

2x660MW UDANGUDI STPP

VOLUME – IIB

TECHNICAL SPECIFICATION FOR PUBLIC ADDRESS SYSTEM

BHEL DOCUMENT NO. : PE-TS-435-557-E001, REV-0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA – 201301**



2 x 660MW UDANGUDI STPP

Doc. No

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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

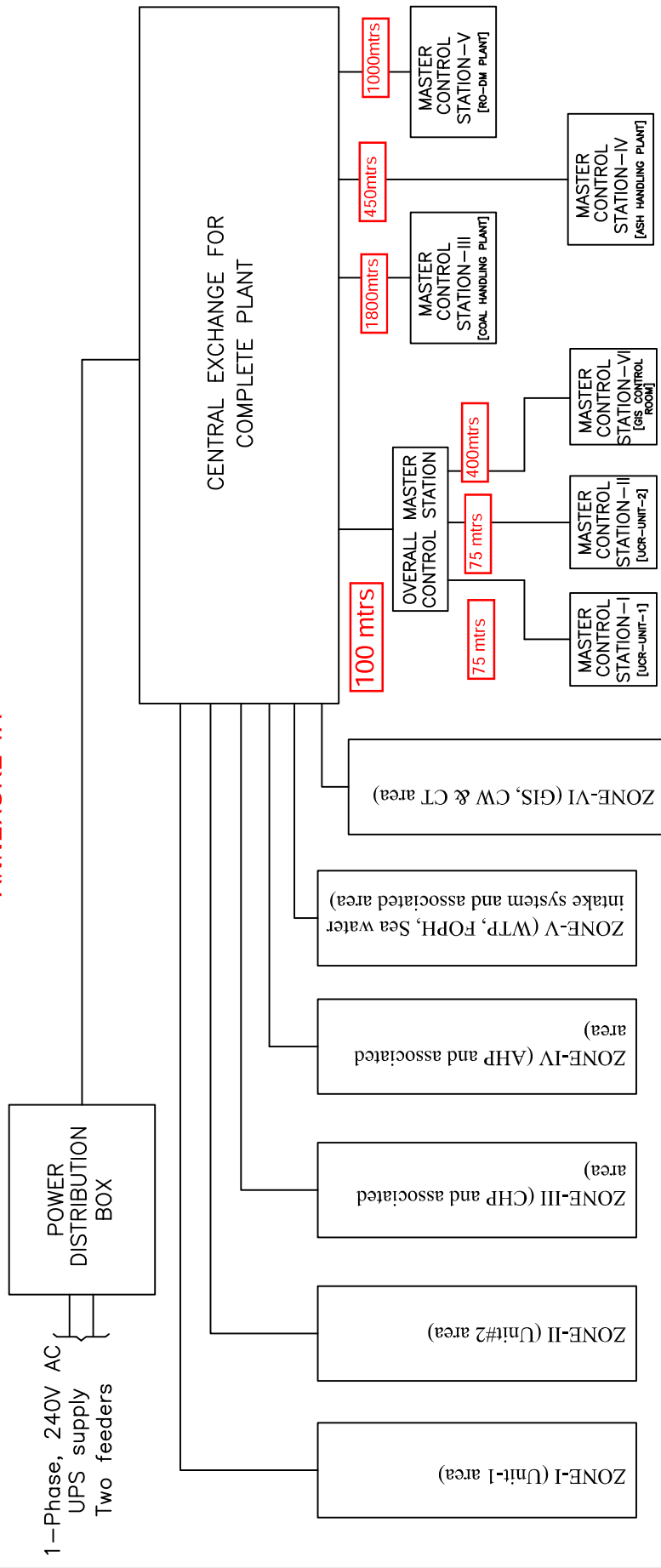
BIDDER'S STAMP & SIGNATURE

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SECTION-I
SPECIFIC TECHNICAL REQUIREMENTS

ANNEXURE-1A



NOTES:

1. CENTRAL EXCHANGE, MDF & POWER DISTRIBUTION BOX WILL BE LOCATED IN CONTROL EQUIPMENT ROOM.
2. OVERALL MASTER CONTROL STATION, MASTER CONTROL STATION-I & II TO BE LOCATED IN CENTRAL CONTROL ROOM.
3. MASTER CONTROL STATION-VI TO BE LOCATED IN GIS CONTROL ROOM.
4. MASTER CONTROL STATION-III TO BE LOCATED IN COAL HANDLING PLANT.
5. MASTER CONTROL STATION-IV TO BE LOCATED IN ASH HANDLING PLANT.
6. MASTER CONTROL STATION-V TO BE LOCATED IN RO-DM PLANT.

5. MASTER CONTROL STATION-IV TO BE LOCATED IN ASH HANDLING PLANT.													6. MASTER CONTROL STATION-V TO BE LOCATED IN RO-DM PLANT.													TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD. (TANGEDCO). 2x660 MW UDANGUDI STPP (UNIT # 1 & 2)												
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ANNEXURE-1B

ZONE WISE DISTRIBUTION OF HANDSET STATIONS:**1. Zone I (Unit # 1)**

Sl. No.	Description	Total Qty/ Unit	Type
1	ESP Control Room	1	A
2*	ID Fan-A	1	B
3*	ID Fan-B	1	B
4	Boiler Elevations	8	B
5*	FD/PA Fan-A	1	B
6*	FD/PA Fan-B	1	B
7	Near ESP Structure	1	B
8	Near Dearator	1	B
9*	Near TDBFP/HPHeater	1	A
10*	TG Hall	2	A
11*	Near TG Main Oil Tank	1	A
12*	Near MDBFP/LPH	1	A
13#	Charger/UPS room (8.5 mtrs)	1 + 1	F + S
14	Near Gas cylinder room	1	E
15	Near TG Seal oil unit	1	A
16	Near Hotwell	1	A
17	Near Clean oil/Dirty oil tank	1	A
18	Control fluid room	1	A
19	Boiler MCC Room	1	A
20	LT Switchgear Room	1	A
21	MV Switchgear Room	1	A
22	CCR (On UCD)	2	C
23	CER (Common for both units)	1	C
24	Shift Incharge Room	1	S
25	C&I Shift Engr Room	1	S
26	Programmer Room	1	S
27*	Mill area (Left)	1	B
28*	Mill area(Right)	1	B
29	Transformer yard area	1	B
30	TG Hall A row	2	B

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31 [@]	CCR	1	D
32	MV switchgear cable vault room	1	A
33	LV switchgear cable vault room	1	A
34	ESP cable spreader room	1	A
35*	Compressor house	1+1	A+B
36	Service Building	1	A
37*	DG set building for unit-1	1	A
38*	DG set building for unit-2	1	A
39	Aux. Boiler	1+1	A+B

2. Zone II (Unit # 2)

Sl. No.	Description	Total Qty/ Unit	Type
1	ESP Control Room	1	A
2*	ID Fan-A	1	B
3*	ID Fan-B	1	B
4	Boiler Elevations	8	B
5*	FD/PA Fan-A	1	B
6*	FD/PA Fan-B	1	B
7	Near ESP Structure	1	B
8	Near Dearator	1	B
9*	Near TDBFP/HPHeater	1	A
10*	TG Hall	2	A
11*	Near TG Main Oil Tank	1	A
12*	Near MDBFP/LPH	1	A
13 [#]	Charger/UPS room (8.5 mtrs)	1 + 1	F + S
14	Near Gas cylinder room	1	E
15	Near TG Seal oil unit	1	A
16	Near Hotwell	1	A
17	Near Clean oil/Dirty oil tank	1	A
18	Control fluid room	1	A
19	Boiler MCC Room	1	A
20	LT Switchgear Room	1	A
21	MV Switchgear Room	1	A
22	CCR (On UCD)	2	C

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23	CER (Common for both units)	1	C
24	Shift Incharge Room	1	S
25	C&I Shift Engr Room	1	S
26	Programmer Room	1	S
27*	Mill area (Left)	1	B
28*	Mill area(Right)	1	B
29	Transformer yard area	1	B
30	TG Hall A row	2	B
31 [@]	CCR	1	D
32	MV switchgear cable vault room	1	A
33	LV switchgear cable vault room	1	A
34	ESP cable spreader room	1	A
35	Work shop	1	B

- Handset stations at Sr. no. marked with “*” will be provided with acoustic hood. Also, 1 acoustic hoods shall be provided at boiler firing floor elevation also which shall be decided during detailed engineering.
- Sr. no. 13 marked with “#” will be provided with Portable handsets & sockets. The location, etc., details shall be finalized during detailed engineering stage & shall be subject to Customer’s approval.
- Sr. no. 31 marked with “@” will be provided with 3 nos. master control stations for both units. One no. of these shall be overall master control station (OMCS)
- Exact location of handset stations on boiler platform shall be decided during detailed engineering.

3. Zone-III (CHP Area)

Sl. No.	Description	Quantity	Type
1	Bunker Floors	4	B
2	CHP CR	1	D
3	Machinery Wells	4	A
4	MCC Rooms	3	A
5	Pent Houses	4	A
6	Pump Houses	1	A
7	TPs	12	B
8	Wagon tippler area	4	B
9	Crusher Houses	5	B
10	Track Hopper (at different points)	3	B
11	Stacker cum Reclaimer hopper	2	B
12	Administration building	1	A
13	Canteen and dormitory	1	A

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14	Dispensary	1	A
15	Main gate & Time office security complex	1	B
16	Dust suppression pump house	1	A
17	Compressor house for DE system	1	A
18	Fire station	1+1	A+B

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4. Zone-IV (AHP and associated area)

S. No	Area	Quantity	Type
1*	Ash conveying air Compressor house	1+1	A+B
2	Vacuum pump house unit-1	1	A
3	Vacuum pump house unit-2	1	A
4	Bottom ash slurry pump house	1	A
5	AHP MCC building	1	D
6	Conveyer area	2	B
7	Fly ash slurry pump house	1	A

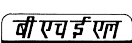
5. Zone-V (Common Area)

S. No	Area	Quantity	Type
1	AC plant room	1	A
2	Fire water pump house	1	A
3	Electro-chlorination Plant	1	A
4	Sea water intake pump house	1	A
5	Sea water outfall	1	A
6	DM plant area	1	B
7	DM plant control room	1	A
8	Hydrogen Generation Plant	1	E
9	Fuel oil unloading pump house	1	E
10	HDO/LDO Tank dyke area	1	E
11	HDO/LDO forwarding pump house	1	E
12	ETP	1	A
13	STP	1	A
14	Weigh Bridge & guard house	1	B (pilfer proof)
15	CPU Regeneration building	1	A
16	Chimney area	1	B
18	Chemical lab	1	A

6. Zone-VI (GIS, CW & CT area)

1	NDCT	2	B
2	CW pump house	1	A
3	GIS control room	1 + 1	C + D
4	Ash water recovery pump house	1	A

Notes:-

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1. Handset stations at Sr. no. marked with “*” will be provided with acoustic hood.
2. Exact location of handset stations shall be decided during detailed Engineering.
3. In hazardous area, the station will be kept in control room/ MCC room

Note:

1. Sockets for portable stations will be located as per requirement during erection.
2. These are tentative locations, Customer to confirm exact locations & titles with approval.
3. Allocation of subscriber stations to master control station has been done based on location of the facilities in Plot plan.

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1.0 SCOPE OF ENQUIRY

1.1 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing, despatch to site, system engineering and erection & commissioning of central exchange type Public Address System as described in the various sections of this specification. Public Address System shall generally conform to IS. It is not the intent to completely specify all details of design and construction herein.

Products/equipment offered with latest technology and advanced features, meeting functional requirements of the technical specification are also acceptable.

1.2 General technical requirements of the Public Address System are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.

1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.

1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements (Supply, E&C, mandatory spares etc.) shall be as per 'BOQ-cum price schedule' as part of NIT.

2.2 E&C spares are those which would be required during plant or equipment erection and commissioning. All spares used until the plant is finally handed over by the bidder to the Owner come under this category. All E&C spares as required shall be provided by the bidder without any additional cost to the Owner. The list and details of E&C spares shall be furnished by bidder prior to award of Contract. Bidder shall be responsible for the ready and timely availability for all the spares as required during various stages of erection and commissioning up to handing over of the PA system of the plant.

3.0 SCOPE OF SUPPLY AND SERVICES

3.1 The scope of supply and services covers the complete supply of equipment and services for central exchange type distributed amplifier Public Address System in accordance with the requirements of various sections of this specification. Equipment offered by the bidder shall be type tested as per relevant standard.

3.2 Public address system shall be provided for the entire plant including switchyard and offsite areas.

3.3 Consumables such as cable glands, cable lugs, ferrules, tags, self-locking clamps, screws,

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supports, fixing hardware and special supporting structure, as required for outdoor/indoor equipment erection shall be included as part of supply. Wherever the quantity has been specified as on as required basis, the same are to be supplied on as required basis without any cost implication to the Contractor from the quoted lump sum price.

3.4 The successful bidder shall furnish the system write-up, complete erection/mounting drawing for each of the equipment, testing & commissioning procedure for individual equipment and for complete PA system during contract stage.

3.5 The Bidder's scope shall also include successful demonstration of performance testing specified herein complete in all respects along with cables, junction boxes, earth wire and accessories like standard brackets, nut-bolts, glands, lugs, conduit sleeves, etc., as required, to complete the proper installation conforming to IS: 1881, IS: 1882 of all the equipment supplied as covered in this specification.

4.0 TERMINAL POINTS

Incoming power supply to Power Distribution Box (PDB)

5.0 POWER SUPPLY:

The system shall be suitable for operation from 230V AC 1-phase supply. For TG building central exchange and CHP central exchange, there will be two UPS supply feeders. In event of failure of one UPS supply, it will switch automatically to another UPS supply through auto changeover. UPS shall be in the scope of owner.

6.0 ZONE WISE DISTRIBUTION OF SYSTEM:

PA system shall comprise six separate zones:

- Zone-I for Unit-1 area
- Zone-II for Unit-2 area
- Zone-III for CHP and associated area
- Zone-IV for AHP and associated area
- Zone-V for WTP, FOPH, Sea water intake system and associated area
- Zone-VI for GIS, CW & CT area

All the zones shall be connected with central exchange located in central control room. There shall be 6 nos. Master control stations; one for each zone mentioned above (Total 6 nos.) & one overall Master control station (OMCS). Master stations for Zone-I, II, VI shall be connected to OMCS, which shall in turn be connected to central exchange. Master control stations for Zone I, Zone II, OMCS and Central exchange shall be located in Central control room. Master control station for Zone-III shall be located in CHP control room. Master control station for Zone-IV shall be located in AHP control room. Master control station for Zone-V shall be located in RODM control room. Master control station for Zone-VI shall be kept

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in GIS control room. Each zone shall have number of subscriber stations. Each subscriber station can do conversation with other stations and with master control station. The PAS shall also be interfaced with the EPABX and walkie-talkie system. Typical utility block diagram of different zones & their interconnections is enclosed.

7.0 OPERATION:

PAS shall have two modes, i.e. Paging mode and party mode. Each of the two modes shall be open line, common talking type.

Paging mode shall be used for locating a person and for general instructions.

Party mode shall be used for conversation between individuals without broadcasting the same over the loudspeaker.

The system shall provide two-way voice communication on each party line and use a page line for voice transmission over a plant-wide speaker system. While a conversation is taking place on a party line, other conversation may be held on other party lines or page line.

Paging shall be used for everyday contact with plant maintenance staff and shall provide a means to alert plant personnel to an emergency.

Each page/party handset station shall have party lines and page line.

Communication between handset within Zone

To originate a call, the caller shall lift the handset off-the cradle at his station and press the page button. The associated loudspeaker shall get muted to prevent acoustic feedback. A call attention gong shall be heard over all other loudspeakers. The caller shall then make his announcement and release the page button. The announcement shall be heard over all loudspeakers except those muted. On hearing the announcement, the called party likewise shall lift the handset off the cradle at his station and establish two way communications over party channel. Party channel busy lamp shall be lit up at all stations as soon as the channel is in use. Loudspeaker associated with any station engaged in party channel conversation shall be free to receive any paging announcement. An additional switch shall be provided at each handset to mute the associated loudspeaker, if required, when engaged in party channel. The slave stations in each zone shall have conference facility so that any number of stations of that zone can join in the conference on private channel.

Communication between handset and Master control station

The person at the slave station shall press the necessary switch to call the Master station. A red lamp indicating call pending shall light up at the Master station and simultaneously buzzer shall be activated. It shall be possible to mute the buzzer by a switch but the red lamp shall continue to glow till the operator answer the call. Once the call is attended, a green lamp shall glow, which shall go off, when the switch is put in the 'OFF' position.

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Communication Between Masters Control Stations

To initiate a call, the calling station shall operate the selector switch corresponding to the desired station. At the called station, a buzzer shall sound and a lamp corresponding to calling station shall glow. The buzzer can be muted but the lamp stays lighted till the calling party reset his switch. To attend a call, the called party shall also operate the relevant selector switch at his station. The call is now established and communication can now proceed in duplex mode over the handsets. After the call is over, the selector switch at both stations shall be reset to terminate the call. It shall also be possible to have conference facility, if required by calling other stations through relevant switches.

Communication from Master Station:

Master station operator shall be able to select the desired zone by putting the switch for that zone in paging position and talk into his mouthpiece. This announcement shall be heard at all the loud speakers of that zone. A call attention gong tone shall automatically precede all paging announcement. The called party shall go to the nearby Slave station and shall press necessary button to indicate his availability at the call station. The Master station operator shall then put the selector switch in private position and both the parties shall be able to talk on the private channel.

It shall be possible for the Master station operator:-

- To connect two Slave stations for direct communication between two selected zones.
- To hold a conference between the selected Slave stations in different zones and/or the Master station. unmanned by any chance, by putting the switch in the "ALL CALL" mode, each zone should be able to contact other zones without the aid of the Master station operator.
- To introduce an emergency call attention gong which shall sound different from the normal call attention gong, when it is required to draw the attention of the personnel.
- To sound emergency hooter using the necessary switch, through all the zonal station loud speakers overriding all other communication.
- To enable emergency evacuation alarm / siren tone

Communication Between Handsets of different Zone through Master Control Stations

To originate a call between two zones through Master control station, the person of a particular zone shall press the necessary switch to call the Master station. Master station operator shall be able to select the desired zone by putting the switch for that zone in paging position and talk into his mouthpiece. This announcement shall be heard at all the loud speakers of that zone. A call attention gong tone shall automatically precede all paging announcement. The called party shall go to the nearby Slave station and shall press necessary button to indicate his availability at the call station. Master station operator shall connect two Slave stations by putting the selector switch in private position and both the parties shall be able to talk on the private channel. It shall be possible to hold a conference between the selected Slave stations in different zones and/or the Master station.

The central exchange shall have the capacity of future expansion to accommodate additional 10%

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handset stations.

Self-diagnostic facility shall be provided.

The Handset station shall have all solid state component mounted in an enclosure suitable for the environment in which it shall be located and assembled in plug in type module The PA System handset stations shall include the following devices mounted on the front panel:

- Handset hang-up switch.
- Telephone type handset with retractable cord.
- Push button "Page-Party line."
- Push button "All Call."
- Amplifier, handset type, mounted on the back of the panel.
- Amplifier, speaker type, mounted on the back of the panel.
- Amplifier self-aligning plug mounted on the back of the panel.
- Headset jack

Drivers used in hazardous area shall be rated for hazardous classification of the area.

8.0 TECHNICAL PARAMETERS

Sl. no.	Items Technical Particulars	Items Technical Particulars
(i)	Overall Installation Band width (± 3 db)	400-6000 Hz
(ii)	Amplifiers	
a.	Band width (± 3 db)	200-10000 Hz
b.	THD	not more than 1 % at 1 KHz at rated output
c.	Signal to Noise Ratio	60dB
(iii)	Microphones	
a.	Band width (± 3 db)	200-7000 Hz
b.	Type	Noise cancelling type
(iv)	Loudspeakers	
a.	Outdoor	wall/column mounted Horn Type
	Capacity	15W (RMS)
b.	Indoor	wall/column mounted Cone Type
	Capacity	4W (RMS)

All handset stations and their components shall be capable of continuous satisfactory operation at an ambient temperature of 55 degree centigrade. Handset transmitter/receiver shall be noise cancelling type and shall have filters to protect from dust. All switches and push buttons on the handset stations shall be encapsulated contact type.

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9.0 CENTRAL EXCHANGE

Central exchange shall be wide band microprocessor based modular design with all the control and Switching hardware without any moving part. Band width shall be at least 200-10 kHz (± 10) dB. This exchange shall consist of all the necessary control hardware, required for operation, monitoring, protection, indication, switching, testing, measurement of all the voltages and load conditions of the entire system, facility for checking of the operation of all the stations and quality of speech from the master control units etc. All the card etc. shall be plug in type. Solder less termination shall be provided for every wiring. Systems bandwidth shall be at least 200-10 kHz (± 10 dB) and shall not alter frequency response of the open line system. The various oscillators for the ring tone, all tones shall be mounted inside the exchange and shall be complete in all respects. The central exchange shall be enclosed in a freestanding cabinet to be located in control equipment room all the cable entries shall be from bottom only. The working of the system shall be noiseless such that the same can be installed in the office area.

Central control exchange cabinet shall be single front, fabricated out of CRCA sheet steel of 2 mm thickness, dust proof and with swing out assembly of Plug-in card rack. It shall be possible to locate faults by monitoring from the cabinet. All hardware necessary for fault isolation and troubleshooting shall be supplied in the Central control exchange. System shall have provision for sufficient spare zone for future expansion. Suitable hardware and programming tools for communication between any handset of the communication system with Telephone system shall be provided.

10.0 MASTER CONTROL STATION

Master Control Units shall be microprocessor based and of modular design. These units shall be mosaic grid compatible flush mountable/desk mounted type along with flexible goose neck type microphone, luminous miniature push buttons for inter zone communications, alarm tone generation, fire alarm tone generation etc., speaker, selector switches, call registering device, indicating switches, 'ALL CALL' switch, Emergency hooter switch, loud speaker mute switch, Buzzer, Buzzer mute switches and all other associated auxiliaries and accessories.

Master control stations shall have facility for generating and introducing the siren tone in the page channel. The tone generator shall be provided to produce a siren tone (fire alarm signal) that can be inserted into the "All Call" paging channel of the Public Address System.

11.0 DIFFERENT TYPE OF HANDSET STATIONS:

Following types of handset stations will be used:

- a) Type-A: Wall/column mounted station with built-in amplifier and cone type speaker for indoor area. Degree of Protection is IP-52
- b) Type-B: Wall/column mounted station with built-in amplifier and horn type speaker and

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canopy for outdoor area. Degree of Protection is IP-55. For CHP outdoor area, degree of protection is IP-65. Additionally, canopy shall be provided

c) Type-C: Indoor desktop mounted station with cone type speaker. Degree of Protection is IP-32

d) Type-D: Master control station with built-in amplifier and speaker. Degree of Protection is IP-32

e) Type-E: Wall/column mounted explosion proof station with built-in amplifier and explosion proof horn type speaker. Degree of Protection is IP-52.

f) Type-F: Portable station complete with handset, speaker, amplifier, push buttons, indication lamps and coupling cable terminated by a multipin plugs.

g) Type-S: Socket for Portable station. Degree of protection shall be IP 55.

Note: Portable type handsets with multi pin plugs shall be used at certain locations where operational personnel are not present normally. Necessary sockets, wiring, etc. shall be provided at these locations. The location, etc., details shall be finalized during detailed engineering stage & shall be subject to Customer's approval.

The Slave station shall be suitable for wall / column / structure mounting, conventional telephone type complete with sensitive microphone ear piece, coiled cord retractable cable and loud speaker. It shall have push button feedback switches on the front panel for two independent channel namely page and private channel operation along with functional switch necessary control and indication facilities. Each station shall be complete with its own preamplifier, signal processing and power amplifier with provision for future extension.

12.0 AMPLIFIERS

The PAS shall be of distributed amplifier type, i.e. each loudspeaker shall have a separate power amplifier of its own which may be located in the associated handset station enclosure or in a separate enclosure. Amplifiers shall be solid state, class B push-pull type, fully conforming to IS: 1301 and IS: 10426 or equivalent international standard, with modular construction (card type with edge connectors). Each amplifier shall have 0-100% volume control setting with bass cut filter and external short circuit protection. Electronically operated idle power cut-off feature shall be provided for both pre-amplifiers and power amplifiers.

13. LOUD SPEAKERS

Indoor loudspeakers shall be cone type housed in sturdy metal cabinet treated with acoustic undercoats to prevent resonance and shall be suitable for wall/column mounting. Outdoor loudspeakers shall be horn type weatherproof with canopy. The mounting brackets shall be with

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adjustable base suitable for vertical and horizontal orientation. False ceiling type speakers shall be provided for control rooms, where applicable.

Speaker sound density shall be kept higher than the ambient noise.

14. ACOUSTIC HOOD:

The acoustic hood will be provided in noisy area like BFP, turbine, firing floor, mills & PA/ID/FD fans. The acoustic hood will be made of MS material (Minimum 1.6mm thick)/FRP material (3 mm thick), identical to panels, paint finish. The Stations envisaged inside the acoustic hood shall not be provided with canopy. The design noise level within the hood shall be limited to a maximum of 60 dB S.I.L. Please refer Annexure-A for the stations envisaged with acoustic hood.

15. JUNCTION BOXES:

All junction boxes (JB) shall be made of Fibre glass reinforced polyester (FRP) 4 mm thick/ polycarbonate (3mm)/ Al LM6 3 mm thick, door handle, self-locking with common key, door gasket shall be of synthetic rubber & provided with cage clamp type terminal blocks.

16.0 CABLES:

Following power, signal & loudspeaker cables will be used:

- Power cable : 3C-2.5 mm² Cu armoured.
- Signal cable : 4P-0.5 mm² (7/0.3mm) Cu overall screened armoured.
- Loud speaker cable : 2P-0.5 mm² (7/0.3mm) Cu overall screened armoured.

The cable size between MDF to SDF will 24P-0.5 mm² / 12P-0.5 mm² as per requirement.

The power cable & signal cables will be as per main plant cable specification, including the applicable standards.

17.0 CABLE ROUTING:

The PA system cables will be laid in already routed cable trays in different areas of power plant for power & signal cables. Power cable will run in separate trays, similarly the signal cables will run in separate trays.

18.0 SIGNAL LOOP LENGTH:

The signal loop length will be around 2.5 KM in unit area, around 8 KM in coal handling plant area and around 10 Km in common plant area from the central exchange. The distance between two stations in areas other than unit may be more than 1 KM. Necessary repeaters, power supply modules etc. will be provided to meet the requirement of the same.

19.0 COLOUR OF EQUIPMENT

Paint shades of central exchange shall be subjected to BHEL/customer approval during contract stage without commercial implications. For all other equipment, paint shade shall be as per

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manufacturer's standard practice. All painting shall be through powder coated epoxy base paint.

20.0 PA system shall be have provision for interfacing with EPABX telephone exchange system so that it shall be possible to communicate with any station in any zone through master control unit from a telephone

21.0 Bidder shall furnish separately the power supply requirements (in watts) for both central exchanges along with different stations attached to each exchange to decide the feeder size.

22.0 Design engineering includes submission of data sheets of each equipment along with GA drawings, technical write-up of the system, schemes & interconnection dwgs as per equipment layout in different zones, various schedules and bill of material. Mounting arrangement drawings of different equipment, testing & commissioning guidelines, operation & maintenance manuals for complete system.

23.0 Makes of equipment/components shall be subject to BHEL/OWNER approval during detailed engineering. However, bidder shall furnish the list of makes along with the offer.

24.0 After completion of work at site, bidder shall prepare "As built and O & M Manuals'. The number of copies of document/data to be submitted as distribution print shall be NIT.

25.0 INSPECTION & TESTING

25.1 All equipment shall be subjected to routine test as per relevant standards.

25.2 A sample copy of Quality Plan (doc. No. PE-QP-999-557-E001 REV 03) is enclosed (as Annexure-3) with the specification for compliance. During detailed engineering, the successful bidder shall furnish this QP for purchaser/customer approval. The changes in the Quality Plan (QP) during customer approval shall be incorporated by vendor without any implication on cost and delivery to BHEL.

25.3 The bidder shall furnish the certificates for type tests as specified in the specification (Annexure A to QAP (doc. No. PE-QP-999-557-E001 REV 03)) for purchaser/customer review/acceptance. If type tests certificates are found non-satisfactory then the bidder has to carry out the type test without any price and delivery implication to BHEL.

25.4 Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished. For all components / materials, for which Type tests have not been specified in the specification, only type test reports shall be furnished by the bidder. In absence of such type tests reports or in case such reports are not found to be meeting the specification/standards requirements, bidder shall conduct, free of cost to the purchaser, all such type tests according to the relevant standards and reports shall be submitted to

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the owner for approval.

For the various bought out item test certificates from equipment Manufacturer shall be furnished.

25.5 DOCUMENTS TO BE FURNISHED BY THE SUCCESSFUL BIDDER in addition to those specified in Section II. GA Drawings with applicable technical details and other drawings/documents as per attached drawing schedule (Annexure 2) shall be furnished after award of contract.

ANNEXURE-2

2x660 MW UDANGUDI STPP - PA SYSTEM [LIST OF DOCUMENTS & NUMBERING]

Sl.No	BHEL DRAWING NO.	TITLE	CATEGORY
1	PE-V0-435-557-E001	DATA SHEET FOR PA SYSTEM	PRIMARY
2	PE-V0-435-557-E002	SYSTEM DESCRIPTION WITH CABLES & EARTHING DETAILS	PRIMARY
3	PE-V0-435-557-E003	PA SYSTEM O&M MANUAL	SECONDARY
1	PE-V0-435-557-E101	GA OF CENTRAL EXCHANGE (WITH INTEGRATED MDF/MJB) FOR UNIT & COMMON AREA	PRIMARY
2	PE-V0-435-557-E102	GA OF CENTRAL EXCHANGE (WITH INTEGRATED MDF/MJB) FOR CHP AREA	PRIMARY
3	PE-V0-435-557-E103	GA OF DESKTOP MOUNTED STATION	PRIMARY
4	PE-V0-435-557-E104	GA OF MASTER CONTROL STATION	PRIMARY
5	PE-V0-435-557-E105	GA OF WALL/COLUMN MOUNTED FIELD CALL STATION	PRIMARY
6	PE-V0-435-557-E106	GA OF WALL/COLUMN MOUNTED FIELD CALL STATION IN PILFER PROOF ENCLOSURE	PRIMARY
7	PE-V0-435-557-E107	GA OF EXPLOSION PROOF HANSET STATION WITH HORN TYPE LOUDSPEAKER	PRIMARY
8	PE-V0-435-557-E108	GA OF PORTABLE STATION	PRIMARY
9	PE-V0-435-557-E109	GA OF SOCKET FOR PORTABLE STATION	PRIMARY
10	PE-V0-435-557-E110	GA OF 4W CONE TYPE LOUD SPEAKER	PRIMARY
11	PE-V0-435-557-E111	GA OF 15W HORN TYPE LOUD SPEAKER	PRIMARY
12	PE-V0-435-557-E112	GA OF SIGNAL LINE BOOSTER	PRIMARY
13	PE-V0-435-557-E113	GA OF SUB DISTRIBUTION FRAME (SDF) 24 PAIRS	PRIMARY
14	PE-V0-435-557-E114	GA OF EXTENSION AMPLIFIER	PRIMARY
15	PE-V0-435-557-E115	GA OF SOUND PROTECTING ACOUSTIC HOOD	PRIMARY
16	PE-V0-435-557-E116	GA OF CANOPY FOR FIELD STATION	PRIMARY
17	PE-V0-435-557-E117	GA OF POWER DISTRIBUTION BOX	PRIMARY
18	PE-V0-435-557-E118	GA OF POWER JUNCTION BOX	PRIMARY
19	PE-V0-435-557-E119	GA OF SIGNAL JUNCTION BOX	PRIMARY
20	PE-V0-435-557-E120	GA MOUNTING ARRANGEMENT DWG	PRIMARY
1	PE-V0-435-557-E201	QUALITY PLAN FOR PA SYSTEM	PRIMARY
1	PE-V0-435-557-E301	BLOCK DIAGRAM FOR PA SYSTEM	SECONDARY
2	PE-V0-435-557-E302	INTERCONNECTION DIAGRAM FOR PA SYSTEM	SECONDARY
3	PE-V0-435-557-E303	CABLE LISTING FOR PA SYSTEM	SECONDARY
1	PE-V0-435-557-E401	TYPE TEST PROCEDURES FOR PA SYSTEM	PRIMARY
2	PE-V0-435-557-E402	TYPE TEST REPORTS FOR PA SYSTEM	SECONDARY

ANNEXURE-3**PA SYSTEM-PACKING SPECIFICATION**

1. Packing procedure shall conform to the following.
 - i) The equipment shall be properly packed before dispatch. The packing shall be capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of site storage in adverse weather condition are required. Workmanship and material used shall be of high standards meeting the technical requirement.
 - ii) The equipment shall be wrapped in weather proof packing using polythene sheets/ air bubble sheets/ thermocol sheets and then secured in Carton boxes / wooden packing cases. Further, carton boxes/ packing cases of smaller item shall be clubbed & packed finally in wooden box. Suitable cushioning material like rubberised coir shall be provided in the gap between items and casing.
 - iii) Wood for wooden packing cases/ crates shall be fir, chir, silver oak (gravilea robusta), (Normally wood for Wooden crates will be pinewood, fir, chir, silver oak without any bends, cracks and splits.)
 - iv) Central Exchange / MDF / SDF / PDB etc. shall be secured by fixing base plate/ frame with the help of bolt and nuts, etc. to bottom frame of the wooden packing cases/ crates.
 - v) Detailed case wise packing list in water proof envelope shall be inserted in each package together with equipment/material. One copy of 'Detailed Packing List' shall be fastened outside of the package in waterproof envelope
2. Specification for the sea worthy packing, if enclosed, for the export jobs shall form part of the specification.

Note: In case Manufacturer has a different packing standard which is equivalent or better same to be submitted for approval during contract stage.

	PUBLIC ADDRESS SYSTEM Datasheet A	SPECIFICATION NO. PE-TS-435-557-E001 VOLUME IIB SECTION D REV 0 DATE 24/03/2021 SHEET 1 OF 3	
S.No.	Description	Unit	Data
1	SYSTEM DESIGN DATA		
1.1	Design ambient temperature	deg C	50
2	POWER SUPPLY		
2.1	AC Normal Supply		
i	Rated voltage	V	240V AC
ii	Rated frequency	Hz	50Hz
iii	Voltage variation	%	±10%
iv	Frequency variation	%	±5%
v	Combined voltage & frequency variation (sum of absolutes)	%	10%
2.2	AC UPS		
	Rated voltage	V	240V AC
	Rated frequency	Hz	50Hz
	Voltage variation	%	±10%
	Frequency variation	%	±5%
	Combined voltage & frequency variation (sum of absolutes)	%	10%
3	EARTHING		
3.1	Type		
3.2	Size		
3.3	Type of power cable for earthing		GI Wire (for central Exchange & Power distribution box) and 3rd core of power cable (for handset stations).
4	SYSTEM REQUIREMENTS		
4.1	Frequency response	Hz	400-6000Hz (±3 dB)
5	CENTRAL EXCHANGE		
5.1	Capacity (Main area & CHP area)	Lines	As per Annexure-1A
5.2	Frequency response	Hz	200 -10000Hz (±10 dB)
5.3	Rated voltage / frequency		230V 50Hz AC UPS
5.4	Central Exchange Interior and exterior paint		Grey RAL 7032/Glossy white
5.5	Any misc. item		Integrated MDF/MDB
5.6	Degree of protection		IP-32
5.7	Material		CRCA sheet steel, 2mm thick minimum
6	MASTER/DESKTOP STATION		
6.1	Type of protection		Electronic circuit protection
6.2	Material		High impact polystyrene or equivalent / ABS plastic/CRCA sheet
6.3	Colour		As per manufacturer's standard practice
6.4	Degree of protection		IP-32 (min)

	PUBLIC ADDRESS SYSTEM Datasheet A	SPECIFICATION NO. PE-TS-435-557-E001 VOLUME IIB SECTION D REV 0 DATE 24/03/2021 SHEET 2 OF 3	
	7 HAND SET STATION		
7.1	Gain	dB	50 dB
7.2	Microphone		
	Type		Noise cancelling type
	Frequency response		200- 7000Hz (±3 dB)
7.3	Receiver type		High efficiency dynamic type
7.4	Enclosure material, thickness		■ Al (3 mm) ■ FRP (4 mm) ■ PVC (3 mm) ■ high impact polystyrene or equivalent
7.5	Degree of protection		IP52 for indoor, IP-55 with canopy for outdoor (IP-65 with canopy for CHP outdoor area)
7.6	Paint shade		As per manufacturer's standard practice
7.7	Type of mounting		Wall / column mounting
7.8	Canopy		For outdoor handset only
	8 AMPLIFIER		
8.1	Class		Class-B push-pull type
8.2	Frequency response		200 -10000 Hz (±3 dB)
8.3	Total harmonic distribution at 1000 Hz		Less than or equal to 1%
8.4	Signal to noise ratio		60dB(min)
8.5	Supply voltage		230 V AC
8.6	Enclosure material, thickness		Aluminium, 3 mm / FRP 4 mm
8.7	Degree of protection		IP-55
8.8	Paint shade		As per manufacturer's standard practice
	9 HORN TYPE LOUD SPEAKER		
9.1	Power Handling capacity		15 watts (rms) minimum
9.2	Frequency response		500-4500 Hz (±3 dB)
9.3	Sound pressure level at 1kHz at 1Mtr		102 Db (min)
9.4	Bell diameter		10 inch minimum
9.5	Enclosure material		18 SWG Aluminium (Spin)
9.6	Degree of protection		IP-55 for main plant area , IP-65 for CHP area
9.7	Paint shade		As per manufacturer's standard practice
	10 CONE TYPE LOUD SPEAKER		
10.1	Power Handling capacity		4 watts (rms) minimum
10.2	Frequency response		200-7000 Hz (±3 dB)
10.3	Sound pressure level at 1kHz at 1Mtr		84 dB (min)
10.4	Enclosure material		16 SWG MS sheet (Spin)
10.5	Degree of protection		IP-52
10.6	Paint shade for all areas		Shall be decided during detailed engg
10.7	Paint shade for CCR/EER		Shall be decided during detailed engg
	11 JUNCTION BOX(POWER/SIGNAL)		
11.1	Degree of protection		IP- 55
11.2	Enclosure material & thickness		■ polycarbonate (3mm) ■ Di-cast aluminium – LM6 (3mm) ■ FRP (4mm)
11.3	Paint shade		As per manufacturer's standard practice

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12	POWER DISTRIBUTION BOX		
12.1	Capacity		2 inputs (Auto change over switch) & 12 outputs
12.2	Enclosure material		16 SWG MS Sheet
12.3	Degree of protection		IP-55
12.4	Paint shade		As per manufacturer's standard practice
12.5	Paint finish		Powder coated, textured
12.6	MCB provided		Yes
13	SIGNAL LOOP LENGTH		
13.1	Unit area	km	4
13.2	CHP/LHS area	km	8
13.3	Common area	km	10
14	SUB- DISTRIBUTION FRAME (SDF):		
14.1	No. of pairs		24 pairs
14.2	Material of enclosure & thickness		14 SWG MS Sheet
14.3	Degree of protection		IP-55
15	ACCOUSTIC HOOD		
15.1	Material, thickness		MS 1.6 mm thick/FRP 4mm thick

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S.NO.	DESCRIPTION	PARTICULARS	UNIT
1.0	SYSTEM DESIGN DATA		
1.1	Design ambient temperature	:	°C
2.0	APPLICABLE STANDARDS		
2.1	Whether all standards specified in Annexure I of Data Sheet A followed	: ☐ Yes ☐ No	
3.0	COMPLETE SYSTEM REQUIREMENTS		
a)	Frequency response	:	Hz
b)	Hum & noise level or signal to noise level	:	
4.0	SCOPE OF SYSTEM DESIGN ENGINEERING	: ☐ Included ☐ Excluded	
5.0	POWER SUPPLY		
5.1	Whether the system suitable for operation for power supply details given in specification and Data Sheet A.	: ☐ Yes ☐ No	
5.2	Power supply requirement at 240V AC	:	kVA
6.0	CONSTRUCTIONAL REQUIREMENTS		
6.1	AMPLIFIERS (To be furnished separately for each type of amplifier)	: Pre-Amplifier Line Amplifier Loud Speaker Amplifier	
a)	Name of the manufacturer	:	
b)	Type and manufacturer's catalogue no.	:	
c)	Power supply details	:	
d)	Full load consumption(VA)	:	
e)	Rated load/ (W/Ohm) output impedance	:	
f)	Max. ambient conditions	:	
g)	Output voltage (V)	:	
h)	Frequency response (Hz)	:	
i)	Total harmonic (%)	:	
j)	Noise level (db)	:	
k)	Power band width (Hz)	:	
l)	Construction	:	
m)	Controls provided		
i.	Cont. variable volume control	: ☐ Yes ☐ No	



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S.NO.	DESCRIPTION	PARTICULARS	UNIT
	ii. Standby and idle time power supply cut-off arrangement arrangement	: ☐ Yes ☐ No	
	iii. Bass & treble control	: ☐ Yes ☐ No	
	n) Sensitivity w.r.t. (mV) nominal output	:	
	o) Output connections	:	
	p) Indications	:	
6.2	HANDSETS		
6.2.1	Master Handset Station(s)		
	a) Name of the manufacturer	:	
	b) Type and manufacturer's catalogue no.	:	
	c) Material	:	
	d) Degree of protection	:	
	e) Surface treatment	:	
	f) Whether all features provided on master handset station as per specification requirements	: ☐ Yes ☐ No	
	g) Type of circuit protection	:	
	h) Mounting arrangement	:	
	i) Dimensions (L*D*H)	:	mm
	j) Weight	:	kg
6.2.2	HANDSETS (To be furnished separately for each type)	Outdoor/ Indoor Wall mtd	Indoor desk mtd
	a) Name of the manufacturer	:	
	b) Type and manufacturer's catalogue no.	:	
	c) Material	:	
	d) Impedance of the transmitter	:	Ohm
	e) Frequency response of the transmitter	:	Hz
	f) Impedance of the receiver	:	Ohm
	g) Receiver output	:	mV
	h) Receiver frequency response	:	Hz
	i) Details of provision for noise cancellation features	:	
	j) Details of provision for directional features	:	
	k) Whether all features provided on handset station as per	: ☐ Yes ☐ No	



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S.NO.	DESCRIPTION	PARTICULARS	UNIT
	specification requirements		
	l) Degree of protection	:	
	m) Surface treatment	:	
	n) Mounting	:	
	o) Dimension with control box (L*D*H)	:	mm
	p) Weight	:	kg
6.3	LOUDSPEAKERS (To be furnished separately for each type)	Reentrant	Cone
	a) Name of the manufacturer	:	
	b) Type and manufacturer's catalogue no.	:	
	c) Material	:	
	d) Degree of protection	:	
	e) Surface treatment		
	i. Exterior surface	:	
	ii. Interior surface	:	
	f) Impedance matching volts (Transformer details)	:	Ohm
	g) Output power		
	i. rms	:	Watt
	ii. Peak	:	Watt
	h) Frequency response	:	Hz
	i) Cut-off frequency	:	Hz
	j) Sound level at 1000 Hz db/watt mtr. distance	:	
	k) Controls provided	:	
	l) Bell diameter	:	mm
	m) Acoustic length	:	mm
	n) Dispersion angle	:	Deg.
	o) Speaker diameter	:	mm
	p) Weight	:	kg
6.4	MAIN DISTRIBUTION BOX		
	a) Name of the manufacturer	:	
	b) Type	:	
	c) Construction	:	
	d) Material	:	
	e) Sheet steel thickness	:	mm
	f) Number of ways	:	
	g) Degree of protection	:	
	h) Surface treatment	:	
	i) Dimensions (L*D*H)	:	mm
6.5	JUNCTION BOX (to be furnished separately for each type)	JB-1 JB-2	JB-3
	a) Name of the manufacturer	:	
	b) Type	:	
	c) Construction	:	
	d) Material	:	
	e) Sheet steel thickness	:	mm

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S.NO.	DESCRIPTION	PARTICULARS	UNIT
	f) Number of ways	:	
	g) Degree of protection	:	
	h) Surface treatment	:	
	i) Dimensions (L*D*H)	:	mm
6.6	COMMON REQUIREMENTS OF VARIOUS EQUIPMENTS		
6.6.1	Surface Treatment		
	a) If painted;		
	i. Application	:	
	ii. Colour of paint		
	1. Inside	:	
	2. Outside	:	
	iii. Minimum thickness	:	microns
	b) If galvanized;		
	i. Method	:	
	ii. Applicable Standard	:	
	iii. Minimum thickness	:	microns
	of zinc deposit on		
	all points		
	iv. Weight of zinc	:	g/m ²
6.6.2	Labels		
	a) Material	:	☐ Anodised Aluminium ☐ Stainless Steel
6.6.3	Earthing		
	a) Name of the manufacturer	:	
	b) Type	:	
	c) Size	:	mm
	d) Details of earthing arrangement	:	
7.0	OTHER MAJOR EQUIPMENTS OF SUPPLY		
7.1	CABLES (To be furnished separately for each type of cable)		
7.1.1	Applicable Standard IS:1554 Part 1 & IS:694(In general)	:	☐ Yes ☐ No
7.1.2	Name of the manufacturer for		
	a) Power cable	:	
	b) Signal cable	:	
	c) Loud Speaker cable	:	
7.1.3	Whether FRLS type cable provided for		
	a) Power cable	:	☐ Yes ☐ No
	b) Signal & loud speaker cable	:	☐ Yes ☐ No



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S.NO.	DESCRIPTION	PARTICULARS	UNIT
7.1.4	Voltage Grade for		
	a) Power cable	:	Volts
	b) Signal & loud speaker cable	:	Volts
7.1.5	Conductor		
	a) Material		
	i. Power cable	:	
	ii. Signal & loud speaker cable	:	
	b) No. of pairs/cores, conductor cross sectional area, no. of strands and dia. of each strand for		
	i. Power cable	:	
	ii. Signal cable	:	
	iii. Loud Speaker cable	:	
7.1.6	Insulation		
	a) Material	:	
	b) Application	:	
	c) Volume resistivity	:	
7.1.7	Identification of cores/pairs		
	a) Power cables, Control cables upto 5 core & Paired cables	:	
	b) Control cables above 5 core	:	
7.1.8	Paired cables		
	a) Min. number of twists per metre for paired cables	:	
7.1.9	Inner sheath		
	a) Material	:	☐ Type ST1 ☐ Type ST2
	b) Whether FRLS	:	☐ Yes ☐ No
	c) Fillers provided	:	
	d) Material of filler	:	
	e) Method of application	:	
	i. with fillers	:	☐ Pressure Extruded ☐ Vacuum Extruded
	ii. without fillers	:	
7.1.10	Armour	:	
7.1.11	Outer sheath		
	a) Material	:	☐ Type ST1 ☐ Type ST2
	b) Application	:	
	c) Colour	:	
7.1.12	Characteristics of FRLS sheath		



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S.NO.	DESCRIPTION	PARTICULARS	UNIT
	a) Oxygen index (min.)	:	
	b) Temp. index (min.)	:	
	c) Acid gas generation (max.)	:	
	d) Smoke density rating (max.)	:	
7.1.13	Progressive sequential length marking provided on outer sheath	: ☐ Yes ☐ No	
7.2	CONDUITS		
	a) Name of the manufacturer	:	
	b) Type	:	
	c) Gauge	:	
	d) Size	:	mm
7.3	ITEMS OF SUPPLY FOR CABLING INSTALLATION WORK		
7.3.1	Cable Glands		
	a) Type	: ☐ Single compression ☐ Double compression	
	b) Whether Nickel plating done	: ☐ Yes ☐ No	
8.0	DOCUMENTATION		
	Whether following documents enclosed :		
	a) Full description and design of the equipment and its operation.	: ☐ Yes ☐ No	
	b) Dimensional and mounting details of all equipments.	: ☐ Yes ☐ No	
	c) General arrangement drawings for handset station (all types), loud speakers (all types), JB's, Auto changeover Box, distribution box etc.	: ☐ Yes ☐ No	
	d) Auto changeover switching scheme.	: ☐ Yes ☐ No	
	e) Bill of quantities of cables, JB boxes, conduits etc.	: ☐ Yes ☐ No	
	f) Detailed write up on the method of testing.	: ☐ Yes ☐ No	
	g) Copies as specified in Section C of all test certificates for the tests actually conducted on the equipment.	: ☐ Yes ☐ No	
	h) Final Quality Plan (enclosed in Vol III)	: ☐ Yes ☐ No	
	i) Field quality plan	: ☐ Yes ☐ No	

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SUPPLY



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1.0 GENERAL

- 1.1 The scope of this specification covers engineering, design, manufacturing, inspection & testing at works, packing, supply, delivery, unloading and handling at site of Public Address System for efficient and trouble free operation after installing the same at site.
- 1.2 Engineering: The “Engineering” shall broadly cover the detailed design of PA System as per the requirements of this specification, selection of equipment, materials, estimation of quantities etc. and preparation of all drawings necessary for the erection of the system. Complete engineering shall be as per the guidelines of purchaser and shall be subject to the approval.
- 1.3 It is not the intent to specify complete details of design and construction of equipment. However, the equipment shall conform in all respects to acceptable standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser, who shall be entitled to reject any work or materials, which in his opinion is not in conformity with the duty requirements.
- 1.4 Review of the bidder’s documents by the purchaser shall not relieve the bidder from his responsibility for the design and supply.
- 1.5 The Bidder shall guarantee satisfactory performance of the equipment under stipulated variations of voltage and frequency. The design and manufacture shall be such that equipments/components of same type and rating shall be interchangeable.
- 1.6 Bill of Quantities is enclosed in NIT.
- 1.7 Exclusions: Unless mentioned otherwise in NIT,
- 1.7.1 Civil foundations of central exchange, main distribution frames, main distribution boards & civil works like foundations and cable trenches are excluded from the scope of bidder.
 - 1.7.2 Supply of Armoured/ unarmoured power cables, screened control cables
 - 1.7.3 laying of cables, conduits and grounding materials
- 1.8 In case of any deviation, the bidder shall indicate the same clause-by-clause in the enclosed “Schedule of Deviations”. In the absence of duly filled schedule it will be construed that the bid conforms strictly to the specification.

2.0 CODES AND STANDARDS

- 2.1 The equipment covered under this specification shall be designed, constructed and tested in accordance with latest revisions of applicable codes/ standards.
- 2.2 The equipments furnished under this specification shall conform to the latest revisions of the following standards.
- | | |
|---------|--|
| IS10426 | PA System amplifiers-recommendations for minimum performance requirements and PA System amplifiers-recommendations for general requirements. |
| IS1882 | PA system-code of practice for out door installations. |
| IS1881 | Indoor amplifying and sound reinforcement system-code of practice for installation. |
| IS1031 | Method of measurements on loudspeaker and loud speakers systems. |
| IS2382 | Recommended mounting dimensions of loud speakers. |



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- IS9302 Characteristics and Methods of Measurement for sound System equipment.
- IS616 Code of safety requirement for mains operated electronic and related apparatus.
- IS7741 Specification for loudspeaker.
- IS13947 Degrees of protection provided by enclosures for low voltage switchgear and control gear.
- IS9537 Specification for conduits for Electrical (Part-I, II) installation/wiring

Equivalent IEC in lies of IS are also acceptable.

The system shall be adequately protected from signal and power line noise and meet the Surge Withstand Capability (SWC) requirements of ANSI C37.90 A/IEEE standard 472-1989 equivalent.

3.0 DESIGN REQUIREMENTS (CONCEPTUAL VIEW)

- 3.1 The PA system shall essentially comprise of a number of communication handset stations each of which will be provided with a telephone handset, amplifier, hook micro-switch (if provided, will be spring return to normal type), loudspeaker muting switch (spring return to normal or push button type Volume control, any other associated equipment and the loud speaker.
- 3.2 The PA system shall be of two channel open type having facilities for simultaneous communication on two modes namely 'PAGING' and 'PRIVATE' without any interference.
- 3.3 On the PAGING MODE, conversation shall be heard over the loud speakers for all to hear and this shall normally be used to locate people and also to convey messages of general nature.
- 3.4 On the PRIVATE MODE, conversation shall not be heard over the loud speakers, but it shall be carried over the telephone handsets. This mode shall be used for actual conversation, exchange of information and issue of specific instructions.

3.5 ZONE WISE DISTRIBUTION OF SYSTEM

The central exchange type PA system shall comprise of a number of separate zones as specified in section-I. The various zones shall be connected with a central exchange to be located In Control room/Control Equipment room. There will be a corresponding number of master control stations. Each zone shall have number of subscriber stations. Each station can do conversation with other stations and with master control station.

3.6 Communication within a zone

- 3.6.1 It shall be possible to make a paging call by lifting the hand set hook switch / hand free mode by pressing the page switch on all call / selected group basis. This shall initiate a call attention tone to be transmitted to all the speakers and gets off automatically after a preset time. The paging message shall then be transmitted over all the loudspeakers when the paging person shall speak in the microphone of the handset. While paging under this channel it shall be possible to mute the loudspeaker near the paging handset to eliminate the acoustic feed back. The page switch shall then be released to allow the paged person to come to the nearest hand set station. After lifting the handset off the hook of the nearest handset station it shall be possible for the paged persons to carry on the conversation on the private mode with the party. The system shall have the conference facility in either of the channels by any no. of persons by simply lifting the handset off the hook and selecting the required channel.



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3.6.2 The system shall have minimum following features:

- Normal call- Communication between two handsets within(ref S.N. 3.4 Above)
- Paging-Ref S.N. 3.3 above
- All call- All the field stations terminated on the MCD can be contacted by using this feature. Group call- More than two handsets should be able to join the conversation
- Priority call- Reset feature on MCD, using this feature an existing conversation can be superseded for making any emergency announcement
- Interfacing facility with existing PA system/EPBAX System

3.6.3 Unless requested to be routed through the central exchange, announcements/ communication within a zone shall not be audible in other zones.

3.7 Interzone communication

3.7.1 Each of the zones shall be connected to a central exchange.

3.7.2 For sub-zones of zone, all the communication facilities like paging and party mode communication as described above between the two sub-zones shall be possible as if any have now become a single zone.

3.7.3 It shall be possible to communicate from a station in one zone to another station of different zone through a master control unit to be located on unit control desk. Another master control unit, in parallel with earlier ones, shall be located in shift in-charge room. Further, suitable interface with telephone exchange (existing/new) shall be provided so that it shall be possible to communicate with any station in any zone through master control unit from any telephone set. The central exchange shall have the capacity of future expansion in number of stations, as specified in section-I. Diagnostic facility of individual equipment shall be provided.

4.0 POWER SUPPLY AND GROUNDING

4.1 Unless specified otherwise in Data Sheet-A, the system shall be suitable for operation from 240V AC 1-phase UPS supply. There will be two feeders of 240V AC 1-phase UPS supply. In event of failure of one UPS supply, it will switch automatically to another UPS supply.

4.2 All panels, desks, cabinet shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted / welded to the panel structure and efficiently ground the entire structure.

4.3 If microprocessor control, monitoring and information system or backup control system requires its own unique and isolated grounding requirements, then these requirement should be clearly stated and shall be provided, so as to ensure proper operation of the above mentioned system.

4.4 Connections of cables and changeover facility for power supply connections shall be the scope of the vendor.

5.0 SYSTEM DESIGN ENGINEERING

5.1 ENGINEERING INPUTS: Complete engineering shall be done by the vendor on the basis of following documents to be furnished by purchaser:



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- a) Area wise allocation of handsets & loudspeakers and their type.
- b) Layout drawings of areas.

5.2 ENGINEERING OUTPUTS: Vendor shall prepare and submit following documents and drawings for purchaser's approval:

- a) Technical write-up (system Description).
- b) Bill of quantities for all items.
- c) GA drawing cum technical datasheet of all the equipments as per BOQ.
- d) Mounting arrangement drawings.
- e) Interconnection diagram showing the interconnection among Main Distribution Box, Master Handset Station, JBs, Handsets, Loud Speakers and also covering the sizes of cable.
- f) Conductor sizes of cables and wires with voltage drop calculations.
- g) Cable schedule.
- h) Testing and commissioning guidelines
- i) O& M Manuals
- j) Type test report
- k) Test procedure if required

6.0 CONSTRUCTIONAL FEATURES

Public Address system shall comprise of central exchange, Handset stations, master control stations along with their associated distributed amplifier and loud speakers, Main distribution box/Junction box, a number of communication handset stations along with their associated loud speakers and other associated equipment. Details of each of these and other items required to make the system complete are furnished below.

6.1 CENTRAL EXCHANGE

Microprocessor controlled electronic exchange unit is stored programme controlled (SPC) unit with distributive processing. Switching shall be fully digital using Time Division Multiplexing (TDM) and Pulse Amplitude Modulation (PAM)/Space switching technique. The fully digital switching provides higher number of simultaneous communication links, better reliability, advanced features with no cross talk and other problems related to conventional systems.

The electronic exchange is a central control unit (CCU) comprising of rack, power supply arrangement, and control processors with control wiring. In the CCU, microprocessor controls the operation and power supplies of the system. Central Exchange shall have modular type construction for the purpose of easy expansion, maintenance, operation and fault detection. The racks are the modular mechanical structures mounted in a cabinet.

Central exchange shall be wide band microprocessor based modular design. This exchange shall consist of all the necessary control hardware, required for operation, monitoring, protection, indication, switching, testing, measurement of all the voltages and load conditions of the entire system, facility for checking of the operation of all the stations and quality of speech from the master control units etc. All the card etc. shall be plug in type. Solder less termination shall be provided for every wiring. Systems bandwidth shall be at least 200-10 kHz (± 10 dB) and shall not alter frequency response of the open line system. The various oscillators for the ring tone, all tones shall be mounted inside the exchange and shall be complete in all respects. The central exchange shall be enclosed in a freestanding cabinet to be located in control equipment room all the cable entries shall be from bottom only. The working of the system shall be noiseless such that the same can be installed in the office area.

Further, all the programming tools that will be required to program/reprogram the system shall also be provided.



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Unless otherwise specified in Section I, Main Distribution Frame (MDF) /MJB as specified below at 6.2 shall form part of the central exchange cabinet i.e. Central exchange shall be suitable for terminating signal cables directly from Handset stations.

SCHEME I:

6.2 MAIN DISTRIBUTION FRAME (MDF)

- 6.2.1 The main distribution frame (MDF) shall consist of two sides. On one side the cables from exchange equipment shall be brought and terminated, on the other side the cables from extension stations are brought and terminated. Thus providing interconnections through jumper wires. The MDF connectors shall have screwless cage clamp (WAGO) type terminals.
- 6.2.2 The MDF shall be suitable for wall/floor mounting and shall be flexible by way of connecting any extension line to any other exchange line.
- 6.2.3 The MDF shall be complete with fuse mountings and shall be fitted with delayed action fused on the extension side. It shall be complete with requisite number of test jack assemblies on the exchange side.
- 6.2.4 The MDF shall be dust proof and shall be suitable for floor/ wall mounting along with all facilities and hardware. The mounting shall be done by means of nuts and rawl plug of appropriated size. Degree of protection shall be IP-55.

6.3 SUB-DISTRIBUTION FRAME (SDF)

- 6.3.1 The sub-distribution frame (SDF) shall be of 24 pairs with screwless cage clamp (WAGO) type terminals module. SDF shall be of minimum 14 SWG MS sheet enclosed over suitable angle iron framework with base channel, pedestal etc as required for outdoor installation with flush/wall mounting arrangement. Degree of protection shall be IP-55.

SCHEME II :

6.4 MAIN JUNCTION BOX

- 6.4.1 Main Junction Box shall have provision for cable termination for looping of handsets. Handsets with in zone are connected in serial connection and will be terminated to MJB. The MJB will establish link between handsets and central exchange.
Maximum 10 No's handset can be connected in one serial connection of MJB with limitation upto 1.5Km loop length exceeding which signal line booster shall be provided.

6.5 DISTRIBUTED AMPLIFYING SYSTEM

The amplifier system shall be distributed type i.e. each handset station/ loudspeaker shall have its own preamplifier, line amplifiers (wherever required, shall be provided for long line signal transmission) and power amplifiers to suit the loudspeaker capacity. The system shall be as below:

- a) Unit amplifying system shall be designed to deliver the wattage of connected load in the unit system.
- b) The amplifiers shall be designed for high quality amplification. The amplifiers shall be class-B push-pull type as per IS616, IS10426 or equivalent and the range of frequency response shall not make the amplifiers liable to pick up low and high frequency noise which might disturb the original speech reproduction. Frequency response shall be as per Data Sheet A.



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- c) The amplifiers shall be heavy-duty type.
- d) The amplifiers shall be of solid-state electronic type and compact in construction.
- e) Pre-amplifying stages shall be furnished to make it suitable for operation with low level input such as microphone.
- f) Suitable arrangement shall be provided for amplifiers as well as preamplifier, to cut down the power requirement during standby or idling time in order to minimise open line hum as well as unnecessary loss of power.
- h) Controls to be provided.
 - i. 0 - 100% volume control setting with facility of coarse and fine setting.
 - ii. Input sensitivity control.

All these controls shall be located inside the handset station.
- i) Wherever a number of loud speakers are connected to one handset, suitable amplifier shall be provided.
- j) Amplifier set of a handset station shall be complete with power amplifier, voltage stabiliser, mike preamplifier, etc. and housed in the control box of handset station.
- k) The various amplifiers shall be modular in construction (preferably card type edge connectors) for ease of maintenance and trouble shooting.

6.6 HANDSET STATIONS

6.6.1 The following type of handset stations shall be offered as per BOQ:

- a) Desk mounted master type
- b) Desk mounted indoor type
- c) Wall/ Column mounted indoor type
- d) Wall/ Column mounted outdoor type
- e) Portable handsets

6.6.2 Facilities

- a) Master Station:

Master Control Units shall be microprocessor based and of modular design. These units shall be mosaic grid compatible flush mountable/table mounted type along with flexible goose neck type microphone, luminous miniature push buttons for interzone communications, alarm tone generation, fire alarm tone generation etc.

However, master control unit for CHP zone (if required) shall be table/desktop monitoring type.

The master station of each group shall have following operational features:

- i. Originate calls within its own group on "Normal" as well as on "Priority" basis.
- ii. Communicate with handset stations of a particular group.
- iii. Call handset stations of all groups on "All Call Basis".
- iv. Facility for generating and introducing the siren tone in page channel.

- b) Handset Station:

Each of the handset stations shall have the following facilities:

- i. Originate and receive calls within its own group.
- ii. Receive calls from any of the group masters.
- iii. Communicate with handset stations as well as the group master of other group via his group master station.



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Each handset station shall have following:

- (i) One (1) - telephone handset.
- (ii) One (1) - Cradle switch for resetting the handset.
- (iii) One (1) - “Press to Page” push button.
- (iv) One (1) - “Press to Mute Loudspeaker” push button.
- (v) Pre-amplifier and Power amplifier.
- (vi) Indication for “A.C. SUPPLY ON”.
- (vii) Indication for “PARTY CHANNEL BUSY”.

6.6.3 Material

- a) The desk/ wall mounted indoor handsets shall be of elegant look and be made of die cast aluminium/ mild steel/ fibre glass/ reinforced polyester or any other material subject to prior approval of purchaser.
- b) Wall mounted outdoor handsets shall be made of high impact polystyrene/ fibre glass/ reinforced polyester or any other suitable material to prevent it from breaking due to fall or rough handling etc.
- c) However the material of handsets shall be subject to purchaser’s approval.

6.6.4 The outdoor wall/ column mounted handsets shall be of weatherproof construction and shall be provided with neoprene gaskets. Suitable pilfer protection of wall/ column mounted handset stations shall be provided with the help of internal anchoring bolts and special (e.g. triangular) screws which can be operated only by special spanners.

Outdoor handsets shall be provided with lockable type cover for protection against pilferage. Alternatively, pilfer protected wall/column mounted handset stations with built-in microphone/ loudspeaker shall be provided. Vendor to provide either or both the alternatives as specified in BOQ.

6.6.5 Wall/ column mounted instruments shall be heavy duty type and shall also be suitable for dust and noise laden atmosphere.

6.6.6 Desk mounting type (indoor) and wall mounting column type (outdoor) handset stations shall have a degree of protection as follows:

Indoor desktop mounted - IP32
Outdoor (including CHP Area) Wall/column mounted - IP55

6.6.7 All the switches, including the hook switch shall be encapsulated dustproof micro-switches. Alternatively, in place of micro-switches, reed relays/ tactile push switches can be offered. Any other suitable mechanism may be used subject to prior approval of purchaser (before placement of order). All switches shall be suitably protected from the prevalent atmosphere and shall have an extremely long life.

6.6.8 Each handset shall be provided with sensitive dynamic noise cancelling type retractable coil type of cord of length not less than 1.2 metres when stretched.

6.6.9 The amplifier units in the handset station shall be plug-in type so that maintenance of the faulty unit can be done without much downtime. These amplifiers shall be of special design suitable for industrial use such that while providing high line drive audio signal, it shall also provide a special anti side tone circuit.



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6.6.10 The db level of the announcement at any station by its own handset shall be lower than the announcement at the same station by any other handset. This shall be provided to ensure that after all the line losses, the db level of announcement from any other station at a particular station is not less than the db level of announcement of that station itself. Vendor shall demonstrate the above at site.

6.6.11 For intelligibility of the human speech, the microphones of the handsets shall be noise cancelling along with directional features by providing necessary acoustic tailoring of frequency response for external noise. Frequency response and type of microphone shall be as per Data Sheet A.

6.6.12 The handset shall be mounted on or within a control box complete with matching transformer, cradle switch, page switch, loud speaker mute switch, power indication lamp, terminal strips, call master switches etc. The handset shall also contain amplifying system of the station. "Private Channel Busy" indication shall also be provided.

6.6.13 Power terminals shall be shrouded. Isolating switch & fuses for incoming power supplies shall be mounted inside handset.

6.6.14 Portable Handsets/ Sockets

- a) For portable handsets, multi-pin sockets with inbuilt power supply unit shall be provided. Multi-pin socket shall be suitable for outdoor operation with IP55 degree of protection.
- b) Degree of protection of portable handsets shall be as specified in Data Sheet A.
- c) Portable handsets shall be light in weight(upto 5Kg) but sturdy in design and shall be housed in a weather proof enclosure with shoulder straps.
- d) Separate provision of power supply for portable handset will not be provided by BHEL
- e) Length of connecting wire from socket to portable handset should be 5 meter minimum.

6.7 LOUD SPEAKERS

6.7.1 Re-entrant type

- a) Re-entrant horn type speakers shall be provided with line matching transformer, and bracket suitable for wall/ column mounting.
- b) Material and degree of protection shall be as specified in Data Sheet A.
- c) For distributed system, volume level adjustment shall be provided at handset if the line-matching transformer is not provided.
- d) The mounting bracket shall be with adjustable base suitable for vertical movement. However, it shall be possible to change the axis of rotation by loosening the screws. Firm fixing arrangement with spring lock washers shall be provided.
- e) Other technical parameters for re-entrant horn type speakers shall be as per Data Sheet A.

6.7.2 Cone Type

- a) Permanent magnet, cone type speaker with line matching transformer shall be housed in a sturdy metal cabinet suitable for wall/ column or ceiling mounting as specified in the schedules and drawings.
- b) Material and degree of protection shall be as specified in Data Sheet A.
- c) For distributed system, volume level adjustment will be provided at handset if the line-matching transformer is not provided.
- d) The cabinet shall have grilled metal faceplate to diffuse high frequencies and prevent damage to the speaker. Housing shall be treated with acoustic under-coats to prevent resonance.
- e) Other technical parameters for cone type speakers shall be as specified in Data Sheet A.



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6.8 JUNCTION BOXES

6.8.1 Type of Junction Boxes

- a) Power Junction Box: This type of junction box shall be used for looping of incoming and outgoing power cables for handset stations.
- b) Signal Junction Box: If required, this type of junction box shall be used for looping of incoming and outgoing signal cables for handset stations.
If Signal JB is not the part of Power junction Box it should be provided for Desktop station, flush mounted and master control station separately. In case Power Junction Box can accommodate Signal cable termination and power cable termination both then Bidder shall not quote for SJB.

Number of ways	12/24/36/48/64/72/96/128 with 20% spare terminals
Material & thickness	Fibre glass reinforced polyester (FRP) 4 mm thick/ Mild Steel (MS) 2mm thick/ Al LM6 3 mm thick
Surface Type	Hot dip galvanised(except for Al Alloy LM6 which shall be painted) Screwed at all four corners for door. Door handle shall be of stainless steel (SS). Self-locking . Door gasket shall be of synthetic rubber
Mounting clamps & Accessories	Suitable for mounting on walls / columns / structures etc. The brackets bolts, nuts, screws, glands and lugs required for erection shall be of brass.
Type of terminal block	Rail mounted maxitermi or cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided
Protection class	IP-55 (minimum) for all applications including CHP AREA.

- 6.8.2 It shall be possible to isolate any part of the circuit during maintenance/ testing without affecting the other circuits.

6.9 MAIN DISTRIBUTION BOARD (POWER Distribution Board)

- 6.9.1 Main distribution board shall be used for distribution of incoming power supply to different loops. Construction of main distribution board shall be similar to other junction boxes. Degree of protection and material shall be as specified in Data Sheet A.

6.9.2 Main distribution Board shall consist of two separate units:

- a) Auto changeover Box
Auto changeover box shall have provision for terminating incoming AC normal and UPS supply and the outgoing line to PA System distribution box. Suitable switch-fuse units/MCB shall be provided independently for both the incoming supplies.
Heavy-duty auto changeover contactor(s) and indicating lamps for "Supply Healthy" indication shall be provided. Vendor to ensure that no supply paralleling or fault coupling occurs during changeover.
- b) Distribution box
Distribution box shall be used for distribution of power supply to the different loops. Suitable number of outgoing switch-fuses and incoming switches shall be provided.

Auto changeover box and distribution box may be accommodated in a single box.

Main distribution box shall be of MS sheet with thickness 16 SWG. MDB shall have provisions of two inputs with auto changeover and 12 outputs (minimum), MCB at input and MCB & HRC fuse at output.



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6.10 PDB shall be wall/column mounted. Necessary glands required for cable entry shall be provided along with PDB.WEATHER PROTECTING CANOPY / ACOUSTIC HOOD

6.10.1 WEATHER PROTECTING CANOPY

Weather protecting canopy shall be provided for outdoor field call station to meet the DOP IP-65 for CHP area and IP-55 for all other outdoor areas. The canopy shall be made of 18SWG MS/ 1.75 mm minimum glass fiber material to house the field call stations.

6.10.2 ACOUSTIC HOOD

The handset stations in the noisy areas like turbine Hall, BFP, firing floor, mill area, etc., shall be housed in Acoustic hoods. The acoustic hood will be made of MS material(Minimum 1.6mm thick)/FRP material(3 mm thick), identical to panels, paint finish . An industrial type free standing, wall mounted hood shall be used for providing the above requirements. The design noise level within the hood shall be limited to a maximum of 60 dB SIL. The Stations envisaged inside the acoustic hood shall not be provided with canopy.

6.10.3 ACOUSTIC BOOTH : Sound protecting Industrial type free standing booth Floor mounted Acoustic booth shall be 850(L)X700(W)X2200(H) mm and made of MS 1.6mm thick/ FRP material 4mm thick. The degree of protection for acoustic booth shall be IP -55. Hinged door entry shall be provided. Suitable table /Mounting arrangement shall be provided inside the booth for mounting the handset.

6.11 SIGNAL LOOP LENGTH

The signal loop length will be around 4 Km in unit area, around 8 Km in coal handling plant area and around 7 Km in common plant area from the central exchange. Further, the distance between two stations in areas other than unit may be more than 1 Km. Bidder shall provide necessary repeaters, power supply modules etc to meet the requirement of the same. No. of Repeaters will be indicated in BOQ NIT.

6.12 CABLES & CABLING

Following power, signal & loudspeaker cables will be used:

- a) Power cable : 3C-2.5 mm2 Cu armoured.
- b) Signal cable : 4P-0.5 mm2 (7/0.3mm) Cu overall screened armoured.
- c) Loud speaker cable : 2P-0.5 mm2 (7/0.3mm) Cu overall screened armoured.

The cable size between MDF to SDF will 24P-0.5 mm2 / 12P-0.5 mm2 as per requirement.

If different size of cable is required, bidder must intimate in their offer.

6.12.1 The PA system cables will be laid in ready trays routed in different areas of power plant for power & signal cables. Power cable will run in separate trays, similarly the signal cables will run in separate trays.

6.13 ENCLOSURE FOR INSTRUMENTS & OTHER EQUIPMENTS

Unless otherwise indicated with the equipment, all panels, desks, cabinets and enclosures furnished shall at least comply with the requirements of protection classes as indicated below:

Indoor air-conditioned (AC) areas	-	IP22
Indoor non air-conditioned (AC) areas	-	IP42
Ventilated enclosures	-	IP42
Non-Ventilated	-	IP54
Outdoor(included CHP)	-	IP55

The design of panels, cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10⁰ C above the ambient under the worst conditions. All panels/ cabinets housing electronic equipment in non-air-conditioned area shall be provided with redundant cooling fans along with filters.



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6.14 INTERFACE WITH EXISTING EXCHANGE:

PA system central exchange for the unit will be interfaced with existing/new EPABX/ PA System.

6.15 OTHER

6.15.1 Locations in different zones for different type of handset stations and loudspeakers are indicated in Section – I.

6.15.2 Bidder shall furnish separately the power supply requirements (in watts) for both central exchanges along with different stations attached to each exchange to decide the feeder size.

6.15.3 Makes of equipment/ components shall be subject to purchaser's approval during detailed engineering. However, bidder shall furnish the list of makes along with the offer.

6.15.4 Three sets of hard as well soft copies (in pdf form) of dwg/ documents will be required for the purchaser's review/ approval.

6.16 COMMON REQUIREMENTS OF VARIOUS EQUIPMENT OF SUPPLY

6.16.1 Surface Treatment

6.16.1.1 Painting:

- Pre-treatment: In the first step, complete surface shall be cleaned with sand paper and/ or cotton cloth to remove accumulated dust and dirt. Surface pre-treatment shall generally conform to IS: 6005. Pre-treated surface shall be provided with one coat of red oxide paint.
- Surface Finish: Two coats of abrasion resistant, anticorrosive synthetic enamel shall be applied on the pre-treated surface. Second coat shall be applied only when the first coat has completely dried-up. Surface finish after the painting shall be smooth, uniform and free from spots.
- Thickness of paint shall be 80 microns.

6.16.1.2 COLOUR OF EQUIPMENT

Following colour paint shade shall be followed for different items. All painting shall be through powder coated epoxy base paint.

Central Exchange Interior and exterior	: As per project requirement
Any misc. item including wall mounted MDB in CCR/EER area	: As per project requirement
Field Stations, junction boxes, horn type speakers, extension amplifier and cone type speakers, Flush mounted, desktop and master stations	: As per project requirement /As per manufacture standard color shade
Weather protecting canopy, acoustic hood ,MDB	: As per project requirement

6.16.1.3 Galvanizing

- Pre-treatment: In the first step, complete surface shall be cleaned with sand paper and/ or cotton cloth to remove accumulated dust and dirt. Surface pre-treatment shall be done before galvanization, which shall conform to the requirements of IS: 6005.
- Surface-Finish: Articles shall be hot dip galvanized after fabrication, surface cleaning and pre-treatment. The galvanizing shall be done according to IS: 2629. The galvanizing shall be uniform, clean, smooth, continuous and free from acid spots. If the galvanizing of the samples is found defective, the entire batch of steel will have to be regalvanized at vendor's cost.



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- c) Weight and thickness of zinc deposited shall not be less than 610 gm/m² and 75 microns respectively. The purchaser reserves the right to measure the thickness of zinc deposit by an Elkometer or any other instrument acceptable to purchaser and reject any component, which shows thickness of zinc at any location to be less than the value specified.

6.16.2 Labels

All components whether mounted inside or on the surface of the main equipment, shall have identifying references as per the arrangement drawings and wiring diagrams. The labels shall be of non-rusting metal or 3 ply lamicoid and shall have white inscriptions on black background. The label size shall be subject to the purchaser's approval.

6.16.3 Earthing

6.16.3.1 Earthing of all sheet metallic parts of enclosures of all equipments covered in this specification which are non-current carrying shall be bonded to an earth stud provided in the equipment. The Contractor shall ensure that proper earthing terminals are provided in all equipment covered in this specification.

6.16.3.2 Earthing of cabling system: Armour of cables shall be earthed at both ends of cable.

For earthing of power supply cable, an additional core shall be provided or else a continuous ground conductor of 16 SWG GI wire shall be run along each conduit run.

6.16.3.3 The supply and installation of all earthing wires, earthing plates and other materials for earthing the entire PA System shall be under the scope of the Contractor. The Contractor shall properly earth the system so that there is no interference in the communication system due to electromagnetic noise.

6.16.4 Packing

The material shall be packed as per manufacturer's standard to ensure the protection against mechanical damage, jerks, rain etc. during transit and for a prolonged period of storage. Packing procedure shall be subject to the purchaser's approval.

7.0 INSPECTION AND TESTING

7.1 INSPECTION

7.1.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorised representative.

- a) Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing, painting etc.
- b) Inspection of finished products.
- c) Inspection of packing material and procedure.

7.1.2 All materials, components and equipments covered under this specification shall be procured, manufactured, inspected and tested as per the purchaser's standards and quality plan of vendor duly approved by purchaser.

7.1.3 All material used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilized shall be those, which have established themselves for use in such applications.

7.1.4 All acceptance and routine tests as per relevant standards and specification shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.



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7.1.5 Bidder shall prepare and submit along with the bid the quality plan on the prescribed format. Quality plan shall include details of quality control and testing at different stages of manufacture, testing of completely assembled items.

7.2 TESTING

7.2.1 Tests at Works

7.2.1.1 The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and that such tests are adequate to demonstrate that the equipment will comply with the requirements of this specification. Copy of the standards/ test methods to which the tests will be conducted are to be furnished during detailed engineering stage.

7.2.1.2 Test certificates shall be submitted for purchaser's approval before despatch of the equipment. The purchaser may witness the test at supplier's works, for which sufficient advance notice shall be given before testing.

7.2.1.3 The following tests shall be conducted as acceptance tests at manufacturer's works:

- a) Printed Circuit Boards
Following tests are to be performed on different PCBs and those shall also conform to approved Quality Plan:
 - i. Burn-in test for all PCBs (Routine test)
 - ii Climatic and Durability tests (Vibration, dry heat test, damp heat cycle, low temperature and transportation)
- b) Amplifier & Handset
 - i. Rated output power
 - ii. Rated input voltage
 - iii. Power consumption
 - iv. Current drain
 - v. Harmonic distortion
 - vi. Input/ Output Impedance
 - vii. Insulation resistance
- c) Speakers
All the speakers shall be tested as per IS: 7741. Apart from these during assembly, the components like transistors, ICs, resistances, capacitors, switches, relays etc. shall be tested and a certificate shall be obtained from the manufacturer which may be verified by others.
- d) Junction Boxes
All junction boxes shall be checked for 100% IR, HV and dimensional checks.
- e) Tests for painting
The painting of articles shall meet the requirements of IS: 1477 (Part 1 & Part 2) in general.
- f) Tests for galvanizing
Weight, thickness and uniformity of zinc, coating shall be determined in accordance with IS: 6745 and IS: 2633 shall conform to the specification requirements.

7.2.2 Site Tests

7.2.2.1 After assembly, all major equipment together are to be site tested to establish the workability of the system at site.



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7.2.2.2 Following tests are to be performed at site:

- a) Insulation resistance, HV test for cables.
- b) Rated output power.
- c) Performance of PAGE and PRIVATE channels for all equipments in the entire Public Address System.
- d) Proper functioning of auto-changeover unit.
- e) Test to ensure that db level of announcement at any station by its own handset shall be lower than announcement at the same station by any other handset.

7.2.2.3 Bidder to perform all site tests as per the Field Quality Plan. During contract stage bidder to furnish details of these tests & the standards to which these conform for purchasers approval.

7.2.3 General Requirements of Site Testing

7.2.3.1 The Owner may ask for any tests at site which in his opinion are necessary to determine that the works comply with the specification, manufacturer's instruction or the applicable IS code of installation. The

Contractor shall be responsible for conducting the tests and shall bear the cost of such additional tests.

7.2.3.2 The contractor shall have to bring all testing equipment & instruments to carry out the job. All instruments shall be calibrated to the satisfaction of the Engineer before actual testing and tests shall be conducted by qualified & experienced personnel.

7.2.3.3 All documents/ records regarding test data and all other measured values shall be submitted to Engineer for approval and subsequent record and reference. The results of all tests shall conform to the specification requirements as well as any specific performance data guaranteed during finalisation of contract.

7.2.4 Type test

Type test reports should be furnished as per enclosed Annexure A of Quality plan.

9.0 PRICES

9.0.1 The bidder shall quote his prices for equipment of complete Public Address System, supply, as per BOQ format enclosed with NIT.

9.0.3 Purchaser reserves the right to delete/add any equipment or services from the bidder's scope and, for price adjustment in such cases, unit prices quoted by the bidder will be considered.

9.0.4 The bidder shall furnish unpriced "Price Schedule" of all equipment and services, as per BOQ along with the technical bid.

9.0.5 Bidder to note that the price for System Engineering Design shall form part of main equipment and will not vary with the change in scope of supply of equipment.



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9.0 PERFORMANCE GUARANTEES

Bidder shall guarantee that the system offered shall meet the requirement as indicated in this specification and as confirmed by them in various clauses of technical data sheets. If it is proved that the system doesn't conform to performance guarantee, the bidder shall be ready to replace the faulty equipment/components at site without any extra cost.

10.0 INSTALLATION AND MAINTENANCE MANUAL

10.1 Instruction manuals for the installation, operation and maintenance of PA System shall be furnished before despatch of the equipment.

10.2 Draft manual shall first be submitted for Purchaser's approval. The manual shall contain minimum following details:

- a) General description of equipment
- b) Brief system description for which equipment is meant
- c) Technical data
- d) Salient constructional details
- e) Technical leaflets of important components used in the system
- f) All drawings
- g) Type and routine test certificates
- h) Instructions to be followed on receipt of equipment at site and for storage
- i) Material handling instructions
- j) Erection procedure and checks
- k) Pre-commissioning checks
- l) Commissioning procedures
- m) Operation instructions
- n) Maintenance instructions
- o) Trouble shooting
- p) Safety instructions

11.0 DOCUMENTATION

11.1 DOCUMENTS TO BE FURNISHED WITH THE BID

- a) Brief System Description.
- b) Filled and stamped Data Sheet B

11.2 DOCUMENTS TO BE FURNISHED BY THE VENDOR DURING DETAILED ENGINEERING STAGE

- a) Full description and design of the equipment and its operation.
- b) General arrangement drawings cum Technical Datasheet for various equipment as per drawing list.
- c) Detailed write up on the method of testing.
- d) Interconnection diagram showing the interconnection between main distribution board, master station(s), JBs, handsets, loud speakers covering the size of cable.
- e) Cable schedule
- f) Operation and maintenance (O&M) manual.
- g) Signed and stamped Standard Quality Plan.
- h) Minimum 3 copies of all test certificates for the tests actually conducted on the equipment

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Erection and Commissioning



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1.0 GENERAL

The scope of this specification covers handling and storage at site; installation, testing and commissioning of Public Address System for efficient and trouble free operation after installing the same at site.

2.0 CODES AND STANDARDS

The installation shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the vendor of his responsibility.

3.0 INSTALLATION

The contractor shall carry out total installation work as per the requirements of the specification and instructions of Engineer.

3.1 PA SYSTEM EQUIPMENT INSTALLATION

3.1.1 Installation of PA System equipment shall include erection, connection, grounding, testing and commissioning of the equipment. Installation activity shall also include provision of all fittings, supports, hangers and other accessories which are not specifically mentioned but are required to complete the installation work.

3.1.2 Equipment shall be brought to the place of work only at the time of erection. Unpacking, handling, assembling and erection shall be as per the guidelines of installation manual and Field Quality Plan.

3.1.3 Erection shall commence in an area only after the clearance has been obtained from the Engineer. Vendor shall ensure that all activities, which are liable to damage the equipment in that area, have been completed.

3.1.4 The drilling and welding of building steel work for fixing supports and brackets shall not be done without the prior approval of Engineer.

3.1.5 Wherever drilling and welding of building steel work for fixing supports and brackets is done, the same shall be re-painted and restored to the same paint shade as per site requirement at no extra cost to purchaser.

3.2 ITEMS OF SUPPLY FOR CABLING INSTALLATION WORK

The supply of below listed items shall be considered to be part of cabling installation work:

3.2.1 Cable glands

Cable glands shall be single or double compression type. Material of glands shall be brass. Nickel plating shall be provided if indicated in Data Sheet A. Rubber components used in the gland shall be of neoprene. Name/ trade name of manufacturer, type no. and applicable range of outer diameter of cable shall be engraved/ printed on the cable gland.

3.2.2 Cable lugs

Cable lugs shall be of tinned copper. Name/ trade name and size shall be engraved/ printed on each cable lug.

3.2.3 Self Locking Clamps

Clamps shall be of nylon material having self-locking feature when the cord is looped. They shall be provided with manual lock release. Clamp cord shall not move in the backward direction once it has been locked, unless the lock release is depressed.



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3.2.4 Ferrules

Ferrules shall be required for individual core of cables hence they shall be suitable for the insulated conductor diameter. They shall be of plastic material. Numbering on the ferrules shall be engraved type. Colour of base shall be yellow and that of engraving shall be black. Engrave colouring shall be of durable quality to match the entire life of the plant. Engraving shall be legible from a distance of 600 mm. Ferrules shall be interlocked type such that the interlocked ferrules take the shape of tube with complete ferrule number marked in a straight line.

3.2.5 Tags

For identification, cables shall be provided with cable number tags of durable fibre, aluminium or stainless steel sheets. Cable numbers shall be engraved type in case of aluminium or stainless steel tags, and printed type in case of fibre sheet. Tags shall be of durable quality of size 60mm x 12mm with a tie hole at each end and shall be provided with non-corrosive wire of sufficient strength for tagging.

3.3 INSTALLATION OF CABLES AND CONDUITS

3.3.1 All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Tags shall be fixed at both ends of cables and on both sides of floor/ wall crossings.

3.3.2 All cable entries in the equipment shall be sealed by cable glands.

3.3.3 Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals.

3.3.4 Control cable cores entering the equipment or control panels shall be neatly bunched and strapped with PVC perforated tapes/ nylon ties and suitably supported to keep them in position at the terminal block. Copper conductor control cables shall be terminated directly into screw type terminals provided in the equipment.

3.3.5 Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.

3.3.6 All spare cores shall be connected to spare terminals wherever possible. If spare terminals are not available, spare cores shall be neatly dressed and suitably taped at both ends.

3.3.7 Individual cores of control cables shall have ferrules for identification. Ferrule numbers shall be provided as per the control schemes and other related documents supplied by the purchaser.

3.4 ADDITIONAL POINTS OF CONSIDERATION

3.4.1 The installation work shall be carried out in a neat workman-like manner by skilled, experienced and competent workmen.

3.4.2 Installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made to avoid interference with any part of the building, structures, equipment, utilities and services. Any such adjustment shall be done with the approval of Engineer.

3.4.3 All materials being supplied or consumed during erection by the vendor in the process of erection work shall be of the best quality and according to the relevant standards. All materials shall be got inspected and approved by the Engineer before the same is used for erection work.



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3.4.4 Any work like chipping/ breaking of existing structure like walls, floors, fabrications, etc. shall be done after taking prior approval of Engineer.

3.4.5 Any wrong erection shall be removed & re-erected promptly to comply with the design requirements to the satisfaction of Engineer. Re-erection shall be done at no extra cost to the purchaser.

3.4.6 While testing and commissioning, if the system is observed to be not functioning, it shall be the responsibility of the contractor to check, rectify and demonstrate that the defect has been removed to the satisfaction of purchaser.

3.4.7 Before energisation of system, physical inspection shall be carried out and all foreign bodies shall be removed and loose connecting bolts etc. shall be tightened.

4.0 QUANTITY MEASUREMENT AND WASTAGE ALLOWANCE

4.1 MEASUREMENT OF QUANTITIES

4.1.1 For all payment purposes, measurement shall be made on the basis of the execution drawings/ physical measurements. Physical measurements shall be made by the contractor in the presence of the Engineer.

4.1.2 Wastage allowance shall be kept in consideration while making material appropriation of supplied items.

4.2 CUTTING AND WASTAGE ALLOWANCE

Vendor shall carefully plan the cutting schedule of each cable drum such that wastages are minimised and any resultant short lengths can be used where appropriate route lengths are available.

5.0 TESTING

5.1 Site Tests

5.1.1 After assembly, all major equipment together are to be site tested to establish the workability of the system at site.

5.1.1.1 Following tests are to be performed at site:

- a) Insulation resistance, HV test for cables.
- b) Rated output power.
- c) Performance of PAGE and PRIVATE channels for all equipments in the entire Public Address System.
- d) Proper functioning of auto-changeover unit.
- e) Test to ensure that db level of announcement at any station by its own handset shall be lower than announcement at the same station by any other handset.

5.1.1.2 Bidder to perform all site tests as per the Field Quality Plan. During contract stage bidder to furnish details of these tests & the standards to which these conform for purchasers approval.

5.2 General Requirements of Site Testing

5.2.1 The Owner may ask for any tests at site which in his opinion are necessary to determine that the works comply with the specification, manufacturer's instruction or the applicable IS code of installation. The Contractor shall be responsible for conducting the tests and shall bear the cost of such additional tests.



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5.2.2 The contractor shall have to bring all testing equipment & instruments to carry out the job. All instruments shall be calibrated to the satisfaction of the Engineer before actual testing and tests shall be conducted by qualified & experienced personnel.

5.2.3 All documents/ records regarding test data and all other measured values shall be submitted to Engineer for approval and subsequent record and reference. The results of all tests shall conform to the specification requirements as well as any specific performance data guaranteed during finalisation of contract.

6.0 PRICES

6.1 GENERAL

Unit prices listed out in this clause shall be applicable for payment to the contractor for activities covered under this specification. The following shall be kept in consideration while quoting the prices:

6.2 UNIT PRICES OF INSTALLATION WORK

Detailed requirement for all the items are given in the specifications, Data Sheet A and Annexures.

- a) Unit price of installation shall include transportation of materials from Vendor's/ Owner's storage yard to work site, handling, testing before erection, testing after erection and commissioning of materials including supply and installation of all associated materials (including support materials) and consumables, carrying out of all associated minor civil works and furnishing of all skilled/ unskilled labour, supervisory and commissioning staff.
- b) Price of earth connections are to be included in the erection price of equipment as above.
- c) No separate prices shall be applicable for termination of cables. Cable termination shall include drilling of gland plates, fixing of glands, ferrules and lugs and connection to the equipment.
- d) Purchaser reserves the right to delete/ add any of the equipment or services from the bidder's scope of work.
- e) The unit prices quoted shall be for supply and/ or installation as explained in detail in the clauses in subsequent paragraphs. No other prices shall be applicable for the purpose of payment.
- f) While quoting the prices for installation, the following shall be considered as part of job:
 - i. Cable glands and lugs
 - ii. Clamps, ferrules, aluminium/ stainless steel tags as per the project requirements
 - iii. Fasteners like nuts, bolts, washers, spring washers, rawl plugs, anchoring bolts and lugs etc.
 - iv. Conduit plugs, gaskets, couplers, and insulated bushings
 - iv. Sealing compounds for wall and floor openings
 - v. Consumables like enamels, cold zinc paint, electrodes for welding etc.
 - vi. Materials for minor civil works
- g) The following shall be arranged by the contractor at no extra cost:
 - i. All unskilled and skilled labour
 - ii. All supervisory and commissioning staff
 - iii. All facilities/ equipment for site fabrication such as cutting, bending and drilling equipment
 - iv. Welding set(s)
 - v. Material handling equipment
 - vi. All special tools and tackles for erection
 - viii. All testing equipment
- h) Requirement of Quality Plan and Field Quality Plan shall be considered in the quoted prices.
- i) E & C spares required shall be part of E & C charges.
- j) Instruments required for testing & commissioning shall be arranged by the contractor and shall be taken back after E & C.
- k) Fabrication and painting of support structures of various equipments shall be in contractor's scope. However structural steel shall be free issue by BHEL.

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		QUALITY PLAN										SPEC. NO. :		DATE:							
		CUSTOMER :		PROJECT:		ITEM: PUBLIC ADDRESS SYSTEM		QUANTUM		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		AGENCY		REMARKS			
		TYPE OF CHECK		QUANTUM OF CHECK		C/N		M		7		8		9		M		C		N	
		CLASS		CHARACTERISTICS CHECK		3		4		5		6		7		8		9		10	
1	2	3	4	5	6	7	8	9	10	11											
1.0	CENTRAL EXCHANGE	1. AESTHETIC	MA	VISUAL	100%	100%	APPD. DWG.	APPD. DWG.	INSPE. REPT.	P	W	W									
		2. MECHANICAL	MA	DIMENSION	100%	100%	APPD. DWG.	APPD. DWG.	INSPE. REPT.	P	W	W									
		3. SHEET THICKNESS	MA	DIMENSION	100%	100%	APPD. DWG.	APPD. DWG.	INSPE. REPT.	P	W	W									
		4. ELECTRICAL -Rated input voltage -Rated output voltage	MA	ELECTRICAL	100%	100%	APPD. TP	APPD. TP	INSPE. REPT.	P	W	W									
	ELECTRONIC MODULE	5. Burn in test at 50 °C for 48 hours in energised condition.	MA	ELECTRICAL	100%	100%	APPD. TP	APPD. TP	INSPE. REPT.	P	W	W									
2.0	MASTER CONTROL STATION (MCS)	1. AESTHETIC	MA	VISUAL	100%	100%	APPD. DWG.	APPD. DWG.	INSPE. REPT.	P	W	W									
		2. MECHANICAL	MA	DIMENSION	100%	100%	APPD. DWG.	APPD. DWG.	INSPE. REPT.	P	W	W									
		3. THICKNESS	MA	DIMENSION	100%	100%	APPD. DWG.	APPD. DWG.	INSPE. REPT.	P	W	W									
		4. ELECTRICAL -Input sensitivity at 1KHz -THD at 1 KHz. -Frequency Response -Signal to Noise Ratio	MA	ELECTRICAL	100%	100%	APPD. TP	APPD. TP	INSPE. REPT.	P	W	W									
	ELECTRONIC MODULE	5. Burn in test at 50 °C for 48 hours in energised condition.	MA	ELECTRICAL	100%	100%	APPD. TP	APPD. TP	INSPE. REPT.	P	W	W									
														*BHEL witness voltage level at minimum 5 points randomly.							

ENGINEERING				BHEL				QUALITY				BIDDER/ SUPPLIER				FOR CUSTOMER REVIEW & APPROVAL			
Prepared by:		Checked by:		Name		Sign & Date		Name		Sign & Date		Name		Sign & Date		Name		Seal	
V. HARI		HARI		V. HARI		21/11/2020		V. HARI		21/11/2020		V. HARI		21/11/2020		V. HARI		21/11/2020	
PRAVEEN DUTTA		PRAVEEN DUTTA		PRAVEEN DUTTA		21/11/2020		PRAVEEN DUTTA		21/11/2020		PRAVEEN DUTTA		21/11/2020		PRAVEEN DUTTA		21/11/2020	

QUALITY PLAN										SPEC. NO. :		DATE:	
CUSTOMER :										QP NO.: PE-QP-999-557-E001 REV 03		DATE:	
PROJECT:										PO NO.:		DATE:	
ITEM: PUBLIC ADDRESS SYSTEM										SECTION:		SHEET 2 OF 3	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									M	C	N		
1	2	3	4	5	6	7	8	9	10	11			
3.0	CONE TYPE SPEAKER, HORN LOUD SPEAKER	1. AESTHETIC 2. MECHANICAL 3 THICKNESS 4. ELECTRICAL -DC Resistance 5. FUNCTIONAL TEST - SPL at rated output - Sweep test response	MA	VISUAL	100%	APPD. DWG.	APPD. DWG. INSP. REPT.	INSP. REPT.	P	W	W	*BHEL witness on 5% sample (min 5) selected at random of each type per Lot.	
4.0	FIELD CALL STATION, PORTABLE STATION & FLUSH MOUNTED STATION (AS APPLICABLE)	1. AESTHETIC 2. MECHANICAL 3 THICKNESS 4. ELECTRICAL -THD at 1 KHz -Frequency Response -Signal to Noise Ratio -Input Impd. at 1 KHz	MA	VISUAL	100%	APPD. DWG.	APPD. DWG. INSP. REPT.	INSP. REPT.	P	W	W	*BHEL witness on 5% sample (min 5) selected at random of each type per Lot.	
5.0	EXTENSION AMPLIFIER	1. AESTHETIC 2. MECHANICAL 3 THICKNESS 4. ELECTRICAL -Input sensitivity at 1KHz -Rated output power -THD at 1 KHz -Frequency Response -Signal to Noise Ratio -Input Impd. at 1 KHz -IR & HV Test	MA	VISUAL	100%	APPD. DWG.	APPD. DWG. INSP. REPT.	INSP. REPT.	P	W	W	*BHEL witness on 10% sample (min 3) selected at random.	

ENGINEERING

Prepared by: Harj Chand

Reviewed by: Praveen Duttia

BHEL

Sign & Date: [Signature]

Name: Kunal Gandhi

QUALITY

Sign & Date: [Signature]

Name: R K Jaisankar

ENGINEERING

Prepared by: Harj Chand

Reviewed by: Praveen Duttia

BHEL

Sign & Date: [Signature]

Name: Kunal Gandhi

QUALITY

Sign & Date: [Signature]

Name: R K Jaisankar

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				QUALITY PLAN				SPEC. NO. :		DATE:			
				CUSTOMER :				QP NO.: PE-QP-999-557-E001 REV 03				DATE:	
				PROJECT:				PO NO.:				DATE:	
				ITEM: PUBLIC ADDRESS SYSTEM				SECTION:				SHEET 3 OF 3	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS			
									M C N				
1			4	5	6	7	8	9	10	11			
6.0	POWER DISTRIBUTION BOX, LOUD SPEAKER JB, POWER JB, SIGNAL JB, MAIN DISTRIBUTION FRAME (MDF), SUB DISTRIBUTION FRAME (SDF), SOCKET BOX FOR PORTABLE STATION	1. AESTHETIC 2. MECHANICAL 3 THICKNESS 4. HV / IR	MA	VISUAL	100%	APPD. DWG.	APPD. DWG. INSP. REPT.	INSP. REPT.	P W	*BHEL witness on 5% (min 1) sample selected at random of each type per Lot.			
7.0	WEATHER PROTECTING CANOPY & SOUND PROTECTING HOOD	1. AESTHETIC 2. MECHANICAL 3 THICKNESS	MA	DIM.	100%	APPD. DWG.	APPD. DWG. INSP. REPT.	INSP. REPT.	P W	*BHEL witness on 3% sample (min 3) selected at random of each type per Lot.			
8.0	INTEGRATED TESTING ON PA SYSTEM	FUNCTION -Party call -Paging call -Busy tone -Alert tone	MA	VISUAL	100%	APPD. DWG.	APPD. DWG. INSP. REPT.	INSP. REPT.	P W	*BHEL to witness on 5 no. of stations or min 5% connected to central exchange.			
9.0	TYPE TEST	As per Annexure A	MA	ELECTRICAL /FUNCTIONAL	SAMPLE	Reference standard as per annexure A	Reference standard as per annexure A	REPORT	P W	*Refer note below			

NOTE: CONDUCTION OF TYPE TEST/ SUBMISSION OF AVAILABLE VALID TYPE TEST REPORTS ON PA SYSTEM EQUIPMENT SHALL BE AS PER SPECIFICATION.

LEGENDS:
 *RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL

BHEL				BIDDER/ SUPPLIER				FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING		QUALITY		SIGN & DATE		SIGN & DATE		SIGN & DATE		SIGN & DATE	
Prepared by:	Name	Checked by:	Name	Reviewed by:	Name	Reviewed by:	Name	Reviewed by:	Name	Reviewed by:	Seal
Praveen Chandra	Praveen Chandra	R. K. Jaiswal	R. K. Jaiswal								
21/11/2020		21/11/2020									

10.0 PACKING

Dimensions/Type/Finish/Freedom from defects

Major

Visual

100%

100%

Tech spec/ Approved packing procedure

Tech spec/ Approved packing procedure

Inspection report

P

W

Packing shall be witnessed as per Annexure-3 to Section-1

ANNEXURE-A

QUALITY PLAN
STANDARD QP NO. : PE-QP-999-557-E001, REV. 03

LIST OF TYPE TEST FOR PUBLIC ADDRESS SYSTEM

S No	Equipment	Type test description	Referred standard	Test to be specifically conducted (Yes/No)	BHEL/Customer's approval Req. on test certificate (Yes/No)
1	Central Exchange	• High frequency radiated magnetic field test	IEC 61000-4-3	no*	yes
		• Electrostatic discharge test	IEC 61000-4-2		
		• Susceptibility test	IEC 61000-4-6		
		• Vibration test	IEC 60068-2-6		
		• Dry heat & damp heat test	IEC 60068-2-2 & IEC 60068-2-30		
		• Surge protection test	IEC 61000-4-5		
2	Field call stations, Junction box, power distribution box, Central Exchange, Master Control station, Desktop station, Flush mounted station, MDF/MJB (if not integrated in central exchange)	DOP test (dust test & water test)	Relevant IS / IEC		
3	Cone type speaker	Sound pressure level (SPL) before & after DOP test (dust test & water test)	Relevant IS / IEC		
4	Horn type speaker	• Sound pressure level (SPL) before & after DOP test (dust test & water test)	Relevant IS / IEC		
		• Frequency response test	IS: 9302 Part- IV		
		• Sound pressure level (SPL) test			
		• Impedance test			
5	Field Call station	• Dry heat & damp heat test	IEC 60068-2-2 & IEC 60068-2-30		
		• Vibration test	IEC 60068-2-6		
		• Electrostatic discharge test	IEC 61000-4-2		
		• Electromagnetic immunity test	As per relevant standard		
		• Surge protection test	IEC 61000-4-5		
		• RF immunity test	As per relevant standard		
6	Amplifier	• Frequency response test	Relevant IS / IEC		
		• Power output test			
		• Signal to noise ratio test			
		• Distortion test			
7	Flameproof handset station, flameproof horn type speaker, flameproof junction box (if applicable)	Type test as per relevant IS for flameproof properties	Relevant IS		

*If type tests certificates are found non-satisfactory then the bidder has to carry out the type test without any price and delivery implication to BHEL.

next
21/1/2020.
(HARI CHAND).

P. Dutta
21/1/2020.
(P. Dutta)

Kunal
22/01/2020
(Kunal Grand hi)

Kr 21
22/1/2020
CRK JASWAL

	2X660 MW UDANGUDI STPP PUBLIC ADDRESS SYSTEM	SPECIFICATION NO.	PE-TS-435-557-E-001
		VOLUME	IIB
		SECTION	D
		REV 0	DATE 30.12.2019
		SHEET	1 OF 1

ANNEXURE 4

List of applicable codes & standards

- 1.0 The equipment covered under this specification shall be designed, constructed and tested in accordance with latest revisions of applicable codes/ standards.
- 2.0 The equipments furnished under this specification shall conform to the latest revisions of the following standards.

IS10426	PA System amplifiers-recommendations for minimum performance requirements and PA System amplifiers-recommendations for general requirements.
IS1882	PA system-code of practice for out door installations.
IS1881	Indoor amplifying and sound reinforcement system-code of practice for installation.
IS1031	Method of measurements on loudspeaker and loud speakers systems.
IS2382	Recommended mounting dimensions of loud speakers.
IS9302	Characteristics and Methods of Measurement for sound System equipment.
IS616	Code of safety requirement for mains operated electronic and related apparatus.
IS7741(Part-I,II and III)	Specification for loudspeaker.
IS9000	Basic environmental testing procedures for electric and electronic items.
IS2147	Degree of protection provided by enclosures for low voltage switchgear and control gear.
IS9537(Part-I and II)	Specification for conduits for Electrical (Part-I, II) installation/wiring.
IS:1301	Code of safety requirement for electric mains operated audio amplifiers
IS:1982	Code of practice for outdoor installation of PA system
IS:732	Code of practice of electrical wiring installations (System voltage not exceeding 650 volts)
IS:2667	Fittings for rigid steel conduits for electrical wiring

The system shall be adequately protected from signal and power line noise and meet the Surge Withstand Capability (SWC) requirements of ANSI C37.90 A/IEEE standard 472-1989 or equivalent.