

5.7

cont.

II. Short test over 10

# TEST SPECIFICATION

NO. CH/RS/I-21/A

Short test over 10

carried out in the

1979

test to a maximum

limiting voltage

3 seconds.

Specimen: (P.C.11)

1. Insp. No. CH/RS/SK-1/I-21 TO CLW/RS

Alt. SK-6/I-21

Alt.

2. Insp. No.

Alt.

TOTAL NO. of SPECIMENS TO BE TESTED: 10

ALT

SUBJECTS

ALT

SUBJECTS

## SPECIFICATION OF MEASURING INSTRUMENTS FOR FOR

25 MV AC ELECTRIC LOCOMOTIVES

CLASS MAP-5, MAP-7 & MAP-1 1980.

CHITARRANJAN LOCOMOTIVE WORKS  
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OCT, 2000

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क्रमांक/NO. CH/RS/S-21/A  
दिनांक/DATE: OCT, 2000

SHT. NO.					
ALT. NO.	AUTHY.	EFFECT. SHT. NO.	DESCRIPTION	INITIAL	DATE
A	Dy.CEE/D	6,13,14	Clause No:10.2.4 sheet No.6 and sheet No:13,14 modified as per letter No. vide CEE/PLM Insp dtd:26-8-08	<i>L-03/n108</i>	
Specn. of measuring instrument for WAG-7 WAG-5 and WAP-1 class of locomotives			<i>L-03-X-0P</i> DY.CEE(D)	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW./ES/I-21/Alt-A DATE:	

15269  
 SSE/D  
 15269  
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 15269  
 SSE/D  
 DRN.

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Specification of measuring instruments for WAG-7, WAG-5 and WAG-1 class of locomotives.

  
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क्रमांक/NO. CLW/ES/I-21/A  
दिनांक/DATE: 06.7.2008

प्रमाणित  
CHKD  
प्रमाणित  
CHKD

## 1. SCOPE

- 1.1 This specn. covers the manufacture and supply of measuring instruments along with their accessories for mounting on the driver desks on 25kv, single phase 50 Hz. Ac Elect. locomotives of Indian Rlys.

## 2.0 SERVICE CONDITIONS

- 2.1 The measuring instruments shall be suitable for working satisfactorily in an ambient temperature varying from 0°C to 55°C and a max. relative humidity of 100%. The locomotive shall be working in an altitude upto a maximum of 1000 metres above mean sea level, and dusty environment.

- 2.2 The measuring instruments and their mounting arrangements shall be of robust design for traction duty and shall withstand satisfactorily the vibrations and shocks normally encountered in services conditions indicated below:

- i) Max. vertical acceleration - 1.0 g
- ii) Max. longitudinal acceleration - 3.0 g
- iii) Max. transverse acceleration - 0.5 g

where 'g' being the acceleration due to gravity.

## 3.0 DESIGN AND WORKMANSHIP

- 3.1 The instruments offered shall be

- simple in design
- of good workmanship
- Easy for maintenance and operation
- Robust and rugged in construction.

- 3.2 Wholly indigenous instruments if coming up to the standards of this specification shall be given preference consistently with the reasonableness of the offer.

## 4.0 Deviation

- 4.1 Any deviation from the standards laid down with a view to improve the performance, may be given due consideration provided, full particulars with justification, thereof, are furnished. It may, however be noted, that due to limited availability of space in the locomotive and the necessity to ensure inter changeability with the existing measuring instruments increase in the overall and mounted dimensions shall not be allowed normally.

**SPECIFICATION OF MEASURING  
INSTRUMENTS FOR MOUNTING  
ON DRIVER DESKS OF  
LOCOMOTIVES.**

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5.0 Approval of samples

- 5.1 The successful tenders shall make available at least two prototype samples of the measuring instruments proposed to be supplied by them for inspection and tests at their works and advise the Dy.Chief Elect. Engrg(Design)/Chittaranjan, and Controller of Store, Calcutta as and when they are ready with the prototype samples and necessary testing and measuring apparatus and facilities for carrying out the tests.
- 5.2 After the above tests, if it is considered necessary by the Dy.Chief Elect. Engrg(Design) or his authorized representative to carry out any further tests or trials of the prototype samples at Chittaranjan, the supplier will arrange for the same by the quickest means.
- 5.3 Any short comings or defects in the design and workmanship of the measuring instruments shall be pointed out after the tests, to enable the manufacturer to incorporate the necessary improvement before bulk manufacture is commenced, without affecting the guaranteed deliveries or guaranteed performance characteristics.
- 5.4 Any testing and approval by the purchaser of the design, working dra. and prototype shall in no way absolve the supplier of his responsibilities under the terms of the contract for the equipment, supplied.
- 5.5 The supplier shall not offer measuring instruments of series production to the Inspector authorised under the contract until the prototype has been finally approved.

6.0 Condition of contract

- 6.1 The standard I.R.S. Conditions of contract will be applicable for the supply of the equipment.
- 7.0 Techl. Documents and drawings to be furnished by the supplier as part of the contract.
- 7.1 The following drawings and documents shall be supplied by the supplier.

I. Type test Report or Certificates

This shall be supplied in standard 'A4' size of sheets with punched holes for filing. It shall be suitably enclosed in a cover. Type test reports shall have to be signed both by the supplier's Engineers and CLK's engineers. Ordinarily 10 copies of the report shall be supplied.

Spec. of measuring instruments for WAG-7 WAG-8 and WAG-9 class of locomotives.

  
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अतिरिक्त  
DIN.  
CHKO

## II. Routine Test Certificates

This shall be supplied in standard 'A4' size of sheets with punched holes for filling. Routine test certificates shall be submitted along with each individual measuring instrument in 6 copies.

## III Drawings

Detailed dimensioned drgs. in twenty (20) copies shall be supplied in standard sizes of paper viz. 'A4' 'A3' etc. indicating the constructional features to such a scale as to make these clear enough to appreciate the details of constructions assembly etc.

### 8. Guarantee

- 8.1 The supplier shall give a guarantee of clear 12 months on all components from the date of commissioning & 18 months from date of despatch of the measuring instruments on the locomotive and any damage or defect noticed during the period due to defective material or workmanship, will be replaced by supplier free of cost. The manufacturer shall arrange to send his Techl. Officer for any investigation to any where on the Indian Railways where the measuring instruments will be working on the locomotive and shall submit a report of his investigation together with his proposals for any modification or improvements to the Deputy Chief Elect. Engr (Design) for approval before commencing the repair works under guarantee.

### 9.0 Submission of Tender-Quotation

- 9.1 All tender documents including the quotation shall be submitted in duplicate including any correspondence till a contract is finalised.
- 9.2 The tenderer shall give sufficient information to prove that his factory has adequate facilities and capacity to manufacture the measuring instruments, to meet fully the techl. requirements of the specification and quality of materials and workmanship.
- 9.3 The Tenderers are permitted to quote for alternative designs for the measuring instruments. For such deviations full particulars shall be furnished.
- 9.4 Quotations shall not be considered complete unless all informations are furnished and are therefore liable to be rejected.
- 9.5 Clause wise comments on the specification & test programme.
- 9.6 Techl. documents & Drawings.

Specn. of measuring instruments for WAG-7, WAG-5 and WAP-1 class of locomotives.

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दिनांक/DATE: OCT, 2000

## 10.0 Techl. Specification

10.1 The following instruments are covered by this specification:

- i) Traction motors alongwith their associated shunts.
- ii) Traction motor voltmeters alongwith their series resistance.
- iii) Auxiliary voltmeter.
- iv) Battery voltmeter (96mm x 96mm)

10.2 The instruments mentioned in clause 10.1(i) (ii) & (iii) shall be of edgewise type for flush mounting on sheet steel panels at a maximum possible inclination of 45° to the horizontal and the Battery voltmeter of the square type suitable for vertical flush mounting.

10.2.1 The instruments shall be of the moving iron/moving coil type as per particulars indicated in the following pages. The movement of the instruments shall be either supported by a test band suspension or by its jewel bearings of adequate and robust design. The tenderer shall clearly indicate the type of support of the movement offered by him alongwith a design clear enough to appreciate the design offered.

10.2.2 The pointer shall be of a light construction but of robust and sturdy design, and lead itself to ease and accuracy of reading.

10.2.3 The range, scale, overall dimensions, fixing corners, dial particulars, graduations etc, shall comply with the drawings attached to this specification.

10.2.4 The instrument shall be complete with self contained 24V dial illuminating lamp. The numbers of 24V. W lamp indicated in design to that in Philips catalogue No. 1364 shall be provided. LEDs (Yellow) with suitable Series Resistance.

10.2.5 The construction of the instruments shall be mechanically sound, free from evident mechanical defects, suitable for the purpose for which they are intended and such as to give reasonable assurance of permanent in mechanical, electrical and magnetic adjustments. Further, they shall be able to withstand shocks and vibrations which are normally encountered in locomotives without in anyway impairing their accuracy. Suitably and adequately designed resilient rubber padding shall be provided between the bases of the instruments and the housing and finally all along the edges of the bases of the complete instruments to enable their mounting on sheet steel panels which are subjected to severe shocks and vibrations in service.

Specn. of measuring instruments for WAG-7, WAG-5 and WAP-1 class of locomotives.

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दिनांक/DATE: OCT, 2000

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The external rubber padding for the bases shall be supplied alongwith the instruments.

- 10.2.6 Casing: The cases shall be so constructed that they are dust proof, weather proof, & insect proof. All reasonable precautions shall be taken in the design and manufacture of instrument to prevent any fogging of the instrument glass.
- 10.2.7 Damping: The instrument shall be so damped that on switching on a current equal to two thirds (2/3) of full scale value the first oscillation shall not exceed 30% of the final reading. The time taken for attaining the final stable reading shall not exceed 4 seconds.

10.2.8 ACCURACY

The instruments shall confirm to "1.5 class" of accuracy.

ZERO ADJUSTMENT:-

- 10.2.9 The ~~precision~~ ammeter, voltmeter and other instrument zero adjustment shall be provided by means of a bifurcated regulation pin on the pointer side, inside the housing. Due note of clause 6.6. of IS:1246 (pt-3)-1983 shall be taken in this regard.

10.3 Shunts (Ammeter)

i) The shunts shall be manufactured from Manganin Resistance strips/wires and shall comply with clause 3.3.1 of IS:1246 (part-6)-1984. The wire/conductor used for winding precision shunt resistors should preferably undergo negligible changes in resistance over a wide range of operating temperatures. Manganin wires/conductors having resistance/temperature curves following parabolic curve are recommended as ideal for this purpose, provided that their temperature of peak resistivity occurred as near as ambient temperature.

ii) Electrolytic copper to IS:1897 shall be used for fabrication of shunt end blocks.

iii) With the rated current passing through the shunt, the temperature rise at the middle of the manganin element shall not exceed 92° (corresponding to an ambient of 55° C i.e. total temperature not to exceed 147° C).

iv) Temperature rise at the end terminals shall not exceed 43° (corresponding to an ambient of 55° C, i.e. total temperature not to exceed 117° C).

Specn. of measuring  
Instruments for WAG-7,  
WAG-5 and WAP-1 class of  
locomotives

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दिनांक/DATE : Oct, 2000





15.1.2 The instruments under test shall <sup>be</sup> connected with their resistance shunts/~~series resistance~~.

15.1.3 Instruments shall be tested for pointer deflection by passing a known current of any 50 to 60% of full scale value and tilting the instrument in all directions to ascertain that the pointer does not deflect from the chosen reading.

Same as type test.

15.1.4 Damping tests: On switching ON current equal to  $\frac{2}{3}$  of the full scale value, the instrument shall comply with the following stipulations

Same as type test.

a) The first oscillation shall be within 30% of the final reading.

b) The time taken for attaining the final stable reading shall not exceed 4 seconds.

15.1.5 Overload test: This shall be conducted by subjecting gradually the instruments and accessories to a current of 120% corresponding to the full scale value for a period of one hour. At the end of the tests, the accuracy of the Instruments shall be within the specified limits.

15.1.6 Vibration test: The instrument and their accessories shall be subjected to a vibration test as per clause 7.50 of IS:1248 (Pt-2)-1983. In addition the instrument shall also be subjected to a vibration of the order of 3 to 7 cycles per second at an amplitude of 10mm on a shaking machine, with the pointer being deflected electrically to  $\frac{2}{3}$ rd of the full scale value. The test shall be carried out for 6 hours. During the test no deviation of the pointer from the adjusted value shall be observed and there shall not be any fusing of indication lamps and looseness of any component.

15.1.7 High current injection tests for traction ammeters and their shunts:

This shall consist of 9 tests each of 18 kilo amperes (18 kA) for half a second each (0.5 seconds) and one test at 18 kilo-amperes for 5 seconds. At the end of the end of the test the accuracy shall be measured and found to be within the specified limits.

Specn. of measuring instruments for WAG-7 WAG-5 and WAG-1 class of locomotives.

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क्रमांक/NO. CLM/ES/I-21/A  
दिनांक/DATE: Oct, 2000

**15.1.8 High potential test for traction voltmeter and its series resistances**

This shall consist of 9 tests each at 3600V(3.6kV) each of half a seconds duration and one test at 3600V(3.6kV) for 5 seconds duration. At the end of the test the accuracy of the instrument and accessories shall be within the specified limits.

**15.1.9 Dielectric test. The instrument and their accessories shall be subjected to the electric test as per schedule (Annexure-A).**

Same as  
type test

The test voltage shall be applied between terminals & between terminal shorted & mounting frame.

**15.2 Test for Ammeter shunt**

**15.2.1 Visual examination and checking for dimensional requirements.**

15.2.2 Each shunt under inspection shall be examined visually for any cracks as well as checked for physical, mechanical and marking requirements.

15.2.3 Voltage drop test shall be carried out by injecting full rated current(1500 amps) into the shunt. The value of voltage drop in hot condition shall be within  $60 \pm 1\%$  milli volts.

**15.2.4 Temperature rise test**

The test shall be carried out at the rated current of 1500 amps. After attaining the steady state condition of temperature, the temperature rise shall be measured by using thermo couples or precision thermometer at the location as shown in the drg. No. CLN/ES/2000/I-21. The Temp. rise at the middle of the shunt shall be the average of temperature measurements taken on individual elements.

The temp- rise ( $\Delta t$ ) shall not exceed the limits laid down under the clause No. 10.3 of this specn.

**15.2.5 Load test**

The test shall be carried out as per 15.2.4. This test is conducted to determine the hot resistance at full load current and the voltage drop at steady state condition.

Specn. of measuring instrument for WAG-7, WAG-5 and WAP-1 class of locomotives

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चक्र  
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- 1) Measure Hot Resistance  
 11) Measure voltage drop at full load current of 1500 amps, it shall not exceed 60 mV  $\pm$  1% in Hot condition.

15.2.6 Special test: After removing the hardware from the shunts, particularly the spring washers, the shunt shall be hung in and oven by one end-terminal with a load of 2kg hung from the other (lower) terminal. The shunt shall be subjected to a temperature of 250°C for 6 hours. This test shall not show any sign of softening of bearing alloy at the joints of Manganin elements with end terminals and shall also not result in change of the value of millivolt drop (60mV when passing 1500amps compared to the readings recorded earlier).

16. Test for voltmeter resistance : The voltmeter resistor shall comply with requirements of IS8909 (Part 1 & 2) 1978.

Sl.No.	Type test	Routine test
16.1	Dimensional check shall be carried out in accordance with enclose drg.	Same as type test
16.2	The resistance shall be visually examined for workmanship, finish, termination hardware etc.	-do-
	a) Manufacturer's name & address .	
	b) Rating in watts, ohms.	
	c) Month, year of manufacturing and serial number	
	General examination of resistance element to ensure that the enamelling is smooth hard and flame proof and free from any crack or any surface defect.	
16.3	Measurement of cold resistance at room temperature	-do-
16.4	Measure current at 900V D.C.	-do-
16.5	Temperature rise tests: - The voltmeter resistance shall be loaded at 900V D.C. to stabilisation of surface temperature. After stabilisation surface temperature shall be measured. Maximum rise in surface $\pm$ 7°C	

Specn. of Measuring instruments for WAG-7 WAG-5 and WAG-1 class of locomotives.

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temperature shall be measured Maximum rise in surface temperature  $75^{\circ}\text{C}$

At  $75-85 = 20^{\circ}\text{C}$

Measure hot resistance and Calculate inherent rise in temp over ambient.

### 16.6 Over load test

16.6.1 The resistance shall be 50% over loaded for 15 minutes and at the end of test rise in temperature to be recorded. General examination regarding pulsing/cracking of resistance for both resistance element and cover to be recorded.

### 16.6.2 Short term over load test:

Over load test shall also carried out for short duration in terms of para 6.4.2 of IS:1246 (part-8)-1984

Resistance Upto	voltage factor	Number of over loads	Duration of each over-load.	Interval between two over load
2kv	2 is. 1000V ac.	5	5 seconds	15 seconds.

16.7 vibration test: The resistance shall be energized at 900V.D.C. The resistance will be mounted on a table. It will be subjected to vibration with an amplitude of 3.5mm at 20 cycle/second in the vertical plane for period of 6 hrs. The resistance be turned by  $90^{\circ}$  and the test shall be repeated. During the test no interruption of power is desired. At the end of test there shall be no mechanical damage in resistance, nor, loosening of component.

16.8 Endurance Test: The resistance for voltmeter/heated at 900V D.C. for 4 hrs. and then be cooled at room temperature which complete one cycle, like this 10 cycles are to be repeated. The source of voltage supply shall be such that, the voltage applied to the resistor is not changed by fluctuation of the resistance value.

The resistance shall be visually examined, there shall be no damage of the resistance and the marking shall be legible. The resistance value shall be measured and the change of resistance compared to the initial value shall not exceed 5%.

Specn. of resistance measuring instrument to be used, and name of class of resistances

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17. Type test/Routine Test

The tests given under type tests shall be conducted on prototype samples as well as samples required for such test from time to time to ascertain the consistency to the quality of such shunts. Routine tests shall be conducted on each shunt/series resistance.

	<u>Type test</u>	<u>Routine test</u>
i)	Dimensional check	yes
ii)	Visual examination & checking for mechanical & physical requirement.	yes
iii)	Cold resistance	yes
iv)	Temp. rise test	-
v)	Load test for determining the hot resistance of the shunts / Series Resistance.	-
vi)	Voltage drop test at rated current for shunt.	yes
vii)	Special test	-

18 CLW RESERVE THE RIGHT TO PROCURE MATERIALS ONLY FROM THE ISO CERTIFIED FIRMS.

19 The following items are included in routine inspection schedule -

- Alt. A
- 100% visual inspection of all meter offered for inspection to check layout etc.
  - 10% of the lot may be picked up and put to 750VAC continuously for atleast 2 (two) hours.
  - Accuracy test to be carried out on these 10% of meters.

Specy. of measurement  
Instruments for MS-7,  
MAG-1 and MAG-2 class  
of locomotives.

  
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क्रमांक/NO. CLW/MS/I-21/A  
दिनांक/DATE: OCT, 2000

REQUIREMENTS FOR MAG-5, MAG-7 AND MAG-1 (GP) LOGOS

Annexure-A

Sl. No.	Description	Qty/lot	Type	Over all dimen.	Scale	Range/Value	D.E. Test voltage	Re-forecast	Re-marks
1.	Traction motor voltmeter	2	Moving coil	153mm X 70mm X 133mm	82mm	0-900V	5kv for 1 minute	Fig. I & Fig. VIII	
2.	Series Resistance for voltmeter in Sl. No. 1	2	-	-	-	88 Kilo ohms in 9 units $\pm 1\%$	5kv for 1 minute	Fig. III	
3.	Traction motor Ammeter	4	Moving coil	153mm X 70mm X 133mm	82mm	1.5-0-1.5 KA	5kv for 1 minute	Fig. I & IX	
4.	Shunts for Ammeters at Sl. No. 3 above	2	-	-	-	1500 mho. 60 milli-volt, $\pm 0.06V$ .	-	Fig. II	
5.	Auxiliary line voltmeter	2	Moving Iron/Coil Att. (A)	153mm X 70mm X 133mm	82mm	0-600V 0-35kv	2.5kv for 1 minute	Fig. III, IV	
6.	Battery voltmeter	1	Moving coil	96mm X 96mm X 71mm	84mm	0-150V	2kv for 1 minute	Fig. VII	

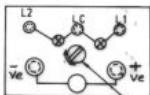
For use in the station

CHITTARANJAN LOCOMOTIVE WORKS  
WEST BENGAL, INDIA  
SHEET NO. CLM/WS/X-21/A  
Rev./DATE: OCT, 2000

For use in the station  
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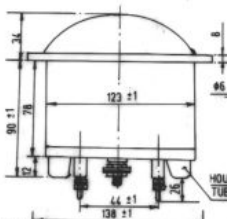
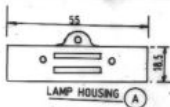
For use in the station  
Attachment for MAG-5, MAG-7 & MAG-1 Logos

DRM. CHKD

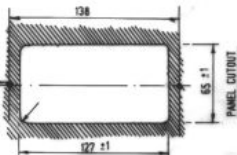


ZERO ADJUSTER

VIEW LOOKING ON REAR SIDE CONNECTION DIAGRAM

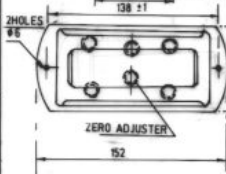


HOUSING FOR  
TUBULAR LAMP

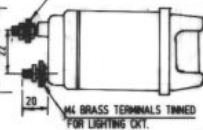


PANEL CUTOUT

M6 BRASS (FREE CUTTING)  
TERMINALS TINNED FOR METER CKT.



ZERO ADJUSTER



MC BRASS TERMINALS TINNED  
FOR LIGHTING CKT.

FIG-1

... 16

SPECIFICATION OF MEASURING  
INSTRUMENT FOR WAG-7, WAG-5 AND  
WAP-1 CLASS OF LOCOMOTIVES.

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क्रमांक/NO. CLW/ES/SK-1/I-21/A  
दिनांक/DATE: 17-10-2000

SEE/D-II

SSE/D

CHKD

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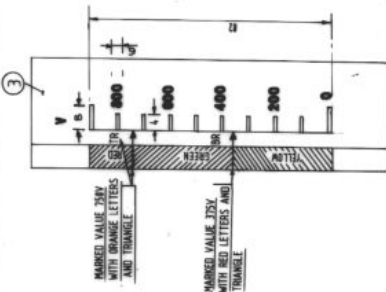


FIG-III

TRACTION MOTOR VOLT METER

(WAG-7 & WAP)

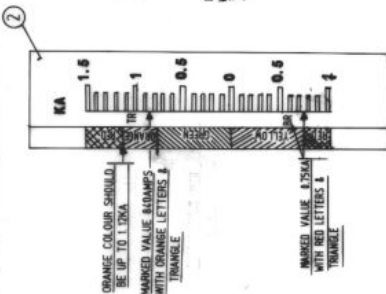


FIG-IV

TRACTION MOTOR AMMETER

(WAG-7 & WAP)

NOTE : HATCHED PORTION TO BE COLOURED AS PER COLOUR INDICATED WITHIN THE BLOCK.

SPECIFICATION OF MEASURING  
INSTRUMENT FOR WAG-7, WAG-5  
AND WAP-1 CLASS OF LOCOMOTIVES

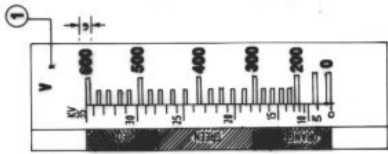
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SPECIFICATION OF MEASURING INSTRUMENT  
FOR WAG-7, WAG-5 & WAP-1 CLASS OF  
LOCOMOTIVES.

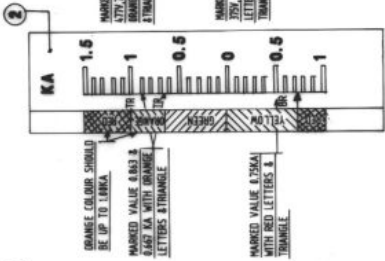
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मितीक/DATE : 17-10-2000



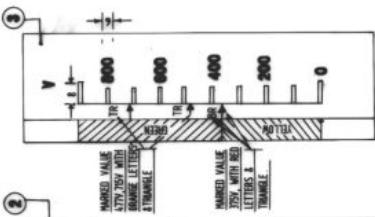
AUX. VOLTMETER  
TYPE OF LOCO - ALL TYPES

FIG- IV



TRACTION MOTOR AMMETER  
TYPE OF LOCO-WAM-4

FIG- V



TRACTION MOTOR VOLTMETER  
TYPE OF LOCO - WAM-4

FIG- VI

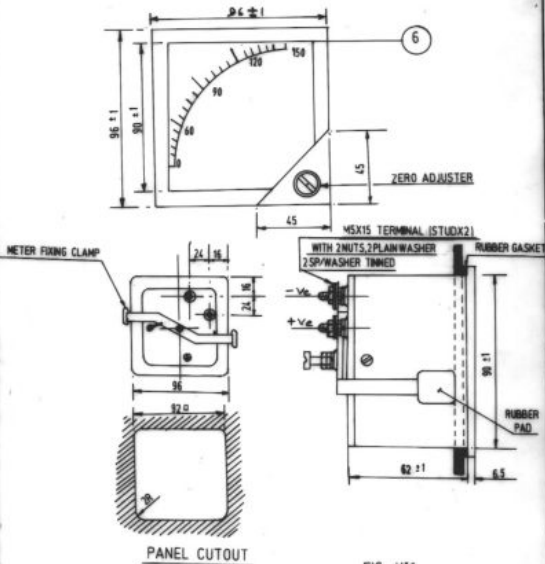


FIG- VII

NOTE :- ALL DIMENSIONS ARE IN MM.

BATTERY VOLTMETER FOR ALL TYPES OF LOCOS

...19

SPECIFICATION OF MEASURING INSTRUMENTS FOR WAG-7, WAG-5, AND WAP-1 CLASS OF LOCOMOTIVES

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दिनांक/DATE : 17-10-2000

SEE/D-II

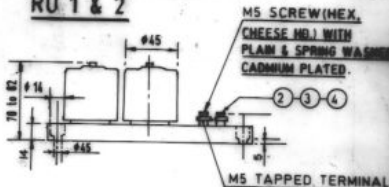
CHKO

सं.वि.अ.

# T.M. VOLTMETER SERIES RESISTANCE

95  
Sheet  
19

**RU 1 & 2**



**FIG-III**

4	SPRING WASHER M5	4	SPR.STL	IS-2063	CAD.PLT.
3	PLAIN WASHER M5	8	STEEL	IS-2016	-DO-
2	CHEESE HD. HEX. SCREW M5	4	STEEL	IS-1364	-DO-
1	INSULATING BOARD 162X84X14	1	DMC	BS-5734	--
REF.	DESCRIPTION	QTY.	MATL.	SPECN.	REM.

## SPECIFICATION OF MEASURING INSTRUMENTS

**WAG-1 & WAP-1, WAG-5**

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अनुमोदित  
CHIEF

अनुमोदित  
D.D.M.

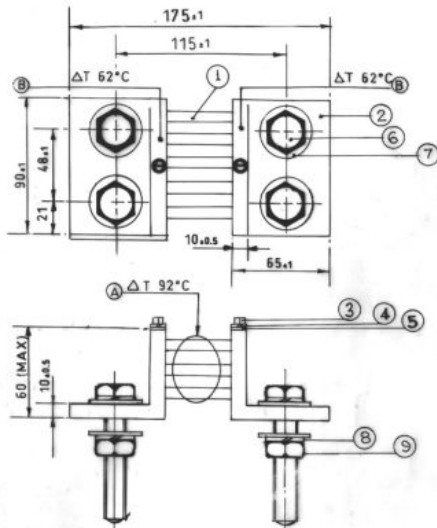


FIG - II

**SHUNT FOR TM. AMMETER  
FOR ALL TYPES OF LOCOS  
1500A / 60mV.**


**NOTE:**

1. ALL BRASS PARTS TO BE NICKLE PLATED.
2. ALL STEEL PARTS TO BE CADMIUM PLATED & PASSIVATED
3. SHUNT END BLOCKS ARE TO BE ELECTRO-TINNED INCLUDING THE BRAZED ZONE.
4. A BLACK ENAMEL COATING IS TO BE PROVIDED ON THE SURFACE OF THE MANGANIN WIRE.
5. A & B ARE THE LOCATIONS WHERE TEMP. RISE IS TO BE MEASURED.

9.			HEX. NUT M16	4	STEEL	15/11/64
8.			SPR. WASHER M16	8	SPR. STL	15/11/64
7.			PLAIN WASHER M16	8	STEEL	15/11/64
6.			HEX. HD. SCREW M16X70/70	4	STEEL	15/11/64
5.			PLAIN WASHER M5	4	BRASS	15/20/64
4.			SPRING WASHER M5	2	STEEL	15/11/64
3.			CHEESE HD. HEX. SCREW M5X5	2	BRASS	15/11/64
2.			END BLOCK	2	COPPER	15/11/64
1.			RESISTANCE		MAGANNIN	


CBD No.	REF.	PART DRG. NO.	DESCRIPTION	QTY.	MATL.	SPECN.	WT.
DGN	DATE	NAME	<p style="text-align: center;">WAG-5 WAG-7 &amp; WAP</p> <p style="text-align: center;">SPECIFICATION OF MEASURING INSTRUMENTS</p>				
DRN							
CHD							
TRD	29/9/64	H. Maitra					
COMP							
REF.							

CHITTARANJAN  
LOCOMOTIVE WORKS  
WEST BENGAL, INDIA



APPROVED—

No. CLW/ES/SK-6/1-21



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