




**SPECIFICATION FOR
PUBLIC ADDRESS (PA)
SYSTEM
(L-S27)**


CKE.LS.06.27.(00).2018

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**CAWANGAN KEJURUTERAAN
ELEKTRIK**

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1.1 Scope

- 1.1.1 This section of the Specification describes and specifies requirements for the supply, delivery, installation, testing, commissioning, handing over in approved working order and maintenance during the Defects Liability Period of the whole Public Address (P.A) System in accordance with the Specification, Schedule of Technical Data, Supplementary Notes, Bill of Quantities, Conditions of Contract, drawings etc.

1.2 Technical Particulars

- 1.2.1 Tenderers shall submit at the time of tendering all catalogues, detailed technical particulars and guarantees in respect of the equipment offered, which shall be binding. No departure from these technical particulars and guarantees will be permitted except with the written approval of the Superintendent Officer's (S.O.'s) representative. Notwithstanding any description, drawings, illustrations or pamphlets which may be submitted with the tender, all details other than those stated by the Tenderers in the schedule of departures from specification, at the time of tendering, will be deemed to be in full conformity with the specification.
- 1.2.2 Additionally the details of the P.A system main equipment supplier or suppliers shall be furnished in Appendix A.

1.3 Guarantees


- 1.3.1 The Tenderers shall guarantee the equipment to be supplied under this contract against faulty design, materials and workmanship at the manufacturer's works within the defect liability period (DLP).

1.4 Electrical System

- 1.4.1 All equipment shall be rated for operation on a 240/415 V, 3 phase, 4 wire, 50 Hz system with solidly earthed neutral

1.5 Deviations to Specification

- 1.5.1 Any deviations, alternatives or substitutions of the materials as detailed in this specification shall be clearly stated in the tenderer's offer. In the absence of such indication, it will be deemed that the tenderer is offering to supply goods fully in accordance with this specification.


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2.1 System Description

- 2.1.1 The types of P.A System shall be one or combination of the following types, distinguished mostly at the signal management stage which are basic, modular or matrix.
- 2.1.2 Core equipment such as mixer-amplifier, pre-amplifier, power amplifier, monitoring unit, change-over unit, zone selector etc. for signal management, amplification and, output and control monitoring shall come from the same manufacturer (brand). Loudspeakers and accessories other than those above may be sourced from same or different manufacturer (brand).
- 2.1.3 The types can briefly be described as follows:-
- 2.1.3.1 Basic – It is normally based on mixer-amplifier (pre-amplifier c/w built-in amplifier) or pre-amplifier input management systems. Usual application is in small installation where input sources requirement are fixed and no expansion is expected.
- 2.1.3.2 Modular Mixer – It is characterised by having input management system which is modular, flexible and interchangeable. The number of inputs can be varied while the input types can be changed based on needs. Inputs are managed by input cards which are plugged-in to the main frame or enclosure. It can be configured for multiple inputs and multiple outputs.
- 2.1.3.3 Matrix – It has an input management system by which signals are processed digitally and allows for matrix routing of outputs. Simultaneous broadcasting from multiple input sources to different zones can be achieved.

2.2 Emergency Voice Alarm (EVA)

- 2.2.1 Emergency voice alarm (EVA) is a public address system that functioned as voice alarm during an emergency in a building. The EVA requirement which is part of the voice communication system is specified in the Malaysian Uniform Building By Laws 1984. A system that was designed and specified as an EVA shall clearly be stated so in the drawing and/or bill of quantities.
- 2.2.2 It shall have equipments that were certified to be in conformance with BS EN 60849:1998 or in accordance with BS 5839-8:2013. This certification shall clearly be indicated in the supporting documents submitted. In EVA the following shall be the minimum primary levels of priorities:-


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2.2.2.1 Evacuate – An emergency situation that requires an immediate evacuation;

2.2.2.2 Alert – Dangerous situations are developing nearby and warning of pending evacuation; and

2.2.2.3 Non-emergency – Normal operation.

2.2.3 The system design and distribution of the loudspeakers shall be capable of addressing these primary levels of priorities.

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3.1 Input Signals


- 3.1.1 P.A system shall be equipped as a minimum standard with the following input facilities which are emergency paging, general paging and background music.
- 3.1.2 The inputs priority shall be emergency paging, followed by general paging and background music. The minimum performance for the input signals facilities shall be as follows.

3.2 Emergency Paging

- 3.2.1 The function of emergency paging is to allow authorities to broadcast short announcements through the P.A system during an emergency or evacuation. Emergency paging microphone designed to be used in EVA shall conform to the requirement of BS 5839-8:2013 or BS EN 60849:1998 or BS EN 54-16.
- 3.2.2 The microphone used shall be of a dynamic hand-held type. It shall be of uni-directional or omni-directional polar pattern type that is designed for close talking applications and fitted with push to talk side button, and electronically balanced for excellent speech reproduction. Frequency response shall be of minimum 350Hz – 8kHz. The microphone shall be constructed in a manner where it will be easy to use in times of emergency.


3.3 General Paging

- 3.3.1 The system is intended for normal announcement and paging purposes during day to day operations. It shall be equipped with a slim gooseneck, dynamic or condenser type microphone complete with a sturdy base. The microphone shall be of uni-directional polar pattern type. Frequency response shall be of minimum 150Hz – 10kHz. The system shall be equipped with built-in or attached keypad for zone paging. It shall be capable of zone paging with the minimum numbers as indicated in the drawings or bill of quantities. At minimum it shall have all call and all clear capabilities, and chime features.
- 3.3.2 At minimum a paging microphone shall be located at the room where the equipment rack is located. For paging microphone that is being specified as remotely located away from this, the design shall ensure that the signal loss occurred is kept at minimum and will not affect the quality of the voice transmission. Balanced cable connection shall be considered for application of more than 5 metres.

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3.4 Background Music

- 3.4.1 The P.A system shall be equipped with background music facilities. The system shall at minimum be provided with a complete tuner and CD player. Equipment provided shall comply to all applicable safety standards and approved by the relevant authorities. It shall be of 19" rack mountable type and being properly integrated into the P.A system.

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4.1 Inputs Management


- 4.1.1 The design of the input signal management shall clearly be identified as one of the types mentioned in Section 2.0, para 2.1 of this specification. The followings shall be the minimum performance specifications of the input management system for each type.

4.2 Basic

- 4.2.1 Input signals management shall be done using a pre-amplifier with the minimum number of inputs as indicated in the drawings or bill of quantities. It shall be mountable on a standard 19" rack. A mixer amplifier based system shall only be used when specified as so, otherwise a separate pre-amplifier shall be the minimum requirement.
- 4.2.2 The pre-amplifier shall be equipped minimally with master gain and individual gain control for each channel. Bass and treble control shall be provided individually or as master levels. The pre-amplifier shall have minimum frequency response of 100Hz – 10kHz (at -3dB).
- 4.2.3 The inputs shall be suitable for microphone or line inputs in the form of XLR, DIN or RCA. Low level microphone XLR input shall have sensitivity between -60dBu (0.78mV) to 0dBu (775mV) and be provided with phantom power supply for microphone. Auxiliary line input shall have sensitivity between -12dBu (200 mV) to 9dBu (2.2V). There shall be facilities for priority control. Priority in descending order shall be fireman/emergency microphone, general paging microphone, and BGM. Relay contacts for priority and emergency control shall be provided.
- 4.2.4 It shall have nominal output level range suitable for the amplification input.

4.3 Modular Mixer

- 4.3.1 A main frame or enclosure shall be provided to house all the modular cards with the minimum number of allocated slot as indicated in the drawings or bill of quantities. It shall come complete with a built-in power supply system and printed circuit board (PCB) for the modular cards to be plugged in. Facilities shall be made available (if specified so) for the main frame or enclosure to be able of interconnection to another frame or enclosure to increase the capabilities of the P.A system. Facilities for priority and program shall be made available to the modular system.

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4.3.2 Modular cards shall be provided for the inputs as shown in the drawings or bill of quantities. It shall not however be less than the minimum number of inputs as indicated in Section 3.0 para 3.1 of this specification. Each input may require one or more modular cards to make it fully functional and this is deemed to be included whether or not it is explicitly mentioned in the drawings or bill of quantities. Modular card shall be able to be plugged in directly to the PCB without the needs of extra wiring to make it operational.


4.3.3 The input card shall have a minimum frequency response of 100Hz – 15kHz (at -3dB). Microphone input cards shall be provided for low level signal microphone type or line signal type or both as indicated in the drawings or bill of quantities. For low level signal microphone type input card, it shall have sensitivity between -60dBu (0.78mV) to 0dBu (775mV) and be provided with phantom power supply for microphone. For auxiliary line level it shall have sensitivity between -12dBu (200 mV) to 9dBu (2.2V).

4.3.4 A dedicated output card shall be provided for the system. It shall have input sensitivity between -20dBu to 0dBu and a minimum frequency response of 100Hz – 10kHz (at -3dB).


4.4 Matrix

4.4.1 The digital matrix system shall have the minimum number of inputs and outputs as indicated in the drawings or bill of quantities. The inputs shall not however be less than the minimum number of inputs as indicated in Section 3.0 para 3.1 of this specification. For modular type, each input may require one or more modular cards to make it fully functional and this is deemed to be included whether or not it is explicitly mentioned in the drawings or bill of quantities. The number of outputs shall correspond to the number of zones intended for the system. Each output shall be able to channel signal exclusively to an external amplifier. Multiple inputs shall be able to be broadcasted simultaneously to multiple outputs or zones.

4.4.2 For modular type, a main frame or enclosure shall be provided to house all the necessary cards. It shall come complete with a power supply system and printed circuit board (PCB) for the cards to be plugged in. The matrix system shall be expandable (if specified so) by means of additional unit, main frame or enclosure. If more than one number of units, main frames or enclosures are required for the full functioning of the P.A system, it shall be deemed to be included whether or not they are being explicitly mentioned in the drawings or bill of quantities. Signal processing shall be done digitally by an on-board microprocessor or attached central processing card. It shall be able to coordinate all the activities on-board or of the attached cards and communicate with an external PC for configuration.


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- 4.4.3 Each input or modular input card shall be provided with digital signal processing facilities. At minimum a high (10kHz) and low (100Hz) frequency signal processing shall be made available. The input shall have a minimum frequency response of 100Hz – 10kHz (at -3dB). Microphone input cards shall be provided for low level signal microphone type or line signal type or both as indicated in the drawings or bill of quantities. For low level signal microphone type input card, it shall have sensitivity between -60dBu (0.78mV) to 0dBu (775mV) and be provided with phantom power supply for microphone. For auxiliary line level it shall have sensitivity between -12dBu (200 mV) to 9dBu (2.2V).
- 4.4.4 Dedicated output or output cards corresponding to the total number of zones connected shall be provided. All the necessary software and initial configuration of the matrix system is deemed to be included whether or not they are explicitly mentioned in the drawings or bill of quantities.
- 4.4.5 Inputs management system designed for use in EVA shall conform to the requirement of BS 5839-8:2013 or BS EN 60849:1998 or BS EN 54-16.

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5.1 Amplifier

- 5.1.1 The P.A system shall be run in a 100V amplified line. The amplifier shall operate from both mains power and on a 24 V DC back-up battery power supply for emergency back-up, with automatic switchover capabilities.
- 5.1.2 Amplifier shall be mountable on a standard 19" rack and equipped with thermostat controlled side fan which should only be active if the operating temperature exceeds a factory pre-set level. The overheat protection function shall be able to switch off the amplifier when the internal temperature reaches a critical limit. The power amplifiers shall also be equipped with built-in circuitry to protect against overload and short circuits. It shall have status indicators for supply on and audio level meter. Amplifier for the use in EVA shall conform to the requirement of BS 5839-8:2013 or BS EN 60849:1998 or BS EN 54-16.
- 5.1.3 Amplifier shall be rated in watt RMS as specified in the drawings or bill of quantities. It shall be rated according to the total number of speakers connected multiplied by their respective tapping wattages, plus a minimum twenty percent (20%) headroom for spares. It shall have a minimum frequency response of 100Hz – 10kHz (at -3dB). Line input sensitivity nominal level shall be between 775mV – 1V with input impedance >10,000 Ohm. Signal to noise ratio shall be > 60dB and total harmonic distortion (THD) < 1% at 1kHz.
- 5.1.4 The amplifier shall have a balanced input and loop-through outputs to ensure easy connection between amplifiers. Standby amplifier shall be provided for the P.A system in the event of one duty amplifier fails. One (1) standby shall be provided for every five (5) duty amplifiers and it shall be rated based on the highest wattage of the duty amplifiers.
- 5.1.5 Where a large number of power amplifiers are present, sequential power switcher shall be provided to ensure that the mains or stand-by power supply can cope with the initial switch-on surge.

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6.1 Output Control And Monitoring


- 6.1.1 The P.A system shall be equipped with facilities for output signals control and monitoring. The following facilities shall be provided as minimum requirements which are amplifier monitoring unit, amplifier automatic change-over unit, zone selector and volume control (attenuator).
- 6.1.2 Additionally the system designed for EVA shall be capable of monitoring the integrity of the loudspeaker circuits. The built-in or external monitoring system shall be capable of identifying faults such as open and short circuit. Any associated equipment or accessories required for the full operation of the monitoring system shall deemed to be included whether or not it is explicitly mentioned in the drawing or bill of quantities. The output control and monitoring equipment designed for use in EVA shall conform to the requirement of BS 5839-8:2013 or BS EN 60849:1998 or BS EN 54-16.
- 6.1.3 The minimum performance for the output signals control and monitoring facilities shall be as follows.

6.2 Amplifier Monitoring Unit

- 6.2.1 A built-in or an external monitoring unit system whichever specified, capable of monitoring the 100V line output level of each amplifier shall come as a standard. It shall have at minimum the number of inputs (ways) corresponding to the number of amplifiers to be monitored as specified in the drawings or bill of quantities. For a built-in system clear indication shall be displayed to indicate correct operation of each amplifier. The external system shall be mountable on a standard 19" rack and equipped with built-in speaker, visual level meter, amplifier selection buttons and channel indicators.

6.3 Amplifier Automatic Change-over Unit

- 6.3.1 The changeover unit system shall be of fully automated unmanned type complete with all the necessary equipment whether or not specifically mentioned in the drawings or bill of quantities. It can be built-in inside the amplifier or as a separate equipment. Changeover shall be performed at both input and output sections, and at any one time only a failed duty unit shall be replaced by a standby amp to avoid overloading. The unit shall have at minimum input channels for five(5) duty and one(1) standby amplifiers, and shall be capable to be cascaded for P.A system with more than five(5) duty amplifiers. Each channel contact shall be rated at 100V and based on the wattage of the amplifier connected to it.

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6.3.2 For a separate changeover system, the unit shall be mountable on a standard 19" rack. A buzzer alert with switch and indicators to indicate normal, fault and changeover operations shall be provided at the front panel. For a built-in system similar status indicators shall be provided.

6.4 Zone Selector

6.4.1 Facility for zone selection shall be provided based on the number of amplifier inputs and zones as specified in the drawings or bill of quantities. Each zone contact shall be rated at 100V and based on the wattage of the amplifier or load connected to it. It shall have zone selection buttons at the front panel and complete with all call and all clear paging facilities. Active zone shall be highlighted by an individual indicator.

6.5 Volume Control (Attenuator)

6.5.1 The volume control (attenuator) shall be rated at 100V and the total wattage of the speakers connected to it. In any case the rated power shall not be less than 5W. It shall be equipped with a minimum of five (5) attenuation level while a built-in emergency relay shall be provided to allow overriding.

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7.1 Loudspeaker


- 7.1.1 The loudspeaker design and distribution shall be able to deliver a required sound pressure level (SPL) of 10dB above the ambient noise (in dBA) measured on-axis at the listening plane, but not less than 65 dBA or exceeding 95 dBA for internal installation. Loudspeakers shall be located to provide as uniform coverage as possible with variation in SPL in the coverage area kept below 10 dB.
- 7.1.2 The loudspeaker distribution shall be divided into several functional and practical zones. In the event that the system was designed for EVA, the zoning shall be capable of assisting in an orderly evacuation of the premise. A staircase core shall ideally be assigned with only one zone to increase voice intelligibility and clarity of information.
- 7.1.3 For ceiling and box speaker, the listening plane shall be between 1.0m to 1.8m above finish floor level. In any case, the loudspeaker shall not have SPL/1W less than 85dB (1kHz, @1m) for internal application (ceiling and box speaker) and 100dB (1kHz, @1m) for external application (horn speaker). Loudspeaker shall be rated in watt RMS at 100V line as specified in the drawings or bill of quantities. It shall be equipped with a built-in multiple tapping transformers to allow for speaker wattage selection. Frequency response shall be at minimum 120Hz – 10kHz (at -3dB) for ceiling and box speaker, and 500Hz – 5kHz (at -3dB) for horn speaker.
- 7.1.4 Loudspeaker for use in EVA shall conform to the requirement of BS 5839-8:2013 or BS EN 60849:1998 or BS EN 54-24. Additionally, each type of loudspeaker shall conform to the following minimum specifications.

7.2 Recessed Ceiling Speaker

- 7.2.1 Ceiling speaker shall be used at locations where suspended ceiling is provided. Unless specified as otherwise, the diameter of the speaker shall not exceed 200mm. It shall come complete with back metal enclosure, mesh grille and of spring mounted installation type, and in finishes approved by the S.O representative. The loudspeaker shall have opening angle of minimum 90° (at 1kHz/-6dB).

7.3 Surface Mounted Box Speaker


- 7.3.1 Box speaker shall be provided at locations where surface/wall mounted is preferred and at staircase areas. It shall be constructed of ABS materials and in

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finishes approved by the S.O representative. The loudspeaker shall have opening angle of minimum 90° (at 1kHz/-6dB).

7.4 Horn Speaker

- 7.4.1 Horn speaker shall be installed for external application requiring clear voice intelligibility. It shall be constructed from light-weight aluminium enclosure and has an IP65 rating. The minimum angle of coverage shall be 70° (at 1kHz/-6dB) horizontally and vertically.


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8.1 General

- 8.1.1 The equipment rack and its associated accessories shall preferably be located at a centrally located room. They shall conform to the following minimum specifications.

8.2 Equipment Rack

- 8.2.1 All P.A system equipment shall be mounted in a standard nineteen inch (19") equipment rack. The equipment rack shall be of the floor standing type complete with castor wheel and heavy-duty levelling feet, and height not exceeding 40U. The rack shall be of stamped metal plate or other approved material of thickness at least 3mm (frame) and 2mm (panel) with black epoxy coating, internal reinforcement and provided with side vents for air ventilation complete with anti-vermin net. At minimum two (2) numbers of low noise ventilation fans shall be installed at the top of the rack mounted inside a dedicated compartment.
- 8.2.2 Front perspex panel shall be provided for easy monitoring of status indicators. It shall be adequate in size to house all the necessary equipment. The rack shall be constructed such that all equipment can be withdrawn from the front for servicing and maintenance. The arrangement of all the audio equipment in the rack shall be determined and proposed by the specialist contractor. It shall allow for heat to flow and be convected freely minimising any temperature built-up. Heat generating equipment shall be stacked appropriately with minimum of 1U separation from other equipment.
- 8.2.3 The equipment rack shall be provided with lockable door for security reasons. The design of the rack shall be submitted to the S.O's representative for approval prior to fabrication. If the rack is standard prefabricated type, catalogue shall be submitted together with the tender document. A power supply system operating at 240V 50Hz AC with sufficient rated power shall be provided to feed the entire P.A system. It shall have power indicators and sufficient socket outlets (in the equipment rack).
- 8.2.4 All inter-racking cables shall be deemed included whether or not they are explicitly mentioned in the drawings or bill of quantities. All wiring within the rack shall be fixed securely without strain by means of approved nylon/PVC cable ties. For the purpose of identification, all cables shall be labelled and/or colour coded accordingly. The wiring shall be arranged in a neat and systematic manner, with cable supports clear off panel and without crossover.


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8.3 24V DC Power Supply

- 8.3.1 A regulated 24V DC power supply shall be provided for equipment operating continuously on 24V DC. It shall have a nominal ampere rating based on the total consumption wattage of all equipment connected to it. In any case the rating shall not however be less than 4A. The mains input shall be 220-240V AC while the DC output voltage shall not varies more than +/- 1%.
- 8.3.2 Protection against voltage surge and over-current shall come as standard. The output DC shall be equipped with protection devices against over-current and for isolation. There shall be a connection to a 24V DC back-up power supply in case of mains failure and the changeover shall be automatic. The 24V DC power supply shall be 19" rack mountable and be provided with front panel visual indicators for mains, battery and DC out.

8.4 24V DC Back-Up Power Supply

- 8.4.1 Sealed lead acid batteries of AH capacity as specified shall be provided for the 24V DC back-up power supply complete with charger and rack. The minimum backed-up period shall be 30 minutes in full load. In the event that the AH capacity was not specified, the minimum shall be 100AH or for 30 minutes operation whichever is higher.
- 8.4.2 The automatic battery charger shall feature automatic charging switches from boost to float mode when the battery is fully charged. It shall feature high efficiency thyristors as its power controlling element. The charger shall incorporate voltage regulation and current limiting features. The charging voltage shall be as specified by the battery manufacturer. It shall however between 26 – 28V DC with 3 – 10A charging current. It shall has trickle, float or boost charge mode. There shall be indications for AC mains, charging and low battery. The voltage and current shall also be displayed. There shall be protection against overheat, short-circuit, high voltage (30V) and low voltage (21V) cut.

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9.1 Infrastructure


- 9.1.1 Unless specified as otherwise in this specification, details for the wiring infrastructure such as general system of wiring, conduits, trunking, cable ladder or cable tray shall be referred to the current JKR Specification for Low Voltage Electrical Installation.

9.2 Service Colour Identification


- 9.2.1 All metallic conduits and trunking for the P.A system shall be clearly identified and distinguished from other services. The identification colour for P.A system services shall be white, with the lettering "P.A." in black painted over them. The identification colour shall be applied by painting over the whole length of the conduits and trunkings and their coverings.
- 9.2.2 For conduits, the lettering shall be of minimum 19mm height, and painted at an interval not more than 2000mm. Lettering for trunking shall have a minimum height of half the width of the respective trunking but need not exceed 50mm in any case, and painted at an interval not more than 3000mm. Conduits/trunking at junctions, both sides of service appliance, wall/floor penetration and any other place where identification is required and necessary shall also be provided with the same letterings. All letterings shall be clearly legible, and to the satisfaction of the S.O representative.

9.3 Cable

- 9.3.1 All loudspeaker wiring shall be installed using twisted pair, PVC insulated, PVC jacketed, stranded tinned copper conductor of relevant dimension as indicated in the drawings or bill of quantities. The cable shall be of 300/500V grade as specified in the current JKR Specification for Low Voltage Electrical Installation with the appropriate current carrying capacity based on the load carried. The wiring throughout shall be on the 'looping-in system' and no 'tee' or other types of joints are allowed. No reduction of the strands allowed at all terminals. All strands shall be effectively secured by approved means.
- 9.3.2 To ensure maximum integrity, loudspeaker wiring for EVA shall be installed using a fire resistant cable as specified in the current JKR Specification for Low Voltage Electrical Installation.
- 9.3.3 Cable size shall be selected such that signal level attenuation between the amplifier output and the input of the final loudspeaker point of one particular

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circuit does not exceed 10%. Care shall be taken to separate the line level signal with the loudspeaker circuit, and with the mains cable.

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10.0.1 The installation of the loudspeaker shall be based on a coordinated services drawing. Loudspeaker mounted on false/suspended ceiling shall be supported adequately by an approved mean to carry its own weight and not rested directly on the ceiling. A typical ceiling recessed installation is shown in Figure 1.

10.0.2 Wall mounted loudspeaker shall not be installed at height more than 2500mm from the finished floor level. Volume controller shall be installed at 1450mm height and of the same level as other wall mounted accessories such switches, dimmers etc.

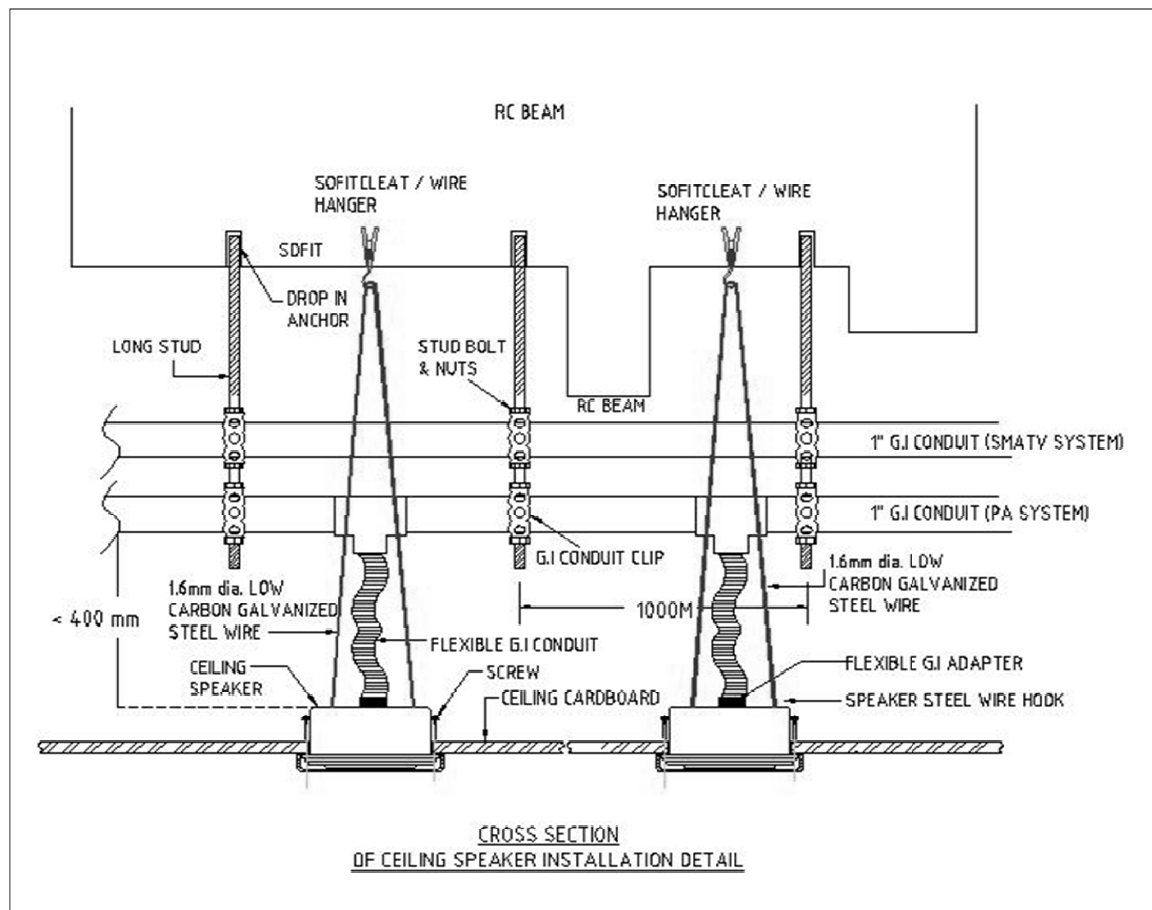



Figure 1: Typical ceiling loudspeaker installation

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11.1 Test, And Calibration of Measuring And Test Instruments


11.1.1 All measuring and test instruments used for testing of the P.A installations shall be regularly tested and calibrated by the manufacturers or accredited calibration laboratories for their functionality and accuracy. The measurement accuracy of reading shall be $\pm 10\%$ for analogue and digital instruments. Test and Calibration Reports or Certificates for the measuring and test instruments issued by the calibration laboratory shall be valid for two (2) years from the date of issuance.

11.1.2 The instruments and their Test and Calibration Reports or Certificates shall be submitted to S.O.'s Representative for verification two weeks before testing of the P.A installations being carried out. No test on the P.A installations shall be carried out without prior approval of the S.O.'s Representative. Notwithstanding the validity of the aforesaid Reports or Certificates the measuring and test instruments shall be re-calibrated if so required by the S.O.'s Representative after any mechanical or electrical mishandling. Fee required for the testing and calibrating of the measuring and test instruments is deemed to be included in the Contract.

11.2 Test And Test Certificates

11.2.1 After the installation work has been completed and before Certificate of Practical Completion is issued, the whole P.A system shall be tested for compliance and performance as follows:-

- 11.2.1.1 Insulation test of the loudspeaker and volume controller circuit wiring;
- 11.2.1.2 Continuity test of the loudspeaker and volume controller circuit wiring;
- 11.2.1.3 Functional test to indicate correct operation and performance of all sound equipment and it associated source equipment;
- 11.2.1.4 Sound pressure level (SPL) measurement throughout the entire target area; and
- 11.2.1.5 Any other tests which may be needed to demonstrate the satisfactory function of the sound system.

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11.2.2 The Contractor shall at minimum have the following test equipment available on site during installation and testing:-

11.2.2.1 Cable insulation and continuity tester;


11.2.2.2 Pink noise generator;

11.2.2.3 Sound level meter;

11.2.2.4 Oscilloscope; and

11.2.2.5 Calibrated microphone.

11.2.3 The S.O.'s Representative reserves the right to be present at all tests and the Contractor shall give at least one week notice in writing to the S.O.'s Representative for this purpose. In any case, no test shall be carried out without prior approval of the S.O.'s Representative. Copies of all the test certificates together with As-Installed Drawings properly bound and titled shall be submitted to the S.O.'s Representative within one week after the completion of the testing.

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12.0.1 During the Defects Liability Period, the Contractor shall be responsible for the service and maintenance work of the complete installation. All works shall be carried out by competent person. All labour, material, tools and parts necessary to rectify the defect due to manufacturing/installation faults shall be supplied/executed at the Contractor's cost.

12.0.2 The service and maintenance to be performed and defects to be rectified and making good shall include but not limited to the following:-


12.0.2.1 Repairs and replacement of all equipment and accessories that become faulty due to manufacturing and installation defects whether it is under the manufacturer's warranty or not;

12.0.2.2 Replacement and making goods of all wiring and accessories;

12.0.2.3 Making good any damage to roads, buildings, drains, cables, pipes, concrete areas, paved areas etc. which had not been properly made good arising out of his work; and

12.0.2.4 All other works deemed as necessary by the S.O.'s Representative.

12.0.3 All works shall be carried out as soon as the Contractor is being informed by the S.O.'s Representative or the occupant, and shall be completed within a reasonable time except under emergency situation. If the Contractor fails to comply with the above requirements, the S.O.'s Representative reserves the right to engage another party to carry out the work, in which case, the Contractor shall be responsible for all the expenses incurred.

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13.1 Manufacturer's Catalogues and Drawings

13.1.1 Manufacturer's catalogues and drawings giving detailed information on the general installation, technical specification and other useful details shall be submitted together with the Tender.


13.2 Shop Drawings

13.2.1 Two sets of prints of shop drawings for construction and/or installation shall be submitted to the S.O.'s Representative for approval. The Contractor shall prepare and submit shop drawings for the whole work or parts of the work at least two weeks before the work begins. If the shop drawings submitted are not acceptable by the S.O.'s Representative, the Contractor shall amend and re-submit the shop drawings within two weeks from the date of return of the shop drawings. No work shall be carried out without the shop drawings being approved by the S.O.'s Representative.

13.2.2 The shop drawings shall include and show the following:-

- 13.2.2.1 Co-ordinated dimensioned general arrangements, layouts and positions of loudspeakers, accessories, equipment racks and all others necessary for the complete installation;
- 13.2.2.2 Schematic line diagrams of the installation;
- 13.2.2.3 The dimensioned general arrangements, layouts and routes of final circuits;
- 13.2.2.4 The dimensioned general arrangements, layouts, routes and positions of all lateral and vertical mains and/or sub-mains;
- 13.2.2.5 The dimensioned layouts and positions of all holes and cut-through in the walls and floors for the lateral and vertical mains and/or sub-mains; and
- 13.2.2.6 Co-ordinated routes for all cables laid external of the building;

13.2.3 The cost of all these shop drawings, whether or not provided in the Bill of Quantities, is deemed to be included in the Contract.

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13.3 As Built Documents And Tools

13.3.1 As built document shall consist of but not limited to the as installed drawings, manuals, certificates, catalogues, inventories and parts lists.

13.4 As Installed Drawings

13.4.1 The as installed drawing shall comprise of:-

- 13.4.1.1 Site plan;
- 13.4.1.2 External cable routes;
- 13.4.1.3 Internal layout plans; and
- 13.4.1.4 Schematic diagrams.

13.4.2 These drawings shall be labelled at the lower right hand corner with the Electrical Contractor's name and address, date of commissioning, scale, drawing number (the drawing number to be obtained from the S.O.'s Representative), title and following particulars: -


JABATAN KERJA RAYA
CAWANGAN KEJURUTERAAN ELEKTRIK
CONTRACT NO.:

13.4.3 If the drawings submitted are not according to the actual installation at site and/or not acceptable to the S.O.'s Representative, the Contractor shall amend and re-submit the drawings within two weeks from the date of return of the drawings to the satisfaction of the S.O.'s Representative.


13.5 Manuals

13.5.1 Manual and documents for the P.A System installation shall be supplied. It shall comprise of:-


- 13.5.1.1 Installation manual;
- 13.5.1.2 Operation manual;
- 13.5.1.3 Service and maintenance manual;

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- 13.5.1.4 Inventories and parts list;
- 13.5.1.5 Product data and catalogue;
- 13.5.1.6 Product test certificates; and
- 13.5.1.7 Installation test results.
- 13.6 Each of the as built document shall be bound together with hard cover and submitted in minimum four (4) sets upon issuance of Certificate of Practical Completion of the project.
- 13.7 In addition, one set of the as installed drawing shall be submitted in the form of tracing/original document, and two sets in CD ROM.
- 13.8 Special tools if any required for the operation, service and maintenance of the P.A System equipment shall also be provided.
- 13.9 The cost of all these prints, manuals, tools etc. whether or not provided in the Bill of Quantities, is deemed to be included in the Contract.

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STANDARD	DESCRIPTION
BS 6259 : 1997	The design, planning, installation, testing and maintenance of sound systems
BS EN 60849 : 1998	Sound systems for emergency purposes
BS 5839-8 : 2013	Code of practice for the design, installation, commissioning and maintenance of voice alarm systems
BS EN 54-24 : 2008	Components of voice alarm system – loudspeakers
BS EN 54-16 : 2008	Voice alarm control and indicating equipment

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A.1 Schedule of Particulars and Guarantees

(To be filled in by the Tenderer)


Section	Parameter	Specification	Equipment Offered
3.2	Emergency Paging Microphone		
	Brand :		
	Model no :		
	Type :	Dynamic	
	Polar pattern :	Uni / Omni - directional	
	Frequency response :	350Hz – 8kHz	
	Output level :		
	Connectors type :		
3.3	Paging Microphone		
	Brand :		
	Model no :		
	Type :	Dynamic / Condenser	
	Polar pattern :	Uni-directional	
	Frequency response :	150Hz – 10kHz	
	Built-in or attached keypad : yes/no?	Built-in / attached	
	Number of zones :		
	All call : yes/no?	Yes	
	All clear : yes/no?	Yes	
	Chime : yes/no?	Yes	
	Output level :		
	Connectors type :		
3.4	Background Music		
	i. AM/FM Tuner		
	Brand :		
	Model no :		

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Section	Parameter	Specification	Equipment Offered
4.2	ii. CD Player		
	Brand :		
	Model no :		
	iii. Other Media (if applicable)		
	Type :		
	Brand :		
	Model no :		
	Pre-amplifier		
	Brand :		
	Model no :		
	Total number of inputs :		
	Number of mono inputs :		
	Number of line inputs :		
	Sensitivity (mV or dBu)		
	Mic input :	-60dBu to 0dBu	
	Line input :	-12dBu to 9dBu	
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Controls		
	Master gain (volume) : yes/no?		
	Channel gain (volume) : yes/no?		
	Master/channel bass : yes/no?		
	Master/channel treble : yes/no?		
	Nominal output level :		
	Allow for priority control : yes/no?	Yes	

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Section	Parameter	Specification	Equipment Offered
4.3	Modular		
	a) <u>Main frame or enclosure</u>		
	Brand :		
	Model no :		
	Number of slots :		
	Built-in power supply module :		
	On board PCB for connectivity : yes/no?		
	Allow for priority control : yes/no?		
	Master bass/treble : yes/no?		
	b) <u>Modular Input Cards</u>		
	i. <u>Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand :		
	Model no :		
	Sensitivity		
	Input 1 :	Mic: -60dBu to 0dBu	
	Input 2 :	Aux/Line: -12dBu to 9dBu	
	Nominal output level :		
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Controls		
	Gain (volume) : yes/no?		
	Bass : yes/no?		
	Treble : yes/no?		
	ii. <u>Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand :		
	Model no :		

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Section	Parameter	Specification	Equipment Offered
	Sensitivity		
	Input 1 :	Mic: -60dBu to -0dBu	
	Input 2 :	Aux/Line: -12dBu to 9dBu	
	Nominal output level :		
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Controls		
	Gain (volume) : yes/no?		
	Bass : yes/no?		
	Treble : yes/no?		
	<u>iii. Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand :		
	Model no :		
	Sensitivity		
	Input 1 :	Mic: -60dBu to -0dBu	
	Input 2 :	Aux/Line: -12dBu to 9dBu	
	Nominal output level :		
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Controls		
	Gain (volume) : yes/no?		
	Bass : yes/no?		
	Treble : yes/no?		
	<u>iv. Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand :		
	Model no :		
	Sensitivity		
	Input 1 :	Mic: -60dBu to -0dBu	

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Section	Parameter	Specification	Equipment Offered
	Input 2 :	Aux/Line: -12dBu to 9dBu	
	Nominal output level :		
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Controls		
	Gain (volume) : yes/no?		
	Bass : yes/no?		
	Treble : yes/no?		
	<u>v. Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand :		
	Model no :		
	Sensitivity		
	Input 1 :	Mic: -60dBu to -0dBu	
	Input 2 :	Aux/Line: -12dBu to 9dBu	
	Nominal output level :		
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Controls		
	Gain (volume) : yes/no?		
	Bass : yes/no?		
	Treble : yes/no?		
	<u>c) Modular Output Cards</u>		
	Brand :		
	Model no :		
	Sensitivity		
	Input 1 :	-20dBu to 0dBu	
	Input 2 :		
	Nominal output level :		
	Frequency response (@ -3dB) :	100Hz – 10kHz	

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Section	Parameter	Specification	Equipment Offered
4.4	Digital Matrix		
	a) <u>Main unit, main frame or enclosure</u>		
	Brand :		
	Model no :		
	Number of slots/inputs :		
	Built-in power supply module :	Yes	
	On board PCB for connectivity : yes/no?	Yes	
	Allow for priority control : yes/no?	Yes	
	Number of outputs :		
	Managing Software		
	Operating system :		
	PC compatible : yes/no?	Yes	
	b) <u>Inputs</u>		
	i. <u>Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand (if modular):		
	Model no (if modular):		
	Input sensitivity :	Mic: -60dBu to -0dBu Aux/Line: -12dBu to 9dBu	
	Frequency response (@ -3dB) :	100Hz – 10kHz	
	Digital signal processing		
	High : yes/no?		
	Low : yes/no?		
	Others (state) :		
	ii. <u>Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand (if modular):		

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Section	Parameter	Specification	Equipment Offered
	Model no (if modular):	Mic: -60dBU to -15dBU Aux/Line: -12dBU to 9dBU 100Hz – 10kHz	
	Input sensitivity :		
	Frequency response (@ -3dB) :		
	Digital signal processing		
	High : yes/no?		
	Low : yes/no?		
	Others (state) :		
	<u>iii. Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand (if modular):		
	Model no (if modular):		
	Input sensitivity :		
	Frequency response (@ -3dB) :		
	Digital signal processing		
	High : yes/no?		
	Low : yes/no?		
	Others (state) :		
	<u>iv. Type (Mic, Aux, Line etc)</u>	Mic / Aux / Line	
	Brand (if modular):		
	Model no (if modular):		
	Input sensitivity :		
	Frequency response (@ -3dB) :		
	Digital signal processing		
	High : yes/no?		

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Section	Parameter	Specification	Equipment Offered
5.1	Low : yes/no?	Mic / Aux / Line	
	Others (state) :		
	<u>v. Type (Mic, Aux, Line etc)</u>		
	Brand (if modular):		
	Model no (if modular):		
	Input sensitivity :		
	Frequency response (@ -3dB) :		
	Digital signal processing		
	High : yes/no?		
	Low : yes/no?		
	Others (state) :		
	Power Amplifier	Mains and back-up battery	
	<u>i. Amplifier (no.1)</u>		
	Brand :		
	Model no :		
	Power source :		
	Rated output power in RMS :		
	Frequency response (@-3dB) :		
	Input sensitivity :		
	Input impedance (Ohm) :		
	Signal to noise ratio (SNR) :		
	Total harmonic distortion (THD) :		
	Protection (state):		
	Indicators (state) :		

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Section	Parameter	Specification	Equipment Offered
	Controls (state) :		
	<u>ii. Amplifier (no.2)</u>		
	Brand :		
	Model no :		
	Power source :	Mains and back-up battery	
	Rated output power in RMS :		
	Frequency response (@-3dB) :	100Hz – 10kHz	
	Input sensitivity :	775mV – 1V	
	Input impedance :	> 10,000 Ohm	
	Signal to noise ratio (SNR) :	> 60dB	
	Total harmonic distortion (THD) :	< 1%	
	Protection (state):	Overheat, overload, short-circuit	
	Indicators (state) :		
	Controls (state) :		
	<u>iii. Amplifier (no.3)</u>		
	Brand :		
	Model no :		
	Power source :	Mains and back-up battery	
	Rated output power in RMS :		
	Frequency response (@-3dB) :	100Hz – 10kHz	
	Input sensitivity :	775mV – 1V	
	Input impedance :	> 10,000 Ohm	
	Signal to noise ratio (SNR) :	> 60dB	

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Section	Parameter	Specification	Equipment Offered
6.2	Total harmonic distortion (THD) :	< 1%	
	Protection (state):	Overheat, overload, short-circuit	
	Indicators (state) :		
	Controls (state) :		
	Amplifier Monitoring Unit		
	Brand :		
	Model no :		
	Power source :		
	Number of inputs :		
	Built-in monitoring speaker : yes/no?	Yes	
6.3	Visual level meter : yes/no?	Yes	
	Amplifier selection button : yes/no?	Yes	
	Input channel indicator : yes/no?	Yes	
	Automatic Change-over Unit		
	Brand :		
	Model no :		
	Type :	Built-in / Separate	
	Power source :		
	Duty input channel numbers :	Min 5 nos.	
	Standby input channel numbers :	Min 1 no.	
6.4	Load rating (W) :		
	Status indicators :		
	Zone Selector		
	Brand :		

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Section	Parameter	Specification	Equipment Offered
6.5	Model no :	Min 5 levels	
	Power source :		
	Number of zone :		
	Load rating (W) :		
	Indicators :		
	Volume controller		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Number of attenuation steps :		
7.0	Attenuation (dB)/step :	120Hz – 10kHz Min 90°	
	Overriding voltage :		
	Loudspeaker		
	<u>i) Ceiling loudspeaker (no.1)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :		
	SPL level (1W, @1kHz, @1m)		
	Opening angle (at 1kHz/-6dB) :		
	Transformer multi-tap (W) @ 100V :		
	Overall diameter :		
	<u>ii) Ceiling loudspeaker (no.2)</u>		
	- Brand :		
	- Model no :		
	- Rated power (@100V) :		

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Section	Parameter	Specification	Equipment Offered
	- Maximum power (@100V) :	120Hz – 10kHz	
	- Frequency response (-3dB) :		
	- SPL level (1W, @1kHz, @1m)	Min 90°	
	- Opening angle (at 1kHz/-6dB) :		
	- Transformer multi-tap (W) @ 100V :		
	- Overall diameter :		
	<u>iii) Ceiling loudspeaker (no.3)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :	120Hz – 10kHz	
	SPL level (1W, @1kHz, @1m)		
	Opening angle (at 1kHz/-6dB) :	Min 90°	
	Transformer multi-tap (W) @ 100V :		
	Overall diameter :		
	<u>iv) Ceiling loudspeaker (no.4)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :	120Hz – 10kHz	
	SPL level (1W, @1kHz, @1m)		
	Opening angle (at 1kHz/-6dB) :	Min 90°	
	Transformer multi-tap (W) @ 100V :		
	Overall diameter :		

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Section	Parameter	Specification	Equipment Offered
	<u>v) Box loudspeaker (no.1)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :	120Hz – 10kHz	
	SPL level (1W, @1kHz, @1m)		
	Opening angle (at 1kHz/-6dB) :	Min 90°	
	Transformer multi-tap (W) @ 100V :		
	<u>vi) Box loudspeaker (no.2)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :	120Hz – 10kHz	
	SPL level (1W, @1kHz, @1m)		
	Opening angle (at 1kHz/-6dB) :	Min 90°	
	Transformer multi-tap (W) @ 100V :		
	<u>vii) Horn Speaker (no.1)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :	500Hz – 5kHz	
	SPL level (1W, @1kHz, @1m)		
	Coverage angle :	70°(H) x 70°(V)	
	Transformer multi-tap (W) @ 100V :		
	Construction material :	Light-weight aluminium	

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Section	Parameter	Specification	Equipment Offered
8.0	IP rating :	Min IP65	
	<u>vi) Horn Speaker (no.2)</u>		
	Brand :		
	Model no :		
	Rated power (@100V) :		
	Maximum power (@100V) :		
	Frequency response (-3dB) :	500Hz – 5kHz	
	SPL level (1W, @1kHz, @1m)		
	Coverage angle :	70°(H) x 70°(V)	
	Transformer multi-tap (W) @ 100V :		
	Construction material :	Light-weight aluminium	
	IP rating :	Min IP65	
	Equipment Rack		
	i) Rack		
	- Brand :		
	- Model no :		
	ii) 24V DC Power Supply		
	- Brand :		
	- Model no :		
	iii) 24V DC Battery		
	- Brand :		
	- Model no :		
	iv) 24V DC Battery Charger		
	- Brand :		
	- Model no :		

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Section	Parameter	Specification	Equipment Offered
9.0	Wiring		
	i) Twisted Pair PVC/PVC		
	- Brand :		
	- Model no :		
	ii) Fire Resistant Cable		
	- Brand :		
	- Model no :		
	iii) Conduit		
	- Brand :		
	- Model no :		
	iv) Trunking		
	- Brand :		
	- Model no :		

NOTE: Tenderer shall enter details at the time of tendering. Technical literature such as catalogues shall also be submitted as supporting documents. If no details are entered, and/or no technical supporting documents are enclosed the evaluating officer shall deem the submission to be incomplete and have the right to reject it.

I hereby acknowledge that the details in the "Schedule of Particulars and Guarantee" are correct and in accordance with the specification.

Tenderer

Signature :


Company's Stamp

Name of tenderer :

Date :

.....

Tenderer is required to obtain declaration for the equipment specified in Section 3.0 – 7.0.

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I/we being the suppliers for the equipment specified in Section 3.0 – 7.0 acknowledge the responsibility for the equipment supplied and, the associated after sales and service during the warranty period.

Declaration by Suppliers

i) Signature :

Name of supplier :

Company's name :

Registration no :

Equipment to be supplied (list down) :

Company's Stamp

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ii) Signature :

Name of supplier :


Company's name :

Registration no :

Equipment to be supplied (list down) :

Company's Stamp

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iii) Signature :

Name of supplier :

Company's name :

Registration no :

Equipment to be supplied (list down) :

Company's Stamp

.....

iv) Signature :

Name of supplier :

Company's name :

Registration no :

Equipment to be supplied (list down) :

Company's Stamp

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