SPECIFICATION
FOR
HIGH VOLTAGE CABLE WITH PLUG
FOR
WAG-9/WAP-7/WAP-5 ELECTRIC LOCOMOTIVES

Specification No : CLW/ES/3/0251 (Rev~~1~~2 ~~December-06~~)

Enclosures :-

i) Drawing no. CLW/ES/3/SK-1/0251 REV.~~01~~ 02 ~~(DEC.06)~~
~~ii)~~ Drawing no. CLW/ES/3/SK-2/0251 REV.~~01~~ 02 ~~(DEC.06)~~
~~iii)~~ Drawing no. CLW/ES/3/SK-3/0251 REV.~~01~~ 02 ~~(DEC.06)~~

ISSUED BY

DY.CHIEF ELECTRICAL ENGINEER/D-I
CHITTARANJAN LOCOMOTIVE WORKS
CHITTARANJAN – 713331
Dist: BARDHAMAN (WEST)
WEST BENGAL (INDIA)

Prepared By	Checked By	Issued By
JE-Design	SEE/D-I	Dy.CEE/D-I

ALTERATION RECORD SHEET

Amendment Number	Date of Amendment	Page number	Alteration/ Revision	Description	Authority
1.	XX-XX-2025		2	i) Specification has been digitized. ii) In Cl.no.3.0, Sr.no.5 Altitude and Sr.no.6 Rainfall have been modified. iii) In Cl.no.4.0 Standard, IS:2089 has been corrected to IS:2099. IEC 60840 & IEEE 386 is included . iv) Drawing no in scope of supply in Cl.no.5.0 has been modified. v) Sub cl.no.6.4.1 Earthing cable and Sub cl.no.6.4.2 Earthing Cable length under cl.no.6.4 is modified. vi) In Cl.no.6.5, Technical details are referred to specification of High voltage Bushing. vii) "or equivalent/ higher rating as approved by CLW/BLW/RDSO" is included in Cl.no.-6.7.1, sl.no.1. viii) Cl.no.6.7 ELBOW Connector assembly & dimensional details is included. ix) In Cl.no.6.7.1, sl.no. 12 for Rated impulse current has been added. x) Proper heat shrinking and crimping of Cable Lugs is includedin sr.no. 7.7.1at cl.no. 7.7 xi) In Cl.no.7.7, Wet power frequency withstand voltage test at 75KV (RMS) has been deleted in sr.no.7.7.3, IEC60502 corrected to IEC60270 in sr.no.7.7.5, temperature rise test modified in sr.no.7.7.7. xii) In Cl.no.7.7 Test: Nominal rated current 800A, Over current carrying ability 900A~~, rated impulse current >125 KA~~ and Nominal Short time current test 40kA as per IEEE386 is included in sr. no. 7.7.8, 7.7.9 and 7.7.10 respectively. Pull out test of Cable(sample basis) as per standred BS EN 50343 is included in sr. no. 7.7.11 and flammability test of Non metallic part is included in sr. no. 7.7.12.	

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				xiii) Cl.no.7.1 to cl.no.7.6 is included. xiv) Cl.no.8 Test condition has been deleted. xv) Test connection under Cl.no.8 is deleted and included in drg.no.CLW/ES/3/SK-1/0251 Rev-~~1~~ 2, ~~Dec 06.~~ xvi) In Sub Cl.no. 9.3, Material composition of Elbow Connector, Stud, Thread of FAL-PLUGS 755 LR and copper lugs is mentioned. xvii) Cl.no.10 Reference type and Cl.no.11 General Condition have been deleted. xviii) Cl.no.12.0 Lebel and Marking have been modified. xix) NOTE is included in drawing no. CLW/ES/3/ SK-2/0251 Rev-2. xx) BOM at SN-4,5 & 12 have been modified in drawing no. CLW/ES/3/ SK-2/0251 Rev-2. xxi) Drawing of STUD (Ref:3EHW470010) is included in drawing no. CLW/ES/3/SK-3/0251 Rev-2.	

Note:- Specification has been digitized and all the alteration i.e addition, deletion, modification etc. has been incorporated in the digitized specification.

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1.0 GENERAL DESCRIPTION

SPECIFICATION FOR HIGH VOLTAGE CABLE WITH PLUG FOR THREE PHASE 6000 HP WAG-9 / WAP-7 & WAP-5 CLASS 50 Hz AC LOCOMOTIVE .

2.0 SCOPE

This specification applies to high voltage cable with plug being used in the 3-phase 6000 HP, WAG-9/WAP-7/WAP-5 Class 50 Hz AC Locomotive with its accessories .

3.0 CLIMATIC AND ENVIRONMENTAL CONDITION

Sr.no.	Description	Remarks
1.	Maximum atmospheric temperatures	Under Sun : +70°C. In shade : +50°C.
2.	Ambient Temperature	Max.55°C, Min.-0°C.
3.	Normal Humidity	60%.
4.	Maximum Humidity	100% saturation during rainy season.
5.	Altitude	~~160 m above mean sea level~~ 1776 m above mean sea level against USBRL project condition.
6.	Rainfall	Very heavy in certain areas. The locomotive will be designed to permit it's running at 10 kilometer per hour in flood water level of ~~102.mm~~ 200 mm above rail level.
7.	Atmosphere during hot weather	Extremely dusty and desert terrain in certain areas.
8.	Coastal areas	Locomotive and equipment will be designed to work in coastal areas in humid and salt laden atmosphere.
9.	Vibration	The equipment, subsystem and their mounting arrangement will be designed to withstand vibrations and shocks encountered in service as specified in corresponding IEC: 61373 or latest publications unless otherwise prescribed.

4.0 STANDARAD

IEC-60077 or latest
~~IEC-60502 or latest~~
IS-13573- 2 or latest
IS-~~2089~~ 2099 -1986 or latest
IEC-60137-1984 or latest
IEC-61373 or latest
IEC-60270 or latest.
IEC 60840
IEEE 386
EN 45545-2 or latest

5.0 SCOPE OF SUPPLY

The scope of supply will be high voltage cable with plug as per drawing No. **CLW/ES/3/SK-2/0251 Rev-~~1~~ 2, ~~Dec 2006~~**.

6.0 TECHNICAL DATA

6.1 HIGH VOLTAGE CABLE GKT, 45/26 KV :-

High Voltage Cable should be as per IEC: 60840 (test requirement as per RDSO spec.no. ELRS/SPEC/ BL/ 0003, Rev.1) and has the following general properties:

- Flexible
- Conductor and screen made of copper.

6.2 MECHANICAL DATA OF HIGH VOLTAGE CABLE :-

Cl.No.	Description	Data
6.2.1	Cross section area of Cable: 185 sq.mm, for cross-linked polyethylene insulated cable (XLPE cable). **OR** 185/240 sq.mm, for ethylene propylene cable (EPR cable).	–
6.2.2	Min. bending radius at pulling (mm)	710
6.2.3	Min. Bending Radius when laid (mm)	475
6.2.4	Max. Pulling force (daN)	1110

6.3 ELECTRICAL AND THERMAL DATA OF HV CABLE :-

Cl.No.	Description	Data
6.3.1	Max. Service Voltage [kV] (Uo Phase/Phase)	52
6.3.2	Test Voltage/Dielectric [kV]	75
6.3.3	Rated impulse withstand voltage [kV]	250
6.3.4	Max. Operate Temperature of conductor [°C] (continuously)	90
6.3.5	Max. Operate Temperature of conductor [°C] (short circuit max. 3 sec.)	250
6.3.6	Max. Operate Temperature of screen [°C] (short circuit max. 3 sec.)	350

6.4 TECHNICAL DATA OF EARTHLING CABLE :-

Cl.No.	Description	Data
6.4.1	Earthling Cable	Earthing cable of nominal cross section of 16 sq.mm. as per spec.no. CLW/ES/3/0458
6.4.2	Total length	~~(250+450)=700 mm.~~ (450+450) = 900 mm
6.4.3	Cable sleeve	SD Sleeve yellow/green.
6.4.4	Conductor	Standard tin-plated copper.
6.4.5	Insulation	Electron beam cross-linked.
6.4.6	Sheath	Electron beam cross-linked copolymer, color- black.
6.4.7	General Properties	Limited fire hazard electrical installation cable dual wall insulation, low smoke, halogen free, flame retardant, excellent resistance to high and low temperature, oil, ozone, weathering and abrasion, easily strippable.

6.5 The High Voltage Cable with Plug shall be compatible with high Voltage Bushing (not in the scope of supply) as per spec.no. CLW/ES/3/0052 of following technical parameters:-

TECHNICAL DATA OF HIGH VOLTAGE BUSHING [MICAFIL] (Not in the scope of supply)

Salient technical details of High Voltage Bushing (Not in scope of supply) as follows:-

Sr. no.	Description	Data
1	Rated voltage	30KV 35KV
2	Max. Operating voltage	30 KV
3	Test Voltage 50 Hz 1 min Dry/Wet	75 KV
4	Shock Voltage- 1.2/ 50 µs full wave	170 KV_P
5	Nominal current at 70°C air temperature	630 A
7	Short time current	50kA
8	Lf	400 mm
9	Creepage path hk	>806 mm1050 mm

6.6 ELBOW Connector- ELBOW connector of 30KV 630Amp of as per ABB Identification No. 3EHW470090R1185 plug type 755 LR or equivalent/ higher rating as approved by CLW/BLW/RDSO shall be mounted as per manufacturer recommendation on to the bushing. The bushing shall be tightening 30 kV basic insulating plug Elbow and other details has been shown as per sketch No. CLW/ES/3/SK-3/0251 Rev-1 2, Dec-06.

6.7 ELBOW Connectors Technical Data- It has been shown on the Sketch No. CLW/ES/3/SK-2/0251 Rev-12, Dec-06.

6.7.1 Dimensions as per Sketch No. CLW/ES/3/SK-3/0251 Rev-1 2, Dec-06.

6.7 ELBOW Connector assembly & dimensional details: Complete assembly with ELBOW Connector has been shown in the drg. no. CLW/ES/3/SK-3/0251 Rev-2 and dimensions as per drg.no. CLW/ES/3/SK-3/ 0251 Rev-2 .

6.7.1 ELECTRICAL DATA :

Sr. no.	Description	Data
1	Connector type	755 LR or equivalent/ higher rating as approved by CLW/BLW/RDSO
2	Voltage	30 kV
3	Max. Line voltage	36 kV
4	Partial discharge	< 5PC
5	Impulse withstand Voltage	170 kV
7	Nominal withstand AC volt	75kV 50 Hz
8	1 min - DC Voltage	144 kV
9	Nominal rated current	800A
10	Over current carrying ability	900A
11	Nominal short-time current (1 sec)	40KA (as per IEEE 386).
12	Rated impulse current	>125KA

7.0 TEST:- The tests shall be carried out in the presence of authorized representative of Railways/ Production Units/RDSO.

7.1 Type test and routine test shall be carried out according to relevant Internationals/ Indian standards.

7.2 Type test: All the type tests, mentioned in clause no. 7.7 shall be carried out on prototype unit. The firm manufacturing for the first time shall get prototype approved by CLW/BLW.

7.3 Routine test: Routine test mentioned in clause no. 7.7 shall be carried out on each by the manufacturer at his works to ensure compliance with the specification and drawings.

7.4 Acceptance Test: Acceptance Test mentioned in clause no. 7.7 shall be carried out by authorized representative of Railways at firm's approved premises on sampling basis.

7.5 QAP & Test protocol shall be submitted by firm for approval before proceeding prototype test.

7.6 A copy of the internal test report, conducted by the firm shall be supplied to inspecting authority during type test and acceptance test.

7.7 Table for Tests:

Sr. No.	Test Description	Specified standard	Test			Remark
			Type (100%)	Routine* (100%)	Acceptance (bulk) 10%	
7.7.1	Preliminary Checks of the Complete CHT System: Check the technical particulars, details of rating plate and all dimensional details as per approved drawing of CLW for the following assemblies. a) HV cable & other supplementary part as per CLW Drg. No. CLW/ES/3/SK-2/0251 Rev-~~1~~2, ~~Dec-06.~~ b) Elbow type connector along with its accessories as per CLW Drg. Nos. CLW/ES/3/SK-3/0251 Rev-~~1~~2, ~~Dec-06.~~ c) Proper heat shrinking and crimping of Cable Lugs.	As per drawing.	Y	Y	Y	For complete assembled cable
7.7.2	Dry power frequency withstand voltage test at 75KV (RMS).	IS: 2099-1986, IEC-60137-1984. or latest	Y	Y To be done at 60KV	Y To be done at 60KV	
7.7.3	~~Wet power frequency withstand voltage test at 75KV (RMS) as per IS:2099-1986, IEC- 60137-11984- Exempted for prototype sample: refer para2 of this office letter No. EL 3.2.21 dated 18.04.2006~~.		NA	NA	NA	

7.7.4	Impulse voltage test at 170KV peak, as per CLW specification No. CLW/ES/3/0251 and IS:2099-1986 or IEC 60137 or latest (10 positive & 10 negative).	IS:2099-1986 or latest	Y	NA	NA	For complete assembled cable
7.7.5	**Partial discharge test**: PD test on CHT shall be carried out at 30KV as per ~~IEC-60502~~ 60270, the PD values shall be less than 5 PC.	IEC-60270 or latest	Y	Y	Y	
7.7.6	**Vibration and Shock Test:** Vibration and shock test as per IEC: 61373 or latest shall be conducted on the complete CHT system.	IEC: 61373 or latest	Y	NA	NA	
7.7.7	~~Temperature Rise Test~~ **AC Voltage Life with Cyclic Current Loading:-** maximum operating temperature of 90°C for the conductor, and test is performed at 10°C above the operating voltage, reaching 100°C ~~At 100ºC~~ - 3 cycles (5 hours heating & 3 hours cooling) as per procedure given in IS: 13573.	IS: 13573 or latest	Y	NA	NA	
7.7.8	Verification of Nominal rated current of Elbow connector for 800A.	IEC 60502 or latest	Y	NA	NA	For connector
7.7.9	Verification of Over current carrying capacity for 900A ~~and rated impulse current >125 KA.~~	IEC 60502 or latest	Y	NA	NA	
7.7.10	Verification of Short time current test	40KA (as per IEEE 386	Y	NA	NA	
7.7.11	Pull out test (sample basis) as per standard BS EN-50343.	BS EN-50343	Y	Y	Y	For cable & LUG
7.7.12	Flammability test	EN 45545-2 or latest	Y	NA	NA	For Non-metallic parts

~~8.0 TEST CONDITION :~~

~~- Bushing complete, lower part submersed in oil.~~

~~- Bushing complete, including HV-Plug and 1.8 m HV Cable including cable and cap, air exposed.~~

MEASUREMENT OF PARTIAL DISCHARGE:

- Measurement of circuit according IEC 60270
- Capacity Impedance: 60 n / Back ground distortion 2 pc.

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~~**TEST CONNECTION:**~~

~~For shock voltage and switch on shock test as per Sketch No. CLW/ES/3/SK-1/0251 .~~
~~Cs = Pulse capacitor~~
~~F = Switch on path~~
~~Rb = load resistance~~
~~Rd = Damping resistance~~
~~Cl C2 = Voltage divider~~
~~KV = Volt meter~~
~~OSC = Oscilloscope~~
~~Control of the ratio of the voltage divides is done by means of Volt Meter. All equipments used during testing shall be calibrated.~~

9.0 DRAWING :

9.1 Connection diagram CLW/ES/3/SK-1/0251, Rev-~~1~~ 2, ~~Dec-06.~~

9.2 Dimensional drawing of HV cable and other supplementary part Drawing No.CLW/ES/3/SK-2/0251 Rev-~~1~~ 2, ~~Dec-06.~~

9.3 **Material composition** :

Sr. no.	Description	Material composition
1	ELBOW Connector	EPDM
2	Thread part of item no.-13 (Mentioned in drg. no. CLW/ES/3/SK-2/0251 Rev-2).	CR:0.3-1.2%, ZR: 0.03-0.3%, CU: Rest (C18150) (Ref. HZN 400523) **or** Te: 0.4-0.7% ,P: 0.004-0.012 % CU: Rest (C14500).
3	Stud (Mentioned in drg. no. CLW/ES/ 3/SK-3/0251 Rev-2).	CR:0.3-1.2%, ZR: 0.03-0.3%, CU: Rest C18150) (Ref. HZN 400523) **or** Te: 0.4-0.7% ,P: 0.004-0.012 % CU: Rest (C14500).
4	Lugs	ETP Copper

9.4 L-PLUG dimensional drawing No. CLW/ES/3/SK-3/0251 Rev-~~1~~ 2, ~~Dec-06.~~

~~**10.0 REFERENCE TYPE :**~~

~~RMF 30Y/630 SL~~
~~Identification No. HBTB 416462 Bushing ABB Drg. No. HUM126284 supplied by ABB manufacturer MICAFIL .~~

~~**11.0 GENERAL CONDITION** :~~

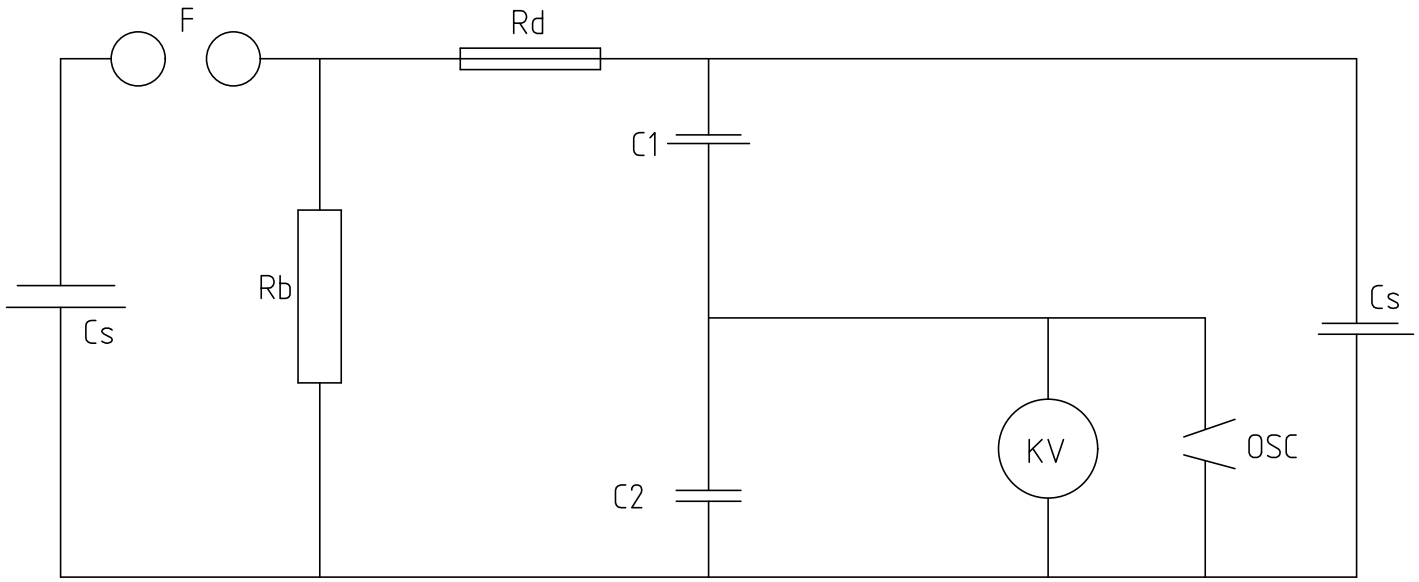
~~The tenderer should confirm that the high voltage cable with plug used as similar to three-phase electric locomotive WAG-9 class manufacturer by M/s. ABB for Indian Railways .~~

12.0 LABEL AND MARKING :

~~i) Manufacturers name~~
~~ii) Year of manufacture~~
~~iii) Trade mark if any~~
~~iv) Batch No. & Code~~
~~v) Serial No of the Product.~~

Following details to be mark/tagged on proper location of High Voltage Cable with Plug which should be clearly visible after laying of item in loco.
(i) Manufacturer name/Trade mark if any
(ii) Month & Year of manufacture
(iii) Batch No. & code
(iv) Serial No. of the Product.

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Cs =Pulse capacitor
F = Switch on path
Rb = Load resistance
Rd = Damping resistance
CI, C2 = Voltage divider
KV = Voltmeter
OSC = Oscilloscope
Control of the ratio of the voltage divides is done by means of Voltmeter.
All equipment's used during testing shall be calibrated.

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित हस्ताक्षर 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	TOL. CLS.
	धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	

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	N.T.S
संदर्भ / REF.	
ALT.-	

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

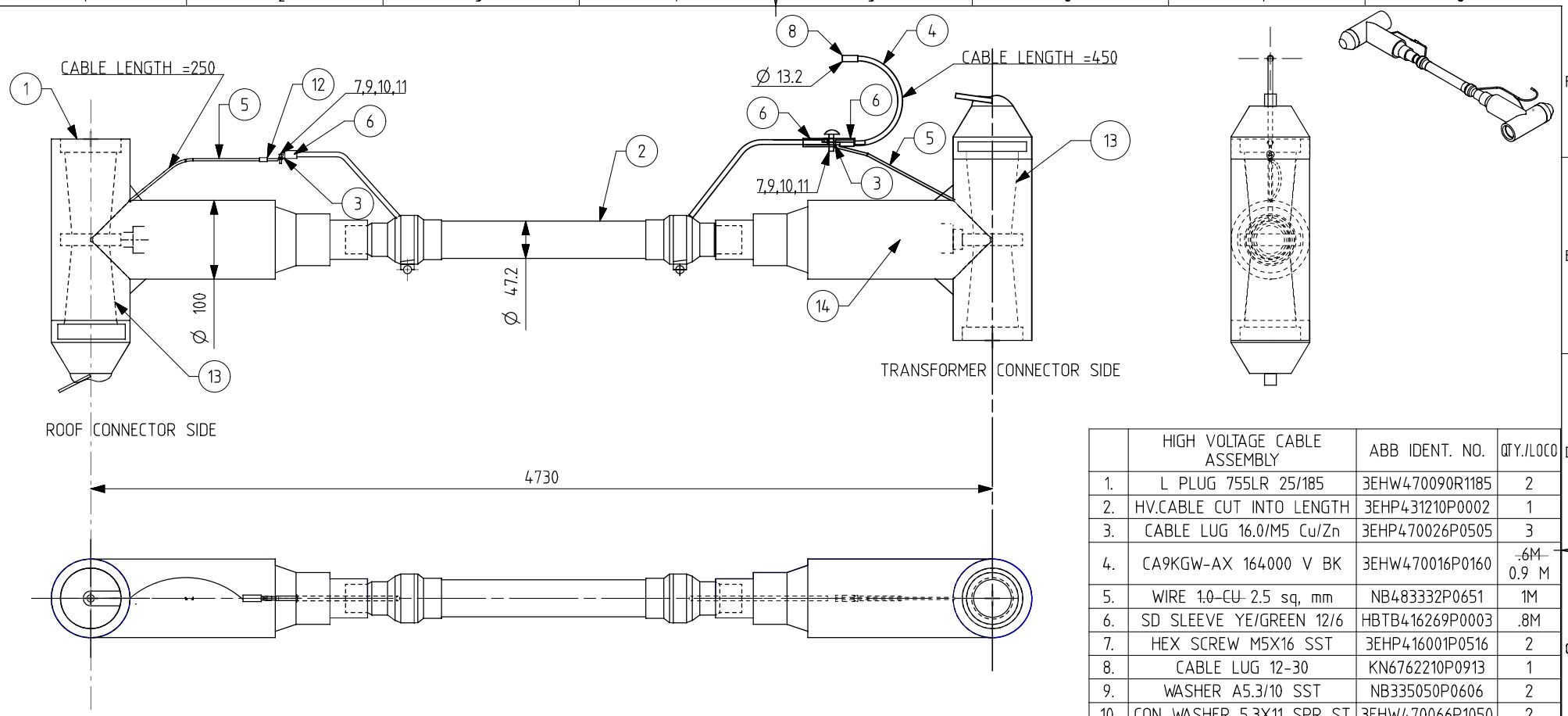
पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	

वर्णन DESCRIPTION: HIGH VOLTAGE CABLE WITH PLUG

आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-1/0251 REV. 2 ~~(DEC.06)~~

परिवर्तन संख्या ALTERATION. NO. | पर्ण SHEET 8 OF 10 | A4

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	HIGH VOLTAGE CABLE ASSEMBLY	ABB IDENT. NO.	QTY./LOCO
1.	L PLUG 755LR 25/185	3EHW470090R1185	2
2.	HV.CABLE CUT INTO LENGTH	3EHP431210P0002	1
3.	CABLE LUG 16.0/M5 Cu/Zn	3EHP470026P0505	3
4.	CA9KGW-AX 164000 V BK	3EHW470016P0160	~~.6M~~ 0.9 M
5.	WIRE 1.0-CU 2.5 sq, mm	NB483332P0651	1M
6.	SD SLEEVE YE/GREEN 12/6	HBTB416269P0003	.8M
7.	HEX SCREW M5X16 SST	3EHP416001P0516	2
8.	CABLE LUG 12-30	KN6762210P0913	1
9.	WASHER A5.3/10 SST	NB335050P0606	2
10.	CON WASHER 5.3X11 SPR ST	3EHW470066P1050	2
11.	HET NUT 0.8D M5 ST	NB332600P0510	2
12.	CABLE LUG~~0.5-10/M5~~ 1.5-2.5/M5	3EHP470026P0015	2
13.	FAL-PLUGS 755 LR 15/25 KV	HBTB650063	2
14.	PR-ASSLY. HV CABLES Q-CL=3	3EHP600045P3540	2

NOTE:-
1. STUD MATERIAL-CR:0.3-1.2%, ZR:0.03-0.3%, CU:REST(C18150)/Te:0.4-0.7%, P:0.004-0.012%, CU:REST (C14500), QTY./LOCO-2
2. SN.-13 FAL- PLUGS 755 LR THREAD MATERIAL-CR:0.3-1.2%, ZR:0.03-0.3%, CU:REST(C18150)/Te:0.4-0.7%, P:0.004-0.012%, CU:REST (C14500).

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768												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
सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	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	100-250
	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												

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

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	
रेखिक अनुपात SCALE	N.T.S
संदर्भ / REF.	ALT.-

चितरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	HIGH VOLTAGE CABLE WITH PLUG
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-2/0251 REV. 2
परिवर्तन संख्या ALTERATION NO.	पर्ण SHEET 9 OF 10 — A3

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CLWES/3/SK-3/0251 REV.-

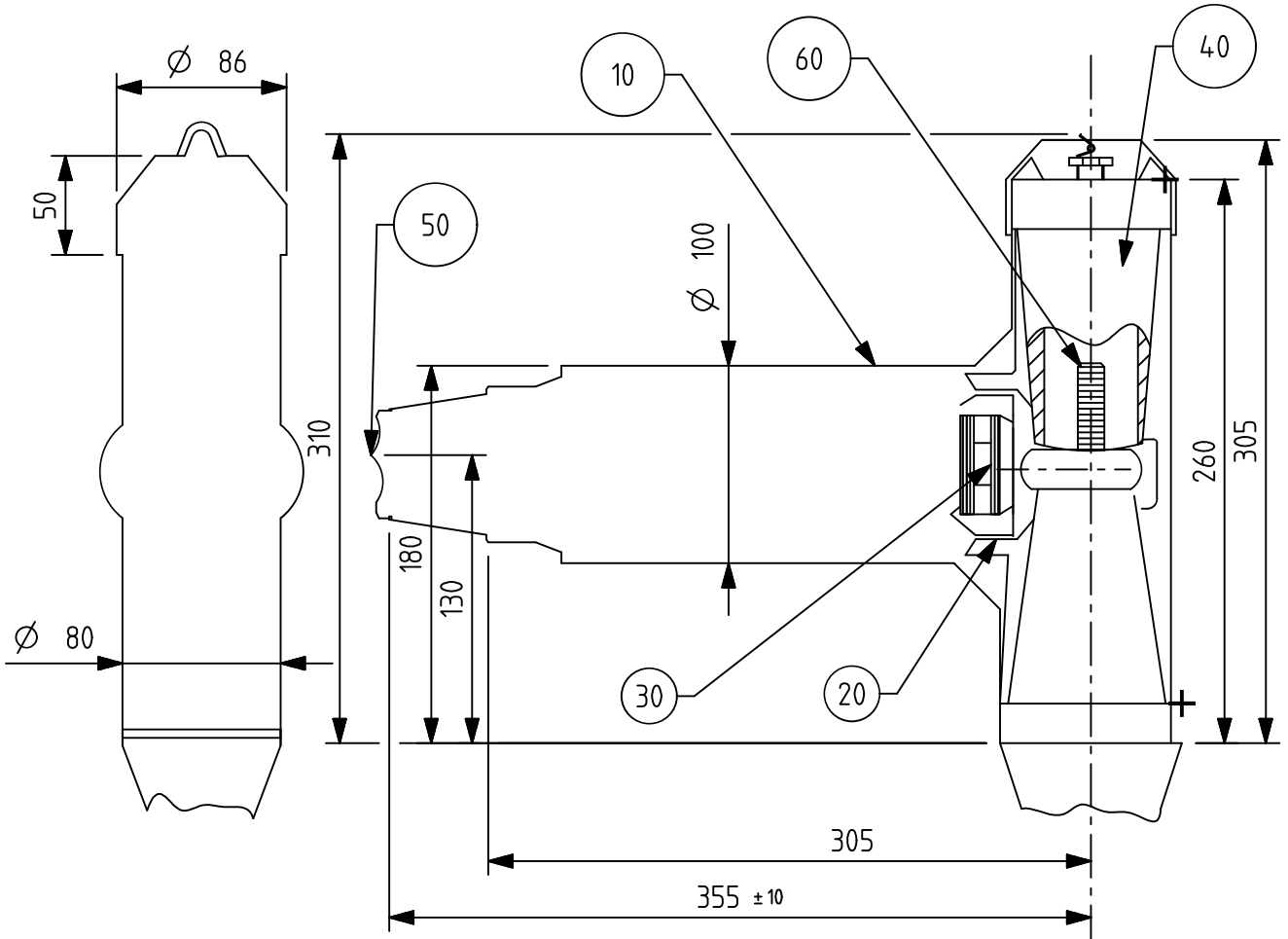
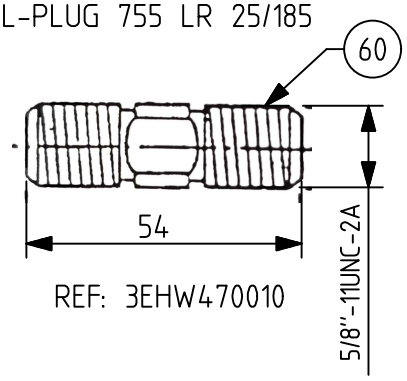


ABB IDENT NO.
3EHW470090

L-PLUG 755 LR 25/185



REF: 3EHW470010

10 CONNECTOR SHELL
20 CONNECTOR INSERT
30 CABLE LUG
40 INSERT FOR SCREW
50 OUT DOOR ADOPTER 20 MA-JB
60 STUD

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांक साक्षर DATED INITIAL

सतह – रूक्षता 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	TOL. CLS.
	धातु-वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	

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	100-250
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	N.T.S
संदर्भ / REF.	
ALT.-	

चितरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	

वर्णन DESCRIPTION: HIGH VOLTAGE CABLE WITH PLUG

आरेखण संख्या DRAWING NO.: CLWES/3/SK-3/0251 REV.2 ~~(DEC 06)~~

परिवर्तन संख्या ALTERATION. NO. | पर्ण SHEET 10 OF 10 | A4

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