Enclosure:

Drawing No: (i) CLW/ES/3/SK-1/0030/~~D~~ E

(ii) CLW/ES/3/SK-2/0030/~~D~~ E

(iii) CLW/ES/3/SK-3/0030/~~D~~ E

TECHNICAL SPECIFICATION
FOR BATTERY FOR 3-PHASE ELECTRIC LOCOMOTIVES

Specification No: CLW/ES/3/0030/~~D~~ E

ISSUE DATE: 17.11.2003

ISSUED BY:

DY. CHIEF ELECTRICAL ENGINEER/D-III

CHITTARANJAN LOCOMOTIVE WORKS

P.O : CHITTARANJAN – 713331

DIST. BARDDHAMAN (WEST), WEST BENGAL (INDIA)

Prepared By	Checked By	Approved By
JE/SSE-DESIGN	AEE/DESIGN	Dy.CEE/ D-II

ALTERATION RECORD SHEET

SL. NO.	DATE	PAGE No.	ALT.	DESCRIPTION	REMARKS (SIGN.)
1.	21.03.2003	14	A	Note : 3 added at sheet no.14	-Sd-
2.	17.11.2003	All	B	The entire specification has been revised.	-Sd-
3.	22.08.2007	10	C	Location of vent plug indicated as (2) in drg. No.SK-1/0030 corrected.	-Sd-
4.	08.07.2021	3,5,6,7, 12 & 13	D	List of spares & accessories with Ni-Cd Battery added. Review note no.GM/CLW/Secy/1 dt 29.06.21	-Sd-
5		11 12,13	E	Quantity of Electrolyte revised from 20 liters/Loco to 10 liters/Loco (Annexure-C) Drawing No-CLW/ES/3/SK-1/0030 and CLW/ES/3/SK-2/0030 corrected	

NOTE: "Specifications have been digitized and all alterations have been incorporated"

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INDEX

SPECIFICATION FOR BATTERY

1. SCOPE :

This specification covers the manufacture and supply of Nickel Cadmium Battery for installation on the 25KV 50Hz 3-Phase AC Electric Locomotives.

2. CLIMATIC AND ENVIRONMENTAL CONDITION: -

- Maximum atmospheric temperature : +70°C (In Sun) &
  : 50°C.(In Shade)
- Humidity : 100% Saturation during rainy season.

Reference site condition

(i)	Ambient Temperature	: Max. 55^0C, Min. 0^0C
(ii)	Humidity	: 60 %
(iii)	Altitude	: 1000 m above mean sea level
(iv)	Rainfall	: Very heavy in certain areas. The locomotive will be designed to permit its running at 10 km/hr. in flood water level of 102 mm above rail level.

- Atmosphere during hot weather : Extremely dusty and desert terrain in certain areas.
- Coastal areas : Locomotive and equipment will be designed to work in coastal areas in humid and salt laden atmosphere.
- Vibration : The equipment, sub-system and their mounting arrangement will be designed to withstand vibrations and shocks encountered in service as specified in IS : 9000 (part-8). The equipment will be mounted in under frame.

3. STANDARD :

Governing standard will be IS:13315. All the applicable standards shall be of latest version.

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4. TECHNICAL DATA :

Nominal capacity	:	199 AH C5A
Nominal Voltage	:	1.2 V/Cell or 3.6 V/Block
No. of Cells	:	78
Cell arrangement	:	26 X 3 Packs
Fast charge Voltage	:	1.5 V/Cell
Float charge Voltage	:	1.38 V/Cell
Discharge Voltage	:	1.05 V/Cell
Operating temp.	:	0 deg.C to 55 deg.C
Cooling	:	Air exchange in battery box.
Topping interval	:	Min. 2 months
Total weight(approx.)	:	748 Kg (max)
Place	:	Battery Box in under frame
Cell connection bolt	:	M10 (material: SS)

5. TEST :

The test should be done according to IS: 13315 unless otherwise mentioned. Firm must offer consistency type test every 05 year.

5.1 **TEST EQUIPMENT**:
The voltmeter, ammeter, thermometer and hydrometer required for the tests specified in this specification shall meet the requirements given in clause 10.2 of IS: 8320.

5.2 **INITIAL CHARGE**:

This charge is for commissioning the battery for the first time. Mode of charging, rate and duration shall be specified by the manufacturer.

5.2 **TEST FOR CAPACITY**

5.3.1 CHARGING OF BATTERY
As per clause 8.1 of IS: 13315.

5.3.2 DISCHARGE C_{10}
As per clause 8.2 of IS: 13315.

5.3.3 CAPACITY AT C_5 HOUR RATE

As per clause 8.3 of IS: 13315.

5.3.4 TEST FOR AMPERE HOUR & WATT HOUR EFFICIENCY

Ampere hour and watt hour efficiencies when tested shall not be less than 80 % and 65 % respectively.

5.3.4.1 AMPERE HOUR EFFICIENCY

As per clause 8.4 .1 of IS : 13315

5.3.4.2 WATT HOUR EFFICIENCY

As per clause 8.4 .2 of IS : 13315

5.3.5 RETENTION OF CHARGE TEST

As per clause 8.5 of IS : 13315

5.3.6 ENDURANCE TEST / LIFE CYCLE TEST

As per clause 8.6 of IS : 13315

5.3.7 INSULATION RESISTANCE TEST

As per clause 8.7 of IS : 13315

5.3.8 AIR PRESSURE TEST

As per clause 8.8 of IS : 13315

*The air pressure shall not fall below 120 mm H_2O at the end of 15 seconds.

5.3.9 STORAGE TEST

As per clause 8.9 of IS : 13315

5.3.10 VIBRATION RESISTANCE TEST

As per clause 8.10 of IS : 13315

6. DATA FROM THE MANUFACTURER

6.1 The Manufacturer along with quotation or supply shall provide the information given in **Annexure – A & B**.

7. MATERIAL AND CONSTRUCTION

7.1 GENERAL

All material used shall be the best of their respective time, free from flaws and defects and shall confirm to latest relevant Indian standard, where applicable. The workmanship shall be in line with highest accepted practice. There shall be no impurities harmful to the performance or life of a cell.

7.2 OVERALL DIMENSION AND WEIGHT

As per Drg. no. CLW/ES/3/SK-1/0030 and Technical Data of this specification.

7.3 BATTERY CONTAINER

The cell container shall be high strength alkali resistant, non-porous, non-hygroscopic industrial grade expanded polypropylene/Auto impact polystyrene material. The container shall not bulge, buckle or disintegrate under the conditions encountered in locomotive operation and shall last the expected life of the battery without any adverse effect on the service. The battery container shall confirm to IS:1146 and shall pass the tests accordingly.

7.4 SEPARATOR

The separators used for the cells shall be porous, alkali resistant and having insulation capacity to avoid shorting or leakage of current between plates of opposite polarity. The separators shall also be dimensionally stable and shall not deform or deteriorate at the temperature of use. Each cell shall be provided with a suitable separator guard, adequately secured to prevent damage to separators while inserting thermometers or service apparatus into a cell.

7.5 VENTING DEVICE

The venting device shall be of the anti-splash type and shall allow the gases to escape freely but shall affectively prevent the escape of electrolyte particles or spray. Provisions shall be made for drawing electrolyte samples and for checking and servicing of the electrolyte. Vents with flame arrestor caps shall be preferred.

7.6 TERMINAL POSTS & CONNECTIONS

The terminal shall be provided on each cell. The polarity of the terminals shall be clearly distinguished. For details of inter battery unit cable connector, please refer to drawing no. CLW/ES/3/SK-3/0030.

7.7 ELECTROLYTE

As per clause 4.5 of IS : 13315.

*Battery should be supplied with full electrolyte and tenderer should supply as per list of spare and accessories with Ni-Cd Battery.

7.8 **SHIPPING METHOD**

Filled and charged.

8. REFERENCE

Schematic position : 111.

The battery used by M/s ABB along with imported 3-phase locomotive is SBL-199 manufactured by :

SAFT NIFE
Industrial Battery Group, 156, Avenue Metz,
93230, Romainville, France.

Note:

1. The tenderer should provide all the connecting terminal wires and other accessories required for batteries as per list of spare and accessories with Ni-Cd Battery at **Annexure 'C'**.
2. The tenderer shall fix name plate on the equipment indicating:
   A. Month and Year of manufacture.
   B. Serial No. of the equipment
   C. Name of the manufacturer
3. The SS fasteners should be procured from Approved sources of CLW vendor list only.

Annexure-A

Sl No.	**Description**	**Particulars to be filled by tenderer**
1.	Maker's name	
2.	Type of cell	
3.	Manufacturer type No.	
4.	Overall dimension of each battery containing 3 cells i.e. length x width x height with filler cap open and filler cap closed.	
5.	Weight per battery complete with electrolyte.	
6.	Construction of positive plates.	
7.	Construction of negative plates.	
8.	Charge and discharge curves with voltage as ordinates and times as abscissae (100 mm = 1 V and 38 mm = 1 Hour) shall be supplied showing the performance of the cell under the following conditions : A. Discharge of cells at the 10 hours rate. B. Discharge of cells at the 5 hours rate. When plotting above curves, a minimum final voltage of 1.10 V across any cell shall be assumed.	
9.	Electrolyte height above the top of the plates.	
10.	Electrolyte depth below the bottom of the plates.	
11.	A. Quantity of liquid electrolyte per cell. B. Quantity of solid electrolyte per cell.	
12.	Period recommended for renewal of electrolyte.	
13.	Composition of electrolyte.	
14.	Type of electrolyte and Supplier's address.	
15.	Specific gravity of electrolyte at 27 deg.C.	

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Annexure-B

Sl No.	Description	Particulars to be filled by tenderer
1.	Internal resistance of cell fully charged at 27 deg.C.	
2.	Ampere hour capacity at the 10 hour rate / 5 hour rate as the case may be when discharged continuously to the minimum of 1.10 volt Approx.. any one cell at the electrolyte temperature of : A. 27 deg.C. B. 40 deg.C.	
3.	Max. rate of charge permissible without material damage when cells are in a fully discharged condition.	
4.	Normal charging rate.	
5.	Max. Charging rate.	
6.	Ampere hour efficiency at : A. 10 hours rate. B. 5 hours rate.	
7.	Watt hour efficiency at : A. 10 hours rate. B. 5 hours rate.	
8.	Rise in electrolyte temperature above 55 deg.C ambient air temperature when the cells are tested continuously by fully charging at normal rate and discharging at the 10 hours rate.	
9.	Max. electrolyte temperature that the cell will withstand without damage : A. Continuously. B. For short period.	
10.	Max. electrolyte temperature at which the cells will give the following output : A. 100 % capacity. B. 90 % capacity.	

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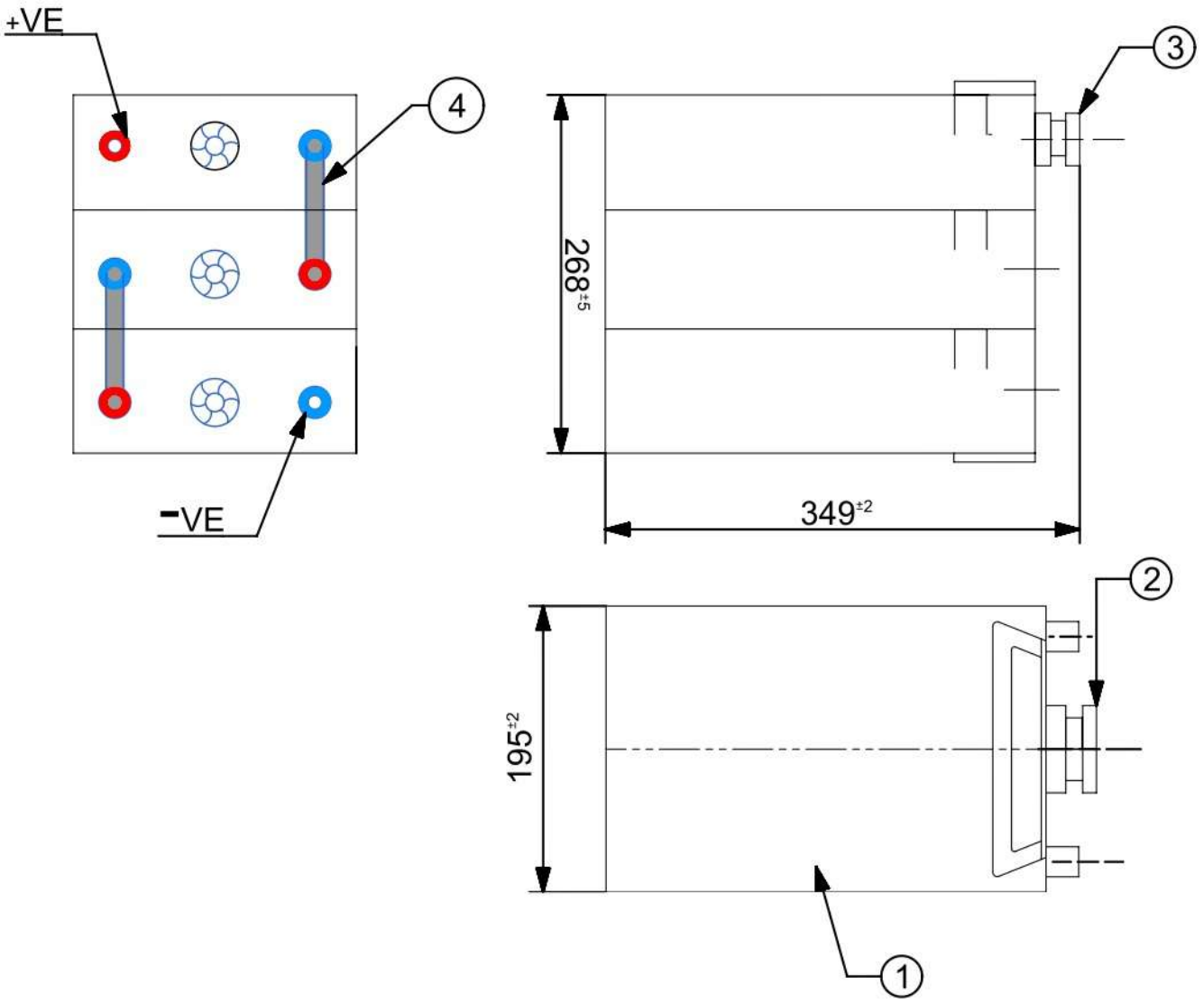
Annexure-C

List of spare & accessories with Ni-Cd battery

Sl.no	Item description	Quantity
1	Cable connector(C1) 70sq mm,L=165mm	03 nos/loco
2	Cable Connector (C2) 70sq mm,L=300mm	24nosloco
3	Shrouds/connector cover	56nos/loco
4	Petroleum jelly	200gm/loco
5	Electrolyte	~~20ltr/loco~~ 10ltr/Loco
6	Vent cap locking tool	01no/loco
7	Vent cap	01no/loco

CLW/ES/3/SK-3/0030/D



QTY.	POS.	DESCRIPTION	MATERIAL
2	4	CELL CONNECTOR	COPPER
6	3	HEX SCREW	SS
3	2	VENT	POLYPROPYLENE
3	1	CELL	POLYPROPYLENE

ALL DIMENSIONS ARE IN mm.

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित बाद्वार DATED INITIAL

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302
SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768
UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553
WELDING SYMBOLS TO IS:813 / ISO:2553

TOL. CLS.

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

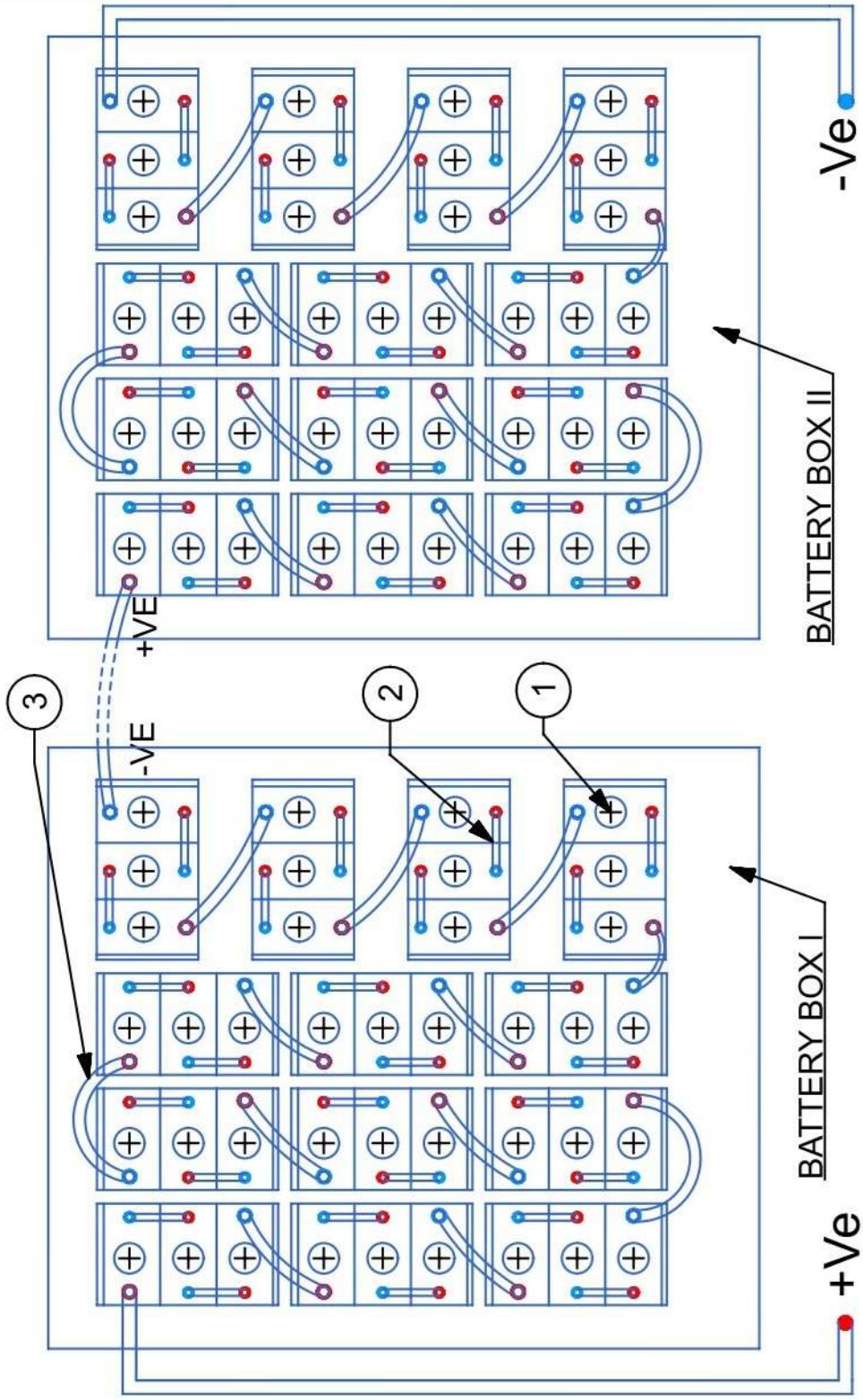
अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NTS
संदर्भ / REF.	ALT.-

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	CLW/ES/3/0030/D/E
वर्णन DESCRIPTION	**BATTERY BLOCK**
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-1/0030/D/E
परिवर्तन संख्या ALTERATION. NO.	पर्ण SHEET 3 OF 3 — A4

REDRAWN BY COE

CLW/ES/3/SK-2/0030/D



BLOCK DIMENSION : 268 $^{\pm 5}$L X 195 $^{\pm 2}$W X 349 $^{\pm 2}$H

BOX DIMENSION : 1000L X 1000W X 400H

QTY.	POS	DESCRIPTION	MATERIAL	SPECIFICATION	TREATMENT
24	3	INTER BLOCK CONNECTOR	COPPER	BC GRADE	IN-PLATED
52	2	INTER CELL CONNECTOR	COPPER	BC GRADE	IN-PLATED
26	1	3 CELL BLOCK			

NO. OF BOXES	NO.OF BLOCKS PER BOX	NO. OF CELLS PER BLOCK	NO. OF CELLS PER BOX	TOTAL NO. OF CELLS
2	13	3	39	78

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित बाबत DATED INITIAL

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302
SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768
UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553
WELDING SYMBOLS TO IS:813 / ISO:2553

TOL. CLS.

ग्रेडांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NTS
संदर्भ / REF.	
ALT.-	

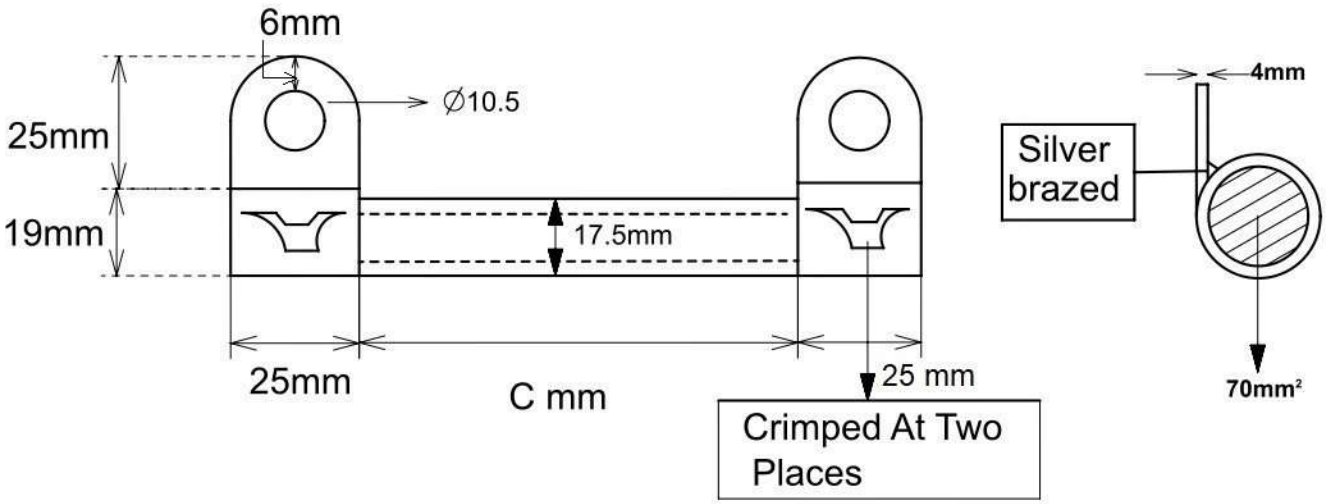
चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	CLW/ES/3/0030/D/E
वर्णन DESCRIPTION	Battery Box Assembly Connection
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-2/0030/D/E
परिवर्तन संख्या ALTERATION. NO.	पर्ण SHEET 1 OF 1 — A4

REDRAWN BY COE

CLW/ES/3/SK-3/0030

INTER BATTERY UNIT CABLE CONNECTOR



C1 = 165 mm
C2 = 300 mm

Quantity as per List of Spares & accessories with Ni-Cd Battery, at Annexure 'C'

NB : The above diagram is not to scale and indicative only.

Cable used in inter battery unit connector should be 70 sq.mm copper cable having annealed EC grade copper strands of nominal diameter 0.2 mm. The cable should be highly flexible. PVC insulationshould not be used in cable.

The cable lug used will be 70/ M10 tubular type with brazing and crimping as indicated in above diagram. The material of cable lug should be tinned EC grade annealed copper.

Entire battery unit cable connector should be similar to the one used in imported 3-Phase locomotives

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित बाद्वारा DATED INITIAL

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553

TOL. CLS.

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NOT TO SCALE
संदर्भ / REF.	
ALT.-	

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	CLW/ES/3/0030/D/E
वर्णन DESCRIPTION	CABLE CONNECTOR
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-3/0030/D/E
परिवर्तन संख्या ALTERATION. NO.	पर्ण SHEET 1 OF 1 — A4

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