

**SPECIFICATION FOR FOUR WIRE VOICE FREQUENCY REPEATER  
STATION EQUIPMENT USED IN AC ELECTRIFIED AREA.**

**0. FOREWORD**

0.1 This specification is issued under the fixed serial No. TC-50-90. The final number indicates the year of original adoption as standard or in the case of revision, the year of last revision.

**ADOPTED**

0.2 This specification requires reference to the following Indian Railways Standard/Indian Standards/Joint services standards specifications.

IRS : S-23                      Electrical signalling and Interlocking equipment.

IRS : TC-23                     Control room equipment for 4 wire control circuit.

IS: 319                         Free cutting brass bars rods and sections.

IS: 2036                        Phonolic laminated sheets.

IS : 9000                      (Series)- Basic environmental testing procedures for electronic and electrical items.

JSS : 50805                    Detail specification for connectors, electrical printed wiring board and insulated board.

JSS: 51700                    General requirements for metal clad base materials, for printed circuit and printed wiring boards.

JSS:51701                    Detail specification for metal clad base material(for printed circuit boards) of thickness 0.8 mm or greater.

JSS:52300                    General requirements for printed wiring boards.

0.3 Wherever in this specification any of the above mentioned specification is referred, it shall be as a reference to the latest issue of the specification, otherwise, the particular year of the issue has to be taken as reference.

0.4 This specification is intended chiefly to cover the technical provision and does not include all the necessary provisions of a contract.

## 1. SCOPE

- 1.1 The objective of provision of repeater station equipment along the transmission line of quaded undergrounds telecommunication cable is to boost the signal by way of compensation of lost in signal strength incurred during the transmission of speech and signalling of railways various communication circuit.
- 1.2 The specification of repeater station equipment is divided in the following parts.
- Pt. I. It covers the requirement of the equipment in general.
  - Pt.II It covers the requirement of 4W VF repeater amplifier.
  - Pt.III It covers the requirement of leak amplifier .
  - Pt.IV It covers the requirement of buffer amplifier.
  - Pt.V It covers the requirement of signal regenerative repeater.
- 1.3 This specification covers the requirements and provision of tests and inspection of 4W VF repeater station equipment in AC electrified areas.
- 1.4 This specification also covers the constructional features, electrical characteristics and technical requirements of 4W. VF repeater station.
- 1.5 This specification does not cover the requirement of composite panel as indicated in Annexure-I and Annexure-II.

## 2. TERMINOLOGY:-

- 2.1 For the purpose of this specification, terminology given in IRS:S-23 shall be applicable.
- 2.2 The term referred to in the specification but not covered in IRS:S-23 are defined below :-
- 2.2.1 Lot – A lot is constituted by 4W VF . repeater station equipment of the same type manufactured in the same factory during the same period using the same process and materials.
- 2.2.2 Main repeater :-  
The repeater station adjacent to control room equipment .
- 2.2.3 Intermediate Repeater :-  
Repeaters situated at intervals after main repeater.
- 2.2.4 Emergency control circuit :-  
This is special circuit in the electrified sections. It is provided from selected point along with the track route for communication between the train crew in emergency, traction and permanent way maintenance staff and the control office.

## Part – I

### 3. General requirements :

3.1 The VF repeater station equipment consists of the following :-

- a. 4W VF repeater amplifier(VFR)
- b. 4W VF repeater with Leak Amplifier (VFL)
- c. Buffer amplifier
- d. Signal regenerative repeater (SRR)

3.1.1 4 Wire V.F. repeater Amplifier :-

It is provided in all main/ intermediate repeater station for all circuits excepting the case of emergency control circuit to compensate the loss incurred due to attenuation of the cable, insertion of the sectionalising transformers at cable huts and repeater and bridging loss due to tapping transformers at way station.

3.1.2 Leak amplifier :-

This equipment is intended to provide side tone and to enable the conversation between way stations.

It is provided at –

- a. Main repeater for all circuits except for supervisory remote control circuit for traction.
- b. Intermediate repeater for emergency control circuit only and also for any other circuit as specified by the purchaser.

3.1.3 Buffer amplifier –

In case of control section comprising of a main line and branch line branching off, from an intermediate location, it is necessary to avoid heavy shunting loss due to the branch cable route. The buffer amplifier works as interface between the main cable and branch cable shunted with a high impedance.

3.1.4 Signal regenerative repeater :-

It is provided to boost up 50V, 50 Hz signalling system to compensate the loss due to attenuation of the cable and insertion of decoder along the line in the omnibus communication system. This is not required for the section having dual tone multi frequency communication system.

3.1.4.1 This specification does not cover the requirement of signal regenerative repeater used for AC signalling of emergency control circuit and also the composite panel installed in repeater station equipment for emergency control circuit.

3.2 Repeater station equipment, shall be capable of working on DC voltage of nominal value 24V which may vary between +20% and -10% from the nominal value.

3.3 Unless otherwise specified, all exposed surfaces/parts shall be plated, painted or otherwise protected from corrosion.

3.4 The general requirements of workmanship, limit and fits and rejection shall be in accordance with IRS:S-23 to the extent applicable.

**4.0 LAYOUT AND TECHNICAL REQUIREMENTS OF THE EQUIPMENTS:-**

4.1 The equipment of signal regenerative repeater, 4 wire VF repeater amplifier leak amplifier and buffer amplifier shall be house in a 4W VF repeater & Miscellaneous equipment Bay.

4.2 The 4W VF repeater and miscellaneous bay shall be of size (2265x650x307) mm. It shall consist of structural frame power distribution and termination panels, link panels and eleven racks where standard cabinets can be mounted. The structural frame shall be of sheet metal steel of minimum thickness  $\pm 2.5$ mm with anti corrosive finish.

4.3 The power distribution and termination panel shall be in the top most position. It shall also accommodate 24V working and 12V spare bus bars and input and output terminals block assemblies.

4.4 The distribution of the panels shall be as indicated in annexure-I for intermediate repeater station and annexure-II for main repeater station.

4.5 The standard cabinet shall be of size (575x256x135) mm. It shall be made of sheet metal steel of minimum thickness 1.2 mm with anticorrosive finish.

4.6 The front door shall be provided with knurled screw for easy opening. The back door shall be covered with a plate screwed to the cabinet with aluminium of four screws set at corners.

4.7 The cable entry hole shall be provided on the back plate and it shall be provided with suitable rubber grommet.

4.8 One cabinet house

(a) 2 nos. of signal regenerative repeater.

or

(b) 4 nos. of VF repeater amplifier cards.

or

(c) 4 nos. of VF repeater amplifier cards with leak.

or

(d) 4 nos. of buffer amplifier cards.

The details of the combination of these cards shall vary as per requirement of the purchaser.

- 4.9 The terminal strip provided for signal regenerative repeater shall be made of paper base thermosetting synthetic resin bonded laminated sheet conforming to grade P4 of IS: 2036. Terminals shall be made of brass conforming to IS:319. All external wiring shall be terminated on screw terminals.
- 4.10 In case of 4W VF repeater amplifier, leak amplifier, buffer amplifier and signal regenerative repeater, the wires from the connector of the printed circuit board shall be terminated on the tag block by means of soldering. External wires shall be connected on the other end of the tags of the tag block. The VF repeater and miscellaneous equipment bay shall be completely prewired.
- 4.10.1 The number of the tags in a row of terminal block shall be sufficient to provide connection for a particular printed circuit board. The distribution of the printed circuit boards and the rows of tags of the tag block shall be such that correspondence of the PCB's with that of the row of the tag block can be easily identified.
- 4.10.2 The tags of the tag block shall be made of brass conforming to IS:319. The insulating base for the tag block shall meet the requirements of sub clause 4.9.
- 4.10.3 The wires carrying the speech circuits of VFR, VFL and buffer amplifier shall be screened wires to avoid cross talk.
- 4.10.4 The main characteristics of the wires used for wiring shall be as under :-
- a. Wires used for speech circuits :-  
Twin core PVC insulated 15/0.17mm conductor and closely covered with a lapped screen consisting of at least 15 - 0.15 mm dia. tinned copper wires laid side by side.
  - b. Wires for S.R.R. panel :-  
PVC insulated 7/0.193 mm twisted pair.
  - c. Wires for battery supply :-  
PVC insulated 1/1.78 mm single strand.
- 4.11 Printed circuit boards used in fabrication of the equipment shall comply with JSS 51700 and JSS 51701. The conductive patterns on PCBs shall comply with JSS-52300. The spacing between conductive patterns shall not in any case be less than 1mm. PCB's shall be made of glass epoxy and coated with epoxy base antifungal varnish to provide protection against dust humidity and mechanical abuse. The glass epoxy PCB' x of 1.58 mm minimum thickness shall be used. The copper cladding thickness shall always be not less than 35 micron and suitably tinned.
- 4.11.1 Suitable arrangements to prevent insertion of wrong cards in the chassis is desirable.

- 4.12 Transistors and diodes whenever used shall be silicon alloy junction type with metal or epoxy encapsulated case. The integrated circuit whenever used shall be of DIP with glass sealor of ceramic package type and shall be commercially available in Indian Market. All semiconductor components shall be burnt in at rated stress levels in accordance with relevant "MIL" specifications.
- 4.13 Electromagnetic relays used in the circuit shall be capable of giving one million operations under normal operating current and voltages. The connectors-plug and socket of PCB's shall comply with the requirement of JSS-50805.
- 4.14 The components of dissipating power of one watt or more shall not be fixed in direct contract with PCB's components which weighs 7gms per piece or more shall be mounted with the aid of clamps. Transistors shall be mounted on resilient teflon or nylon mounting pads.
- 4.15 **The means** of adjustments for gains of amplifier slope of the equaliser and for input current of signal regenerative repeater shall be provided with suitable forks to achieve easy shorting by means of soldering.
- 4.16 The components shall be of high grades like paramalloy transformer. Trntalum capacitors and metal film resistors shall be used for high reliability and high speech qualities and transformer used for signal regenerative repeater shall be made of CRGO Silicon Steel.
- 4.17 The repeater station equipment shall be equipped with space to house the link panel to isolate the input and output of the amplifier. Each link panel shall have sixty four link points.
- 4.17.1 Each equipment shall be provided with ant surges fuse.
- 4.17.2 Separate fuse monitoring panel shall be provided for monitoring all the fuses of the bay. It shall be a separate module with common alarm.
- 4.18 Preferably I.C. technology shall be used with all advantages like high reliability, compactness, low power consumption and easy maintenance.

**5.0 TESTS AND PERFORMANCE REQUIREMENTS:-**

5.1 Unless otherwise specified, all the tests shall be carried out under prevalent ambient atmospheric conditions.

5.2 Type Test :

5.2.1 The following shall constitute type tests. A minimum number of two samples of each equipment are required for type tests to be carried out in the sequence below :-

- a. Visual inspection (Sub cl. 5.5)
- b. Applied high voltage test (Sub cl. 5.6)
- c. Electrical parameters (As per cl.2 of relevant Pt.)
- d. Insulation resistance test (sub cl. 5.7)
- e. Performance test (Sub cl. 5.2)
- f. Climatic severity test (sub cl. 5.9)

5.2.2 All samples shall successfully pass all the tests of the clause 5.2.1 for proving conformity with the specification. If any of the samples fail in any of the type tests, the purchaser or his nominee at his discretion may call for fresh samples not exceeding twice the original number and subject them again to all the tests. No failure shall be allowed in the repeat test.

5.2.3 Type approval shall be accorded if the samples pass the above tests. Such approval once given shall be valid for a period of three years, provided there is no change either in the quality of the material used, design or in the method of manufacture.

5.3 Acceptance Tests:-

5.3.1 The following shall constitute the acceptance tests and shall be carried out in the sequence given below :-

- a. Visual inspection (Sub cl.5.5)
- b. Applied high voltage test (Sub cl.5.6)
- c. Insulation resistance test (Sub cl.5.7)
- d. Electrical parameters (As per cl.2 of relevant Pt.)
- e. Performance test. (Sub cl 5.8)

5.3.2 Any other tests as required by the inspecting authority to ensure that equipment is in conformity with the requirement of the specification.

- 5.4 Routine test:-
- 5.4.1 The following shall constitute routine tests :-
- a. Visual inspection (sub cl.5.5)
  - b. Applied high voltage test (sub cl.5.6)
  - c. Insulation resistance test (sub. cl 5.7)
  - d. Electrical parameters (As per cl.2 of relevant Pt.)
  - e. Performance test (Sub cl. 5.8)
- 5.4.2 Any other tests as required by the manufacturer to ensure that equipment is in conformity with the requirement of the specification.
- 5.4.3 The manufacturer shall certify that routine tests have been successfully carried out on all the equipments offered for inspection. He shall produce these tests results at the time of inspection.
- 5.5 Visual examination:-
- 5.5.1 The 4 wire VF repeater station equipment shall be visually inspected for checking conformity with the requirement of the relevant sub clause-4 and clause 1 of the relevant part of the specification and as per clause 14.2 of IRS: S-23 to the extent applicable.
- 5.6 Applied high voltage test:-
- 5.6.1` The 4W V.F. repeater station equipments shall withstand without any damage a test voltage of 1 KV AC RMS 50 Hz when applied between the body and all current carrying terminals looped together for a period of one minute.
- 5.7 Insulation resistance test:-
- 5.7.1 The insulation resistance measured with 100 V DC between body and all current carrying terminals looped together shall not be less than 100 mega ohm after electrification for one minute.
- 5.8 Performance test:-
- 5.8.1 Performance test for VFR/VFL.
- 5.8.1.1 When a level of -24 dbm is fed in the input of TRANS or RECEIVE amplifier from the terminal strip after the equipment is duly wired the level at the output terminal shall be  $-3 \pm 2$  dbm for VFR card and  $-5 \pm 1$  dbm for VFL card. Output of the amplifier shall be properly loaded.



5.8.1.2 The frequency response shall be flat within  $1.5 \pm 0.2$  dbm in the frequency range of 300 Hz to 3.4 KHz.

5.8.1.3 Cross talk attenuation shall conform to the clause 2.8 of part II.

5.9 Climatic severity test:-

5.9.1 Dry Heat test:-

This test shall be carried out as per IS: 9000(series) at  $55 \pm 2^{\circ}\text{c}$  . The tests of the sub-clause 2 of relevant part shall be performed keeping 4W VF repeater station equipment inside the chamber. The variation in different parameters shall be within 5% of initial reading. On completion of the test, the equipment shall be removed from the chamber and visually inspected to check that no part is damaged or cracked.

5.9.2 Damp Heat (accelerated ) test:-

5.9.2.1 This test shall be carried out as per IS:9000(series) at  $55 \pm 2^{\circ}\text{c}$  . and relative humidity of 90-95%. The equipment shall not be energised during this test in the chamber. On completion of the duration of the test, the equipment shall be taken out and shall be wiped with dry cloth to remove condensed water if any, from the surface. The equipment then shall be kept in the recovery chamber at  $27^{\circ}\text{c}$ , 65% RH for 6 hrs. and the insulation resistance shall be measured as per sub-clause 5.7. The IR value shall not be less than 10 mega ohms.

5.9.3 Cold test :-

5.9.3.1 This test shall be carried out at  $-10^{\circ}\text{C}$  as per IS-9000 (series). The tests of the clause 2 of relevant part shall be performed keeping the repeater station equipment inside the chamber. The variations in different parameters shall be within  $\pm 5\%$  of the initial reading.

**6.0 Marking:-**

6.1 The following shall be legibly and indelibly marked on the side plate of the 4W-VF. Repeater station equipment:-

- a- Manufacturers name and serial number,
- b- Year of manufacture,
- c- Legend 4 wire VF repeater station equipment.
- d- Indian Railways.
- e- Specification No. IRS:TC-50

7.0

**SAMPLING:-**

7.1

Sampling plan :-

Unless other wise agreed to by the purchaser and the supplier the sampling plan given below shall be adopted:-

Lot consisting of 4W.VF Repeater station equipment.	Ist sample size (N1)	2 <sup>nd</sup> Sample size (N2)	Combined sample size (N1+N2)	Acceptance number -C1-	Rejection number -C2-
1	2	3	4	5	6
Under 25	3	6	9	0	2
25 to 50	7	14	21	0	3
51 to 100	10	20	30	0	3
101 to 200	13	26	39	0	5
201 to 300	20	40	60	1	5
301 to 500	25	50	75	1	6

7.2

The number of 4W VF repeater station equipment(N1) as given in col.2 shall first be selected and subjected to the acceptance tests. If in the first sample the number of defective 4W.4F Repeater station equipment that is those failing in one or more acceptance tests, is less than or equal to the corresponding number (C1) given in col. 5 the lot shall be considered as conforming to the requirement of the acceptance tests. If the number of defective 4W.VF repeater station equipment in the first sample is greater than or equal to the rejection number given in Col.6, the lot shall be considered as not conforming to the requirement of the acceptance tests. If the number of defective 4W.VF repeater station equipment in the first sample lies between (C1) and (C2) second sample of size (N2) as given in Col.3, shall be selected and subjected to acceptance tests. If in the combined sample, the number of defective 4W.VF repeater station equipment is less than (C2) the lot shall be considered as conforming to the requirement of acceptance tests.

7.3

The samples shall be selected at random from at least 10% of the packages. For random selection of packages, all the packages in the lot shall be arranged in a serial order and every 'rth' package shall be selected until the requisite number of packages is obtained.

'r) being the integral part of:-

Total number of packages in the lot

-----

Total number of packages to be selected.

**8.0 Inspection:-**

8.1 The inspection and tests shall be carried out to the satisfaction of the purchaser or his nominee.

8.2 The purchaser or his nominee shall have the right to be present during all stages of manufacture and shall be accorded all reasonable/complete facilities to satisfy himself that the 4W.VF repeater station equipment are being manufactured in accordance with the terms and conditions of the specification. The purchaser or his nominee shall have the right to reject any material that fails to conform to the specification.

8.3 When inspection is carried out during the manufacture, the manufacturer shall supply the material and samples required for testing free of charge and shall at his own cost prepare and furnish the necessary test pieces and appliances for such testing as may be carried out at his own premises in accordance with the specification. Failing facilities at his own works for conducting the prescribed tests, manufacturer shall bear the cost of carrying out the tests at an approved test laboratory.

**9.0 PACKING:-**

9.1 The equipment shall be packed as to permit convenient handling and to protect against loss or damage during transit and storage.

**PART-II****4 WIRE V.F. REPEATER AMPLIFIER****1. General requirements:-**

- 1.1 The 4 wire V.F. Repeater amplifier is intended to make good the loss of the speech level due to cable attenuation, insertion loss of the sectionalising transformer installed in repeater station and cable huts and due to bridging loss of the tapping transformers at way station. The repeaters are spaced at an interval of about 50 KM.
- 1.2 Trans and receive amplifier shall be identical. The trans amplifier shall be housed on the right hand half of the PCB, and the receive amplifier on the left hand half of the PCB. The trans and receive pair of the equipment wherever referred to, will be with reference to the controller. A block schematic of the amplifier card is indicated in annexure-III.
- 1.3 Each amplifier shall have two stage amplification having good frequency response, high stability and reliability.
- 1.4 Input and output of the amplifier shall be provided with isolation transformer.
- 1.5 Surge protection shall be provided at input and output of each amplifier.
- 1.6 Each card shall be provided with voltage regulator with built in over voltage and short circuit protection.
- 1.7 Each amplifier shall be provided with 1dB, 2dB, 4dB attenuation pads in the input for the adjustment of the gain.
- 1.8 Each amplifier shall be provided with variable equalisers with a slope of 1dB, 1.5dB, 2dB and 2.5dB to compensate the slope of cable attenuation in the frequency range of 300 Hz to 3.4 KHz.

**2 Electrical parameter:-**

- 2.1 Input and output impedance of the 4W V.F. amplifier shall be 1120 Ohm.
- 2.2 The gain of the amplifier shall be 24dB  $\pm$  0.5dB when measured at a frequency of 1 KHz.
- 2.3 The frequency response of the amplifier shall be flat within  $\pm$  0.1 dB in the frequency range of 300 Hz to 3.4 KHz.

- 2.4 The input and output level of the amplifier shall be -24dbm and 0dbm respectively.
- 2.5 Input return loss measured at input level of -24 dB against 1120 ohm shall be better than 18 dB in the frequency range of 300 Hz to 3.4 KHz.
- 2.6 Output return loss when measured at an output level of 0dB shall be better than 20 dB in the frequency range of 300 Hz to 3.4 KHz.
- 2.7 The amplifier shall not over load for an output of +12dbm with equalisers and pads cut out. The over load point is determined as that point where the gain fails by 0.2db when the input is gradually increased.

**Note :-**

The electrical parameter of clause 2.1 to 2.7 are valid only after strapping out pads and equalisers.

- 2.8 Cross talk level when measured after tag block termination shall be better than 80dB, within the amplifiers meant for same quad and adjacent quad. Frequency for the measurement of cross talk shall be 1 KHz.
- 2.9 Specified values of the attenuator pads shall lie within the tolerance of  $\pm 0.2$  dB.
- 2.10 The loss due to equalisers at 3.4KHz shall be 3 dB.
- 2.11 The equalisers have variable steps of 1 dB, 1.5dB, 2 dB and 2.5 dB with a tolerance of  $\pm 0.2$  dB in the frequency range of 300 Hz to 3.4 KHz.
- 2.12 Harmonic distortion shall not exceed 3% when the gain of the amplifier is set to its maximum and out put is properly loaded with 1120 ohm. at 1 KHz.

**PART-III**  
**LEAK AMPLIFIER**

**1. General requirements:-**

- 1.1 The omnibus communication circuits used for railways control working works on four wire basis. One pair is used for controller's transmission of speech and other for reception of speech. Leak amplifier is provided in the main repeater station to introduce a leak from receive pair to trans pair so that way stations can communicate amongst each other at a low level.
- 1.2 In one printed circuit board one leak amplifier shall be provided in between receive and trans amplifier of 4 wire VF repeater amplifier. This combination of the card shall be termed as 4W VF repeater amplifier with leak (VFL) amplifier shall have good frequency response high stability and reliability. A block schematic of the amplifier card is VFL is indicated in annexure-IV.
- 1.3 Input and output of the amplifier shall be provided with isolation transformer.
- 1.4 The amplifier shall be provided with two sets of 1 dB, 2dB 4dB and 8dB attenuation pads. Input and output impedance matching with the line and another set of 1 dB, 2 dB and 4dB and 8dB attenuation pads. Input and out impedance matching with the line and another set of 1 dB, 2 dB and 4dB pads, input and output impedance matching with that of the leak amplifier.
- 1.5 Each card shall be provided with voltage regulator with built in over voltage and short circuit protection.

**2. Electrical parameters:-**

- 2.1 The input and output impedance of the leak amplifier shall be 50 Kohms or more to provide a low shunting loss. The shunting loss at 1 KHz shall not exceed 1.5 dB.
- 2.2 The leak amplifier shall provide a loss of 20 dB  $\pm$  0.5 dB.
- 2.3 The frequency response of the leak amplifier shall be flat within  $\pm$  0.75 dB in the frequency range of 300 Hz to 3.4 KHz.
- 2.4 Specified values of the attenuator pads shall be within the tolerance of  $\pm$  0.2 dB.
- 2.5 Harmonic distortion shall not exceed 3% when the gain of the amplifier is set to maximum and output of the amplifier is properly loaded at 1 KHz.

**Part-IV**  
**BUFFER AMPLIFIER**

**1. General requirements:-**

- 1.1 When a section branches off from the main alignment of the transmission in underground cable of Railway communication system in electrified area buffer amplifier is provided as an interface between the branched off section and the main alignment so that former does not shunt the latter.
- 1.2 Each printed circuit board shall have trans and receive amplifier. The amplifier provided on the right hand side of the PCB shall be earmarked for trans amplifier and that of left hand side shall be earmarked for receive amplifier. A block schematic of the amplifier card is indicated in Annexure-V.
- 1.3 The amplifier shall have good frequency response, high stability and reliability.
- 1.4 Input and output of the amplifier shall be provided with isolation transformer.
- 1.5 Surge protection shall be provided at the input and output of each amplifier.
- 1.6 Each card shall be provided with voltage regulator with built in over voltage and short circuit protection.
- 1.7 Input impedance of the trans amplifier and output impedance of receive amplifier shall be high to meet the requirement of low shunting loss specified in cl.2.3. The output impedance of Trans amplifier and input impedance of the receive amplifier shall be 1120 ohm.
- 1.8 Trans amplifier shall be provided with 1dB, 2dB, 4dB, and 8dB and 16 dB attenuator pad at the input of the amplifier for gain control. The input and output impedance of the attenuation pad shall match with the input impedance of the trans amplifier.
- 1.8.1 The receive amplifier shall have 1dB, 2dB, 4dB, 8dB, and 16dB attenuation pads for the gain control. The input and output impedance of the pad shall be 1120 ohm.

**2. Electrical parameter:-**

- 2.1 The gain of the trans and receive amplifier shall be 24 dB  $\pm 0.5$  when measured at 1 KHz after strapping off the pads.

- 2.2 The frequency response of the amplifier shall be flat with in 0.2dB in the frequency range of 300 Hz to 3.4 KHz when measured after strapping off pads.
- 2.3 The shunting loss introduced by the insertion of the trans and receive amplifier to the main transmission alignment shall be better than 1.5 dB when measured in the frequency range of 300 Hz to 3.4 KHz.
- 2.4 Cross talk level when measured after tag block termination shall be better than 80 dB within the amplifiers meant for same quad and adjacent quad. The frequency for the measurement of cross talk level shall be 1 KHz.
- 2.5 The specified values of the attenuation pads shall lie within tolerance of  $\pm 0.2$  dB.
- 2.6 Harmonic distortion shall not exceed 3% when the gain of the amplifier is set to maximum and output of the amplifier is properly loaded at 1 KHz.



**PART -V**  
**SIGNAL REGENERATIVE REPEATER**

**1. GENERAL REQUIREMENT:-**

- 1.1 Signal regenerative repeater is provided in intermediate repeater station to boost up 50V, 50Hz signalling to compensate the loss due to line attenuation and insertion loss due to decoder introduced in the omnibus communication system.
- 1.2 Signalling method adopted for selective calling is a 3 digit code with a constant total of seventeen pulses transmitted on phantom circuit at 50V, 50Hz interrupted at 3.5 cycles per second. The details of the signalling system with different codes, speeds and tolerance thereof shall be compatible with the control room equipment conforming to IRS:TC-33.
- 1.3 One cabinet of signal regenerative repeater cabinet panel shall contain two signal regenerative repeaters.
- 1.4 Mercury wetted relays shall be used for out pulsing to ensure a long life and trouble free performance.
- 1.5 There shall be facility to adjust the line current and adjustment of make and break ratio of the signal.
- 1.6 LED indication shall be provided to indicate the availability of DC supply and pulsing out of phantom signals.
- 1.7 Test jacks shall be provided to monitor the DC power supply, output, AC 50V, 50Hz and for the measurement of pulse make and break ratio.
- 1.8 Fuse shall be provided for overload protection and input power supply connections shall be protected against reversal of polarity.

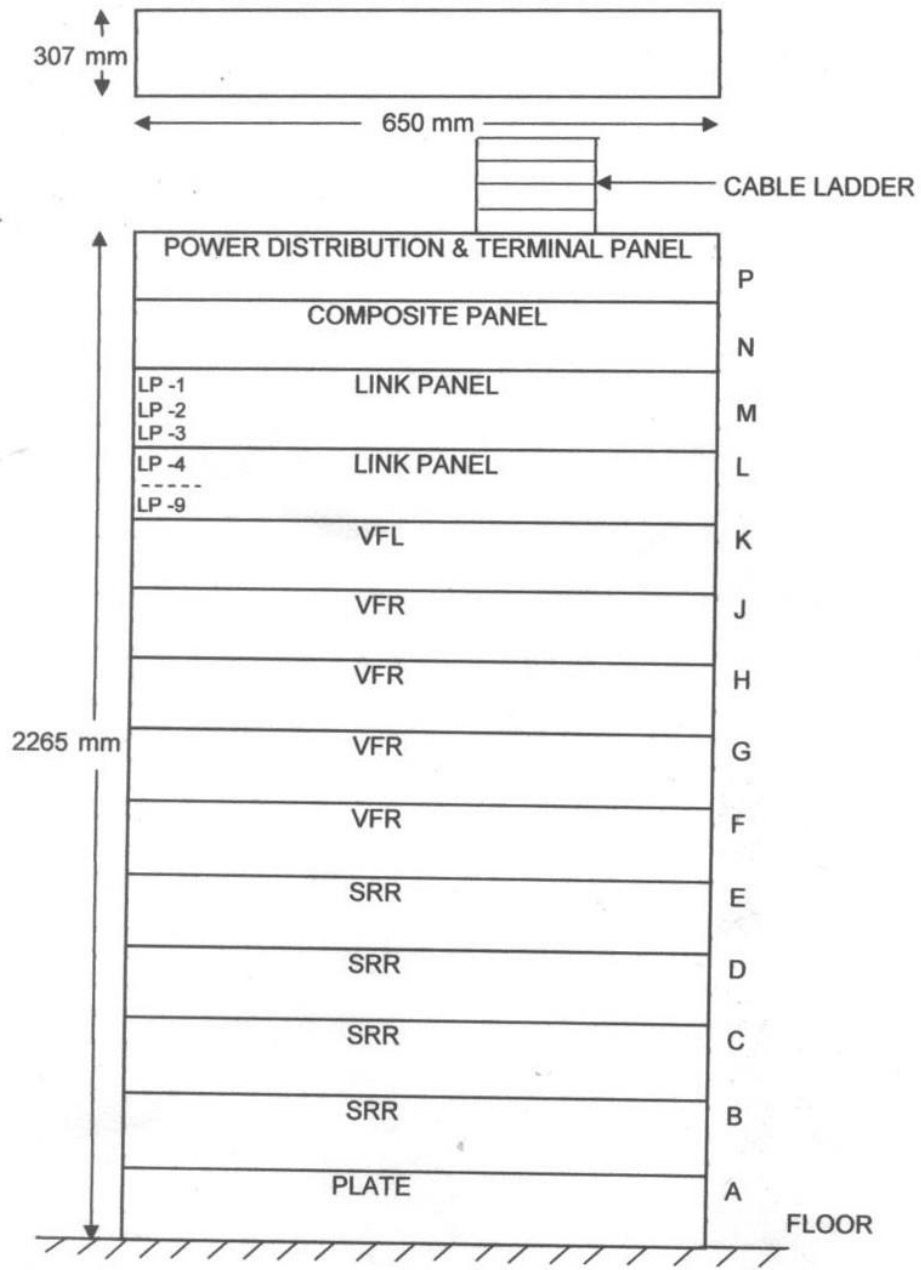
**2.0 Electrical parameter:-**

- 2.1 The electrical parameter of signal repeater shall be as follows:-
  - 2.1.1 Make and break ratio shall be 50:50.
  - 2.1.2 The signal regenerative repeater shall operate with a minimum input voltage of 10V and maximum distortion of the make and break ratio 68:32.

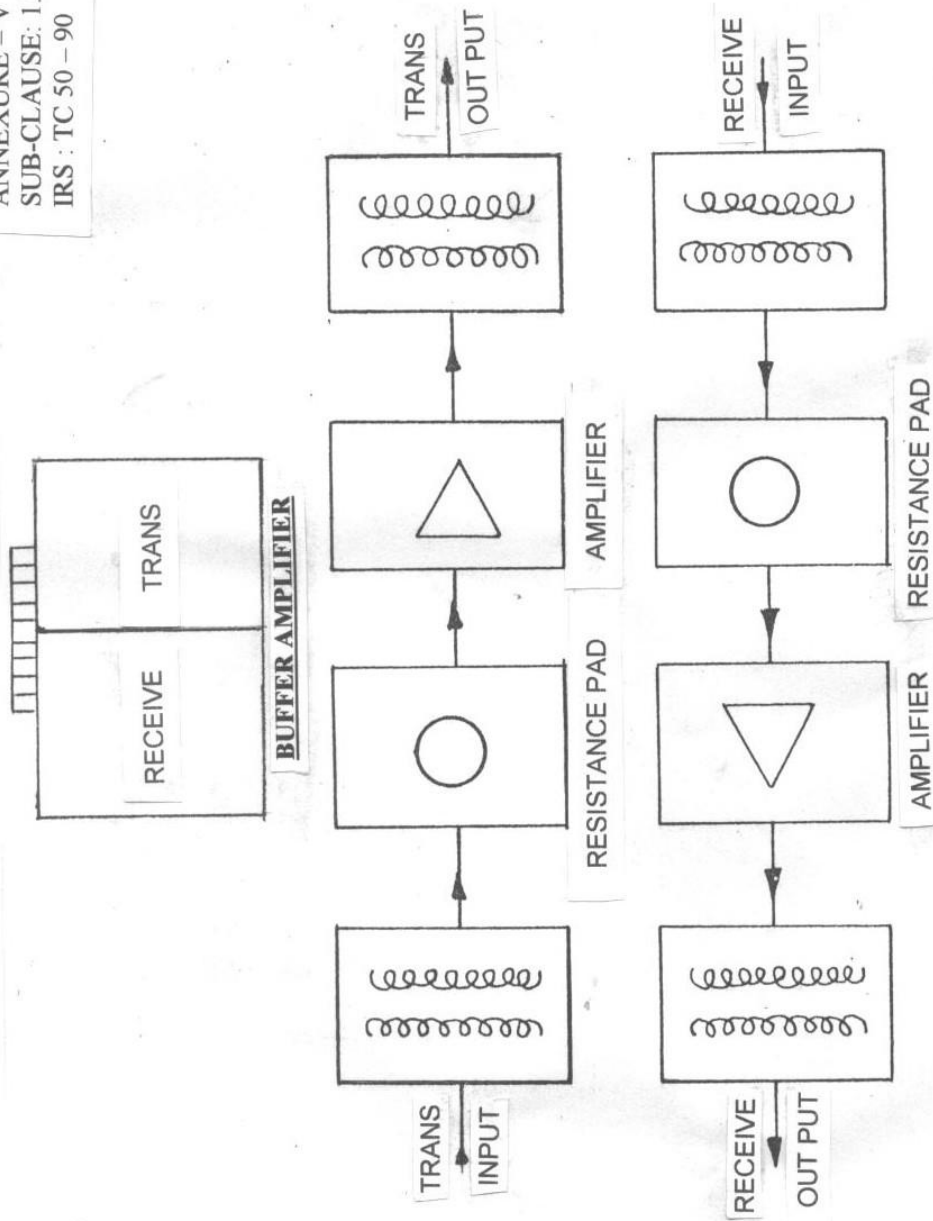
- 2.1.3 The signal regenerative repeater shall faithfully reproduce pulses.
- 2.1.4 The no load output voltage shall be  $58 \pm 0.5V$ .
- 2.1.5 The output voltage on a load of 200 ma shall be  $51V \pm 2V$  and on a load of 250 ma shall be  $46 \pm 2V$ .
- 2.2 The inverter used in the signal regenerative repeater shall have the following characteristics:-
  - 2.2.1 The inverter shall operate on an nominal D.C. voltage of 24V with a voltage variation of 21V to 30V DC.
  - 2.2.2 The idle current of the inverter shall be  $110 \pm 20ma$ .
  - 2.2.3 The input DC current with a load of 200ma shall be  $1.1A \pm 0.1$  amp.
  - 2.2.4 The output voltage without load shall be  $58 \pm 0.5$  volts.
  - 2.2.5 The output voltage with a load of 200 ma shall be  $51 \pm 2V$ .

END OF THE SPECIFICATION

**4 WIRE V.F. REPEATER & MISCELLANEOUS EQUIPMENT BAY  
 ( INTERMEDIATE REPEATER )**

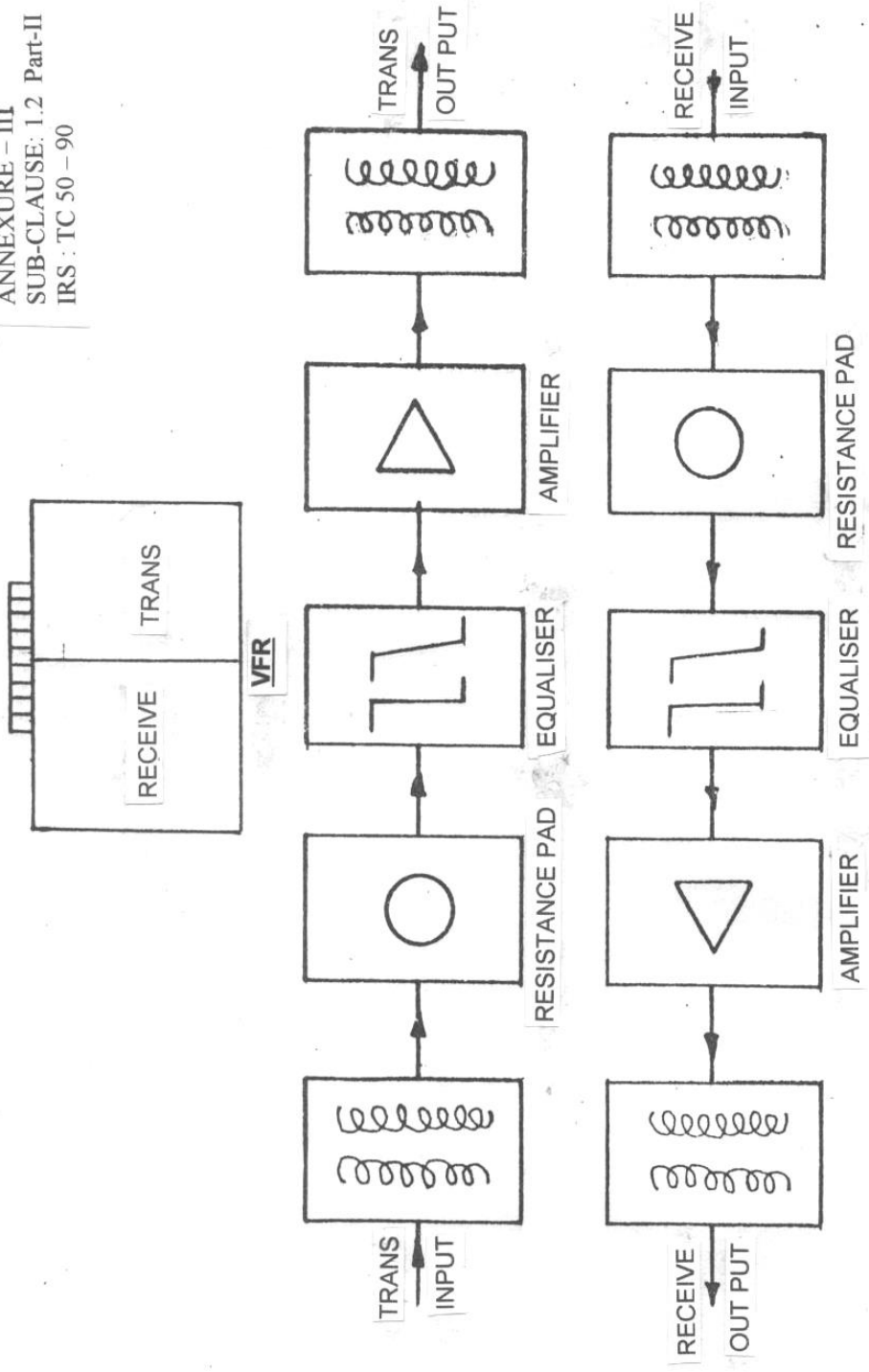


**LEGEND :**  
 COMPOSITE PANEL : MEANT FOR EMERGENCY CONTROL  
 VFL : 4 WIRE VF. REPEATER WITH LEAK AMPLIFIER  
 VFR : 4 WIRE VF. REPEATER AMPLIFIER  
 SRR : SIGNAL REGENERATIVE AMPLIFIER  
 VFL, VFR. ARE THE RACKS TO ACCUMULATE STANDARD CABINET  
 PLATE : DUMMY RACK TO BE COVERED



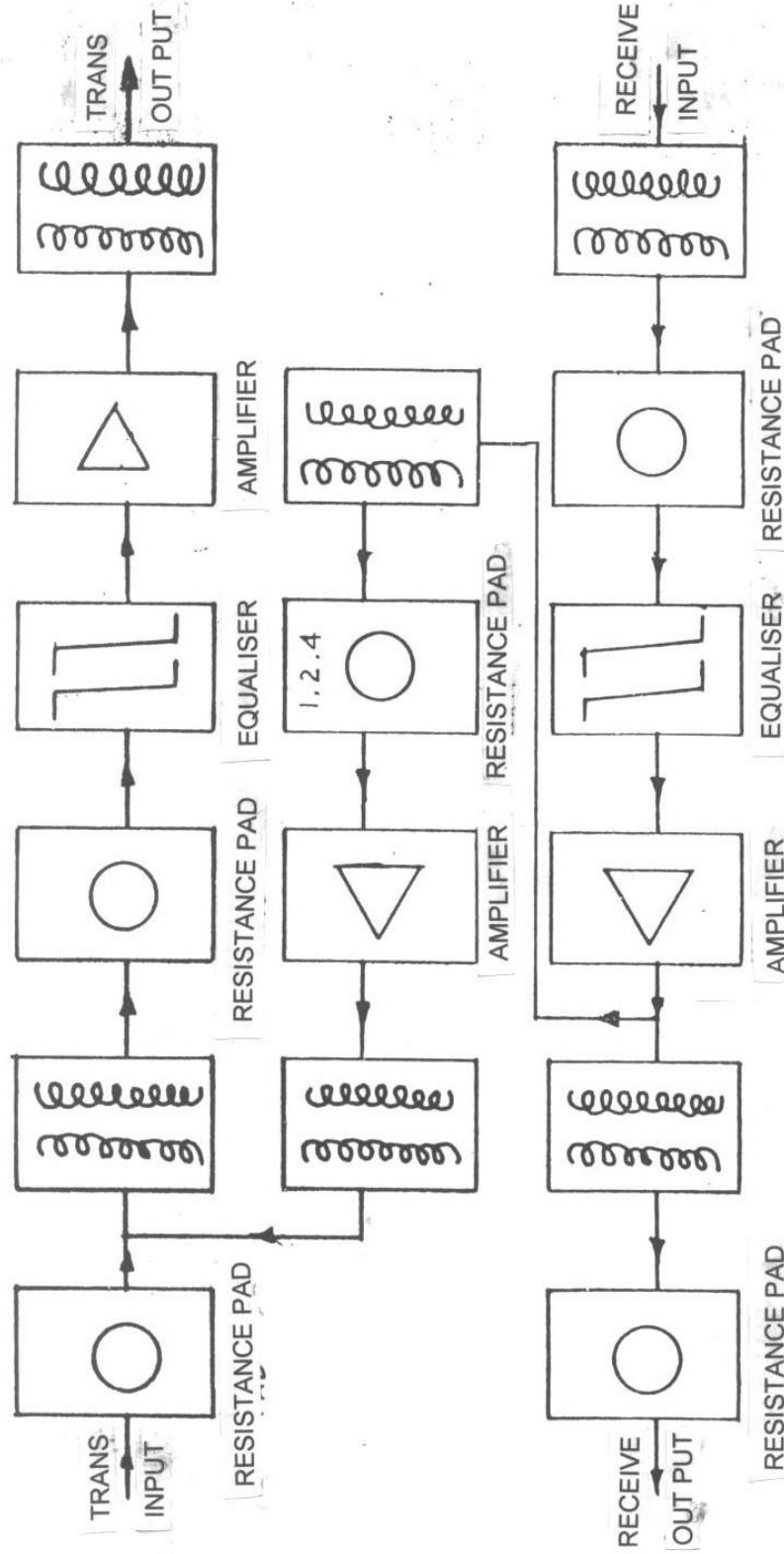
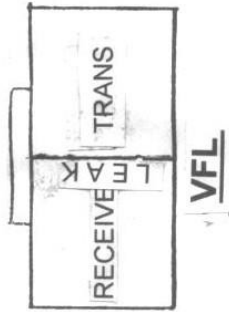
**BLOCK SCHEMATIC 4WIRE VF REPEATER BUFFER AMPLIFIER**

ANNEXURE - III  
 SUB-CLAUSE: 1.2 Part-II  
 IRS : TC 50 - 90



**BLOCK SCHEMATIC 4W. VF REPEATER AMPLIFIER**

IRS : TC 50 - 90



**BLOCK SCHEMATIC 4 WIRE VFL REPEATER WITH LEAK AMPLIFIER**