

SPECIFICATION NO. CIM/ES/A-12 /ALT-^FED
 DRAWING NO. CIM/ES/SK-1/A-12 ALT-^FED
 TOTAL SHEETS: 13

SPECIFICATION FOR 10 KA
 25KV CAPLESS SURGE ARRESTOR(LA)
 FOR
 25 KV SINGLE PHASE 50 C/S
 ELECTRIC LOCOMOTIVES
 TYPE WAG-7, WAP-4 & WAP-6
 EFFECTIVE FROM
 2000-2001 ONWARDS.

SPECIFICATION BASED ON
 RDSO SPEC NO. EARS/SPEC/
 LA/0005 JULY -1999.

PREP. BY	CHKD BY	REVIEWED BY	APPROVED BY	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
		<i>Handwritten initials</i> 8/1/2000	<i>Handwritten initials</i> 8/1/2000 DY. CEE/	
				ALT NO. A B C D

DETAIL OF ALTERATION

95
Sheet
2

ALT.NO.	DATE	DESCRIPTION	SIGNATURE	REMARKS
A	22.9.2K	SHT.NO.12 REVISED & G.A.DRG.FOR 'LA' INTRODUCED.	<i>[Signature]</i>	
B	5-2-02	G.A.Drg.for LA revised	<i>[Signature]</i>	
C	8-7-02	Cl.No.9.2 at Sht.No.7 introduced, & Note on sk-1 is revised	<i>[Signature]</i> 2/7/02	Revised Ref: CEE/Locos Circular No. CEE/ EL/05 dtd: 04-7-02
D	30-9-04	Cl.Nos.- 6.1,7.2,8.1 & 8.3 - Porcelain housing re-introduced Sketch No.CLM/ES/SK-1/A-12 Alt.C (with polymeric housing) removed and Sketch No.CLM/ES/SK-1/A-12 Alt.D (with porcelain housing) re-introduced.	<i>[Signature]</i> 3/10/04	RDSO's L/No. EL/2.2.23/Gen. dtd.20-8-04.

अनुमोदित
DRN

अनुमोदित
CHKD

SPECIFICATION FOR 10KV SURGE ARRESTOR FOR 25KV SINGLE PHASE 50C/S ELECTRIC LOCOMOTIVE.

[Signature]
22.9.2K
उप. नि. न. (अभि.)
DY. CEE. (D)

चितरंजन रेल इंजन कारखाना
उदियन बंगला, भारत
CHITTARANJAN LOCOMOTIVE WORKS
WEST BENGAL INDIA
अभि./NO. CLW/ES/A-12 'ALT. B'
दिना/DATE: 22-9-2K

1. SCOPE

1.1 This specification generally covers the supply of metal oxide gapless lightning arrester for use on rolling stock working on single phase 25 Kv AC 50 Hz system. The arrester is for protection of 25 Kv equipment of the rolling stock from voltage surges.

2. SERVICE CONDITION

2.1 The equipment shall operate satisfactorily under the following climate conditions : -

- i) The ambient temperatures vary from 0°C to 55°C with 100% humidity. The maximum sun temperature is 70°C at an altitude not exceeding 1200 metres above mean sea level.
- ii) The rain fall is fairly heavy and the country is subjected to thunder storms.
- iii) During dry weather the atmosphere is dusty.
- iv) The equipment shall be working in coastal areas with corrosive atmosphere and also subject to chemical pollution, exhaust of steam and diesel locomotives.

2.2 The lightning arrester and its mounting arrangement shall be of robust design and duly approved by RDSO for traction duty and shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below: -

- a) Max. vertical acceleration : 1.0 g
- b) Max. longitudinal acceleration : 3.0 g
- c) Max. transverse acceleration : 2.0 g

('g' being acceleration due to gravity)

2.3 The vibrations are of sine wave form and the frequency of vibration is between 1 Hz and 50 Hz. The amplitude 'a' expressed in millimeters is given as a function of 'f' by equation.

$$a = \frac{25}{1} \text{ for values 1 Hz to 10 Hz}$$

$$a = \frac{250}{f^2} \text{ for values 10 Hz and upto 50 Hz}$$

PREP'D BY	CHKD BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10KA 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/6.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
		<i>S. J. [Signature]</i>	<i>[Signature]</i> DY. CEE/		NO. CLW/23/A-12.
					ALT NO. <u>ABC</u> <u>D</u>

- 2.4 In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for 2 minutes to 50 Hz vibrations of such a value that the maximum acceleration is equal to 3 g (amplitude 'a' = 0.1 mm)

3. PARTICULARS OF POWER SYSTEM AND ELECTRIC LOCOMOTIVES.

- 3.1 Fault level expected in the vicinity of substation on 25 Kv side would be around 100 KVA. Switching surges of short duration to the tune of 120 to 130 Kv peak have been measured on this system.
- 3.2 Basic insulation level of locomotive transformer is 130 Kv peak for standard lightning voltages impulse and 50 Kv (rms) for power frequency voltage.
- 3.3 Existing locomotive is protected through a 200 mm (RT1) rod gap for roof equipment and 75 mm rod gap for loco (RT2) transformer etc. It is proposed to work the lightning arrester in conjunction with RT2 which will be increased suitably (400 mm)
4. GOVERNING SPECIFICATION.

- 4.1 The lightning arrester shall generally conform to the following specifications as indicated and as modified by this specification: -

- | | | | |
|------|------------------------|---|--|
| i) | IS: 1070
Pt.I: 1974 | : | Specification for lightning arrester for AC system. |
| ii) | IEC : 77-1968 | : | Rules for electric traction equipment. |
| iii) | IS: 2629-1956 | : | Recommended practice for hot dip galvanizing of iron and steel. |
| iv) | IS: 2633-1972 | : | Methods of testing uniformity of coating on zinc coated articles(1st Rev.) |
| v) | IS: 3358-1969 | : | Hot dip galvanised coating on fasteners. |
| vi) | IS: 2099-1973 | : | Bushings for alternating voltages above 1000 volts (1st Rev.)with Amendment No.1 |

PREP.D. BY	CHEK BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10KA 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMO- TIVES WAG-7, WAP-4/6	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
		<i>Shukla</i> 3/1-2/80	<i>Shukla</i> 9/1		NO. CLM/ES/A-12.
			DY. CEE/		ALT NO. A B C. D ⁴

- vii) IS: 5621-1980 : Hollow insulators for use in electrical equipment(1st Rev.)
- viii) IS: 5561-1970 : Electric power connectors.
- ix) IEC 99-4 : Metal-oxide surge arresters without gaps of a.c.system.
Dt.Nov'91
- x) IS: 1570(Pt.V) : Schedules for rod steel, stainless and heat resisting stools.
-1972.

5. RATING AND OTHER PARTICULARS

- Nominal system voltage - 25 KV, phase to earth.
- Permissible variation in voltage. - 25.0 ± 10% (Occasionally touching 27.5 and 30 KV)
- System frequency - 50 Hz ± 3%
- Type of L.A. - Non-linear metal oxide gapless type (Heavy duty Class III).
- Nominal discharge current - 10 K Amps (8/20 wave)
- Continuous operating voltage capability - 33 KV
- Maximum discharge voltage at nominal discharge current. - 65 KV
- Power frequency voltage withstand for arrester insulation. - 105 KV(rms)
- Standard lightning impulse voltage withstand for arrester insulation. - 250 KV Peak

6. GENERAL FEATURES

- 6.1 The lightning arrester shall comprise a number of nonlinear resistor blocks, housed inside the porcelain housing. Suitable provision to arrest the relative movement of blocks shall be provided inside the porcelain housing. Lightning arrester

Contd....

PREP. BY	CHKD BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10 KA 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/6	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
		<i>[Signature]</i>	<i>[Signature]</i> 8/11		NO. CLR/SS/A-12
			DY. CEE/		ALT NO. <input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C <input type="checkbox"/> D

- 6.1 shall be hermetically sealed construction to prevent moisture ingress. The arrester shall have seams for relieving internal pressure to prevent explosive shattering of the housing following prolonged passage of follow-on current or internal flash-over of the arrester. The pressure relief device shall be of the Class-A as per IS:3070 (Pt.I)-1974.
- 6.2 The lightning arrester shall be of the outdoor type suitable for mounting on the roof of the coach and designed for continuous duty and repeated operations.
- 6.3 The arrester shall be provided with a terminal connector conforming to IS:5861.
- 6.4 The total height of the lightning arrester including the mounting arrangement, etc., upto the line terminal shall not exceed 630 mm.
- 6.5 All ferrous parts used in manufacture of lightning arrester or or its assembly shall be hot-dip galvanised. Hardwares of dia. less than 12 mm shall be made out of stainless steel conforming to Grade 04 Cr.17 Ni, 12 No₂ of IS:1570 (Pt.V) -1972.

7. MOUNTING AND TERMINAL ARRANGEMENTS.

- 7.1 The arrester base shall be suitably designed for mounting on the base plate with 4x15 mm dia. holes on the pitch circle dia. of 235 mm.
- 7.2 The arrester shall be provided with terminals and or connectors suitable for connection to ~~65 sq. mm (19/3.16 mm) stranded~~ copper conductor on the 25 kv side and 50 mm x 6 mm m.s. flat on the earth side.

8. CONSTRUCTION

- 8.1 The construction of the lightning arrester shall be explosion proof and for this purpose, suitable pressure relief device shall be provided to prevent explosive failure of the porcelain.
- 8.2 The lightning arrester shall be of rugged construction, insensitive to vibration to suitable for mounting on the rolling stock. The special design and constructional feature incorporated to make the lightning arrester suitable for rolling stock application shall be indicated in the tender offer.
- 8.3 As the maximum temperature attainable in an object exposed to the sun may reach 65 deg C manufacturer may, if required, use light colour porcelain instead of brown colour to avoid overheating of internal components of the arrester for its satisfactory operation.

PREP'D BY	CHEK BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10 KV 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/5.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331						
		<i>shah</i> 4/5/1988	<i>g/s</i> 8/1		NO. CIM/ES/A-12.						
			DY. CEE/		ALT NO. <table border="1"> <tr> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td></td> <td></td> </tr> </table>	A	B	C	D		
A	B	C	D								

9. MARKING

9.1 Each lightning arrester shall be provided with a name plate or plates legibly and indelibly marked with at least the following information : -

- a) Name or trade mark of the manufacturer.
- b) Type/Designation/serial number.
- c) Rated voltage.
- d) Frequency.
- e) Continuous operating voltage.
- f) Nominal discharge current.
- g) Pressure relief class.
- h) Long duration discharge current.
- i) Year of manufacture.

9.2 It is essential that firm's name/emblem is embossed on the equip.

10. TECHNICAL DATA AND DRAWINGS

10.1 The tenderer shall indicate his compliance or otherwise against each clause and sub-clause of the technical specification. The tenderer shall for this purpose enclose a separate statement, if necessary, indicating the clause reference and compliance or otherwise. Wherever the tenderer deviates from the provisions of the clauses, he shall furnish his detailed remarks.

10.2 The tenderer shall furnish guaranteed performance data, technical and other particulars for the lightning arrestors in the proforma attached as Annexure-A.

10.3 Drawings showing the overall dimensions of the lightning arrester, a cross-sectional view indicating non linear resistor blocks, retainer arrangement, terminal details, method of connecting high tension and earthing leads and mounting arrangements and avoidance in the form of type test reports for the arrester, if available, shall be submitted along with the tender.

10.4 The successful tenderer shall also be required to submit, copies of the technical booklets, instruction manuals, test reports, etc.

11. TYPE TESTS.

The following type tests shall be carried out in accordance with IEC 99-4 Nov'91 to prove general quality & its conformity with this specification.

PREP. BY	CHKD BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10 KA 25 KV SURGE ARRESTOR FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMO- TIVES WAG-7, WAP-4/6.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
		<i>M. S. / S. / L. / M.</i>	<i>[Signature]</i>		NO. <i>CLW/ES/A-12</i>
			DY. CEE/		ALT NO. <i>A B C D</i>

- 11.1 Power frequency reference voltage test.
- 11.2 Residual Voltage Tests.
 - 11.2.1 Lightning impulse residual voltage test.
 - 11.2.2 Switching impulse residual voltage test.
 - 11.2.3 Steep current impulse residual voltage test.
- 11.3 Long duration current impulse withstand test.
- 11.4 Operating duty tests.
 - 11.4.1 Accelerated ageing test.
 - 11.4.2 Heat dissipation behaviour of test samples.
 - 11.4.3 Switching Surge operating duty test.
 - 11.4.4 Evaluation of Thermal Stability in operating duty test.
 - 11.4.5 Power frequency voltage versus Time characteristics of Arrestor.
- 11.5 Pressure relief test.
- 11.6 Insulation withstand test.
 - 11.6.1 Lightning Impulse voltage test.
 - 11.6.2 Power FEM frequency voltage test.
- 11.7 Other Miscellaneous Tests.
 - 11.7.1 Galvanising test on Metal parts (Cl.7.15 of IS:3070 I.)
 - 11.7.2 Porosity Test on Porcelain components (Cl.7.14 of IS:3070 I.)
 - 11.7.3 Temperature cycle test on porcelain housing (Cl.7.13 of IS:3070 Pt.I.)
 - 11.7.4 Visual examination of porcelain housing Cl.7.16 of IS:3070 Pt.I.
 - 11.7.5 Polluted housing tests (Appendix B of IS:3270 I.).

PREP'D BY	CHKD BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10 KA 25KV SURGE ARRESTER FOR 25KV SINGLE PHASE 50C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/S.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331						
		<i>Sudh</i> S-1270	<i>P. S.</i> S/1		NO. CLW/ES/P-12.						
			DY. CEE/		ALT NO. <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>A</td> <td>B</td> <td>C</td> <td>D</td> <td></td> <td></td> </tr> </table>	A	B	C	D		
A	B	C	D								

12. ACCEPTANCE TESTS.

12.1 The following acceptance tests shall be conducted as per IEC 99-4 Nov'91 on samples selected at random from the lots:-

- i) Residual voltage test at the nominal and twice the nominal discharge current on the complete arrester of sections.
- ii) Measurement of power frequency reference voltage.
- iii) Partial discharge test.
- iv) Measurement of leakage current of continuous operating voltage.
- v) Galvanising test on metal parts.
- vi) Visual examination.

- 12.2 i) Temperature cycle test on porcelain housing.
- ii) Porosity test on porcelain components.

13. ROUTINE TESTS.

13.1 Besides any other test which the manufacture may consider necessary, visual examination test and measurement of leakage current at continuous operating voltage.

13.2 Satisfactory absence from partial discharges and contact noise, by any sensitive method.

13.3 Measurement of power frequency reference voltage.

13.4 Lightning impulse residual voltage test at nominal discharge current.

14. OPTIONAL EQUIPMENT.

Tenderer may also quote for suitable surge counters to be fixed in conjunction with these lightning arrestors, Indian Railways may choose to procure equal number of these counters to be fitted on each of the lightning arrestors or lesser number for representative measurement of different lots.

PREP. BY	CHKD BY	REVIEWED BY <i>A. S. S. 2/2/88</i>	APPROVED BY	SPECIFICATION FOR 10 KA 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/M ELECTRIC LOCOMOTIVES WAG-7, WAP-4/6.	CENTRE FOR R & D CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331						
			<i>CHIT</i> S.V.			NO. CIM/ES/A-12					
			DY. CEE/ CON/TU		ALT NO. <table border="1" style="display: inline-table;"><tr><td>A</td><td>B</td><td>C</td><td>D</td><td></td><td></td></tr></table>	A	B	C	D		
A	B	C	D								

15. EXPERIENCE

Tenderer may indicate experience regarding equipment supplied by him for rolling stock applications indicating at least the following details : -

- i) Nos. Supplied.
- ii) Nos. in service.
- iii) Type of rolling stock.
- iv) Type of power supply system.
- v) Country of operation.
- vi) Year of commissioning.
- vii) Failure data and any other feed back.

16. WARRANTY



Tenderer may indicate warranty clauses applicable for the goods supplied.

PREP'D BY	CHEK BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10 KA 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTI- VES WAG-7, WAP-4/6.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
		<i>[Signature]</i>	<i>[Signature]</i> DY. CEE/		NO. CLA/RS / A-12
					ALT NO. A B C D

SPECIFICATION NO. CIM/ES/A-12 FOR GAPLESS LIGHTNING ARRESTOR

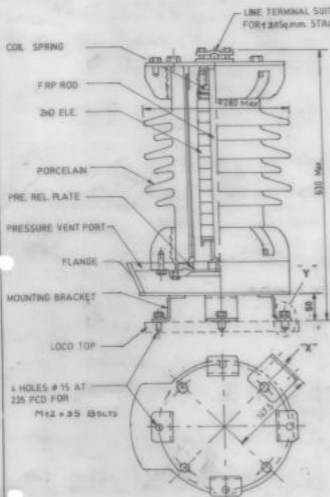
Schedule of guaranteed performance, technical and other particulars.

Sl.No.	Description	Unit of measurement
1.	Name of the manufacturer.	
2.	Country of origin.	
3.	Standard specifications on which performance is based.	
4.	Manufacturer's type designation.	
5.	Rated voltage (rms).	KV
6.	Rated frequency.	Hz
7.	Continuous operating voltage.	KV
8.	Watt loss at continuous operating voltage.	Watt/KV.
9.	Watt loss at rated voltage.	Watt/KV.
10.	Leakage current at continuous operating voltage.	mA
11.	Leakage current at rated voltage.	mA
12.	Nominal discharge current (8/20 wave)	kA
13.	Residual voltage.	kA
	a) at 0.5 times nominal discharge current	KV (Peak)
	b) at nominal discharge current.	KV (Peak)
	c) at twice the nominal discharge current	KV (Peak)
14.	Switching impulse residual voltage test with 45 x 90 micro-second current wave of 3 kA peak.	KVp
15.	Steep current impulse residual voltage test with 0.5 x 1.5 micro-second Current wave of 10 kA peak.	KVp

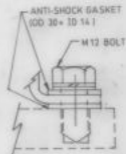
PREP. BY	CHEK BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10 KA 25 KV SURGE ARRESTER FOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/S.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
					
DY. CEE/				ALT NO.	A B C D

S.No.	Description	Unit of measurement	Sheet 12
16.	High current impulse withstand (4/10 wave)	KAP	
17.	Long duration current rating for virtual duration of peak - a) 8000 micro-seconds b) 1000 micro-seconds		
18.	Power frequency voltage withstand of arrester insulation (rms) - a) Dry b) Wet	KV KV	
19.	Type of non-linear resistor disc and voltage rating.	KV	
20.	No. of non-linear discs per section of arrester.	No.	
21.	No. of sections in one arrester.	No.	
22.	Material of retainer used inside lightning arrester bakelite, ceramic, rubber or other material.		
23.	Is pressure relief device provided, and if so, its class.		
24.	Overall dimensions : a) Height b) Diameter	mm mm	
25.	Net weight		
26.	Mounting base - i) No. of holes ii) Dia. of holes iii) Pitch circle dia.	No. mm mm	
27.	Are the live and earth ends of arrester suitable for jumper as specified ?		
28.	If the lightning arrester has already been type tested, give reference and date of that.		
29.	Are grading rings provided ?		
30.	Any other technical data, the manufacturer may like to furnish.		
31.	V.I.Characteristic curves of zinc oxide element at different temperatures. Please indicate diameter & thickness of elements also.		
32.	Condition monitoring of L.A.& methodology for rectification of equipment if feasible.		

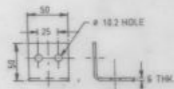
PREP. BY	CHKD BY	REVIEWED BY <i>[Signature]</i>	APPROVED BY <i>[Signature]</i>	SPECIFICATION FOR 10 KA 35 KV SURGE ARRESTOR 25 KV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/6.	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
					NO. CLM/ES/A-12.
			DY. CEE/		ALT NO. A B C D



MOUNTING DETAIL



DETAIL Y



VIEW - X

GROUND TERMINAL DETAIL

(MATERIAL - M.S. GALVANISED)

NOTE :

- 1 ALL DIMENSIONS ARE IN mm.
2. Necessary hardware should be provided by supplier. However high tensile fasteners are to be used only from the firms M/s.Unbrako, M/s. Sundaram Fasteners, M/s.LPS and spring washers to be use of 'FORBE' make.

PREPD. BY	CHKD BY	REVIEWED BY	APPROVED BY	SPECIFICATION FOR 10kA 25 kV SURGE ARRESTER FOR 25 kV SINGLE PHASE 50 C/S ELECTRIC LOCOMOTIVES WAG-7, WAP-4/B	CHITTARANJAN LOCOMOTIVE WORKS CHITTARANJAN-713331
PK.Chavanhuri 22.9.88			DY. CEE/D		
				ALT NO.	A B C D