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RESEARCH DESIGNS & STANDARDS ORGANISATION
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DOCUMENT DATA SHEET		
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Abstract This document defines specification of Electronic LC Gate Telephone System		

AMMENDMENT HISTORY

Serial No.	Date of Amendment	Amendment / Revision	Reasons for Amendment
1.	2004	51-04	First Issue
2.	20.03.2006	51-04 Amdt1	Cl 3.1.1.1 and 3.4.1.2 modified.
3.	23-03-2006	51-04 Amdt2	Gate telephone body colour defined.
4.	15-12-2009	51-09 Rev 1.0	Gate number increased from 4 to 6.
5.	11-03-2013	51-11 Rev 3.0	Incorporated Voice Logger and play back of recorded data
6.	22-11-2016	51-11 Rev 3.0 Amdt.1	Incorporation of ISO clause
7.	12-01-2021	51-21 Rev 1.0	Incorporation of GPS Clock

DOCUMENT CONTROL SHEET

Designation	Organization	Function	Level
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ABBREVIATIONS:

1	AH	Ampere Hour
2	dB	Decibel
3	CACT	Component Approval Centre for Telecommunication
4	DC	Direct Current
5	DIP	Dual Inline Package
6	DTMF	Dual Tone Multi Frequency
7	GDT	Gas Discharge Tube
8	Hz	Hertz
9	IC	Integrated Circuit
10	IR	Insulation Resistance
11	IRS	Indian Railway Specification
12	IS	Indian Standards
13	KHz	Kilo Hertz
14	Km.	Kilometer
15	LCSO	Electronic Components Standardization Organization
16	LD	Lightning Discharger
17	LED	Light Emitting Diode
18	MOVR	Metal Oxide Varistor Resistor
19	PCB	Printed Circuit Board
20	PIJF	Polyethylene Insulated Jelly Filled
21	PTC	Positive Temperature Co-efficient
22	RH	Relative Humidity
23	RMS	Root Mean Square
24	Rx.	Receive
25	S/N Ratio	Signal to Noise Ratio
26	SPN	Specification
27	TC	Telecom
28	Tx.	Trans
29	VF	Voice Frequency

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1.0 INTRODUCTION:

This document covers the technical requirements, constructional features, electrical characteristics, and provisions of tests & inspection of ELECTRONIC LC GATE TELEPHONE SYSTEM for use over Indian Railways and is issued under the serial **No. RDSO/SPN/ TC/51/2021 Revision 1.0.**

- 1.1 This specification requires reference to the following Indian Railway Standards/Indian Standards/Joint Services Standards specifications.

IRS: S-23 Electrical Signaling and Interlocking equipment.

IS: 9000(Series) Basic Environmental Testing procedures for electronic and electrical items.

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

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

- 1.3 **TERMINOLOGY:** For the purpose of this specification terminology as given in IRS: S-23 shall be applicable. The terms referred to in the specification but not covered in IRS: S-23 are defined below:

LOT: A lot is constituted by “Electronic LC Gate Telephone System” of the same type manufactured in the same factory during the same period using the same process and materials.

2.0 GENERAL REQUIREMENTS:

- 2.1 This specification covers general design features and performance requirements of “Electronic LC Gate Telephone System” including procedure for testing.

- 2.2 The “**Electronic LC Gate Telephone System**” will consist of the following items:

- 1) **Station Telephone Unit**
- 2) **Gate Telephone** (Slave Telephones)
- 3) **Surge Protection & Line Connection Unit**
- 4) **Centralized Power Supply System with Battery**

Purchaser will estimate the requirement of items (1), (2), (3) and (4) separately as per actual field conditions.

- 2.2.1 “**Station Telephone Unit**” will be used at Stations/Cabins. SM will be able to call the Gates from this Telephone Equipment. This Station Telephone Unit will be connected to the Line through a “Surge Protection & Line Connection Unit/Circuit”. This Station Telephone Unit is to be directly connected to 12 V output of Power Supply Unit.

- 2.2.2 “**Gate Telephone**” works as a Slave telephone to the Station Telephone unit and will be located at LC Gates. This telephone will be connected to the line through a “Surge Protection & Line Connection Unit”. No Power Supply or Battery will be required at gates.

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- 2.2.3 Surge Protection and Line Connection Unit” will be required to connect the Master Telephone and Gate Telephones to the 2 W omnibus line (4/6 Quad cable, Signal cable, overhead alignment). This unit will have surge protection arrangement with “GD Tube, MOVR, Inductors and PTC resistors and will be suitably connected to a proper “Earthing” terminal to avoid damage due to lightning and other voltage transients. Suitable terminal shall be provided in these units for earthing at the stations and Gates.
- 2.2.4 “**Power Supply Unit**” Power Supply Unit will be centrally located at Stations/Cabins. 12V DC supply shall be connected to the Station Telephone Unit & 24V shall be fed to Line Circuit.
- 2.3 The Electronic LC Gate Telephone System shall be used for point to point and point to multipoint communication between Station/Cabin & Level Crossing Gates, where the number of points to be connected are up-to 7(Seven), [1(Station Tel) + 6(Gate Tel)]. Master telephone, gate telephone and Power supply of all other RDSO approved sources of this specification shall be able to get connected in the Electronic LC gate telephone to be supplied without any limitation or modification. The “Electronic LC Gate Telephone System” shall be used in Master-Slave configuration as shown in Annexure-I.
- 2.4 Station Telephone Unit will have the facility to call individually any of the Level Crossing Gates by pressing the corresponding button designated for a particular Gate.
- 2.5 Station Telephone Unit will have two buttons named as “All UP Gates” and “All Down Gates” to facilitate simultaneous call to all the gates connected in UP/Down direction for imparting certain common instruction simultaneously or for conference purposes.
- 2.6 In addition to above, Station Telephone Unit will have another push button “DISCONNECT” for disconnecting the gate telephones. When this button is pressed, all the Gate Telephones connected in the circuit will be deactivated and speech will not be through to and from those Gate Telephones.
- 2.7 Gate Telephone will have the facility to send an indication to the Station Telephone Unit that it wants to talk to the Station Master. The Gate telephone will have only one push button by pressing which it will draw the attention of the Station Master. The ID (Gate Number) of gate should be settable through DIP switches provided on the circuit. There shall be provision to set any of the Gate phone to keep it in ‘UP Gate Call’ or ‘Down Gate call’ group. It will ring in case DTMF code for ‘UP Gate call’ or ‘Down Gate call’ (as defined in Annexure-II) is received.
- 2.8 The system shall permit working of Voice Communication and Signaling on 2-Wire (Overhead or PE Quad) Omnibus Line tapped at different places for point to point and point to multipoint communication.
- 2.9 Although Station Telephone Unit as well as all the Gate Telephones are connected on 2-Wire Omnibus Line, confidentiality of speech shall be ensured as below

Station-Gate Conversation: Unless permitted and activated by the Station Master, “Gate to Station” or “Station to Gate” conversation is not possible. Only when Station Master presses key designated for a particular Gate, that Gate Telephone will be activated for conversation. Other Gate Telephones will not be activated for conversation and they can neither speak nor listen to ongoing voice communication on 2-Wire Omnibus Circuit. As such confidentiality of speech is ensured.

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Gate-Gate Conversation: Only when Master presses two or more Gate Buttons, those Gates are activated and will be able to converse to the Master as well as between them. The activated Gate Telephone will remain activated for conversation even if the handset of the Station Telephone Unit is placed on the hook so that conversation between the Gate Telephones can continue. The Gate Telephone will be disconnected and Indicating LED on Station Telephone Unit meant for that particular Gate Telephone will go OFF, when the handset of that particular Gate Telephone is placed on the hook. Here as only selected Gate Telephones were activated for conversation, other Gate Telephones were not activated for conversation and they can neither speak nor listen to ongoing voice communication

Conferencing: When UP Gate call or DN Gate call is initiated by ASM Unit only those gate phones will be activated which are set in that particular group (UP or DOWN) and can converse to the Master as well as among themselves, others will not be able to listen. Corresponding LED (UP Gate call LED/Down Gate call LED) will also glow. The LED will go off and activated Gate Telephone will be disconnected when disconnect button of Station Telephone Unit is pressed.

- 2.10 DTMF Signalling Codes for various activities are given in Annexure-II. These Two-Digit DTMF Codes shall be generated by pressing Single Push Button or by an action of Handset. It shall be possible to send the signaling code even when two or more parties are in conversation.
- 2.11 Station Telephone Unit shall record all the voice conversation between Station Telephone Unit and Gate Telephone. This entire recording shall be through Single Channel Voice Logger. Station Telephone Unit should be designed in such a way that it should have built in arrangement to process, record and store any ongoing voice communication taking place with Station Telephone Unit. Station Telephone Unit should have the facility to playback the recorded voice communication through the speaker/jack provided in the unit after selecting the voice file to be played. This selection should be done through the keys provided in the Lock and Key arrangement for this purpose.
- 2.12 The recording and storage of voice communication should start as soon as handset of Station Telephone Unit is lifted from cradle and the same is terminated with the replacement of handset of Station Telephone Unit. This will form one *.Wav file. When again hand set of Station Telephone Unit is made off-hook recording will start and another *. Wav file will be generated.
- 2.13 The system shall have voice recording with 64 kbps PCM Coding. The codec used shall be ITU G.711 or any higher version of codec (Like G711.1) as per ITU standard. Vendor shall submit details of codec used and undertaking in this regard at the time of Type Test.
- 2.14 Recording Sensitivity shall be better than -20 dBm. Frequency Response for 300-3400 Hz shall be +/- 3 dB. The distortion of the Recorded Voice Signal when replayed shall not be more than 5% with respect to Original Signal. Testing for Distortion shall be done at 1000Hz.
- 2.15 All the Voice Recording shall be Date and Time Stamped alongwith stamping of Station Identity. At least Date, Time & Station Identity shall be part of file name of voice files. Recording shall be in *.wav file format, so that it can be replayed on Windows Media Player on any PC/Laptop with Windows OS. Following minimum Information listed below should be made available from the recorded data.
 1. Station identity (Station code: minimum 4 characters).
 2. Recording Start time and End time in HH/MM/SS format for all voice recorded files.
 3. “Who calls whom” information.
- 2.16 The capacity of Voice Storage shall be at least 200 Hours on a Minimum 8 GB Solid State Memory Device. Solid State Memory Device should be FAT32 formatted. Storage of Voice

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Communication should follow the FIFO (First in First Out) methodology. Once Voice Communication is stored in, no way it should get corrupted. It shall also be not possible to format the Solid State Memory Device by conventional methods.

- 2.17 There shall be provision of a Green LED on Station Telephone Unit to indicate that recording is taking place. In case of any problem in Voice Recording, there shall be alarm through flashing Red LED.
- 2.18 There should be provision of an USB Interface Port in Station Telephone Unit through which Recorded Voice can be transferred from Station Telephone Unit to Laptop for replay or taking backup on CD/DVD. Feature of Auto Copy of voice Data on insertion of USB Pen Drive shall also be available. This USB Interface Port shall be protected from unauthorized access through arrangement of Mechanical Locking & Sealing. Through this USB Interface it should also be possible to set Station Identity in Alpha characters. It shall also be possible to set Station identity through the master telephone key board housed inside the Station Telephone Unit.
- 2.19 The equipment should have GPS receiver to update its local clock. Whenever equipment is energised it should update its clock within four minute of switching it on, further it should correct its local clock at an interval of one hour through GPS receiver. If the equipment is not receiving the GPS signal same should be indicated as 'GPS Failure' or in form of symbolic notification in LCD Display. In addition to this the equipment shall have Real Time Clock with an accuracy of + 3.5 PPM within Operating Temperature Range of -10°C to +55°C. It should be possible to set Station ID, Date and Clock Time using Laptop through USB Interface Port. It shall also be possible to set the same from the Station Telephone unit itself. Necessary arrangements like speaker, switches should be provided inside the Station Telephone Unit to enable above facilities. Suitable GPS antenna with minimum 5 mtr cable should be connected to GPS module to have exposure to sky.
- 2.20 A "POWER ON" Green LED shall be provided on all telephones.
- 2.21 The Station Telephone Unit and Gate Telephones should work properly from individual DC Power source of 12 V DC $\pm$ 20%.
- 2.22 The Gate Telephone shall be protected from Surge and Transients by using the protection as specified in Cl. 2.2.3 along-with Inductor of suitable size (as per installation guideline of SPD devices).
- 2.23 The receiver of the telephone instrument shall be protected from acoustic shocks by providing two rectifiers in parallel and with opposite polarity across the receiver.
- 2.24 Workmanship should conform to good engineering practice so as to ensure that the instrument is free from defects, rust, cracks and other defects that could impair the operation or serviceability while in use or under storage. The treatment and finishes shall be such that under operating conditions, no deterioration occurs to any of the parts.
- 2.25 All the components, switches, connectors etc., shall be of *High Quality/Industrial Grade* and should be procured from renowned manufacturer. The components should be freely available in the market. All the numbers of components should be clearly indicated. The LED indicators wherever used shall be of superior quality wide angle with metallic holders. The component type numbers shall not be defaced.
- 2.26 The layout of components and wiring shall be such that all parts are easily accessible for inspection, repair and replacement.

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- 2.27 Station Master Unit should have One LCD Display of at-least 16x2 Character to display the Station ID, Date and Time etc. During Playback it will show the voice file to be played.

3.0 AUDIO-VISUAL INDICATIONS:

3.1 Station Telephone Unit :

- 3.1.1 **Power ON LED:** Power ON LED is of Green colour and will glow when DC Power supply is available.

3.1.2 Calling Indications:

- a. Six Red colored LEDs will be provided near the six Calling push buttons. RED coloured LEDs will also be provided near 'UP Gate Call' and 'Down Gate Call' buttons as per layout shown in Annexure III. Gate telephone numbers shall be suitably printed to designate the push button and the LED.
- b. When a Gateman calls Station Master by lifting the handset and pressing the CALL ASM button, the corresponding LED in Master Telephone will blink, as well as a piezo buzzer will sound. The buzzer sound will be muted after one minute however LED will blink till ASM acknowledges by lifting the handset and pressing corresponding gate button. This blinking LED indicates that either Gate man is calling or there is pending missed call request from particular gate. This LED will glow steadily when ASM presses the corresponding push button.
- c. This LED will also glow steadily when Master calls some gate by pressing the corresponding button.
- d. These LEDs will go OFF when "Disconnect" button of ASM unit is pressed..
- e. A piezo buzzer will also sound when it is being called by the gate telephone and it should generate an interrupted /continuous/ sound, The calling gate shall get RBT sent from Station Telephone Unit for 1-2 seconds.
- f. There shall be provision of a flashing Green LED on Station Telephone Unit to indicate that recording is taking place. In case of any problem in Voice Recording, there shall be alarm through flashing Red LED.

3.2 Gate Telephone :

- 3.2.1 **Power ON LED :** Power ON LED is of Green colour and will glow when DC Power supply is available. This LED is to be fixed on the right hand side of the telephone.

- 3.2.2 **Calling Indication:** A Red colour LED will be in the left side of the telephone, which will indicate that either ASM is calling or there is pending missed call request from ASM. This LED will glow when Master calls the Gate. This LED will go OFF only when the handset of the telephone is lifted. The LED will glow and Piezo Buzzer will also sound both in ON hook and OFF hook condition.

3.2.3 Ring back Tone:

Ring Back Tone (RBT) will be sent back to the Station Telephone Unit when a Gate Telephone Rings. RBT will not sent back in case of Gate Telephone unit buzzer fails. The level of RBT at the Gate Telephone output point will be more than -12 dBm.

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4.0 POWER SUPPLY ARRANGEMENT

4.1 One DC Power source having 12 V and 24 V DC Output Terminals will be required at a centralized place. Station Telephone Unit and all the 6 Gate Telephones connected as per Figure-1 should work from this Single Power Source and no separate Power supply will be provided at the Gates.

4.2 In case the available voltage at a Gate Telephone is less than 9.6 Volt (due to Longer Distance or due to High Conductor Loop Resistance or due to Location of other Telephones), this Gate Telephones should work satisfactorily with individual Power Supply arrangement of 12 V DC $\pm$ 20%.

4.3 The power supply arrangement shall be a part of supply along with “Electronic LC Gate Telephone System”.

Power Supply unit consists of a battery charger having 230 V AC, 50 Hz nominal input and having 27.2 ± 0.5 DC output. The battery charger in addition to supplying the load, shall also charge the battery. The maintenance free 24 V(12 V+12 V) battery is provided for back up of at least 12 hours. The capacity of the same should not be less than 7 AH. However, the railways can ask for a higher capacity of the battery to commensurate with the load. Provision should also be made to charge the battery from Solar Panel of suitable capacity.

4.3.1 Power Supply unit should have another output of $12 \text{ V} \pm 0.5 \text{ V}$, with current capacity of minimum 500 mA for local use of Station Telephone Unit.

4.3.2 Power Supply Unit should able to work satisfactorily for variation of input voltage from 160V to 270 V Single Phase AC to give rated output voltage as mentioned in clause 4.3.

4.3.3 Battery Charging Current of Power Supply Unit shall be rated at one tenth of the Battery capacity and it shall be minimum 1Amp.

4.3.4 Power supply unit should have protection against short circuit at DC output terminals and should have LED indication for same.

4.3.5 Ripple at 12 V/24 V output should be less than 5 mV RMS. Ripple should be measured at a Load Current of 400mA (i. e. full load when all the Telephones are working).

4.3.6 Power Supply Unit should have surge protection arrangement.

4.4 Current consumption by the telephones at 12 V DC shall not be more than the limits mentioned below:

For Station Telephone Unit:

- 250 mA in idle condition.
- 450 mA during ring with all 6 LEDs glowing.
- 350 mA during speech condition.

For Gate Telephone:

- 15 mA in idle condition.
- 45 mA during ring.
- 25 mA during speech condition.

5.0 STATION TELEPHONE UNIT CONSTRUCTION:

5.1 Station Telephone Unit shall consist of the following Parts/Components:

- a) Body of the Station Telephone Unit

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- b) Handset & Cradle Switch Mechanism
 - c) Push Buttons (Industrial Grade Miniature Micro Switch)
 - d) Visual LED Indications
 - e) Piezo Electric Buzzer
 - f) Tone Generator & Decoder
 - g) Single Channel Voice Recorder
 - h) PCB and Wiring
 - i) Surge protection and line interface module
 - j) LCD Display of atleast 16X2 Characters.
 - k) Suitable keys for selection of voice file/setting the ID/ setting the Date and time etc. and USB port for accessing the recorded voice files. This part should have locking arrangement to avoid unauthorized access.
 - l) Global positioning system receiver module.
- 5.2 **Body of the Station Telephone Unit :** The body of the Station Telephone Unit shall be made of MS Sheet(of Minimum Thickness of 1.2 MM) or of Aluminum Sheet(of Minimum Thickness 2 MM) and as per drawing given in Annexure-III. The body shall be powder coated. Operating Panel of Body of Station Telephone Unit shall house Push Buttons, Visual LED Indications & Cradle Switch Mechanism. Body of the Station Telephone Unit shall be electrically insulated and shall be provided with insulated resting pads All the Push Buttons, Visual LED Indications shall be suitably marked/embossed in bold legible alpha/numeric characters in English.
- 5.3 **Handset:** Handset shall be firmly connected through cordage with Body of the Station Telephone Unit. Transmitter & Receiver used in Handset shall be Electro-dynamic Transducer Type.
- 5.4 **Cradle Switch Mechanism:** The Handset when resting on the cradle of completely assembled Station Telephone Unit shall push the plunger(s) down to the limits of travel. The plunger(s) shall be free and shall not stick. The plunger(s) lifting spring shall be tensioned to give a positive action. Handset of the Station Telephone Unit when ON Hook or OFF Hook shall operate the Cradle Switch Mechanism, which shall be checked electrically.
- 5.5 **Piezo Electric Buzzer:** Piezo Electric Buzzer of 40 mm dia and 20mm thickness, operating at suitable voltage generated internally by the circuitry shall be provided. Buzzer of shall be fixed inside the Station Telephone Unit body firmly. Suitable holes or grills should be available in the body of the Station Telephone Unit for audibility of sound from Piezo Electric Buzzer.
- 5.6 **Tone Generator:** Standard DTMF Tone Generator shall be provided to produce DTMF tones.
- 5.7 **Decoder:** Standard DTMF decoder shall be provided. On receipt of the valid code/tone, it shall be decoded and Piezo Electric Buzzer & LEDs shall be activated.
- 5.8 **Single Channel Voice Recorder:** Single channel Voice Recorder shall be as per Clause 2.11 to 2.18 of the Specification. It shall be housed within the Body of Station Telephone Unit. LED Indications as per clause 2.17 shall be extended to the Operating Panel of Station Telephone Unit. USB Port as per clause 2.18 shall be extended to the backside of body of Station Telephone Unit for connecting it to Laptop.
- 5.9 **PCB and Wiring :** Glass Epoxy PCB of minimum 1.6mm thickness shall only be used. The PCB shall be coated with epoxy based anti fungal varnish to provide protection against dust, humidity, fungal infection and mechanical abuses.

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The wiring shall normally be by means of coloured PVC insulated multi strand flexible wire of good quality and of suitable size. The wiring to the components shall be provided with sufficient slack to permit the components to be swung clear of the assembly without any disconnection.

- 5.10 **Transformer:** Ferrite Material shall be used for core so as to obtain required electrical properties. Manufacturer shall provide documentary evidence during Type Test. (i.e. Bill of Material/ purchase details/ process adopted as per QAP) for use of Ferrite Material. The complete winding shall be protected by proper insulation to avoid ingress of moisture.
- 5.11 **Surge Protection & Line Connection Unit:** This unit shall be housed suitably and the 2-Wire line will be terminated to this unit.. This unit will have a separate earth terminal for connecting it to Earthing Point. Technical requirements will be as per Cl. 2.2.3 of this specification.
- 5.12 **LCD Display:** The LCD used in the Station Telephone Unit must meet the following minimum specifications. Display Content: 16 Char x 2 Row, Character Dots: 5x8 or 5x7, Character size: 9-10 mm x 4-5 mm, LCD Display Type: STN or FSTN, LCD Category: Transmissive or Transflective, Minimum Viewing Angle: Horizontal -60°, Vertical - 90°.
- 5.13 GPS Receiver should have following minimum specification:
 - a. 1Hz update rate.
 - b. It should support NMEA protocols on serial port with configurable baud rate (TTL level)
 - c. Fully Compatible with SPS and accuracy should be better than 10 ms.
 - d. Reacquisition time better than 2 sec (90%).
 - e. Hot Start better than 15 sec (90%).
 - f. Warm Start better than 50 sec (90%).
 - g. Cold Start better than 180 sec (90%).
 - h. Antenna short circuit protection.
 - i. GPS Antenna: It shall be provided with either magnetic mounting or screw (fixed) mounting with micro-patch, active antenna powered from the receiver module itself .

6.0 GATE TELEPHONE CONSTRUCTION:

6.1 Gate Telephone shall consist of the following Parts/Components:

- a) Body of the Telephone
- b) Handset & Cradle Switch Mechanism.
- c) Push Button. (Industrial Grade Miniature Micro Switch)
- d) Visual LED Indications.
- e) Piezo Electric Buzzer.
- f) Tone Generator & Decoder.
- g) PCB and Wiring.
- h) Surge protection and line interface module.

6.2 **Body of the Telephone:** The body of the telephone instrument shall be made of ABS (Acrylonitrile Butadiene Styrene) Plastic material. The colour of ABS material used for

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making the body of the telephone shall not be black. ABS Material shall confirm to properties as specified in Annexure-IV.

- 6.3 **Handset :** Handset shall be connected firmly through cordage with Body of the Gate Telephone. Transmitter & Receiver used in Handset shall be Electro-dynamic Transducer Type.
- 6.4 **Cradle Switch Mechanism:** The Handset when resting on the cradle of completely assembled Gate Telephone shall push the plunger(s) down to the limits of travel. The plunger(s) shall be free and shall not stick. The plunger(s) lifting spring shall be tensioned to give a positive action. Handset of the Gate Telephone when ON Hook or OFF Hook shall operate the Cradle Switch Mechanism, which shall be checked electrically.
- 6.5 **Piezo Electric Buzzer:** Piezo Electric Buzzer of 40 mm dia (minimum) and 20mm thickness (maximum), operating at suitable voltage generated internally by the circuitry shall be provided. Buzzer shall be fixed inside the Gate Telephone body firmly. Suitable holes or grills should be available in the body of the telephone instrument for audibility of sound from Piezo Electric Buzzer.

The acoustic output of the buzzer shall not be less than 80 dB Sound Pressure Level (SPL) (Weighted) when measured at a distance of 30 cm from it and buzzer is operated at 9.6 volts..

- 6.6 **Tone Generator:** Standard DTMF Tone Generator shall be provided to produce DTMF tones. It shall be possible to assign any code to a Gate Telephone using 'DIP' switches.
- 6.7 **Decoder:** Standard DTMF decoder shall be provided. On receipt of the valid code/tone, it shall be decoded and Piezo Electric Buzzer & LEDs shall be activated.
- 6.8 **PCB and Wiring:** Glass Epoxy PCB of minimum 1.6mm thickness shall only be used. The PCB shall be coated with epoxy based anti fungal varnish to provide protection against dust, humidity, fungal infection and mechanical abuses.

The wiring shall normally be by means of coloured PVC insulated multi strand flexible wire of good quality and of suitable size. The wiring to the components shall be provided with sufficient slack to permit the components to be swung clear of the assembly without any disconnection.

- 6.9 **Transformer:** Ferrite Material shall be used for core so as to obtain required electrical properties. Manufacturer shall provide documentary evidence for use of Ferrite Material. The complete winding shall be protected by proper insulation to avoid ingress of moisture.
- 6.10 **Surge Protection & Line Connection Unit:** This unit shall be housed suitably and the 2-Wire line will be terminated to this unit. . This unit will have a separate earth terminal for connecting it to Earthing Point. Technical requirements will be as per Cl. 2.2.3 of this specification.

7.0 ELECTRICAL CIRCUIT:

- 7.1 Electrical circuit of the Station Telephone Unit and Gate Telephone shall provide good matching with line with minimum side tone.

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8.0 ELECTRICAL CHARACTERISTICS:

8.1 **Insulation Resistance Test:** The insulation resistance between the body and all terminals of Station Telephone Unit/Gate Telephone connected together shall not be less than 10 Mega ohm when tested with 500V DC Megger / Insulation tester.

8.2 **High Voltage Test:** A voltage of 1.5 KV, 50Hz AC sinusoidal r.m.s., shall be applied between the telephone body and all output terminals connected together for one minute. It shall withstand this voltage, no flash/smoke shall occur and no damage shall take place.

8.3 **Transmission Characteristics Tests:** The Station Telephone Unit/Gate Telephone will be subjected to following transmission tests. The test set up shall be as indicated in Figures. 2 to 5 of Annexure-III

(i) **Send Efficiency:** The test set up shall be as indicated in Figure-1 of Annexure-V.

T1 and T2 : Terminals for Transmitter Inset.

R1 and R2 : Terminals for Receiver

L1 and L2 : Line Terminals

B1 and B2 : Battery Terminals

LM : Level Meter

The transmitter of handset shall be removed and simulated by 100+ 100 Ohm non-Inductive resistance as shown and the Receiver replaced by a 200 ohm Non-Inductive Resistance. 12V battery shall be connected to the battery terminals. The oscillator level shall be adjusted such that it is -44dBm at 1000Hz measured across terminals T1 and T2. The line terminals shall be terminated by 600 ohm Non- Inductive Resistance. The level across 600 ohm resistance shall not be less than 0dBm and total harmonic distortion shall not be more than 3%.

(ii) **Side Tone:** The test set up shall be as indicated in Figure-2 of Annexure-V. The level measured at R1 and R2 across 200 ohm resistance shall not be more than -18dBm with the oscillator level maintained at -44dBm.

(iii) **Receive Efficiency:** The test set up shall be as indicated in Figure-3 of Annexure-V. The line shall be simulated by 300+300 Ohm non-inductive Resistance. The level at 1000 Hz across terminals L1 and L2 shall be adjusted to -12dBm. The level across R1 and R2 shall not be less than -18dBm and total harmonic distortion shall not be more than 3%.

(iv) **Insertion Loss:** The test set up shall be as indicated in Figure-4 of Annexure-V.

(a) **On Hook :** With the setup as in Figure-4 of Annexure-V, oscillator level is adjusted to give 0 dBm across 600 ohms without the telephone being connected. The telephone shall then be connected and the drop in the reading of the level will be measured. Loss should not be greater than 1dB.

(b) **Off Hook :** With the same setup as in Figure-4 of Annexure-V, the oscillator level is adjusted to give 0 dBm across 600 ohms without the telephone being connected. The telephone shall then be connected with handset lifted (Off Hook) and the drop in the reading of the level shall be measured. It shall not be greater than 1.5 dB.

8.4 Test for Code/Tone Generator:

8.4.1 The output of the code generator shall be adjustable from 0 dBm to -7dBm when measured across 600 ohm resistance connected across line terminals L1 and L2.

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8.4.2 It shall be possible to work the signaling system with a minimum input level of -25 dBm at the line terminals with the Line S/N ratio of 15. The telephone shall work satisfactorily for input level of -25dBm to -2dBm.

8.5 Distortion Test: The distortion of the Recorded Signal when reproduced through speaker shall not be more than 5% with respect to Original Input Signal. This Testing will be done at 1000Hz.

9.0 PERFORMANCE TEST:

9.1 One Station Telephone Unit and two Gate Telephones are connected together through an artificial line with distributed loop resistance as shown in Figure-5 of Annexure-V. It should be possible to call and get ring on all the Gate Telephones. Speech quality should be good. Gates which are not called by Station Master should neither be able to listen nor talk.

9.2 One Station Telephone Unit and four Gate Telephones are connected together through an artificial line with distributed loop resistance as shown in Figure-6 of Annexure-V. It should be possible to call and get ring on all the telephones. Speech quality should be good. Gates which are not called by Station Master should neither be able to listen nor talk.

9.3 One Station Telephone Unit and Six Gate Telephones are connected together through an artificial line with distributed loop resistance as shown in Figure-7 of Annexure-V. It should be possible to call and get ring on all the telephones. Speech quality should be good. Gates which are not called by Station Master should neither be able to listen nor talk.

9.4 Misadjust the clock manually, it should correct its time within four minute of switching on the Station Master Unit .

10.0 ENVIRONMENTAL AND CLIMATIC REQUIREMENT:

10.1 The Station Telephone Unit and Gate Telephones shall be capable of working in non-air conditioned environment in the field.

10.2 The Station Telephone Unit and Gate Telephones shall be suitable for installation on AC/DC Electrified and Non-Electrified sections. It shall be suitable in all areas including where locomotives having thyristor controlled Single Phase or 3-Phase Induction Motors haul Passenger or Freight Trains and where Chopper Controlled EMU Stocks are operated.

10.3 Station Telephone Unit and Gate Telephones shall meet the following climatic and environmental requirements:

SN	TEST		REFERENCE
1.	Change of Temp Test		IS 9000 Part XIV Sect. II
	Low temp	-10° C ± 3° C	
	High temp	+55° C ± 2° C	
	Rate of change in temperature	1° C ± 0.2° C / min	
	Duration	3 Hrs at each temp. -10° C & +55° C	
	Cycle	1	
	Condition	Fully functional during Test	
2.	Dry Heat Test		IEC-571; IS:9000 Part-III Sect 3

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	Temp	+55°C ± 2 °C	
	Duration	16 hrs	
	Condition	Fully functional during Test	
3.	Cold Test		IS 9000 Part II Sect. III
	Temp	–10° C ± 3 ° C	
	Duration	2 hours	
	Condition	Fully functional during Test.	
4.	Damp Heat Test(Cyclic)		IS 9000 Part V Sect. 2, 12+12 Hours Cycle, Variant 1
	Upper temp	40° C ± 2 ° C	
	Humidity	95% (+1%, -5%)	
	Cycles	6	
	Condition	Fully functional during one hour period towards end of each cycle. Stabilization shall be done at 25° ± 3 ° C	
5.	Damp Heat Test (Steady State Storage)		IS 9000 Part IV
	Temp	40° ± 2 ° C	
	Humidity	93% (+2% , -3%)	
	Severity	4 days	
	Condition	Fully functional during Test.	
6.	Salt Mist Test		IS 9000 Part XI Procedure I
	Duration	48 Hours	

10.4 Vibration Test : The Station Telephone Unit and Gate Telephones shall be subjected to vibration test as per IS:9000 (Part VIII)

- | | | | |
|------|---------------------------------|---|-----------------------------------|
| (i) | Freq. Range | : | 10Hz to 55 Hz. |
| (ii) | Vibration amplitude | : | 0.35mm |
| iii) | Duration of endurance for sweep | : | 20 sweeps cycles(10Hz-55Hz-10Hz) |
| iv) | No. of axes | : | 3 coordinate axes. |
| v) | Duration at resonant frequency | : | 30 minutes+/- 1 minutes. |
| vi) | Magnitude of “g” | : | 1 |

11.0 TESTS AND PERFORMANCE REQUIREMENT

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

11.2 Type Test

11.2.1 The following shall constitute Type Test:

- | | | |
|----|--------------------------------|---------------|
| a) | Visual Inspection | (Clause 11.4) |
| b) | Electrical Characteristic Test | (Clause 8.0) |
| c) | Performance Test | (Clause 9.0) |
| d) | Climatic Severity Test | (Clause 10.3) |
| e) | Vibration Test | (Clause 10.4) |
| h) | Field Trial | (Clause 11.5) |

11.2.2 Two sets of complete systems including power supply (i.e. two station telephone units, two power supply units and twelve Gate telephone units) shall be offered for type test.

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11.2.3 Unless otherwise specified, all tests shall be carried out at ambient temperature.

11.2.4 Bill of materials indicating details of Parts/Components, their values and make shall be submitted along with samples for Type Tests.

11.2.5 Operating Manual and Maintenance Manual of the system shall be submitted along with samples during Type Tests.

11.2.6 After completion of Climatic And Vibration Tests, the equipment shall be visually inspected to check for any damaged or cracked parts. During Final Tests after climatic and vibration tests, all electrical characteristics values should be within the specified limits.

11.3 Acceptance Test.

11.3.1 The Acceptance Test shall comprise of following tests taken in sequential order as follows:

- a) Visual Inspection (Clause 11.4)
- b) Electrical Characteristic Test (Clause 8.0)
- c) Performance test (Clause 9.0)

During inspection Acceptance Test shall be carried out on all Station Master unit. For Slave telephone and Power supply, the Double Sample Plan given below shall be adopted during Acceptance Test:

Lot consisting Equipment	1 st Sample size (N1)	2 nd 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

The number of Equipment (N1) as given in Column '2' shall first be selected and subjected to the Acceptance Test. If in the first sample, the number of defective Equipment, that is those failing in one or more acceptance test is less than or equal to the corresponding number (C1) given in Column '5', that lot shall be considered as conforming to the requirement of the acceptance test. If the number of defective equipment in the first sample is greater than or equal to the rejection number in Column '6', the lot shall be considered as not conforming to the requirements of the acceptance test. If number of defective equipment in the first sample lies between C1 and C2 a second sample of size N2 as given in Column '3' shall be selected and subjected to the acceptance test. If in the combined sample, the number of defective equipment is less than C2, the lot shall be considered as conforming to the requirement of acceptance test.

11.3.2 Any other tests as required by the inspecting authority to ensure that equipment is in conformity with the requirement of the specification shall also be done.

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11.3.3 ROUTINE TEST : The manufacturer shall certify that all the tests given in para 11.3.1 have been successfully carried out on all the equipments offered for inspection. He shall produce those tests results at the time of inspection.

11.3.4 The manufacturer shall under take auditing of the components/devices for ensuring the reliability. Audit record shall be shown to the inspection authority.

11.4 **Visual Inspection:** The Power Supply Unit, Station Telephone Unit and Gate Telephones shall be visually inspected to ensure that it is free from any physical defects or any other imperfection including marking and painting etc. And that all components are fitted properly. Further the equipment shall be checked to satisfy general requirement as per Clauses 1.0 to 7.0.

11.5 **Field Trial:** On completion of Type Test, Field Trial for 4 to 6 weeks shall be conducted by installing complete equipments in selected stations to judge the satisfactory performance of the system before granting approval. Field Trial will not be conducted during Type Testing conducted for Maintenance Type Approval.

12.0 MARKING & PACKING:

12.1 Complete circuit diagram showing the electrical connection of the instrument shall be fixed or printed by an appropriate process on a suitable location in the base of the instrument.

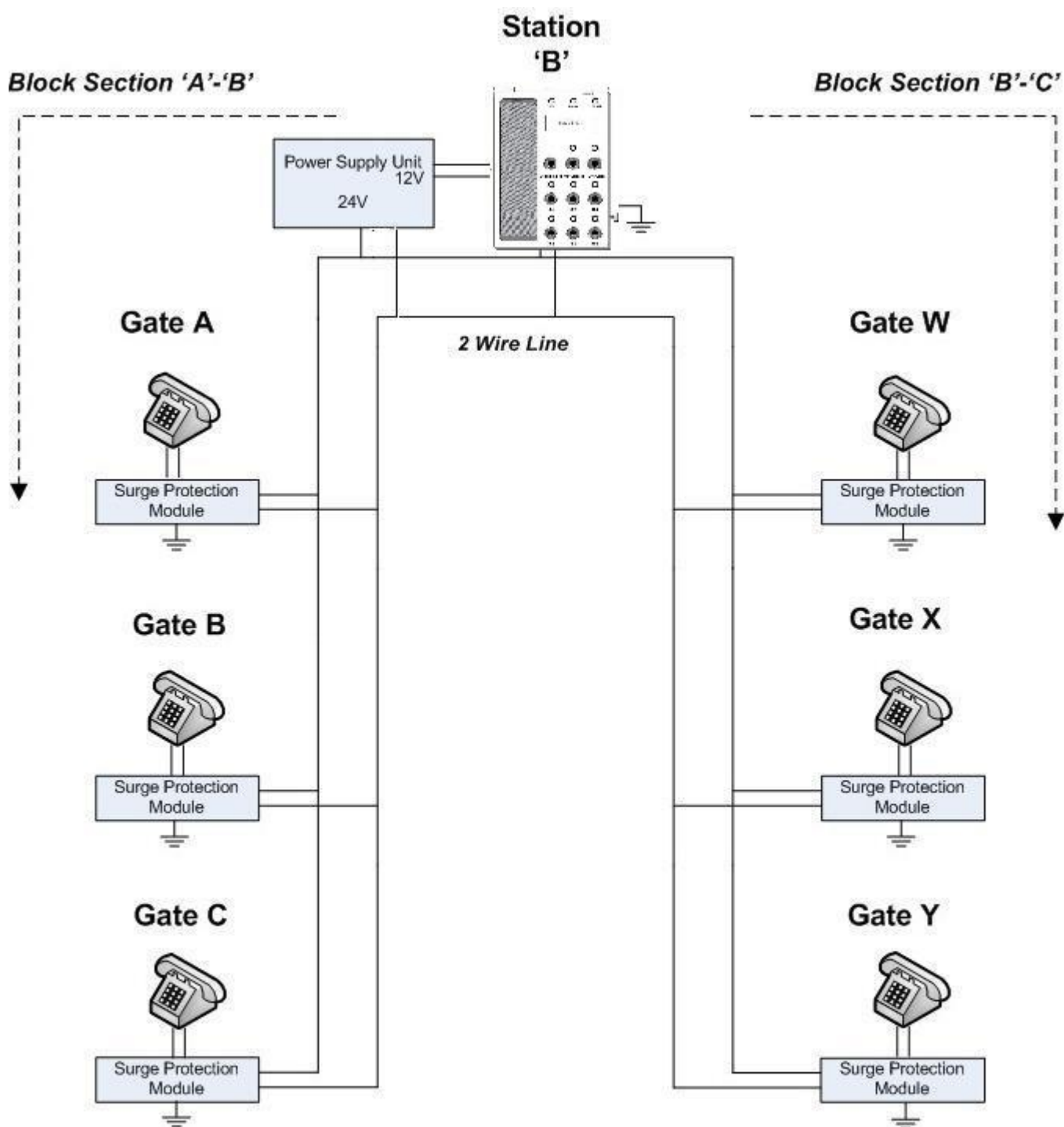
12.2 The following information shall be clearly embossed / engraved / screen printed at a conspicuous places.

- a) Item Name
- b) RDSO Specification Number
- c) Name or monogram of the manufacturer.
- d) Year of manufacture.
- e) Serial Number

12.3 Any other information specially requested and required by purchaser should also be incorporated in the system.

12.4 PACKING: The equipment shall be suitably packed so as to avoid any damage or deterioration during storage and transit.

13.0 “All the provisions contained in RDSO’s ISO procedures laid down in Document No. QO-D-8.1-11 (titled “Vendor-Changes in approved status”) and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways”.

ANNEXURE-I**ELECTRONIC LC GATE TELEPHONE SYSTEM**Figure - 1

ANNEXURE-II

CODE STRUCTURE FOR ELECTRONIC LC GATE TELEPHONE SYSTEM

- (1) 2-Digit DTMF Codes generated by Station Telephone Unit as well as Gate Telephones shall be as below.

- (a) DTMF Codes generated by Station Telephone Unit when it presses Gate Telephone Buttons.

Master presses Gate Telephone 1	21
Master presses Gate Telephone 2	22
Master presses Gate Telephone 3	23
Master presses Gate Telephone 4	24
Master presses Gate Telephone 5	25
Master presses Gate Telephone 6	26

- (b) DTMF Codes generated by Gate Telephones when they call Station Telephone Unit.

Gate Telephone 1 Calls Master Tel	31
Gate Telephone 2 Calls Master Tel	32
Gate Telephone 3 Calls Master Tel	33
Gate Telephone 4 Calls Master Tel	34
Gate Telephone 5 Calls Master Tel	35
Gate Telephone 6 Calls Master Tel	36

- (c) DTMF Codes generated by Gate Telephones when Gate Telephone Handset is put down

Gate Telephone 1 puts down its Handset	51
Gate Telephone 2 puts down its Handset	52
Gate Telephone 3 puts down its Handset	53
Gate Telephone 4 puts down its Handset	54
Gate Telephone 5 puts down its Handset	55
Gate Telephone 6 puts down its Handset	56

- (d) When UP Gate CALL Button is pressed in Station Telephone Unit, DTMF Code 88 is generated.

- (e) When DOWN Gate CALL Button is pressed in Station Telephone Unit, DTMF Code 77 is generated.

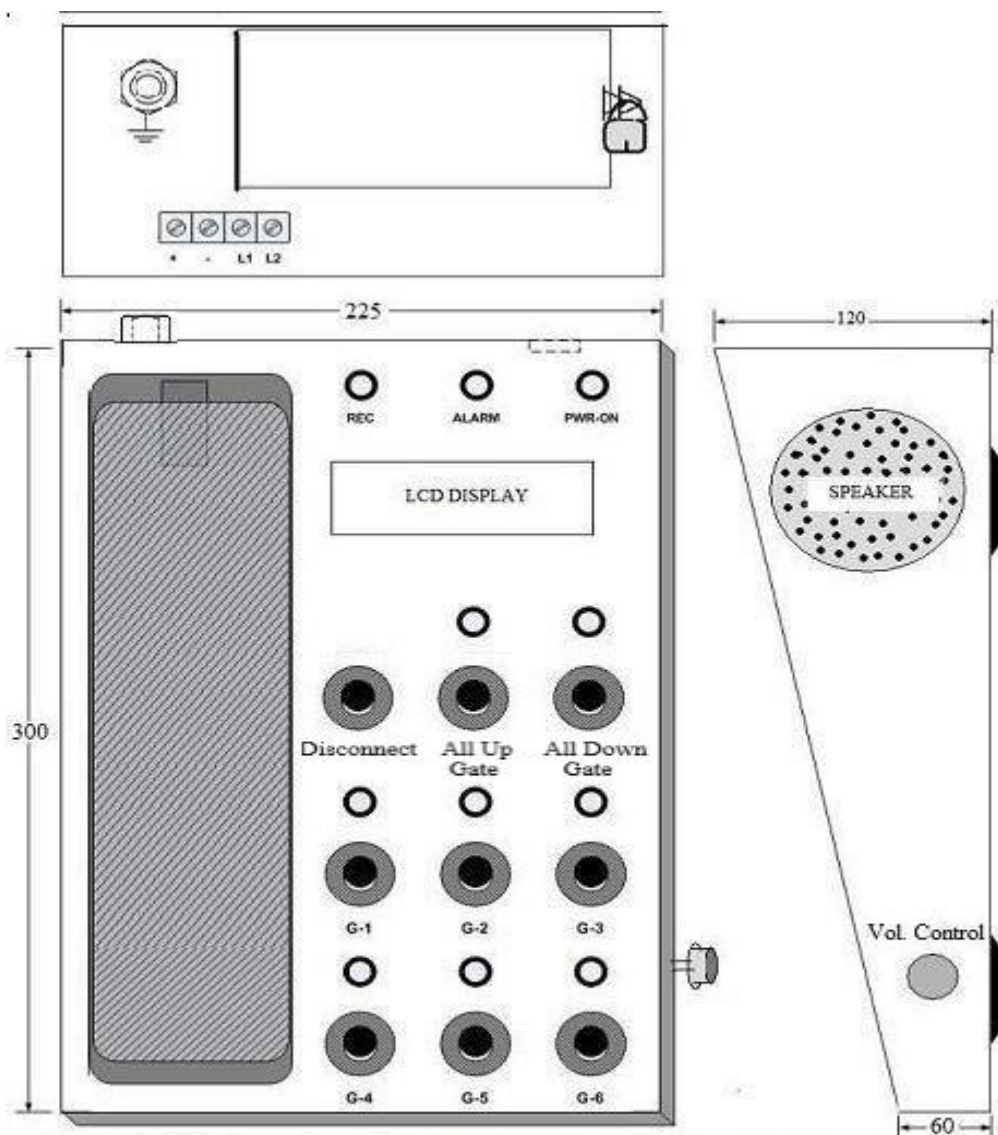
- (f)

When DISCONNECT Button is pressed in Station Telephone Unit, DTMF Code 99 is generated.

- (2) Tone Output Frequency generated with each Digit of Code shall be as below:

Digit	Tone Output Frequency(Hz)
1	697+1209
2	697+1336
3	697+1477
4	770+1209
5	770+1336
6	770+1477
7	852+1209
8	852+1336
9	852+1477
0	941+1336

- (3) Duration of Code will be as per 200±50 ms (Presence Time), 100±50 ms(Absence Time).

ANNEXURE-III

- Note: 1. All dimensions shown are maximum limits.
 2. All dimensions are in mm.
 3. Layout of components is for broad guidance only.

STATION UNIT OF ELECTRONIC LC GATE TELEPHONE SYSTEM

ANNEXURE-IV

Requirements of ABS (Acrylonitrile Butadiene Styrene)

1.0 PROPERTIES

The material shall satisfy the following properties:

1.1 MECHANICAL PROPERTIES

	Mechanical Properties	Specified Values	ASTM Test Method
1.1.1	Tensile strength	380kgf/cm ²	D-638
1.1.2	Flexural Yield strength	650kgf/cm ² (Min)	D-790
1.1.3	Izod Impact Strength notched i) at 23°C ii) at 0 C	30kgcm/cm(Min) 20 kgcm/cm(Min)	D-256(A)
1.1.4	Gloss %	Above 90%	

1.2 Thermal properties

	Thermal Properties	Specified Values	ASTM Test Method
1.2.1	Heat deflection temperature i) At 18.5kg/cm ² ii) At 4.6kg/ cm ²	- 90°C (Min) -100°C (Min)	D-648
1.2.2	Flammability	1.5 Inches/Minute 3.8.1Cm (Max)	D-625

1.3 Electrical Properties

	Electrical Properties	Specified Values	ASTM Test Method
1.3.1	Dielectric Strength	15KV/mm (Min)	
1.3.2	Volume Resistivity	10 ¹⁶ ohm/cm (Min)	D-257

1.4 Other Properties

	Properties	Specified Values	ASTM Test Method
1.4.1	Hardness	05-110 on R Scale	D-785
1.4.2	Mould Shrinkage	0.6% (Max)	D-955

2.0 FASTNESS OF LIGHT

The moulding or a portion of it shall be exposed to light together with cuttings of standard patterns (BS:1006 Part-2). The source of light shall be either day light or a carbon arc of enclosed type. There shall be no detectable fading or change of colour of the exposed moulding when No. 7 of the standard pattern has begun to fade.

3.0 For Type Test, a special sample of size as required and mentioned in the test method ASTM D-1525 and ASTM D-792 should be manufactured from the same raw material as used for moulding the body of the telephone or a part of the telephone body will be cut to conduct the tests mentioned below:

	Properties	Specified values	ASTM Test Method
1.3.1	Specific Gravity	1.04 to 1.07	D-792
1.3.2	Vicat Softening Point	100 to 108°C	D-1525

ANNEXURE-V

TEST SET UP FOR SEND EFFICIENCY

(1) SEND EFFICIENCY (CL.)

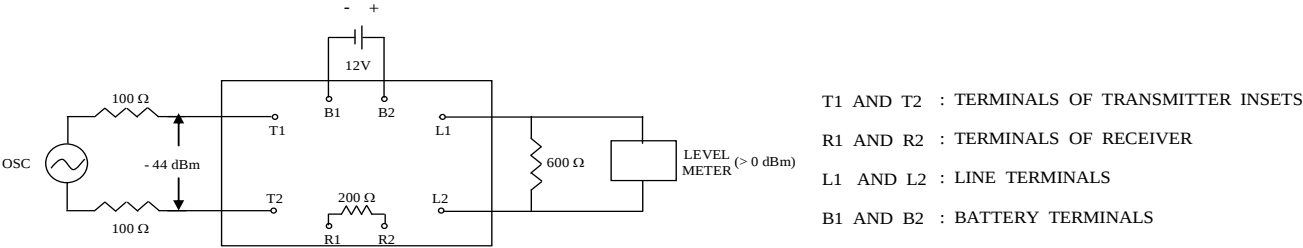


FIGURE - 2

TEST SET UP FOR SIDE TONE

(2) SIDE TONE (CL.)

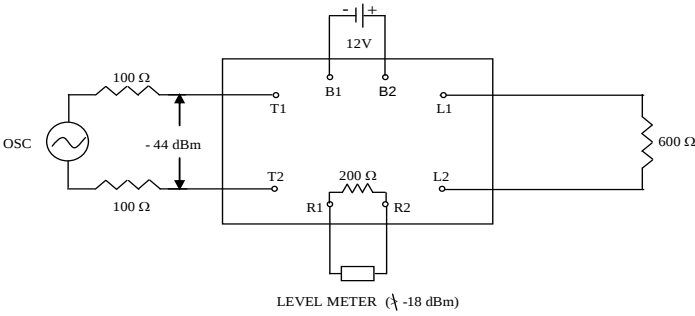


FIGURE - 3

TEST SET UP FOR RECEIVE EFFICIENCY

(3) RECEIVE EFFICIENCY (CL.)

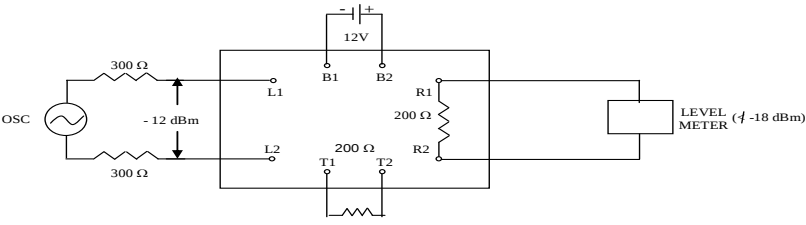


FIGURE - 4

TEST SET UP FOR INSERTION LOSS

(4) INSERTION LOSS (CL.)

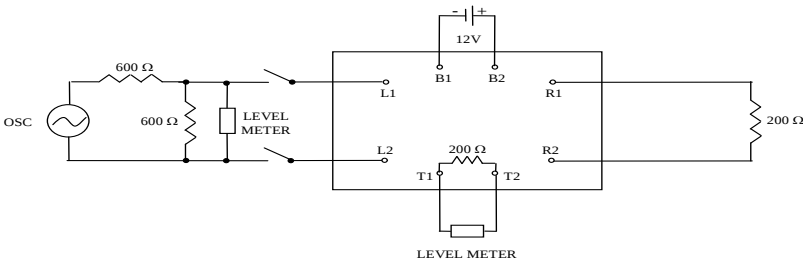


FIGURE - 5

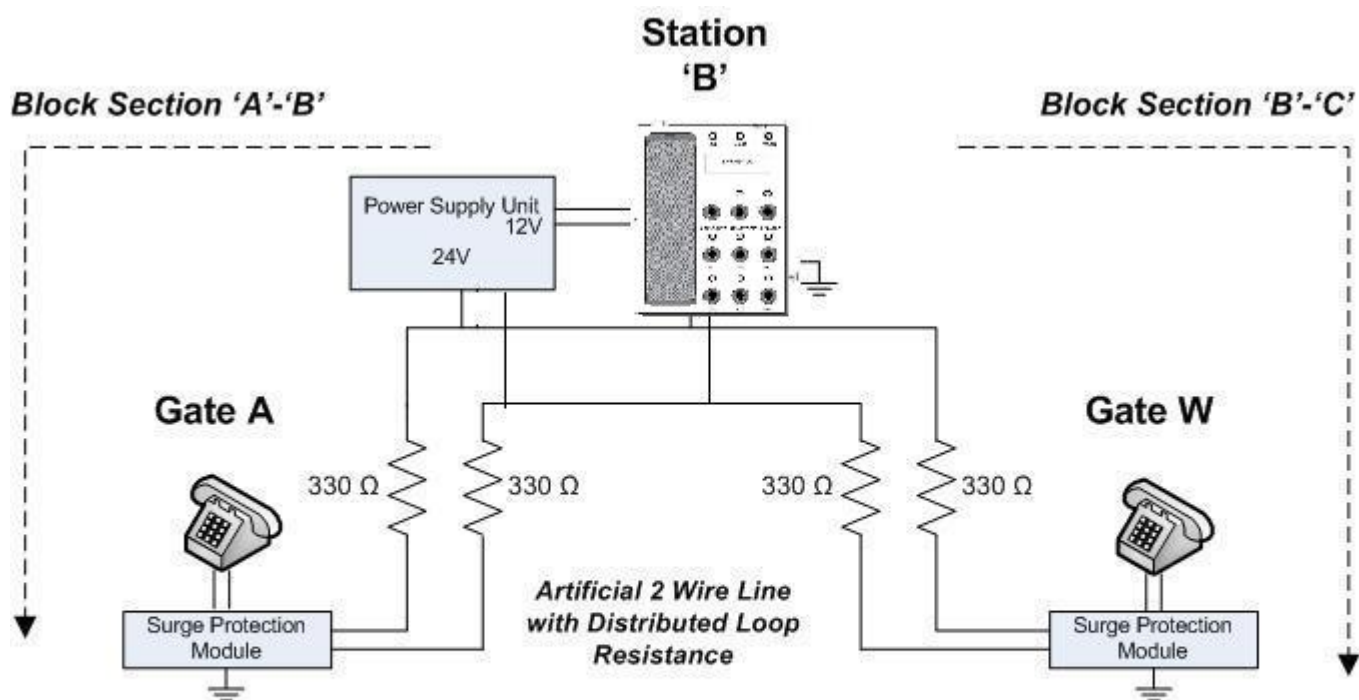


Figure-7 : Test Setup for Performance Test of electronic LC Gate Telephone System with Station Telephone Unit and 2 Gate Telephones.

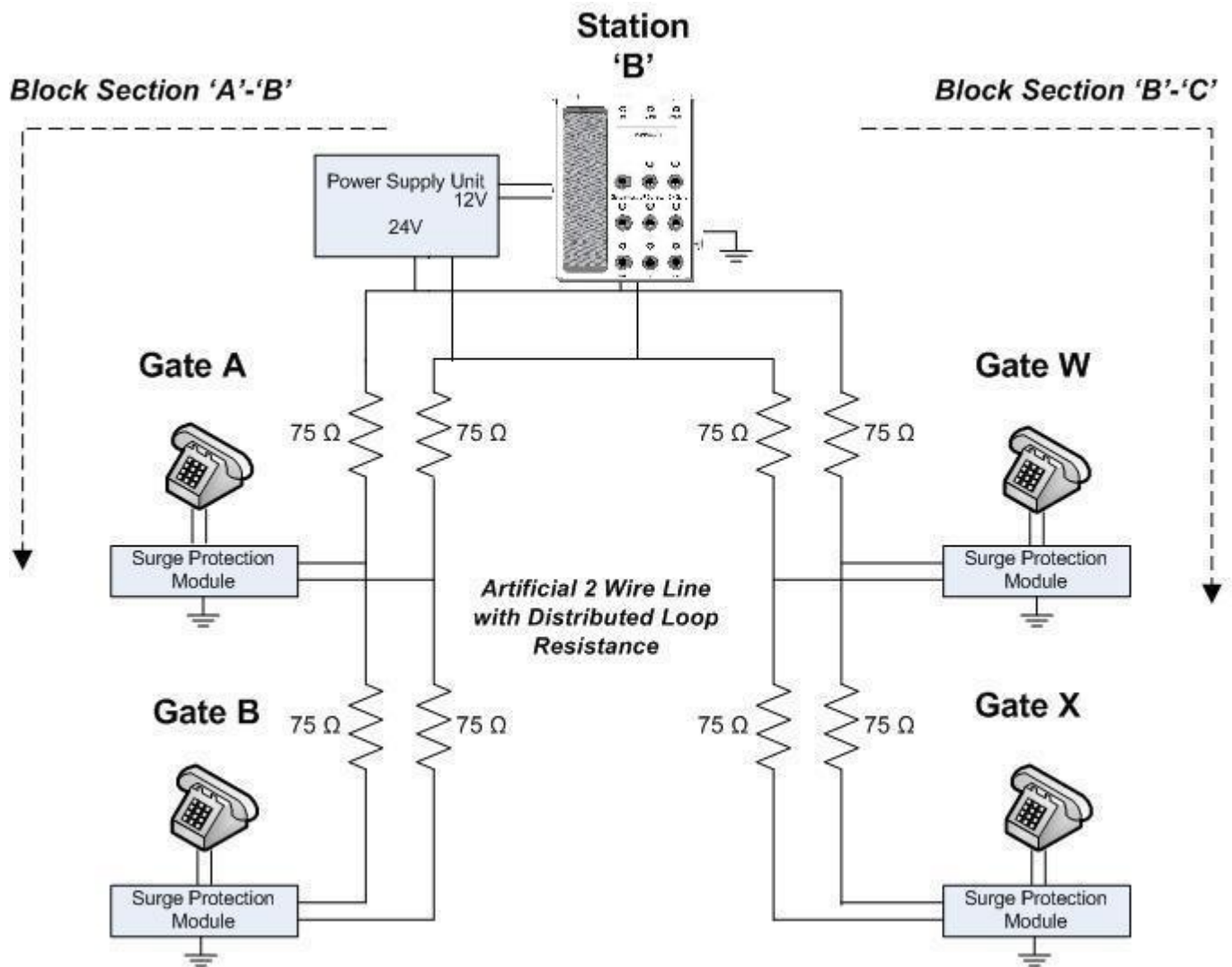


Figure-8 : Test Setup for Performance Test of electronic LC Gate Telephone System with Station Telephone Unit and 4 Gate Telephones.

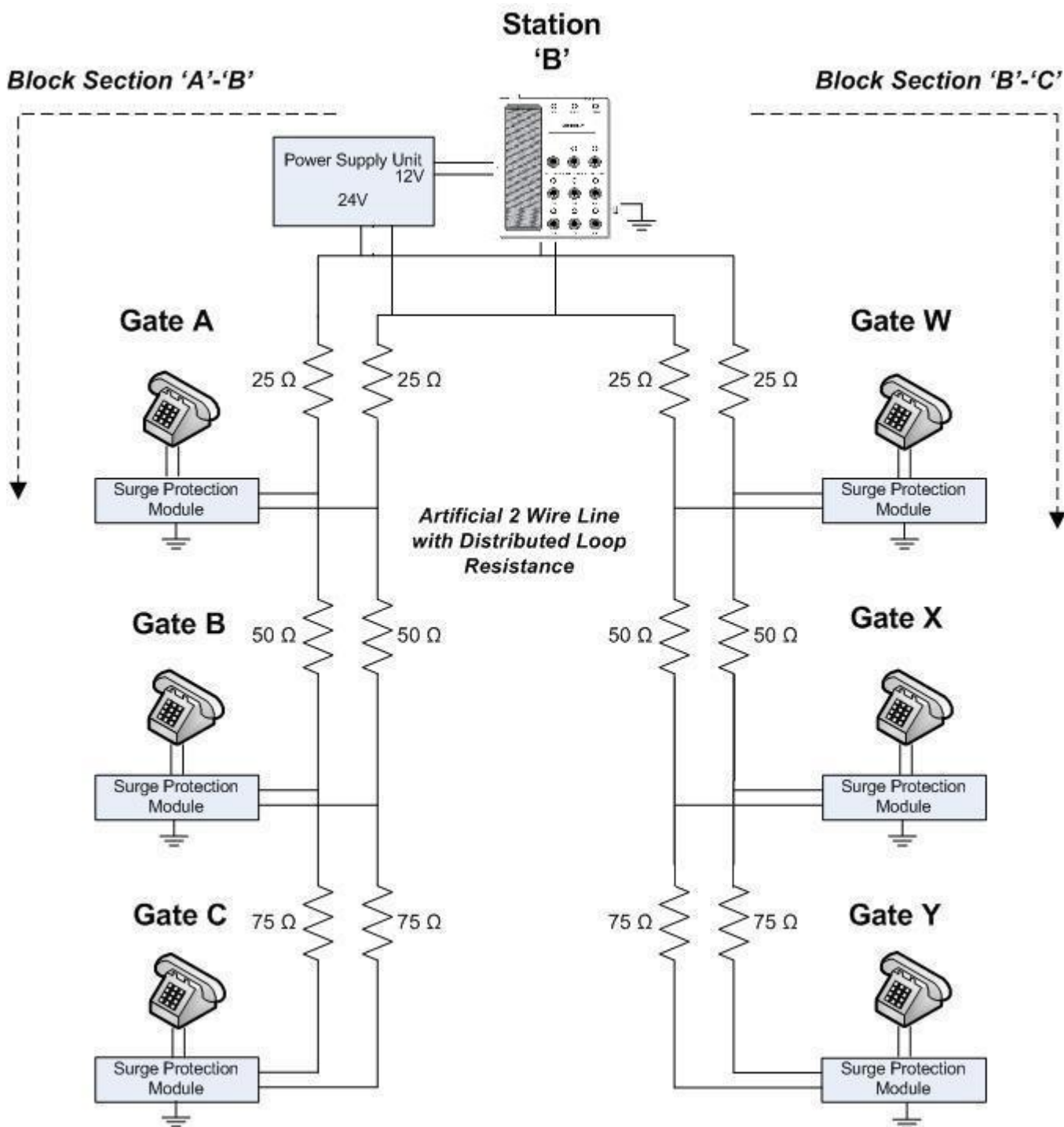


Figure-9 : Test Setup for Performance Test of electronic LC Gate Telephone System with Station Telephone Unit and 6 Gate Telephones.