Rail Coach Factory, Kapurthala

ED-2030

Date: 04.07.2024

Sub: Issue of Specifications/Drawings for testing of Switch Board cabinet.

The specification for test bench for testing of Switchgear provided in Switch Board cabinet for LHB AC coaches has been prepared for fundamental testing and operation of the Switch Board Cabinet under various loads vide EDTS-454. The Switch Board cabinet is suitable for testing of pickup & drop out voltage, milli volt drops, IMR relay, HRC fuse, etc.

The specification has been issued to you for further processing and urgent procurement being safety related issue.

Probable sources are as under:

1. M/s. Abrol Engg & Co. Kapurthala.
2. M/s. Ess Ess Kay Co. Pvt. Ltd. Kapurthala.
3. M/s. International Switchgears Pvt. Ltd. Mohali
4. M/s. Hi-Tech Power Controls Mohali
5. M/s. GND Rail Power Solution Kapurthala

Dy. CEE/DP

Dy. CEE/prod.

SPECIFICATION FOR TEST BENCH FOR TESTING OF SWITCHGEAR PROVIDED IN SWITCHBOARD CABINET FOR THE LHB AC COACHES

1. SCOPE

1.1. The Test Bench has been developed to test/validate the switchgear provided in switchboard cabinet for LHB Coaches. This is to ascertain the equipment operates as intended by the manufacturer and access the behaviour of the equipment under various levels of loads and demand

1.2. SERVICE CONDITIONS

The Test Bench shall be governed by this specification and shall be suitable for following service conditions

Ambient	- 5 to55 deg. C
Train speed	200 KMPH
Humidity	Up to 98% during the rainy season
Altitude	Max.1200m above sea level
Atmosphere	Extremely dusty and desert terrain in certain areas. The dust concentration in the air may reach at the high value of 1.6mg/cubic meter.
Rainfall	Very dusty atmosphere with fog, case iron dust of brake block shoe, flying ballast etc. Very heavy in certain areas.
Coastal area	The equipment shall be designed to work in humid salt laden and corrosive atmosphere. The maximum values of the condition shall be as under:
Maximum Ph value	8.5
Sulphate	7mg/litre
Max. concentration of Chlorine	6mg/litre
Max. Conductivity	130sq/cm
Vibration	The arrangement system and their mounting arrangement shall be capable to withstand satisfactorily the vibration and shocks encountered in service as specified below.

Maximum vertical acceleration	3.0 g
Maximum lateral acceleration	3.0 g
Maximum longitudinal acceleration	3.0 g

Sinusoidal from of vibration, the frequency 'f' lies between 1 Hz and 50 Hz and their amplitude 'a' expressed in mm is given as a function 'f' by the equation.

a=25/f for the values of 'f' between 1 Hz and 10 Hz.
$a=250/f^2$ for the values of 'f' between 10 Hz and 100 Hz.

2. Governing specifications

Reference shall be made to the following standard specifications:-

IEC60571	Electronic equipment used in Railway vehicle
ELRS/SPEC/SPEC/S1/0015 (Rev-1) Oct-2011 or Latest	Specification of electronics used in Rolling Stock application
IEC-61373	Shock & vibration tests for rolling stock application.
IEC-61000	Electromagnetic compatibility (EMC)
IEC-60529	Classification of Degree of Protection
EN 45545	European Railway Standard for fire safety

IEC 62680-1-3	Universal serial Bus Interface for Data & Power
IS:13947	Specification for low voltage switchgear
IS:6911	Stainless steel plate , sheet and strip.
IS:1248	Direct acting indicating analog electrical measuring instruments.

3. Technical requirements: -

3.1. This test bench shall be able to test individual switchgear provided in switchboard cabinet to RDSO specification No. RDSOPE/SPEC/0184-2015 (Rev.-1), RDSO/PE/SPEC/AC/0200-2020 (Rev.-0), EDTS-134 in addition to provision shall be made for testing of all switchgear inside switchboard cabinet without dismantling them or opening of wire terminals. Accessories i.e. external leads connectors etc. shall be in the scope of supply of the test bench along with special tools for fitment or dismantling switchgear. The list of all accessories shall be submitted along with the offer.

3.2. The Test bench shall be equipped with all the components required for all the tests, calibration and settings of protective relays, contactors, instruments, MCB, operation

3.3. The test bench shall be able to test the following switchgear

3.3.1. Disconnecting and Earthing Device – Resistance of each contact/pole of disconnecting device be checked and displayed on milliohm-meter, ON/OFF status, indicated through LED lamps. Rating- 8 pole, 125A at 1000 volts.

3.3.2. MMR-750 volts: - 3-phase 750 volts phase control net-1 & net-2 shall be tested for single phasing. phase unbalance by variac, in at least 2-phases, over-voltage with tripping time display and indication on the test panel.

3.3.3. Pick up & drop out voltage: operation of feeder selection contactors, local mains supply contactors and verify cation of pick-up and drop out voltage. The rating of the contactors shall be 4-pole, 1000volts, 190 Amp

3.3.4. Milli-volt drops: to check the milli-volt drop of the main contacts of power contactors at full load for 190 amps at 1000 volts

3.3.5. MMR-3-Phase 415 V: voltage phase control relay shall be tested for phase unbalance, over voltage, under voltage with tripping time display on meter & indication on test bench panel

3.3.6. MCB/MPCB: Testing of MCB/MPCB at different loads to confirm the load and tripping time characteristics, standard curve for ratings of AC MCB for 6 to 25 amps for 1-pole, 2-pole and 3-pole & MPCB of range 0.4 amps to 20 amps (3-pole)

3.3.7. IMR relay: testing and operation and performance of both the IMR relays at various step less insulation levels with rated voltage of 0-500 volts AC and 110 volts AC.

3.3.8. HRC Fuse testing: Testing of HRC fuse at rated current and verification of blown off current and time for the rating of 125 amps, 1000 volts and 25 to 100 Amps, 690 volts.

3.3.9. DC-DC Converter: testing of DC-DC Converter at full load and verification of output voltage at various loads. The rating of the dc/dc converter is 110/24 volts, 240 watt, 10 amps.

3.3.10. DC MCB test: testing of DC MCB with tripping time display and indication on test bench for a rating of 2-pole 6 amps to 20 amps

3.3.11. Earth Leakage Test: on positive and negative side by resistance method (10mA to 60mA) to be checked and output to be displayed on meter and indication on test bench panel.

3.3.12. Load Test: connected dedicated AC/DC full loads as per individual components rated current testing with load varying from 0-22 amps.

3.3.13. Individual component test procedure in the form of work instructions shall be submitted by the firm at the time of document scrutiny

3.4. **Constructional Requirements:-**

3.4.1. The test bench shall consist of welded tube construction , TIG welded to make the complete frame with dimensions as indicated in the drawing SKED 961 Making of structure with L-channel welded to form a tube is not permitted.

3.4.2. The sheet steel used on the front shall be 2 mm thick CRCA steel conforming to IS:513-1994 & 1.6 mm 304 stainless steel.

3.4.3. Test Bench shall be powder coated to thickness minimum 60 microns Grey shade no 610/08038 of M/s Nerolac paints or 877 of M/s Berger Paints after giving requisite treatment.

3.4.4. All the fasteners used shall be zinc plated and passivated according to IS:1573-86 and conforming to IS:1364.

3.4.5. The general construction shall be such as to keep the various voltage levels separated against each other as far as possible.

3.4.6. Provision of castor wheels with stopper arrangement may be made.

4. **Tests: -**

4.1.1. Type Tests

4.1.1.1. Only after detailed drawing and the design have been approved and the clearance given to this effect, the manufacture shall take up the manufacture of the prototype. It is to be clearly understood that any changes required to be done in the prototype or any additional tests other than specified herein are required to be conducted on the prototype unit or its components, they shall be done expeditiously

4.1.1.2. Internal testing at firm's premises shall be carried out by qualified person & test results shall be submitted to RCF

4.1.2. Routine Test

4.1.2.1. Routine test as mentioned are to be carried out on each unit by the manufacturer at his works to ensure compliance with the specification

4.1.3. Acceptance Test

4.1.3.1. All the acceptance test shall be carried out at the firm's premises at the manufacturer cost.

4.1.4. Schedule of tests

Sno	Clause of IS:8623	Tests	Type test	Routine test	Acceptance test
1	8.3.1	Visual inspection, including inspection of wiring and electrical operation test	Yes	Yes	Yes
2	8.2.1	Temperature rise test	Yes	No	No
3	8.2.6	Mechanical operation and sequence test	Yes	Yes	Yes
4	8.2.5	Test for verification of clearance and creepage distance	Yes	Yes	Yes
5	8.2.2	Test for verification of di-electric properties	Yes	Yes	Yes
6	8.3.4	Test for verification of insulation resistance	Yes	Yes	Yes
7	8.3.3	Checking of electrical continuity	Yes	Yes	Yes

8	8.2.4	Verification of effectiveness of protective circuits	Yes	Yes	Yes
9	--	Check for satisfactory operation of rotary switches by rotating 10 times clockwise and 10 times anticlockwise, (WTC of rotary switches of OEM shall be checked by inspecting authority)	Yes	Yes	Yes
10	–	Check for BOM and proof material as per spec. with proof of invoices.	Yes	Yes	Yes

4.2. **Description of tests**

4.2.1. **Visual inspection including inspection of wiring and electrical operation test**

4.2.1.1. The test shall include visual inspection of control panel, overall dimensions, marking and general layout of housing, earthing, colour coding as mentioned in the specification & drawings. Electrical operations shall also be checked as per concerned drawings and prepared test protocol. General workmanship of Switch Board Cabinet and its accessories such as MPCB, MCB, fuse, relay, contactor, connector, cable etc. shall be checked

4.2.2. **Temperature rise test:**

4.2.2.1. Temperature rise test of the Switch Board Cabinet shall be carried out as per clause no 8.2.1 of IS 8623 Pt -1. The reading at various points of switchgears conductors & insulators, HT fuses, bus bar, Panel body, Panel doors, handles etc. shall be measured at an interval of 30 minutes till the temperature will be stabilized. The firm should submit the test protocol for temperature rise test in advance to RCF.

4.2.3. **Mechanical operation and sequence test**

4.2.3.1. This type test shall not be made on such devices of the assembly which have already been type-tested according to their relevant specifications provided their mechanical operation is not impaired by their mounting. For those parts which need a type test, satisfactory mechanical operation shall be verified after installation in the assembly. The number of the operating cycles shall be 50.

4.2.3.2. At the same time, the operation of the mechanical interlocks associated with these movements shall be checked. The test is considered to have been passed if the operating conditions of the apparatus, interlocks etc. have not been impaired and if the effort required for operation is practically the same as before the test

4.2.4. **Test for verification of clearance and creepage distances**

4.2.4.1. The clearance and creepage distances shall be verified as per the IS:13947(latest edition)

4.2.5. **Test for verification of di-electric properties**

4.2.5.1. The control panel shall be tested with 3KV test set between live parts and earthed body

Applied voltage	Time	Result	Condition	Leakage current
3 KV	60 secs	Should withstand the test for	disconnected equipments - DC-DC converter Insulation monitoring relay	Should be noted

		one minute		

4.2.6. **Test for verification of insulation resistance**

4.2.6.1. During testing, insulation controllers have to be disconnected. All the MPCBs/MCBs shall be kept in the OFF position. Insulation resistance shall be measured with direct current. Measuring voltage and minimum insulation resistance values are given in the single test items. The HV test shall be done with AC (50 Hz) which shall be gradually increasing (applied for one minute). The test is considered pass if no electric breakdown or flashover occurs

4.2.6.2. Insulation resistance test shall be carried out on all the circuits. The meggering voltage and the value of the insulation for the various circuits shall be given as under-

Sno	Rated circuit	Meggering voltage	Insulation resistance
1	750 volts AC	1000 V DC	Not less than 5 M ohms
2	415 volts AC	500 V DC	Not less than 3 M ohms
3	230 volts AC	500 V DC	Not less than 2 M ohms
4	190 volts AC	500 V DC	Not less than 2 M ohms
5	110 volts AC	500 V DC	Not less than 2 M ohms
6	24 volts AC	500 V DC	Not less than 2 M ohms

4.2.7. **Checking of electrical continuity**

4.2.7.1. Continuity of protective circuits shall be ensured by effective interconnections either directly or by means of protective conductors. In particular, screwed connections shall be checked for adequate contact, possibly by random tests.

4.2.7.2. When a part of Switch Board Cabinet is removed from the enclosure, for example for routine maintenance, the protective circuits for the remainder of the Switch Board Cabinet shall not be interrupted.

4.2.7.3. Means used for assembling the various metals parts of Switch Board Cabinet are considered sufficient for ensuring continuity of protective circuits if the precautions taken, guarantee permanent good conductivity and a current carrying capacity sufficient to withstand the earth fault current that may flow in Switch board cabinet.

4.2.7.4. For lids, doors cover plates and the like, the usual metal screwed connections and metal hinges are considered sufficient to ensure continuity provided that no electrical equipment is attached to them.

4.2.7.5. All parts of protective circuit within the Switch Board Cabinet shall be so designed that they are capable of withstanding the highest thermal and dynamic stresses that may occur at the place of installation of Switch Board Cabinet.

4.2.7.6. Verification for effectiveness of protective circuits

4.2.7.7. It shall be verified that the different exposed conductive parts of the assembly are effectively connected to the protective circuit in accordance with some requirements

4.2.8. Check for the BOM and proof of material as per specification

4.2.8.1. Firm shall submit BOM with clear details of the actual part number and make (along with test certificates and data sheets) used in Test Bench and shall be verified as per the documents submitted for approval.

4.3. **Technical Data to be submitted by the manufacturer**

4.3.1. The firm manufacturing the test bench for the first time shall submit mechanical & GA drawings for approval by RCF

4.3.2. The manufacturer shall submit the complete design detail and its accessories, sub-assemblies.

5. Commissioning

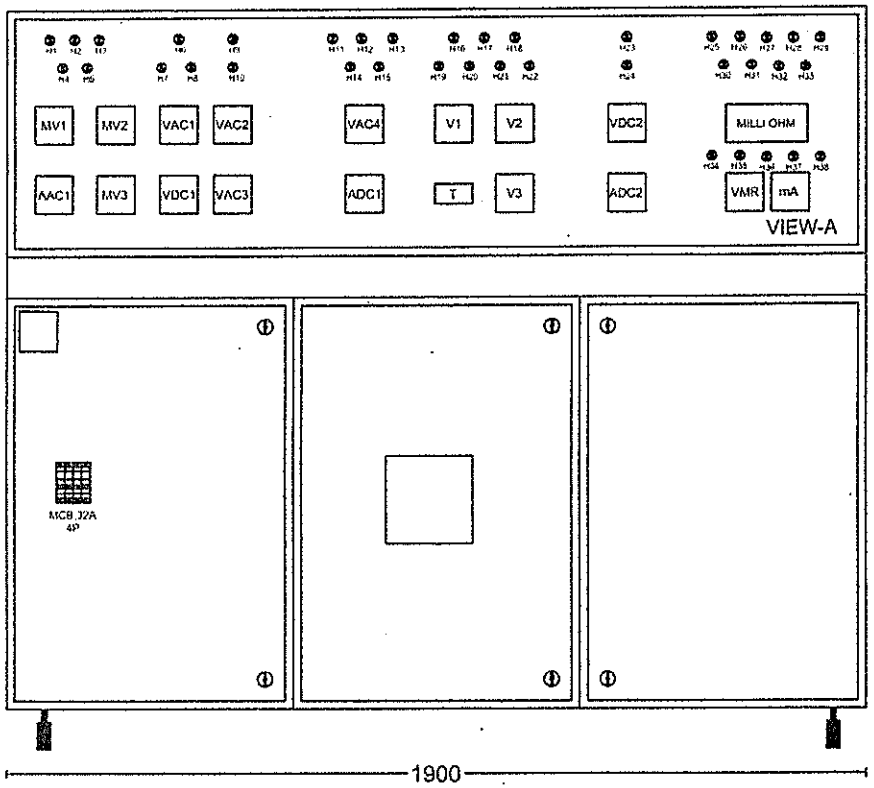
5.1. Firm shall be responsible for commissioning of the unit at RCF and shall prove out the scheme on one switchboard cabinet. Firm shall depute its staff for commissioning at production unit.

6. Guarantee

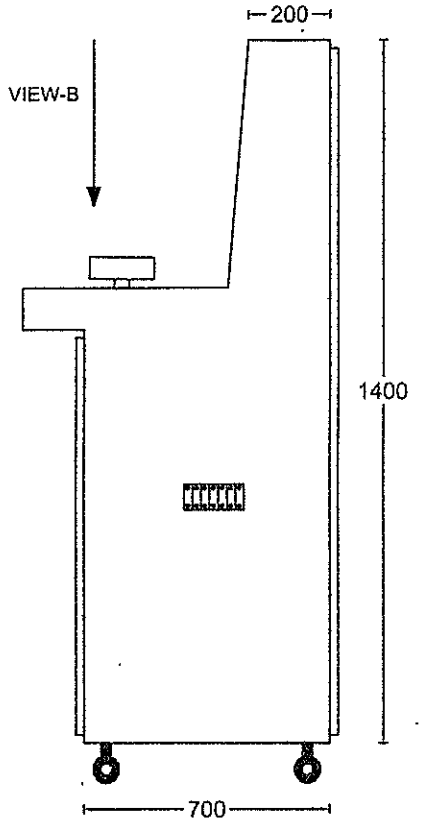
6.1. Guarantee and warranty obligation of the complete test bench shall be as per IRS conditions.

7. Enclosures:

7.1. SKED 961 (9 sheets)



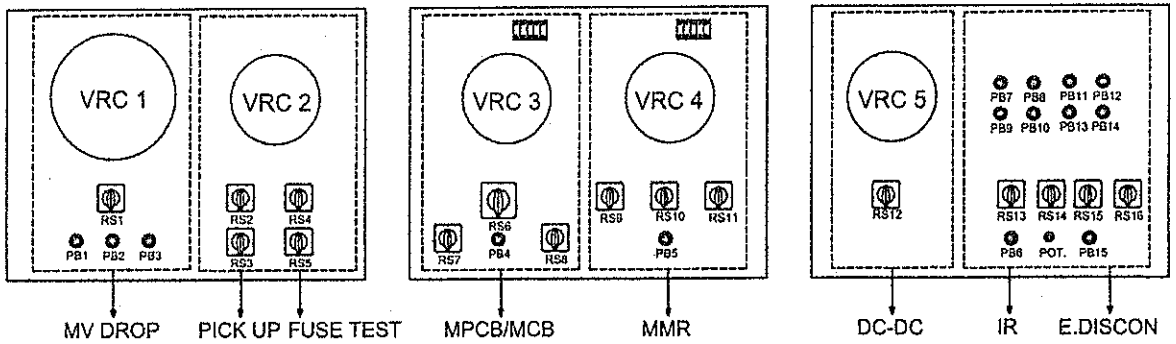
FRONT VIEW



SIDE VIEW

RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (Sheet 1 of 9)

VIEW-B



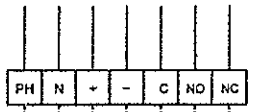
LEGENDS:-

	INDICATION LIGHTS
	PUSH BUTTON
	SELECTOR SWITCH
	LOAD VARIAC
	METERING

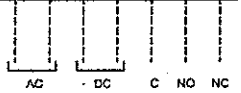
RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 2 of 9)

MPCB/MCB

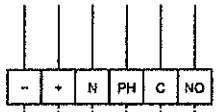
TESTING BENCH:

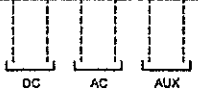


INSTRUMENTS:

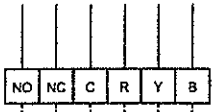


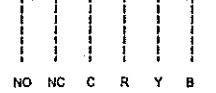
PICK UP



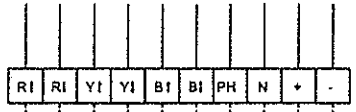


MMR





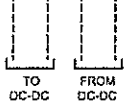
MILLI VOLT



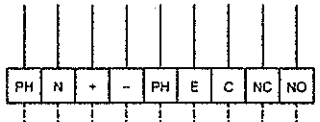
DC DC CONVERTER

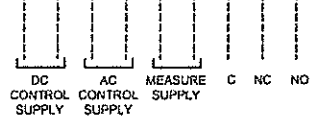
TESTING BENCH:

INSTRUMENTS:

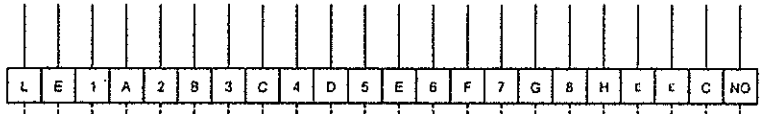


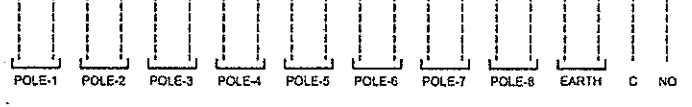
IR RELAY



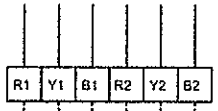


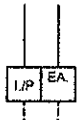
EARTHING DISCONNECTOR





TESTING BENCH:





INSTRUMENTS:

FUSE TEST

RAIL COACH FACTORY ,KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 3 of 9)

LEGENDS:-

INDIACTION LIGHTS:-

H1 : R PHASE
H2 : Y PHASE
H3 : B PHASE
H4 : MV TEST
H5 : MAGNETIC TEST
H6 : CONTACTOR ON
H7 : AC ON
H8 : DC ON
H9 : 415V ON
H10 : 190V ON
H11 : THERMAL
H12 : MAGNETIC
H13 : SETTING
H14 : FAULT
H15 : HEALTHY
H16 : PH.SEQ. NORMAL
H17 : PH SEQ. REV
H18 : 1PH
H19 : SETTING
H20 : TEST
H21 : FAULT
H22 : HEALTHY
H23 : 24V DC
H24 : 110V DC
H25 : POLE 1 ON
H26 : POLE 2 ON
H27 : POLE 3 ON
H28 : POLE 4 ON
H29 : POLE 5 ON
H30 : POLE 6 ON
H31 : POLE 7 ON
H32 : POLE 8 ON
H33 : OFF
H34 : READ K OHM
H35 : TEST K OHM
H36 : TEST mA
H37 : FAULT
H38 : HEALTHY

METERS :-

MV1 : R-PHASE MILLI VOLTS
MV2 : Y-PHASE MILLI VOLTS
MV3 : B-PHASE MILLI VOLTS
AAC : AC LINE CURRENT
VAC1 : VARIABLE - AC VOLTS
VDC1 : VARIABLE - DC VOLTS
V1 : VARIABLE VOLTAGE R-Y PHASE
V2 : VARIABLE VOLTAGE Y-B PHASE
V3 : VARIABLE VOLTAGE B-R PHASE
T : TRIPPING TIME
VDC2 : OUTPUT DC VOLTS
ADC2 : DC LOAD
VMR : MEASURING VOLTAGE
MΩ : RESISTANCE
mA : MILLI AMPERE METER
VAC2 : 190V VOLTMETER
VAC3 : AMMETER

SELECTOR SWITCHES:-

RS1 : MV TEST

RS2 : 1. MMR- B PHASE
2. PICKUP/DC - DC
RS3 : 1. VARIABLE AC
2. VARIABLE DC
RS4 : 415V ON
RS5 : 190V ON
RS6 : 1. MMR - R PHASE
2. MCB/MPCB
3. IR - MEASURE
RS7 : 1. AC LOAD
2. DC LOAD
RS8 : 1. TEST
2. SET
RS9 : SINGLE PHASING
1. NORMAL
2. SINGLE PHASING
3. SINGLE PHASING
RS10 : 1. PH. SEQ NORMAL
2. PH. REVERSE
RS11 : 1. TEST
2. SET
RS12 : DC-DC ON- OFF
RS13 : E. DISC./ON-OFF
RS14 : 1. TEST-IR
2. READ
3. TEST-mA
RS15 : EARTH LEAKAGE

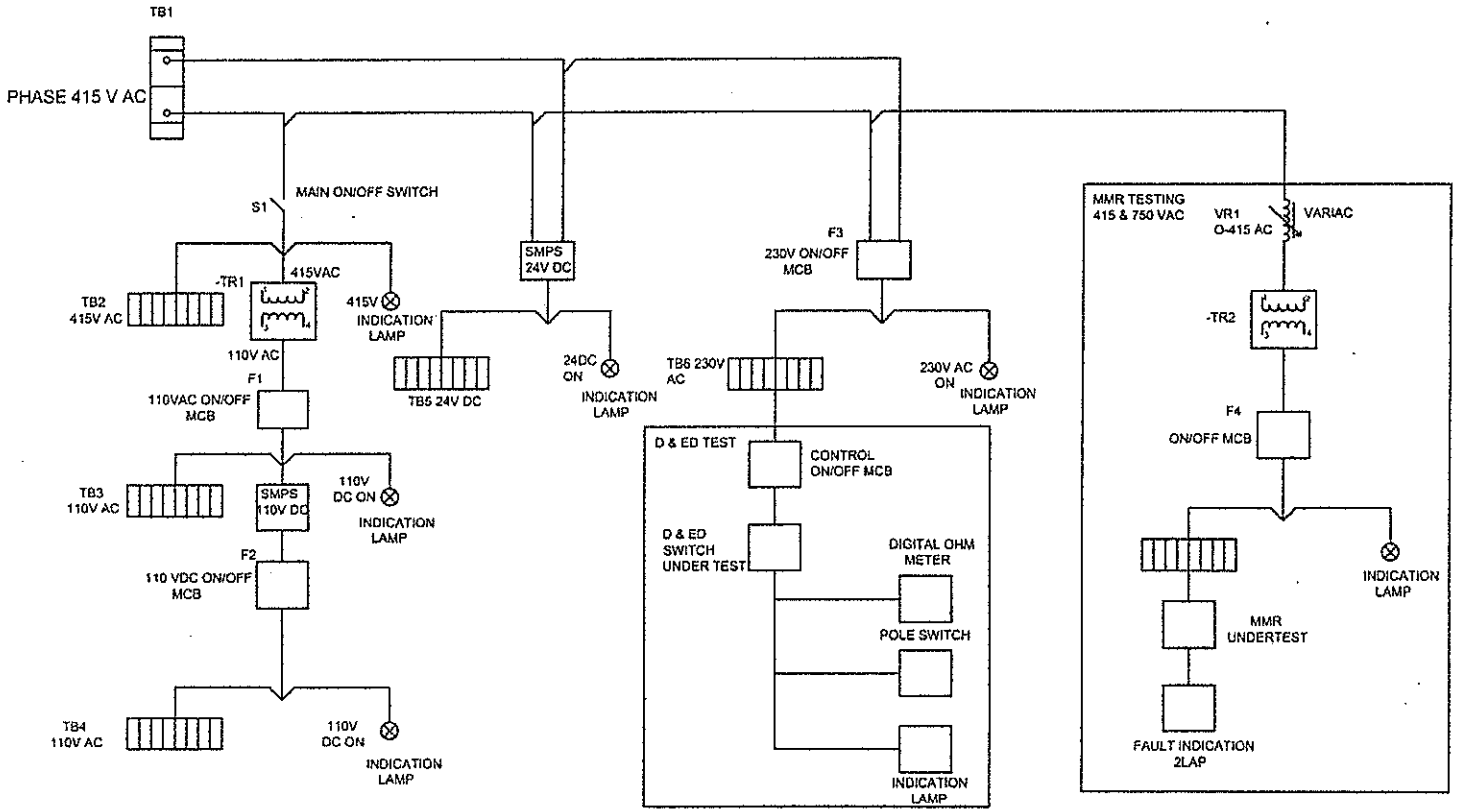
PUSH BUTTONS :-

PB1 : R-PHASE
PB2 : Y-PHASE
PB3 : B-PHASE
PB4 : TEST
PB5 : TEST
PB6 : INSULATION/mA
PB7 : POLE 1 RESISTANCE
PB8 : POLE 2 RESISTANCE
PB9 : POLE 3 RESISTANCE
PB10 : POLE 4 RESISTANCE
PB11 : POLE 5 RESISTANCE
PB12 : POLE 6 RESISTANCE
PB13 : POLE 7 RESISTANCE
PB14 : POLE 8 RESISTANCE
POT : 0-100KΩ POTENTIOMETER

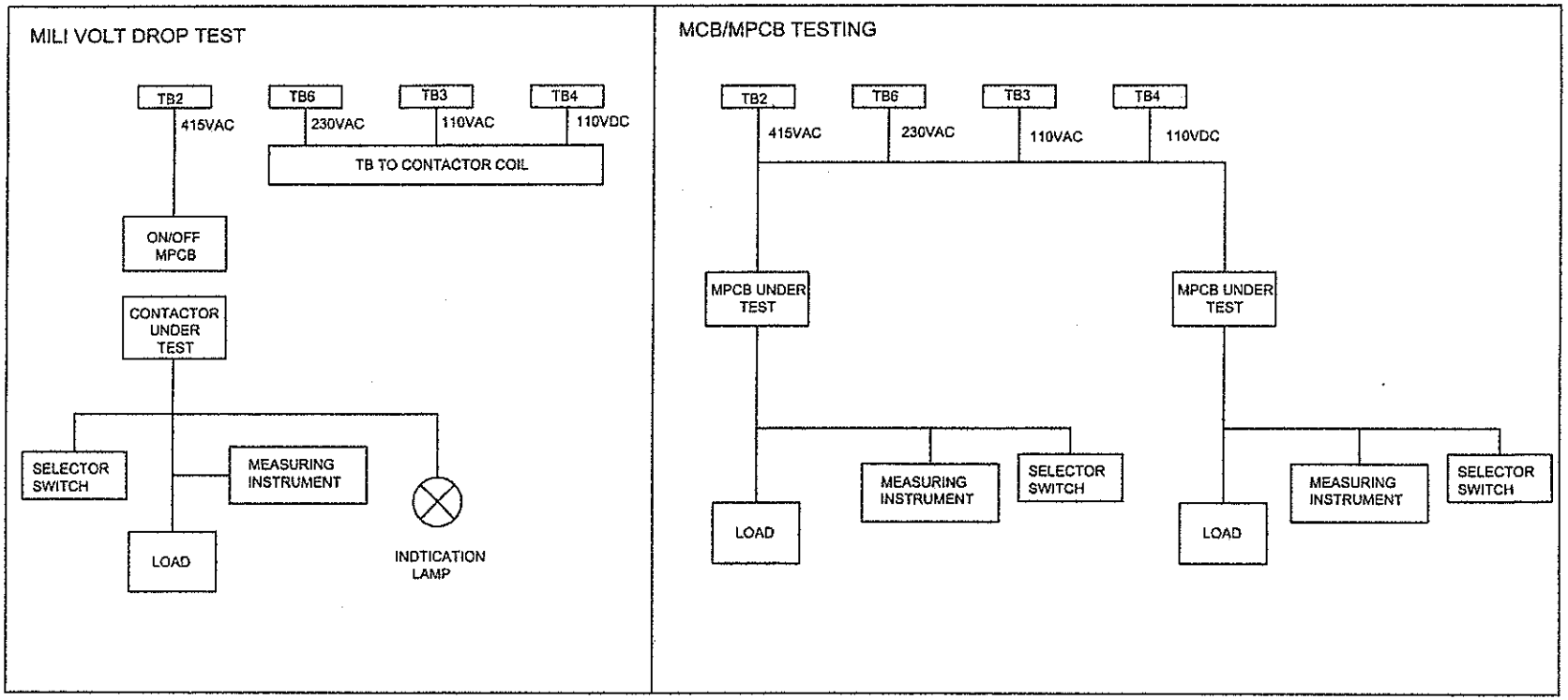
VARIACS:-

VRC1 : 1Ø
VRC2 : 1Ø
VRC3 : 1Ø
VRC4 : 3Ø
VRC5 : 1Ø

RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 4 OF 9)



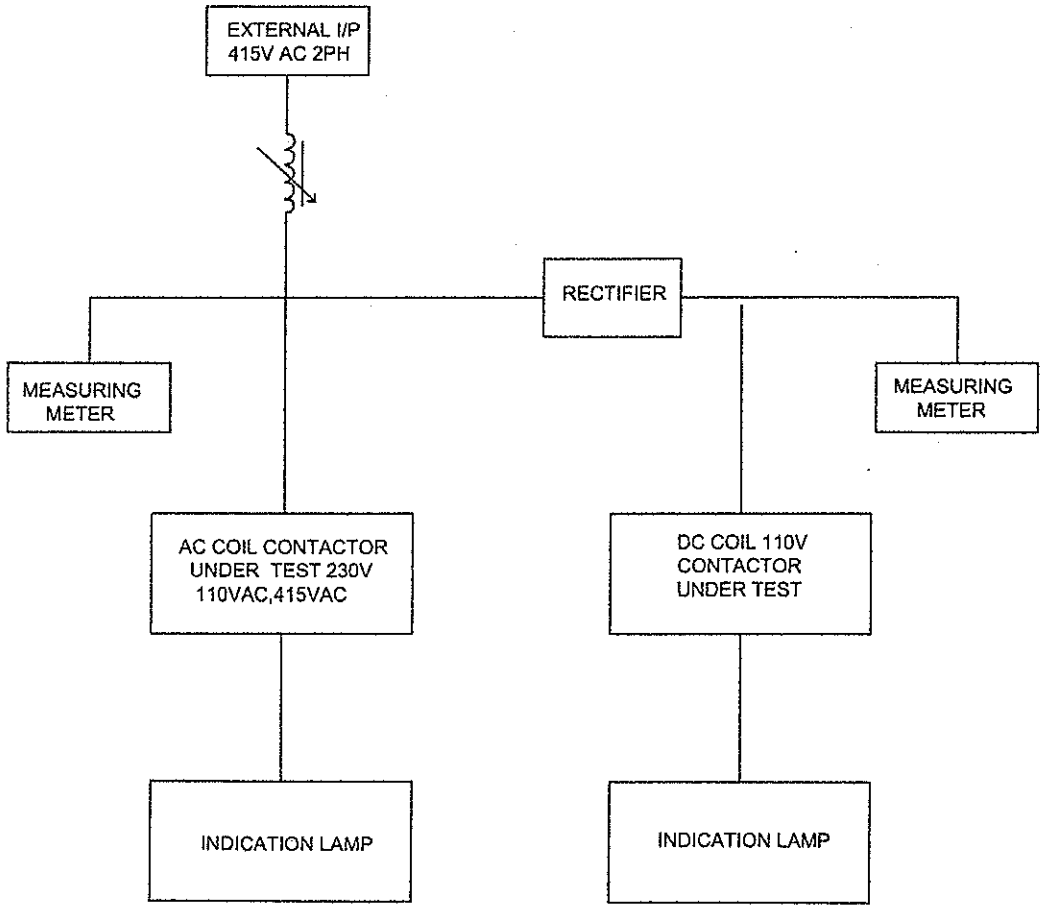
RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 5 OF 9)



RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 6 OF 9)

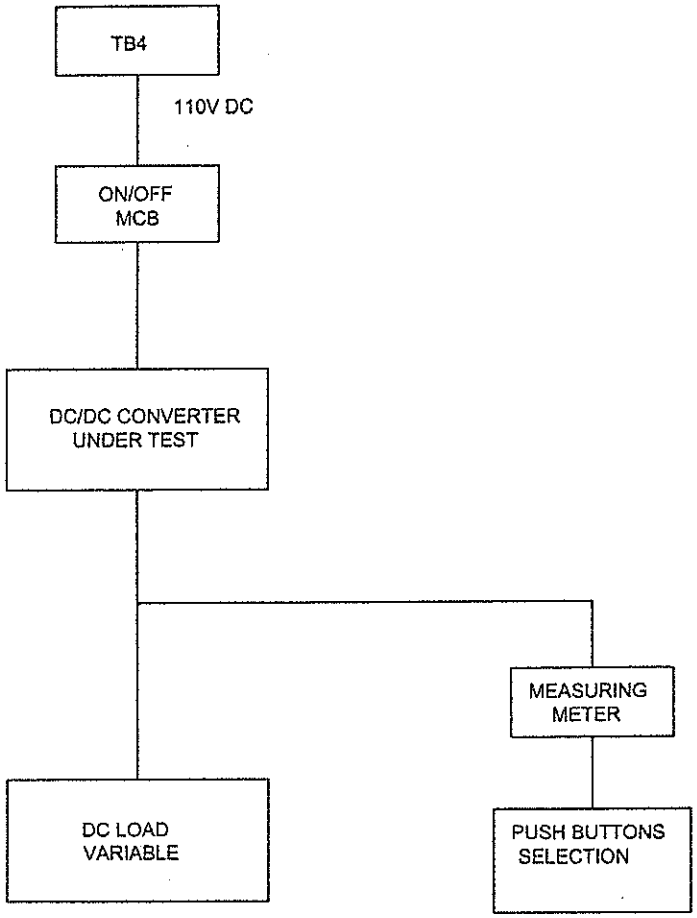
PICK UP & DROP OUT VOLTAGE TEST

CONTACTOR COIL VOLTAGE RANGE



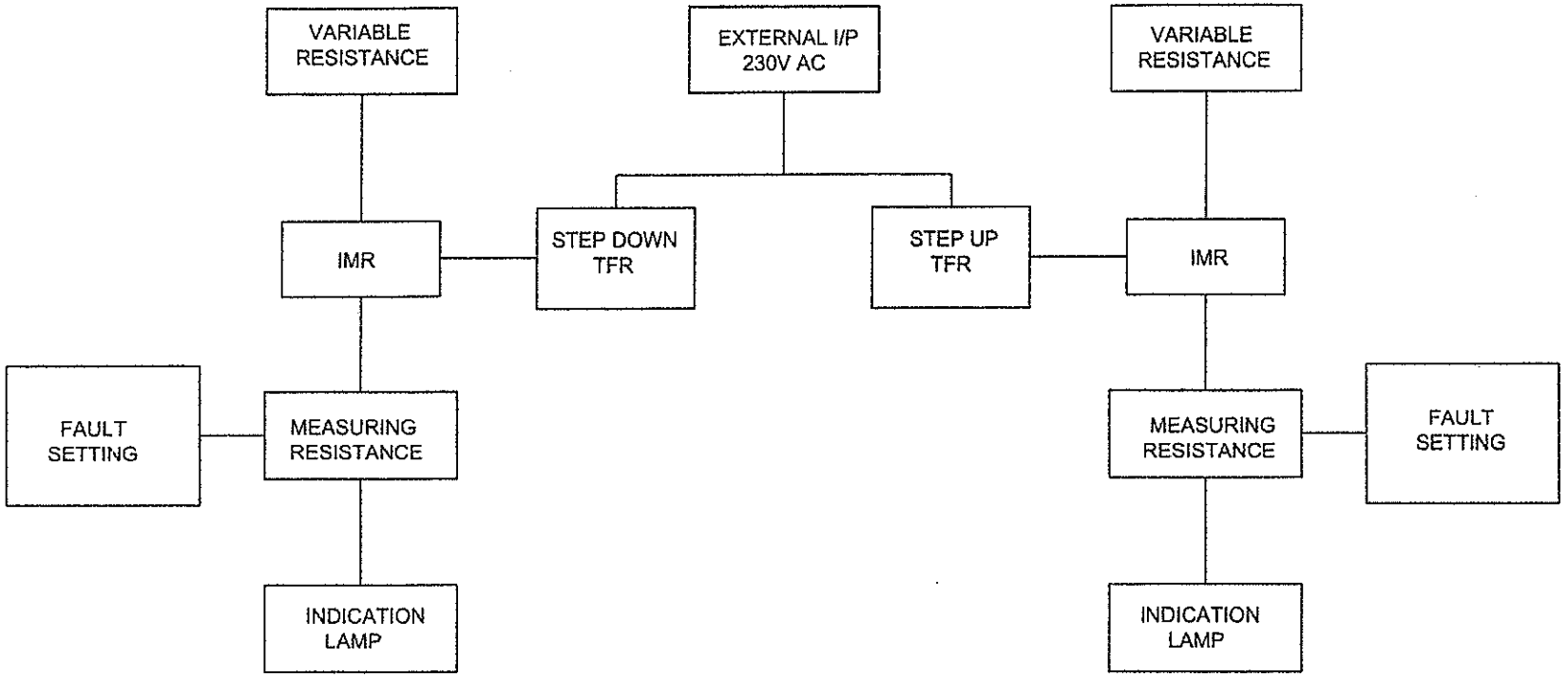
RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 7 OF 9)

DC/DC CONVERTOR TEST



RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 8 OF 9)

IMR TESTING



RAIL COACH FACTORY, KAPURTHALA
OGA DRAWING FOR TEST BENCH
SKED 961 (SHEET 9 OF 9)