights reserved.
Best Viewed in Google Chrome

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 Company.

PACKING OF SILVER/TIN PLATED ITEMS/ BUS DUCT PALMS

1.0 INTRODUCTION:

This standard covers the procedure for packing of Silver / Tin plated items / bus duct palms.

2.0 APPLICATION:

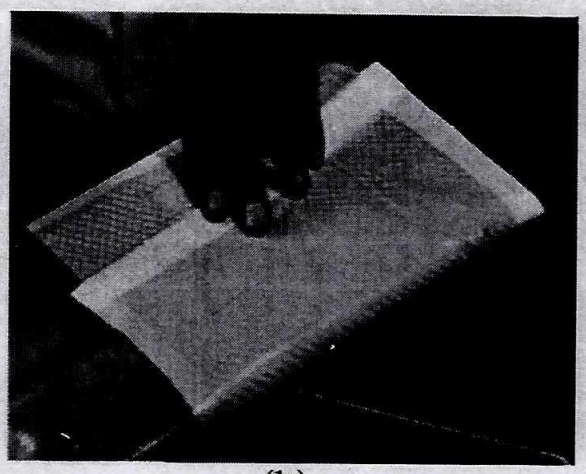
Shall be used for packing of silver plated Al splice plates / palms, silver & tin plated Copper plates.

3.0 PROCEDURE:

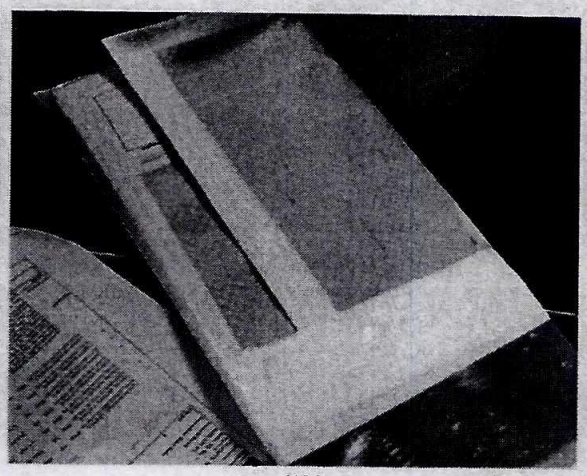
1. After clearance from inspecting agency, surface of the plated portion to be cleaned by using dry cotton cloth to remove dust, loose particles etc.
2. Plated surface shall be covered using envelope of suitable size made of HDPE VCI film and HDPE VCI tape such that air & moisture does not trap between VCI film and Plated surface. (FIG-1a, 1b, 1c, 1d)
3. This assembly shall now be covered with cotton tape for providing cushion.
4. Cotton tape wrapped surface shall be covered with two layers of bubble sheets to avoid ingress of moisture and for providing cushion to plated surface (refer FIG-2a,2b).
5. Bubble sheet shall be covered with VCI Tape.
6. Edges of plated palms shall be covered with hard foam to avoid damage to edges during handling (refer FIG-3a, 3b).
7. Packed components shall be stored under covered shed.
8. Before dispatch of the item / Bus Duct to site, proper packing of Silver / Tin plated surface shall be ensured.
9. If any damage is noticed in the packing, it shall be re-packed by the above given process.

COPYRIGHT AND CONFIDENTIAL

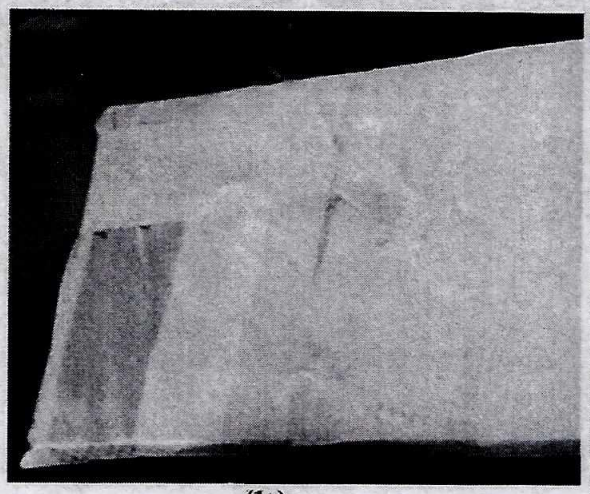
The information on this document is the property of Bharat Heavy Electricals Limited.
It must not be used directly or indirectly in any way detrimental to interest of Company.



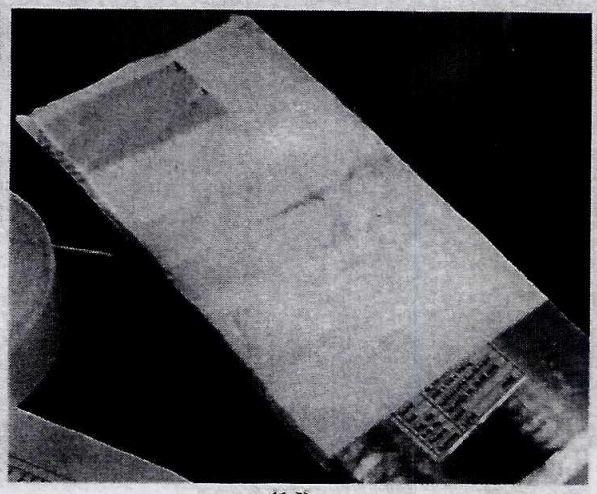
(1a)



(1b)



(1c)



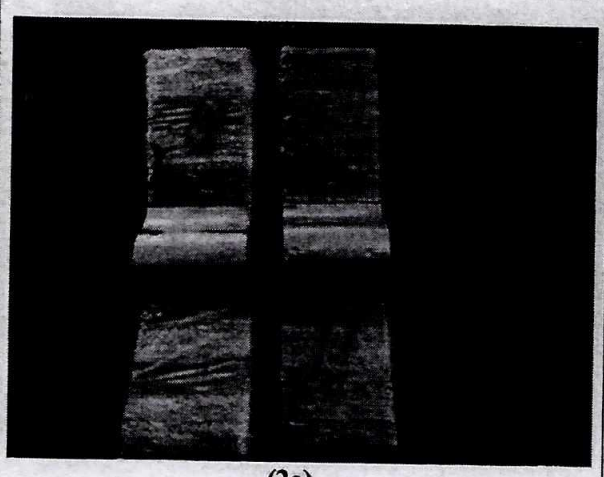
(1d)

FIG-1

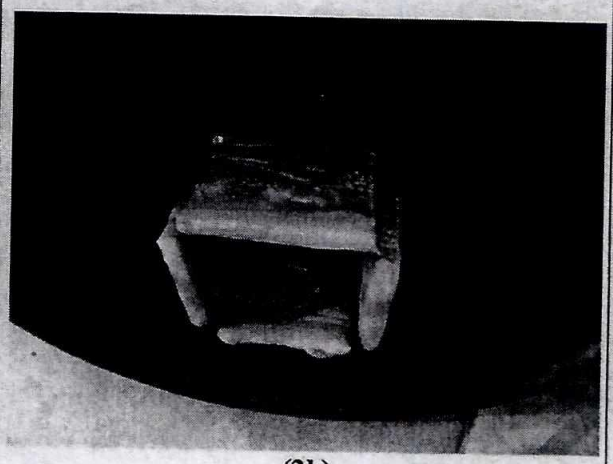
ALOK KUMAR	Manager (REG)		**PACKING OF SILVER/TIN PLATED ITEMS/ BUS DUCT PALMS**		
PARUSH KUMAR	Manager (Engg)				
KAPIL KUMAR BHARTI	Sr.Mgr (Quality & BE)				
AJIT SAHAY	Sr.Mgr (PDN & FES)	30.12.20			
ARVIND NARAYAN	Sr.Mgr (Engg).	30/12/20	PREPARED BY	SANJAY KR. GUPTA - DY ENGR	
R.K. SAXSENA	Sr.DGM (MM & Stores)	30/12/20			
COMMITTEE MEMBERS / AGREED DEPTT.	DESIGNATION	SIGN. & DATE	CHECKED BY	RUPESH KUMAR - MGR	
		Approved by:	PLANT STANDARIZATION COMMITTEE		
REVISION NO.: 02 DATE:30.12.2020		Prepared by:	ENGINEERING. DEPARTMENT.		DATE: 15.12.20

COPYRIGHT AND CONFIDENTIAL

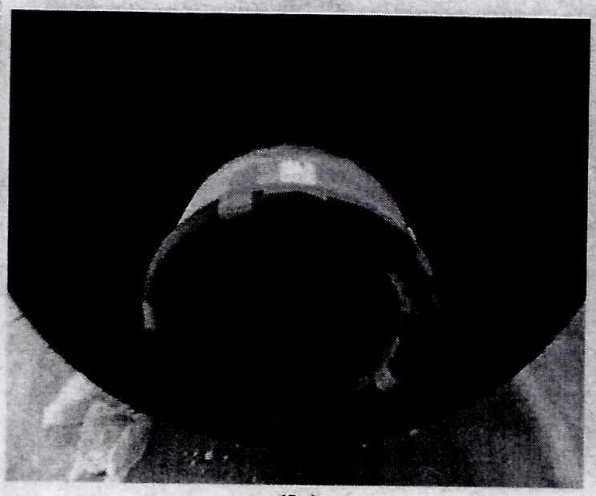
The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Company.



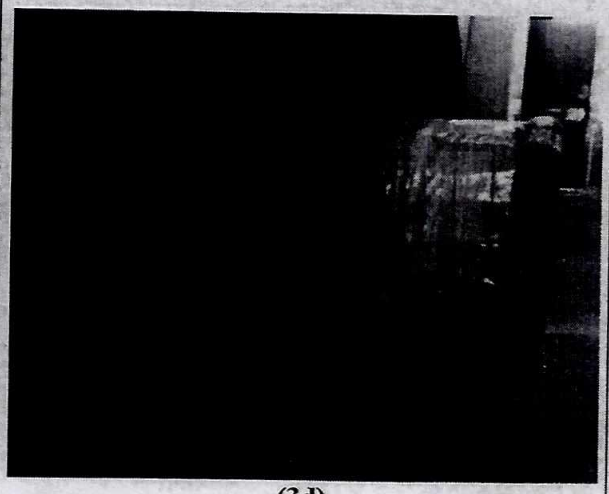
(2a)



(2b)



(3c)



(3d)

FIG - 3

ALOK KUMAR	Manager (REG)		PACKING OF SILVER/TIN PLATED ITEMS/ BUS DUCT PALMS		
PARUSH KUMAR	Manager (Engg)				
KAPIL KUMAR BHARTI	Sr.Mgr (Quality & BE)				
AJIT SAHAY	Sr.Mgr (PDN & FES)	30-12-20			
ARVIND NARAYAN	Sr.Mgr (Engg).	30/12/20	PREPARED BY	SANJAY KR. GUPTA - DY ENGR	
R.K. SAXSENA	Sr.DGM (MM & Stores)	30/12/20			
COMMITTEE MEMBERS / AGREED DEPTT.	DESIGNATION	SIGN. & DATE	CHECKED BY	RUPESH KUMAR - MGR	
		Approved by:	PLANT STANDARIZATION COMMITTEE		
REVISION NO.: 02		Prepared by:	ENGINEERING. DEPARTMENT.		DATE: 15.12.20
DATE:30.12.2020					

REV	DATE	ALTERED	REV	DATE	ALTERED	ADDITIONAL INFORMATION
11	29.07.08	CHECKED			CHECKED	STAUS OF DRAWING
DRAWING RETRACED.						DISTRIBUTION OF PRINTS

<ALL DIM. IN MM>

1. SURFACE PREPARATION FOR SILVER PLATING (BY FABRICATORS) :-

A. WELDED FACES OF CONDUCTOR OR ANY DENT MARK PRESENT ARE TO BE REMOVED EITHER BY SKIM CUT/GRINDING /EMERYING BUT DEPTH OF CUT SHALL NOT EXEED 1.0 mm.

B. DRILLED HOLES SHALL BE DEBURRED ON BOTH SIDE.

C. DRILLED END OF THE CONDUCTOR SHALL BE FACED PERPENDICULAR TO THE AXIS OF CONDUCTOR. SILVER PLATING IS TO BE DONE 35 mm FROM LAST HOLE (SEE FIG -1)

2. SPECIAL INSTRUCTION FOR ELECTROPLATERS :-

A. SILVER PLATING TO BHEL STANDARD 'BP 0673697/REV.00' SILVER PLATING TO BE MINIMUM 13 MICRON SILVER OR AS SPECIFIED ON CUSTOMERS SPECIFICATION WHICH EXCLUDES THIKNESS OF COPPER STRIKE AND DOUBLE ZINCATE TREATMENT FIG -1 TO BE FOLLOWED FOR SILVER PLATING OF SURFACE IF SPECIFIED ON DRAWING.

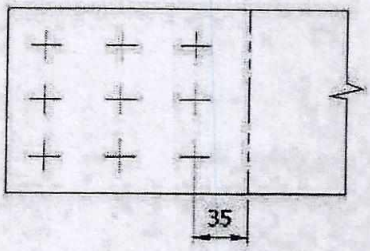


FIG - 1

3. PRECAUTIONS AFTER SILVER PLATING :-

A. PROTECTIVE COATING ON PLATED SURFACE : SILVER PLATED SURFACE SHOULD BE COVERED BY COTTON TAPE IMMEDIATELY AFTER PLATING (BY ELECTROPLATERS).

B. WHILE DOING WELDING, PRECAUTIONS TO BE TAKEN SO THAT SILVER PLATED SURFACE IS NOT DAMAGED (BY FABRICATORS).

C. COTTON TAPE SHOULD NOT BE REMOVED AT ANY STAGE IN THE SHOP. THIS WILL BE REMOVED AT SITE BEFORE MAKING BOLTED JOINTS.

		NAME	SIGN	DATE
BHEL	DRN	VISHAL		29.07.08
BHARAT HEAVY ELECTRICALS LTD. RUDRAPUR	CHD	P.SINGH		29.07.08
	APPD	RK LAL		29.07.08

DEPT.	ECC	SCALE N.T.S.	Wt. [Kg]	REF. TO ASSY. DRG.	ITEM No
TITLE	GEN. INSTRUCTION FOR SILVER PLATING ON ALUMINIUM CONDUCTOR & FLEXIBLE			DRAWING NO. 4 541 00 01 025	REV. 11
				SHEET NO. -02	NO. OF SHEETS -03

BHARAT HEAVY ELECTRICALS LIMITED, JHANSI

1/4 [4 Page]

B.H.E.L. CX/007/0006	STANDARD SUB-VENDOR QUALITY PLAN FOR Electro Plating of Silver On Aluminium and it's Alloys	MATERIAL INSPECTION / IN PROCESS INSPECTION / INAL INSPECTION	SUB-VENDOR'S / VENDOR'S / CONTRACTOR'S WORKS	QP.No. QP/BD/154,R02 Rev.02 Date 16.07.2003 Page 1 of 4

SL.No.	COMPONENT AND OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
	2	3	4	5	6	7	8	9	10	11
A	Composition And maintenance of Bath Solution	a) Alkaline degreasing solution	B	I	Sample to be taken from bath	SG: 15600 Cl. 6.1	SG: 15600 Cl. 6.1	Sub vendor Check list / Formats / Records	Sub vendor	Review of records by BHEL (periodic surveillance by BHEL inspection)
		b) Chromic sulphuric acid picking solution	B	I		Cl. 6.2	Cl. 6.2			
		c) De oxidizing solution	B	I	Sample	Cl. 6.4	Cl. 6.4			
		d) Zincate solution	B	I	Sample	Cl. 6.5	Cl. 6.5			
		e) Copper plating solution	B	I	Sample	Cl. 6.6	Cl. 6.6			
		f) Poltasium Cyanide dip solution	B	I	Sample	Cl. 6.7	Cl. 6.7			
		g) Silver strike solution	B	I	Sample	Cl. 6.8	Cl. 6.8			
		h) Silver plating solution	B	I	Sample	Cl. 6.9	Cl. 6.9			
		i) Brighter addition	B	I	Sample	Cl. 7.9	Cl. 7.9			
		j) Anti tarnishing solution	B	I	Sample	Cl. 6.10	Cl. 6.10			

CONTROLLED COPY

CONTROLLED CO

(18)

BHARAT HEAVY ELECTRICALS LIMITED, JHANSI

B.H.E.L. 00X/007/0006	STANDARD SUB-VENDOR QUALITY PLAN FOR Electro Plating of Silver On Aluminium and it's Alloys	MATERIAL INSPECTION / IN PROCESS INSPECTION / FINAL INSPECTION	SUB-VENDOR'S / VENDOR'S / CONTRACTOR'S WORKS	QP.No. QP/BD/164-Ro2 Rev.02 Date 16.07.2003 Page 2 of 4

Sl. No.	COMPONENT AND OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
B	Cleaning / preparation of Aluminium items	a) wire brushing	B	V	100%	SG: 15600	SG: 15600	Sub vendor Check list / Formats / Records	Sub vendor	Review of Records
		b) solvent degreasing	B	V	100%	Cl. 8.1	Cl. 8.1			
		c) alkaline degreasing	B	V	100%	Cl. 8.2	Cl. 8.2			
		d) Rinsing	B	V	100%	Cl. 8.3	Cl. 8.3			
		e) Acid cleaning / picking	B	V	100%	Cl. 8.4	Cl. 8.4			
		(I)Chromic sulphuric acid pickling	B	V	100%	Cl. 8.4.1	Cl. 8.4.1			
		(II)Rinsing	B	V	100%	Cl. 8.4.2	Cl. 8.4.2			
		(III)Nitric Hydrofluoric acid pickling	B	V	100%	Cl. 8.4.3	Cl. 8.4.3			
		(IV)Rinsing	B	V	100%	Cl. 8.4.4	Cl. 8.4.4			
		f) Deoxidation	B	V	100%	Cl. 8.4.5	Cl. 8.4.5			
		g) Rinsing	B	V	100%	Cl. 8.5	Cl. 8.5			
C	Preparation for Silver plating	a) First zincate treatment	B	I	100%	SG: 15600 Cl. 8.6	SG: 15600 Cl. 8.6	Sub vendor Check list / Formats / Records	Sub vendor	Review of records by BHEL Periodic surveillance by BHEL Inspector
		b) Rinsing	B	I	100%	Cl. 8.6.1	Cl. 8.6.1			
		c) Deoxidation	B	I	100%	Cl. 8.6.2	Cl. 8.6.2			
		d) Rinsing	B	I	100%	Cl. 8.6.3	Cl. 8.6.3			
		e) Second zincate treatment	B	I	100%	Cl. 8.6.4	Cl. 8.6.4			
		f) Rinsing	B	I	100%	Cl. 8.6.5	Cl. 8.6.5			

CONTROLLED COPY

CONTROLLED COPY

(3)

BHARAT HEAVY ELECTRICALS LIMITED, JHANSI

3/4

B.H.E.L. CDX/007/0006	STANDARD SUB-VENDOR QUALITY PLAN FOR Electro Plating of Silver On Aluminium and it's Alloys	MATERIAL INSPECTION / IN PROCESS INSPECTION / FINAL INSPECTION	SUB-VENDOR'S / VENDOR'S / CONTRACTOR'S WORKS	QP.No: QP/BD/164-Rev.02 Date 16.07.2003 Page 3 of 4

S. No.	COMPONENT AND OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
D	Silver plating Process	a) Copper plating	B	I	100%	Cl. 8.7.1	Cl. 8.7.1	Sub vendor Check list / Formats / Records	Sub vendor	Review of records by BHEL (periodic surveillance by BHEL Inspector
		b) Rinsing	B	I	100%	Cl. 8.7.2	Cl. 8.7.2			
		c) Cyanide dip	B	I	100%	Cl. 8.7.3	Cl. 8.7.3			
		d) Silver striking	B	I	100%	Cl. 8.8	Cl. 8.8			
		e) Silver plating	B	I	100%	Cl. 8.10 & 8.11	Cl. 8.10 & 8.11			
		f) Dragout & rinsing	B	I	100%	Cl. 8.12	Cl. 8.12			
		g) Hot rinsing	B	I	100%	Cl. 8.13	Cl. 8.13			
		h) Anti tarnishing	B	I	100%	Cl. 8.14	Cl. 8.14			
		i) Rinsing	B	I	100%					
E	Inspection of Electroplated Surface	a) Surface finish	B	V	Sample	IS 1771 / 3203	Drg	Sub vendor Test report	Sub vendor	CHP by BHEL At sub vendor Works.
		b) Thickness of Plating	B	T	Sample					
		c) Adhesion	B	T	Sample					
		(I) Burnishing test or	B	T	Sample					
		(II) Bend test or	B	T	Sample					
		d) Anti tarnish Treatment	B	T	100%					

CONTROLLED COPY

CONTROLLED C

6

9

4/4

BHARAT HEAVY ELECTRICALS LIMITED

B.H.E.L. COX/007/B006	STANDARD SUB-VENDOR QUALITY PLAN FOR Electro Plating of Silver On Aluminium and It's Alloys	MATERIAL INSPECTION / IN PROCESS INSPECTION / FINAL INSPECTION	SUB-VENDOR'S / VENDOR'S / CONTRACTOR'S WORKS	QP.No. QP/BD/164 Rev.02 Date 16.07.2003 Page 4 of 4

SL.No	COMPONENT AND OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
F	Protection coating for silver plating	a) Application of protective coating	B	I	100%	BD:15012 P Cl. 1.0	BD:15012 P Cl. 1.0	Sub vendor Check list / Formats	Sub vendor	Review of Records
		a) Drying	B	I	100%	Cl. 2.0	Cl. 2.0			
		b) Packing	B	I	100%	Cl. 3.0	Cl. 3.0			
		c) Removal of packing & protective coating	B	I	100%	Cl. 4.0	Cl. 4.0		At Site	

CONTROLLED COPY

LEGENT :- A :- Critical, I :- Inspection, B :- Major, TC :- Test Certificate, T :- Testing
OS :- Observation sheet, C :- Minor, V :- Visual, Drg. :- Drawing.

Prepared by

(H N SHAKYA)
Dy. MANAGER (COX)

Approved by

(P K JAIN)
DGM (COX)

CONTROLLED COPY

(9)

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..

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.

PROCESS FOR ELECTROPLATING OF SILVER ON COPPER AND COPPER BASED ALLOYS

1.0 GENERAL :

This standard details the process for silver plating on copper and copper based alloys from cyanide bath to protect them against corrosion, to provide decorative finish and to improve electrical conductivity.

2.0 APPLICATION :

Used for contact rods, rollers, guide tubes, contact fasteners, etc., in switch gear, out put leads of generators, busbars, ferrules, shunt terminals, control gear equipment, etc.

3.0 COMPLIANCE WITH NATIONAL STANDARDS :

There is no National standard covering this process. However, assistance has been derived from the following National standard regarding surface condition and quality of deposit.

i) IS : 1067-1981 : Electroplated Coatings of Silver for Decorative And Protective Purposes.

ii) IS : 1771-1986 : Electroplated Coatings of Silver and Silver Alloys for General engineering purposes.

iii) IS : 5925-1970 : Recommended Practice for Silver plating for General Engineering Purposes.

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 the Interest of the company.

4.0 MATERIALS :

	Material		CPS No. / IS No. / Available from
4.1	Sulphuric Acid-Technical	:	IS:266
4.2	Silver potassium cyanide 54%	:	IS:6267
4.3	Potassium Cyanide	:	AA 556 09
4.4	Silver anodes	:	IS : 1959
4.5	Potassium Hydroxide (Caustic Potash)	:	IS : 6831
4.6	Stainless Steel Anodes	:	IS : 6911, Gr:07Cr18 Ni9.
4.7	Activated carbon pure (for Electroplating)		M/s Graur and weil (India) Ltd. Mumbai. M/s Artek surfin Chemicals (P) Ltd, Mumbai,
4.8	Silsal 'AX'	:	
4.9	Silsal 'Z'	:	M/s. Canning Mitra Phonix Ltd.,
4.10	Silver Brights	:	Mumbai
4.11	Passival 'AG'		
4.12	'Silvernix' Bright Silver salt	:	
4.13	'Strike Silver' Salt	:	M/s. Grauer and weil (India) Ltd.,
4.14	'Silvernix' Standard Brightener	:	Mumbai
4.15	'Silvernix' Make-up Brightener	:	
4.16	'Silchrome' Anti-Tarnishing Solution	:	
4.17	'Sil Glo' Salt 601A	:	
4.18	'Sil Glo' Salt 601B	:	
4.19	'Strik sil' 610 Salt	:	M/s. Platewel Processes and
4.20	'Sil Glo' 602 Brightener	:	Chemicals Ltd.,
4.21	'Sil Glo' 603 Brightener	:	
4.22	Stopping off lacquer (Resistant to acid, alkali, cyanide and heat)	:	M/s. IEL Ltd.,Kolkata M/s. Shalimar Paints, Kolkata.
4.23	Grey Mesking compound	:	M/s. Phiroz Sethna, Mumbai.
4.24	Argomax Strike silver salt	:	M/s. Artek surfin chemical (p) Ltd.,
4.25	Argomax Bright silver salt	:	Mumbai.

5.0 EQUIPMENT :

5.1 Striking Tank:

The tank for striking solution shall be made of welded steel lined with rubber / FRP/PVC.

5.2 Plating Tank :

The tank shall be made of welded steel lined with rubber/FRP/PVC fitted with cathode rod movement system.

5.3 Rinsing Tanks : Mild steel tanks

5.4 Antitarnishing Treatment Tank :

The tank shall be made of welded steel lined with rubber/PVC.

5.5 Filter Pump :

Rubber lined standard filter pump.

5.6 Drag out Tank :

The tank shall be made of welded steel lined with Rubber / PVC / FRP.

5.7 Hot Water Rinsing Tank :

M.S. tank fitted with heating arrangement.

5.8 Ampere-Hour Meter.

Suitable for the work.

6.0 COMPOSITION OF ELECTROLYTE AND OPERATING INSTRUCTIONS :

6.1 Electrolyte for Striking Bath :

The electrolyte for striking bath shall be prepared according to any one of the compositions specified in Table - 1 and operated at the conditions specified therein.

TABLE - 1 : ELECTROLYTE FOR STRIKING BATH

Parameter	Composition			
	I	II	III	IV
Name of salt	Silal Z	Srike Silver	Strik Sil 610	Argomax Strike Silver Salt
Salt Content, g/l	6	100	50	100
Potassium cyanide, g/l	37	--	40-50	--
Voltage, V	2-4	0.5-2	2-4	0.5-2.0
Current density A/dm2	2-3	0.1-0.20	2-4	0.10-0.20
Time, Sec. (or as required)	15	30-60	30-45	30-60
Temperature	Room	Room	Room	Room
Anodes	Stainless Steel	Silver	---	Silver or Stainless Steel

6.2 Electrolyte for Silver Plating :

The electrolyte for silver plating shall be prepared according to any one of the compositions specified in Table-2 and operated at the conditions specified therein.

TABLE - 2 : ELECTROLYTE FOR SILVER PLATING

Parameter	Composition			
	I	II	III	IV
Name of Salt	Silsal AX	Silvernix	Sil Glo 601 and 601B	Argomax Bright Silver Salt
Salt content, g/l	212.5	200	601A:200 601B:115	200 ---
Potassium cyanide, g/l	19	---	---	---
Silvernix Make-Up Brightener, ml/1 (Optional)	---	30	---	30
Sil Glo : 602 Brightener ml/l (Optional)	---	---	25	---
Voltage, V	1-2	1-1.5	1-1.5	1-1.5
Current density, A/dm2	1.5-2.0	0.5-2.0	0.5-2.0	0.5-2.5
pH	---	12-12.5	12.2-12.5	---
Temperature	Room	Room	Room	Room
Agitation	---- Cathode Movement recommended ---			
Anodes	Silver	Silver	Silver	Silver
Brightener per kAhr, ml (Optional) :	---	---	---	---
Standard Brightener	---	500-1,000	---	500-1000
Sil Glo : 603 Brightener	---	---	600-700	---
Anode to Cathode ratio	1:1	1:1	1:1	1:1
Time	--- As per Thickness Requirement ----			

6.3 Preparation of Electrolyte for strike and plating :

The tank shall be filled with demineralised water to 1/3 to 1/2 the required volume and the required amount of strike and plating salts as per tables 1 & 2 respectively shall be added to the bath in small quantities with stirring.

After complete dissolution, the electrolyte shall be brought up to the working level by adding demineralised water and subsequently stirred thoroughly.

6.4 Analysis of the Electrolytes :

6.4.1 The electrolytes prepared shall be analyzed after initial make up and subsequently at suitable intervals.

6.4.2 The Silver metal content after initial make up shall be minimum.

40 for composition I Table 2

30 --- do --- II, III and IV Table 2

6 ---- do --- I Table 1

3 ---- do --- II, III and IV Table1

6.4.3 The composition of electrolytes as referred in clause 6 shall be maintained at the following limits by adding required quantity of salt or Potassium Cyanide as per the table 3 and 4.

TABLE - 3 : STRIKE BATH

Parameter	Composition			
	I	II	III	IV
Silver as metal, g/l	6	3-4	2-5	3-4
Free potassium Cyanide, g/1	37	90-130	40-45	90-130

TABLE - 4 : SILVER PLATING BATH

Parameter	Composition			
	I	II	III	IV
Silver as metal. g/l	40	40-45	30-35	40-45
Free potassium cyanide, g/l	50-55	100-140	95-100	100-140
Potassium hydroxide, g/l	9-10	--	--	--

6.5 Antitarnishing Electrolyte :

The antitarnishing electrolyte shall be prepared according to any one of the compositions specified in Table - 5 and operated at the conditions specified therein.

TABLE - 5 : ANTITARNISHING ELECTROLYTE

Parameter	Composition	
	I	II
Name of Chemical	Passival 'AG'	Silchrome
Chemical content	100 g/l	200-250 ml/1
Voltage, V	4 - 6	3 - 7
Current density, Ad2m	2.7	1.5 - 4.5
Temperature	Shop	Shop
Time, minutes	1-2.5	2-5
pH	---	8-9
Anodes	Stainless Steel	Stainless Steel
Pointage	---	20-25

7.0 PROCESS :

7.1 Cleaning :

Articles shall be cleaned as described in Corporate Standard AA 067 36 01. Stopping off lacquer is applied wherever the plating is not needed before pickling.

7.2 Rinsing :

All articles after cleaning shall be rinsed thoroughly in running water to avoid contamination of the electrolyte.

Note: 1) In case the articles to be plated are made of brass/bronze, an undercoat of electroplated copper (conforming to AA 067 36 07) or dull nickel (conforming to AA 067 36 05) shall be given.

2) After Bright dip pickling (Clause 8.6 of AA 067 36 01 Rev 05, Page No 9) and cold water rinse (clause 8.7 of AA 067 36 01, Rev 05 Page No 9) give acid activation dip in 5 to 8% sulphuric acid (CP grade for 1 to 2 minute followed by thorough water rinse in cold running water so as to remove last traces of acid from the component.

7.3 All articles shall be given a strike coat of silver to get an adherent silver deposit as per conditions given in Table - 1. It shall be ensured that current is 'ON' before the articles are put into the tank.

7.4 Silver Plating :

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

7.5 Drag Out :

All articles after removal from the plating bath shall be rinsed in drag out tank till all the traces of plating solution are removed.

7.6 Cold Rinsing :

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

7.7 Anti-Tarnishing :

All articles shall be treated for anti-tarnishing, as per the conditions given in Table-5.

7.8 Cold Rinsing :

All articles after removal from the anti-tarnishing bath shall be rinsed in cold running water till all the traces of anti tarnishing solution are removed.

7.9 Hot Rinsing :

All articles after cold rinsing shall be rinsed thoroughly in hot water. Finally, after hot water treatment, articles are allowed to dry in hot air.

8.0 MAINTENANCE OF ELECTROLYTE :

If the working concentration of the plating solution does not lie in the limits as mentioned in Table-4, additions of silver salts and / of potassium cyanide shall be made according to requirement. Potassium hydroxide shall be added to maintain the desired pH value of 12-12.5.

The bath shall be filtered periodically through activated carbon filter beds for removing organic impurities.

Addition of silver brightener (optional) as recommended by the supplier shall be made to maintain the brightness of silver deposit.

9.0 PRECAUTIONS :

Anodes are to be removed from the plating baths after completion of the work. Stainless steel inverted 'V' shaped anode hooks only shall be used to suspend anodes from bus bar.

Any article or copper wire, used for suspending the parts for electroplating, which might have dropped into the tank shall be removed immediately to prevent contamination by their dissolution.

10.0 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 :

10.1 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 3 samples. When the plated components are big and can not be subjected to any of the specified test, a test panel of suitable size of the same basis metal should be plated along with component under identical condition for the purpose of testing. Approximate size of test panel (25 mm wide 100 mm length 1 mm thick).

10.2 Condition of Surface :

The plated surface shall appear as a smooth and continuous film over the basis metal and shall be free from surface defects such as pits, stains, blisters, un plated areas and other superficial blemishes visible to the naked eye. The plated surface shall be bright and free from nodules.

10.3 Thickness of Deposit (IS : 3203 or IS : 6012) :

The minimum thickness shall be as specified in BHEL order / drawing.

10.4 Adhesion (IS : 1771, Cl 1.3.1) :

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

10.5 Anti Tarnishing test (IS : 1771) :

Shall not show black or brown colour .

11.0 REJECTION :

If the samples taken do not comply with clauses 10.2, 10.3 and 10.4 a further quantity not less than twice the number orginally taken shall be subjected to these tests. If any one of these samples also fails, the whole batch shall be rejected.

12.0 REFERRED STANDARDS : (Latest Publications Including Amendments) :

1) IS : 1771	2) IS : 1959	3) IS : 3203	4) IS : 6012
5) IS : 6831	6) IS : 6911	7) IS 8366	8) AA 54101
9) AA 541 02	10) 55609		