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
SSE-Design	SEE-Design	Dy.CEE/D-I

ALTERATION RECORD SHEET

Amendment Number	**Date of Amendment**	**Page number**	**Alteration/** Revision	**Descriptions**	**Authority**
			2	i) Specification has been digitized. ii) Cl.no.7.3 Wet power frequency withstand voltage test at 75KV (RMS) has been deleted. iii) Cl.no.7.8 Nominal Rated current: 800A, Cl.no.7.9 Over current carrying ability : 900 A and Cl. no. 7.10 Nominal short time current (1 sec) : > 50 KA of Elbow Connector have been included in Type test. iv) Cl.no..8 Test condition, Cl.no.10 Reference type and Cl.no.11 General Condition have been deleted.	

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

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INDEX

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

- **Maximum atmospheric temperatures** : Under Sun : 70°C.
  In shade : 50°C.
- **Maximum Humidity** : 100% saturation during rainy season.
- **Reference site condition** :

i) Ambient Temperature : Max. 55°C , Min 0°C
ii) Normal Humidity : 60%.
iii) Altitude : 160 m above mean sea level.
iv) 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 millimeter 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 and subsystem and their mounting arrangement will be designed to withstand vibrations and shocks encountered in service as specified in IEC 61373 publications unless otherwise prescribed.

4.0 STANDARAD :

IEC-77 or latest
IEC-60502 or latest
IS-13573, 20 or latest
IS- 2089-1986 or latest
IEC-60137-11984 or latest
IEC-61373 or latest
IEC-60270 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 :-

This cable has the following general properties:
- Flexible
- Conductor and screen made of copper.

6.2 MECHANICAL DATA OF HIGH VOLTAGE CABLE :-

6.2.1 Diameter 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 :-

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. Temperate. Of conductor [°C] (continuously) : 90
6.3.5 Max. Operate. Temperate. Of conductor [°C] (short circuit max. 3 sec.) : 250
6.3.6 Max. Operate. Temperate. Of screen [°C] (short circuit max. 3 sec.) : 350

6.4 Technical data of earthling cable :-

6.4.1 Earthling Cable- Earthling cable of nominal cross section of 16 sq.mm.
6.4.2 Total length (250+450) : 700 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 cable shall be compatible with High voltage bushing (Not in the scope of supply) of following technical parameters:-
TECHNICAL DATA OF HIGH VOLTAGE BUSHING [MICAFIL] (Not in the scope of supply)

- Rated voltage : 30 KV
- Max. Operating voltage : 30 KV
- Test Voltage 50 Hz 1 min Dry/Wet : 75 KV
- Shock Voltage- 1, 2/ 50 µs full wave : 170 KV
- Nominal current at 70°C air temperature : 630 A
- Short time current : 50 KA
- Lf : 400 mm
- Creepage path hk : >806 mm

6.6 ELBOW Connector- ELBOW connector of 30 kV 630 Amp of ABB Identification No. 3EHW470090R1185 plugtype 755 LR 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-~~1~~2, Dec-06.

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

6.7.2 ELECTRICAL DATA:

- Connector type : 755 LR
- Voltage : 40 kV
- Max. Line voltage : 36 kV
- Partial discharge : < 5PC
- Nominal withstand voltage : 170 kV
- Nominal withstand AC volt : 75kV 50 Hz
- 1 min - DC Voltage : 144 kV
- Nominal Rated current : 800A
- Over current carrying ability : 900 A
- Nominal short time current (1 sec) : > 50 KA

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

Clause No.	**Test Description**	**Type Test**	**Routine Test**
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.	**Y**	**Y**
7.2	Dry power frequency withstand voltage test at 75KV (RMS) as per IS: 2099-1986, IEC- 60137-11984.	**Y**	**Y** **To be done at 60KV**
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**

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7.4	Impulse voltage test at 170KV peak, as per CLW specification No. CLW/ES/3/0251 and IS:2099-1986 (10 positive & 10 negative).	**Y**	**NA**
7.5	Partial discharge test: PD test on CHT shall be carried out at 30KV. AS per IEC-60502, the PD values shall be less than 5 PC.	**Y**	**Y**
7.6	Vibration and Shock Test: Vibration and shock test as per IEC: 61373 or latest shall be conducted on the complete CHT system.	**Y**	**NA**
7.7	Temperature Rise Test:- At 100ºC - 3 cycles (5 hours heating & 3 hours cooling) as per procedure given in IS: 13573.	**Y**	**NA**
7.8	Measurement of Nominal Rated current: 800A of Elbow Connector	Y	NA
7.9	Measurement ofOver current carrying ability : 900Aof Elbow Connector	Y	NA
7.10	Measurement ofNominal short time current (1 sec) : > 50 KAof Elbow Connector	Y	NA

~~**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.~~

8.1 MEASUREMENT OF PARTIAL DISCHARGE:

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

8.2 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-1/025I, 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 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.~~

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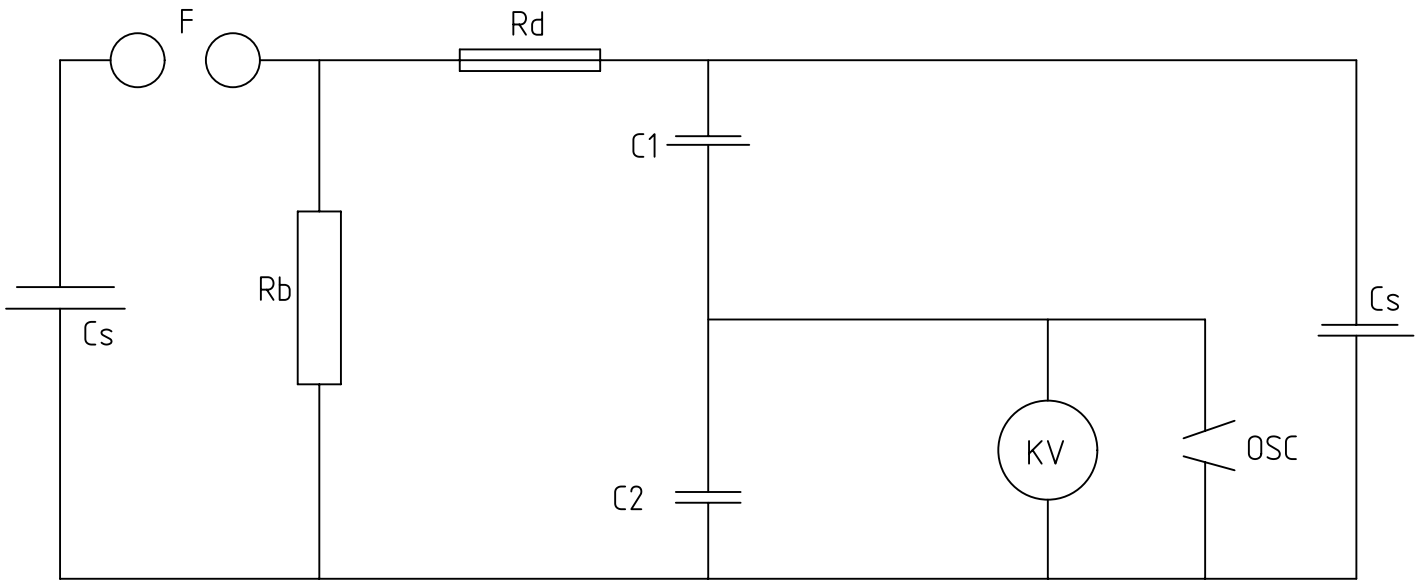
12.0 LABEL AND MARKING :

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

CLW/ES/3/SK-1/0251 REV.



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

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

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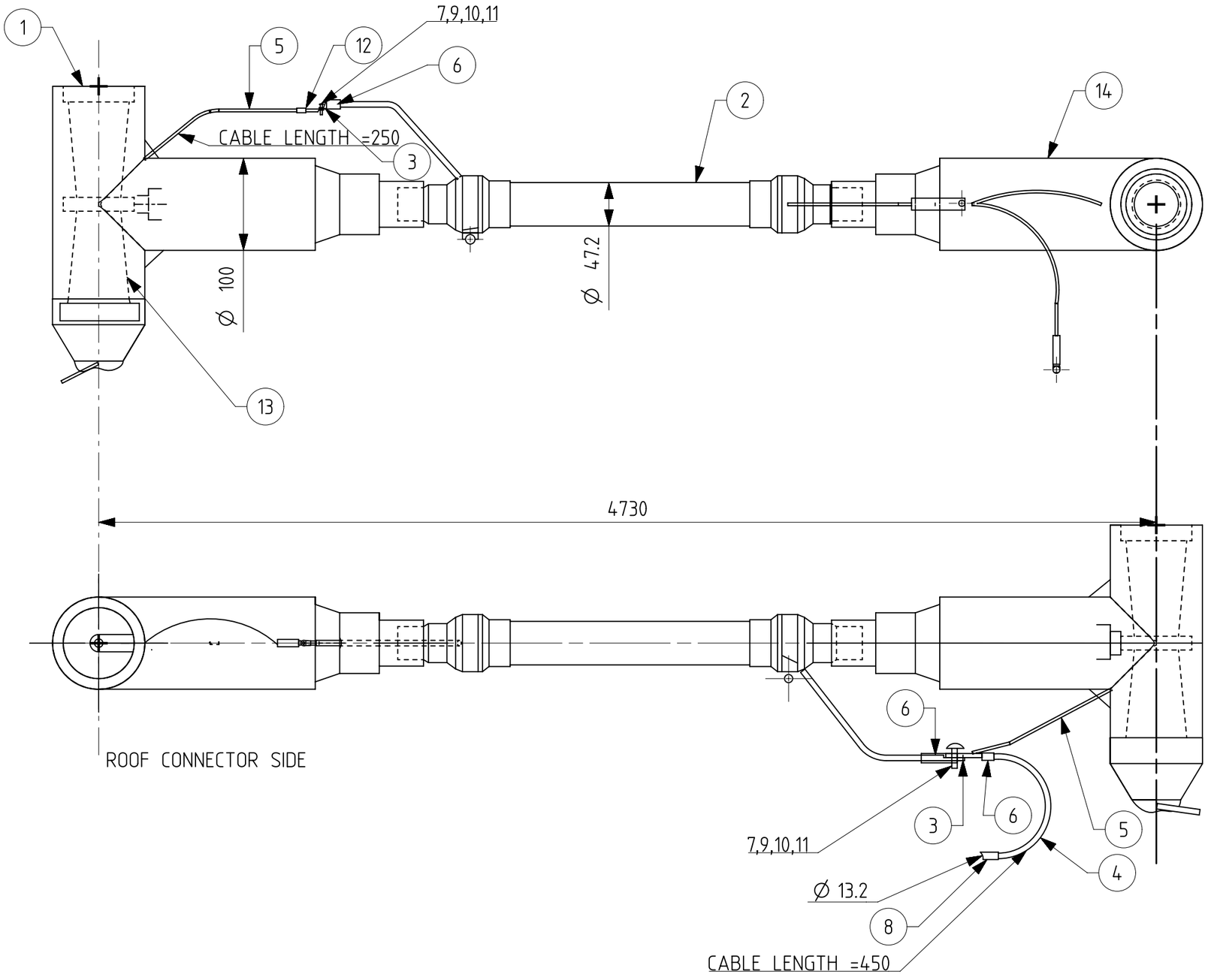

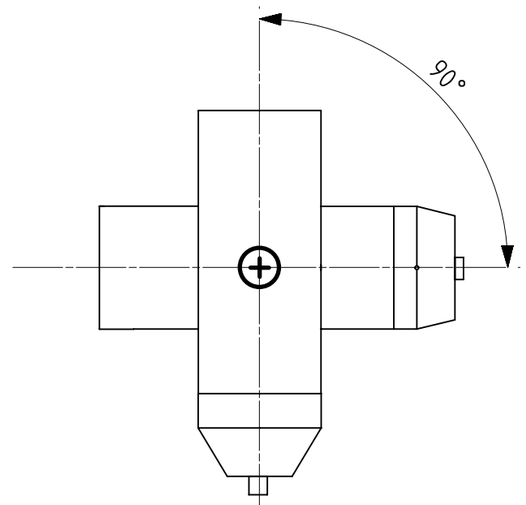

	HIGH VOLTAGE CABLE ASSEMBLY	QTY./LOCO
1.	L PLUG 755LR 25/185	2
2.	HV.CABLE CUT INTO LENGTH	1
3.	CABLE LUG 16.0/M5 Cu/Zn	3
4.	CA9KGW-AX 164000 V BK	.6M
5.	WIRE 1.0-CU	1M
6.	SD SLEEVE YE/GREEN 12/6	.8M
7.	HEX SCREW M5X16 SST	2
8.	CABLE LUG 12-30	1
9.	WASHER A5.3/10 SST	2
10.	CON WASHER 5.3X11 SPR ST	2
11.	HET NUT 0.8D M5 ST	2
12.	CABLE LUG0.5-10/M5	2
13.	FAL-PLUGS 755 LR 15/25 KV	2
14.	PR-ASSLY. HV CABLES Q-CL=3	2

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सद्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768												TOL. CLS.
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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	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
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अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
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दिनांक DATE	
रैखिक अनुपात SCALE	N.T.S
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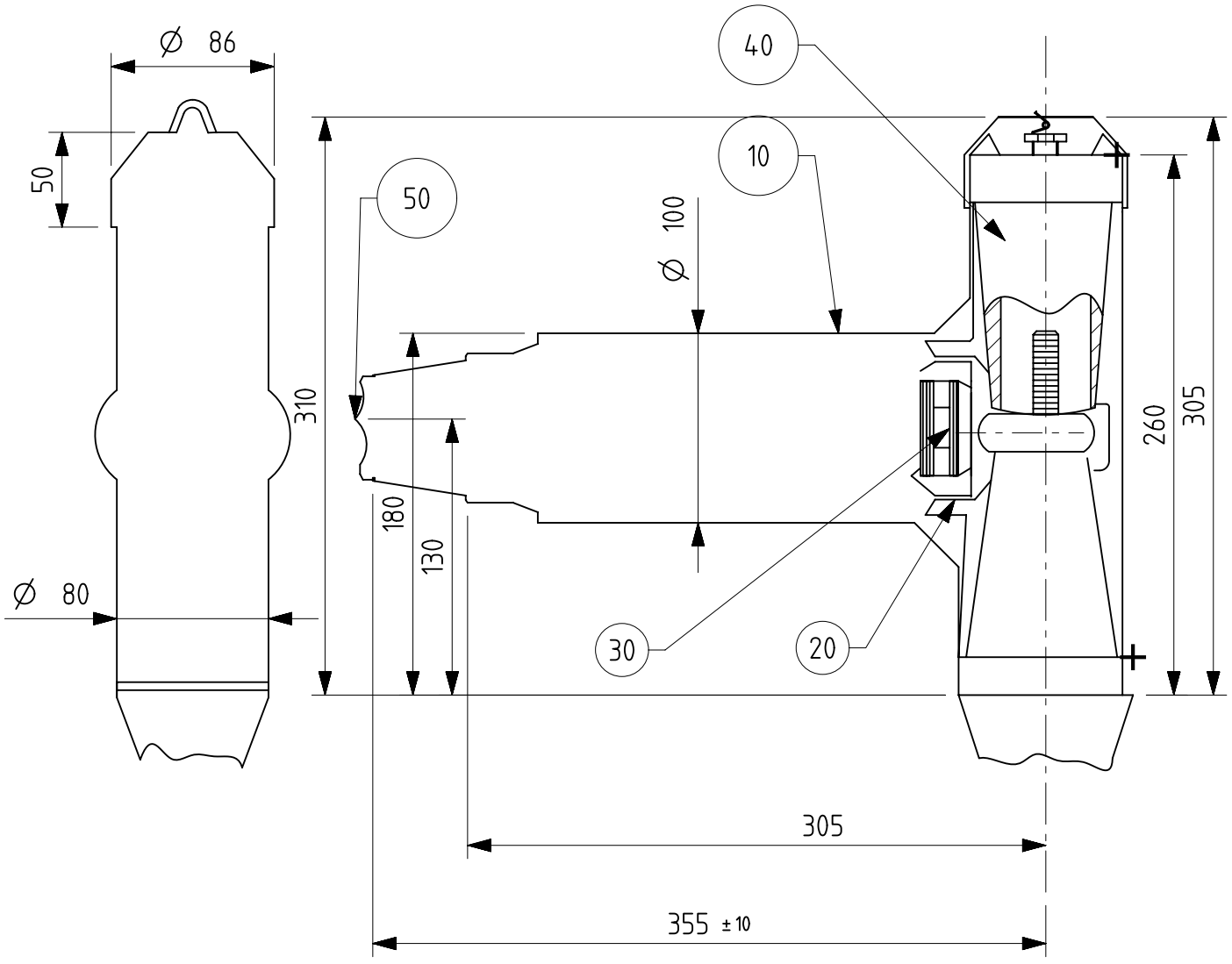
वर्णन DESCRIPTION	HIGH VOLTAGE CABLE WITH PLUG
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-2/0251 REV. 2 (DEC.-06)
परिवर्तन संख्या ALTERATION NO.	पर्ण SHEET 9 OF 10 — A3



L-PLUG 755 LR 25/185

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

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

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	अनिर्दिष्ट सद्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768	TOL. CLS.
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परिवर्तन संख्या ALTERATION. NO. | पर्ण SHEET 10 OF 10 | A4