TECHNICAL SPECIFICATION FOR PRIMARY VOLTAGE TRANSFORMER FOR 3-PHASE ELECTRIC LOCOMOTIVES.

Specification No : CLW/ES/3/0009, Alt. '~~C~~ D'

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ISSUED BY:

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ALTERATION RECORD SHEET

Amendment Number	Date of Amendment	Page number	Alteration	Reason	Initial
01	05.02.97	3,4	A	Clause 3.0 and index sheet has been added and clause 4.0 and clause 10.0 changed For giving Clarity to specification.	S/d-
02	-----	-----	B	Specification revised	S/d-
03	22.03.21	7, 8	C	1. Clause no. 8.0 and Clause no. 9.0 have been deleted as per approval of Note no. ELDD/Misc. dated 26.02.21 by PCEE 2. Mounting & Overall dimensions shall be as per drg. &other dimensions for guidance only added as 'Note' in sheet no. 8.	S/d-
04	------	5, 6	D	1. Power frequency test and impulse voltage test to be conducted as per IEC-61869-1. 2. Total Height of PVT is increased upto Max 600 mm and drawing/design modified in SK-1.. 3. Clause no. 6 has been updated as per CLW approved test protocol. 4. Deletion of 0.5 A Fuse form scope of supply.	

Note: Specifications have been digitized and all alterations have been incorporated.

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1.0 SCOPE

The single pole magnetic primary voltage transformer with cast resin insulation are used on the roof of Three Phase Electric Locomotives.

2.0 Climatic and Environmental Condition

- Maximum atmospheric temperatures: Under Sun: 70°C.
  In shade: 50°C.
- **Humidity** : 100% saturation during rainy season.
- **Reference Site condition** :i) At max.+ 55°C and min. 0°C.
  ii) Humidity: 60%.
  iii) Altitude: 1000 m above mean sea level.
- **Rainfall** : Very heavy in certain areas. The locomotive will be designed to permit it's running at 10 km/hr 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 corresponding IEC 61373 publications unless otherwise prescribed.

3.0. Standards: IEC 61869-3 & EN 50152-3-3.

4.0.Technical data: -

Max.Voltage (Um)	: 36 KV.
Ratio	: 25000 /200.
Rated output / burden	: 30 VA.
Accuracy class	: ±1% between 80%up to 120% of rated burden.
Secondary thermal limiting factor	: 1.0 A continuously.
Voltage factor	: $1.5*U_r$/30 sec
Primary Resistance	: ≥50 kΩ.
Max output	: 150 VA.
Frequency	: 50Hz.

Class of insulating material : E
Insulation level : 36/75/170 KV.
Winding : 1
Creepage path : ≥ 1090 mm
Design criteria :

Insulation	Cast resin, embedded in a burst proof composite insulator
~~Fuse~~	~~Connected in the secondary circuit., having a tripping current of 0.5A~~
Screen	A screen between the secondary and the high voltage winding is embedded in the resin body to protect the secondary winding against overvoltage.
Partial Discharge intensity	≤ 5pC @36KV ≤ 50pC @ 47.6KV

5.0 Description: The transformer is a single pole insulated Voltage Transformer for outdoor application and is suitable for mounting of locomotive roof. The voltage transformer is designed for a primary rated voltage of 25 KV and shall measure the voltage of catenary.

The Transformers are fitted with cast light alloy base, onto which the splash proof secondary terminal box is flanged. The ends of the secondary winding, which are brought out on the bottom of the insulating body, are located inside the transformer base and are connected to bolt type terminals size M10. The bottom of the transformer base is closed with a sealable cover. Also, the removable gland plate (Cable feed- in from below),the removable cover of the terminal box and the rating plate which is fixed to a terminal box wall, are sealable.

The casting resin used for insulation is poured under vacuum cycle to obtain high electrical and mechanical quality. The iron core together with the primary and secondary winding [Live part] is casted in one single production step. The casted live part is embedded in a silicon composite insulator to protect surrounding people against burst resin fragments in case of an internal failure. The resulting high internal pressure is being released by using a spring load pressure relief cover on the top of the voltage transformer. The cover of voltage transformer is made by using non corrosive material. The insulation class correspondence to class 30N. The stacked core which is on ground potential carries the low voltage winding and the concentrically arranged high voltage winding. All live parts are completely moulded into the resin in one casting process. The high voltage terminal is a central vertical bolt.

CONSTRUCTION DETAILS:

- Built in terminal box (secondary terminals)
- Cable gland : PG16.
- Connector construction.
  - i) Primary : M10 x 30 mm
  - ii) Secondary. : Terminal clips 4x6 mm
  - iii) Earth : M12 screw

6.0 Tests for Primary Voltage Transformer

Sl. No.	Test description	CLW specification Spec. No. CLW/ES/3/0009/D	Type test	Routine test
1.	Visual Inspection ➢ Spring loaded pressure release device. ➢ Insulation: - Cast Resin and housing: - Burst Proof composite insulator. ➢ BOM verification	➢ Primary & secondary terminal, cable gland, ~~fuse~~, flange, gasket (rubber seal), hardware, Earthing point, Name plate (I-Mark, Serial No. , Manufacturing Month & year and brand/make name), Polarity marking and others as specified in CLW Specification ➢ Pressure release device. ➢ Cast Resin Surrounded by Silicon based Composite insulator against burst resign fragment in case of internal failure. (material test report of silicon based composite insulator & resin is required.) ➢ ISO certified sub-vendors for the item not available in CLW/RDSO vendor list. /Approved BOM	Yes	Yes
2.	➢ Screen construction	➢ A screen between the secondary and the high voltage winding is embedded in the resin body to protect the secondary winding against over voltage.	Yes (verification of the screen should be verified during stage inspection i.e. manufacturing of coil winding.)	Yes (verification of the screen should be verified during stage inspection i.e. manufacturing of coil winding.)
3.	Dimensional Checking and creepage path	As per requirement of specification spec. and drawing. Creepage path **≥ 1090mm.**	Yes	Yes
4.	Verification of technical data	As per specification 4.0	Yes	Yes
5.	Measurement of the winding resistance.	• Primary winding (High Voltage Winding) R1 > 50KΩ. • Secondary Winding (Low	Yes	Yes

		voltage Winding) R2 < 10Ω		
6.	Verification of terminal marking	Primary (H.V Winding)- A,N Secondary (L.V Winding)- a,n	Yes	Yes
7.	Phase displacement error/~~Polarity test~~	~~Less than 1%~~ ± 40 minutes	Yes	Yes
8.	Polarity test	The terminals 'A' and 'a' have same polarity and are positive compared to terminals 'N' and 'n'.	Yes	Yes
9.	Induced voltage test for measurement of partial discharge	Partial discharge intensity At 36 KV <5pC. At 47.6 KV <50pC. Test voltage 75 KV Test to be conducted as per IEC 61869-3.	Yes	Yes
10.	Power-frequency test primary/secondary Primary to earth	Test voltage 3KV 1 min. at 50 Hz 75KV 1 min. at 50 Hz (As per IEC-61869-3 to be followed)	Yes	Yes
11.	Accuracy test/ Determination of errors 1. Rated voltage range 80% to 120%. 2. Rated Burden - 1%, 25% and 100%), Power factor and freq. Cos Ø= 0.8,50 Hz.	i. Ratio error 1% Rated voltage range 80% to 120% ii. Ratio error 1% Rated voltage range 80% to 120% (Acceptance as per specification and IEC 61869-3)	Yes	Yes
12.	Verification of functionality of pressure relief device for protection with high internal pressure of PVT.	Test as per IEC standard for Spring loaded pressure relief device. **Note: Test to be performed for above verification as per IEC - 61869 or applicable standards if any).**	Yes (The verification of functionality of Pressure relief device is to be done in the stage inspection during the prototype inspection on mock/dummy model of outer vessel of PVT).	~~Yes~~ ----------

13.	Impulse voltage test	Test voltage 170 KV full impulse Impulse shape: 1.2/50micro seconds Test cycle: Negative polarity 15 full impulse and Positive polarity 15 full impulse (Also, IEC-61869-1 to be followed)	Yes	------
14.	Power frequency test, wet	Test voltage 75 KV	Yes	------
15.	Temperature-rise test (Insulation class E)	As per IEC: 61869-3	Yes	------
16.	Measurement of Ferro resonance test	As per EN 50152-3-3	Yes	------
17.	Test with secondary winding short circuited	Short-circuit withstand capability test As per IEC: 61869-3	Yes	------
18.	Shock & Vibration test	Vibration test as per IEC-61373 (Catagory-1 class A)	Yes	------
19.	Fire and Smoke test	As per standard: CEN/TS 45545 and accordance with requirement of specification.	Yes	------

Above mentioned test is for guidance only, however firm shall have to conduct and bear test charges for any other test required to be conducted for ensuring quality and further improvement in reliability of primary voltage transformer for fulfilment of applicable IEC/ DIN/ ASTM/ UL etc. not covered from above mentioned test.

7.0 Documents to be supplied by the Tenderer:

The tenderer shall inter alia furnish the following along with the quotation.

i) Clause-wise comments on the specification and test programme.

ii) Detailed drawings.

iii) Past experience with supporting papers (if any).

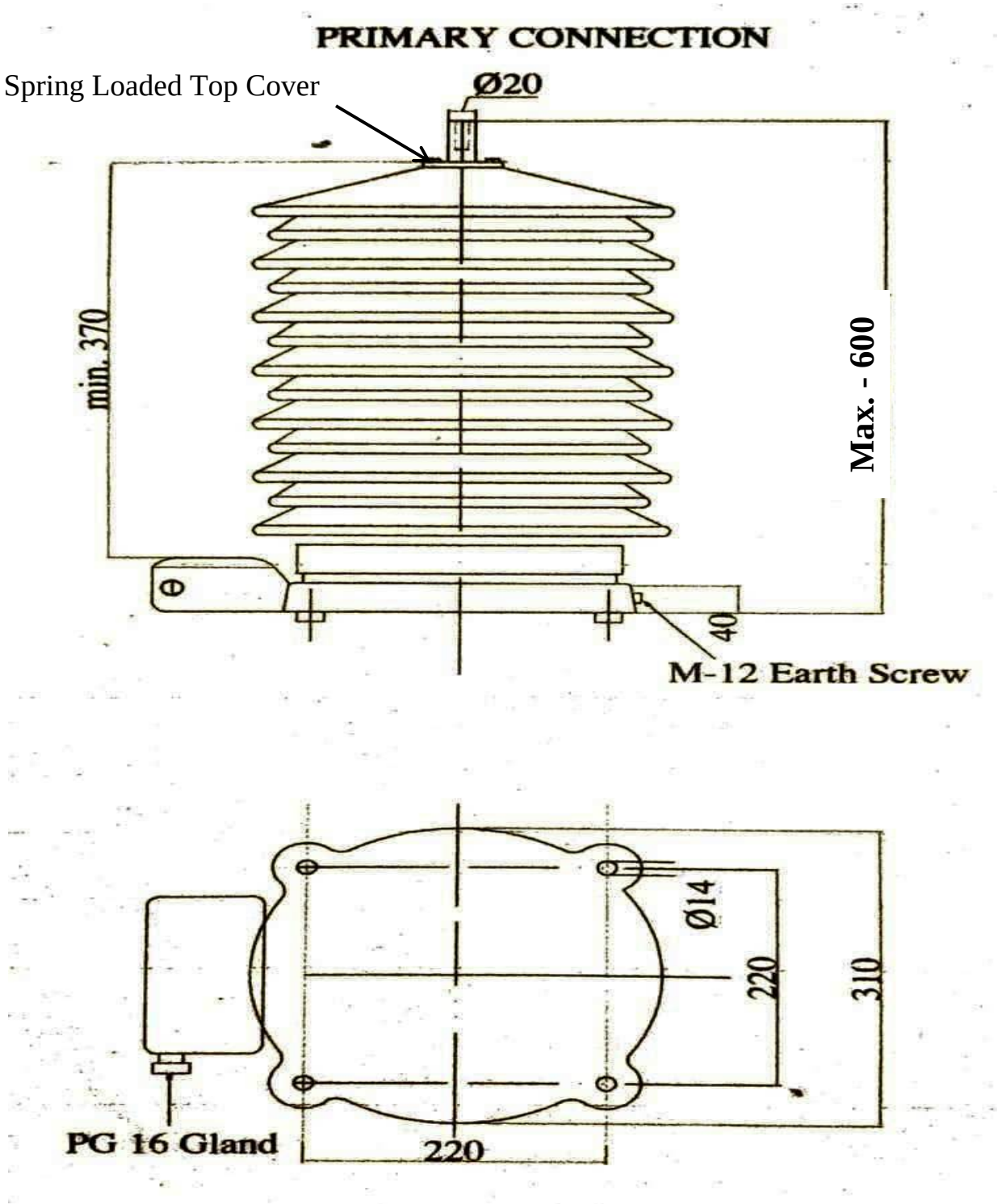
iv) Past test reports (if any).

Schematic pos. 3

Notes-

A) Tenderer shall Fix Name Plate on the equipment consisting month, year of mfg., electrical ratings, voltage, current & SI. No. of the equipment.

B) All Hardwares including spring washer should be purchased from CLW approved sources.



CLW/ES/3/SK-1/0009

Note: Mounting and overall dimensions shall be as per above drawing. The other dimensions of drawing are for guidance only.

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