

**SECTION 16791**

**STATION PUBLIC ADDRESS SYSTEMS**

COMMON DESIGN PACKAGES	SUBMITTAL PHASE	STATUS	ORIGIN/APPLICATION
DP-37 Lechmere Station	RFC	UNDER REVIEW	REV.00 05/03/2019 REV.01 06/06/2019 REV.02 04/06/2020
DP-38 Union Square Station	PRE-RFC	UNDER REVIEW	NO CHANGES/*
DP-39 E Somerville Station	INTERMEDIATE	UNDER REVIEW	NO CHANGES/*
DP-40 Gilman Station Plans	RFC	UNDER REVIEW	REV.00 05/03/2019 REV.01 06/06/2019 REV.02 04/06/2020
DP-41 Magoun Square Station	INTERMEDIATE	UNDER REVIEW	NO CHANGES/*
DP-42 Ball Square Station	INTERMEDIATE	UNDER REVIEW	NO CHANGES/*
DP-43 College Station Plans	PRE-RFC	UNDER REVIEW	NO CHANGES/*
DP-57 Communications	RFC DCN 001	UNDER REVIEW	REV.02 04/06/2020

\*ALL CHANGES APPLY

UDD-UNDER DESIGN DEVELOPMENT

RFI DB#83 MBTA#135 SUBMITTED & ACCEPTED WITH REV.00 05/03/2019

RFI DB#443 MBTA#488 SUBMITTED & ACCEPTED WITH REV.01 06/06/2019

**SECTION 16791****STATION PUBLIC ADDRESS SYSTEMS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This Section specifies designing, furnishing, and installing a complete and operational Public Address, which shall be integrated with the Variable Message System (VMS) at MBTA GLX Stations. See section 16742 Variable Message Sign (VMS) System Mandatory Specification.
- B. System functionality is based on the Mandatory Specifications given. Actual system performance shall be measured against design performance criteria.
- C. The Station Public Address System installed under this Project shall receive, amplify, monitor, and distribute (via loudspeakers) voice announcements originating remotely from the Announcement Control System at OCC and Workstations, and locally from a local microphone station or Station Public Address Computer, and rack KVM.
- D. Station Public Address system shall be configured for a minimum of 3 zones (inbound, outbound & mezzanine). Additional zones to be added as required to meet the design criteria of this project.
- E. Zones shall consist of both VMS Signs and speakers.
- F. Each zone of speakers shall consist of two circuits of alternating speakers A & B. The PA System shall be configured so equipment and wiring failures related to circuit A shall not affect the operation of circuit B. The PA System shall be configured so equipment and wiring failures related to circuit B shall not affect the operation of circuit A. Each circuit shall carry half the speaker load per zone.
- G. The Public Address System installed under this Contract shall fully integrate, interface and work with the existing Rockwell Collins (formerly ARINC) PA/VMS Head End hardware and software system installed at the Operations Control Center (OCC). Including all local station maintenance and diagnostic functions, both local and remote monitoring. The maintenance functions shall include but not be limited to: remote monitoring and configuration of public address Digital Signal Processor (DSP), Public Address power amplifiers, Station Control Units (SCU), and Electronic Signs. Note that remote maintenance functions may be executed via the SCU.
- H. The DB Entity shall be responsible for designing, procuring, installing, configuring, and testing Rockwell Collins (ARINC's) AIM PA/VMS software on each SCU. Each SCU shall be fully compatible with that software. Installation and testing shall include full integration with the existing AIM PA/VMS Head End system.
- I. The DB Entity shall be responsible for designing and configuring the MBTA's existing PA/VMS system at the OCC to allow the MBTA's personnel to trigger Public Address messages, both visual and audio, to MBTA stations throughout the system. The VMS signs shall display LRV arrival count down time as currently displayed in existing MBTA stations.

- J. The transmission from the OCC shall be over the MBTA's new and existing Wide Area Network. The DB Entity shall be responsible for providing interface connections to and from the designated Main Distribution Frame (MDF) and or the Wide Area Network.
- K. The PA/VMS network exists and uses a combination of TCP/IP, UDP/IP over Ethernet, Voice over Internet protocol (VoIP) to deliver PA/VMS messages.
- L. The Station Public Address System shall be a fully integrated system. The system shall use a local SCU configured with AIM PA/VMS software to manage and control all station functions and hardware including microphone page stations and associated queuing, distribution of emergency announcements, local announcements, OCC announcements, recorded announcements, pre-recorded and assembled messages, and visual display paging.
- M. The Passenger Station Public Address System shall include an Ambient Noise Analysis System that shall automatically change the volume level of the Public Address System dependent on the amount of the ambient noise level at the station.
- N. The system shall interface directly via Ethernet to one or more zones within the passenger station. Provisions shall be made for Ethernet or serial RS-422 communication between signs within each zone as appropriate. Signs within a zone shall consist of single and double-faced 2-line electronic signs. Mounting of the electronic signs shall be per manufacturer's recommendations. Two line signs shall consist of 32 LED high x 256 LED long. Cable interconnect shall consist of shielded category 6 or better wiring. The DB Entity shall provide the appropriate Ethernet to Serial Adapters necessary for communication to each Sign. Refer to Mandatory Specification 16742 Variable Message Sign (VMS) System.
- O. The system shall be capable of distributing data and audio from the OCC to local audio zones and visual displays within the passenger station.
- P. The system shall be capable of monitoring and configuring local PA equipment and PA/VMS equipment installed at passenger stations from the OCC.
- Q. All Public address equipment installed under this Project shall be connected and monitored from the PA/VMS Head End at 45 High Street Operations Control Center.
- S. The PA subsystem shall accept and integrate and fire alarm muting integration requires as defined in the fire alarm specification. The PA subsystem shall provide effective sound-masking system which utilizes loudspeakers strategically placed to produce uniformly distributed audio throughout the passenger stations, yards and shops and central control areas. Uniform audio in both tonality and sound level, at 5 feet elevation above the walking area, so that normal moving does not result in 5 dB changes in the sound level.
- a. Headroom: Sufficient to allow a minimum increase in output of 12 dB, without increase in hum, noise, or total harmonic distortion.
  - b. PA subsystem shall maintain a uniformly distributed sound level at least 10 dB above ambient station operating noise level measured at 5 ft above floor for indoor stations. Outdoor stations shall be not less than 60 dBA plus or minus 30 degrees off Axis, 4 feet above the floor, at vehicle ambient noise level. The maximum sound level at any point shall be no greater than 85 dBA. The minimum sound level at any point 5 ft. or lower, above the floor sound level shall be:

- Mezzanine: 70 dBA minimum
  - Platforms: 78 dBA minimum
  - c. Speakers' frequency response shall be in the range of 150 Hz to 15 KHz.
- T. Speech Transmission Index (STI) per the NFPA 72 National Fire Alarm and Signaling Code establishes the acoustical guidelines for speech intelligibility of emergency signal system as follows:
- a. 90% of STI measurements shall exceed 0.45.

## 1.2 PUBLIC ADDRESS HARDWARE PROFILE

The DB Entity shall install all equipment, materials, and cables required to support the station PA/VMS. Installation shall be in accordance with all Contract requirements, Design Documents, and custom commercial practices. Prior to delivery of any equipment on MBTA property, Public Address equipment shall be racked and staked in a cabinet and fully tested as an integrated unit. Testing shall include microphone inputs, ambient level microphone control, zone control, electronic sign messaging, audio outputs, system diagnostics utilizing Ethernet connectivity to amplifier, SCU, DSP, and electronic signs, remote monitoring, and full AIM PA/VMS software functionality. DB Entity shall provide certification of all testing prior to installation at the passenger station.

## 1.3 AUDIBILITY/INTELLIGIBILITY CRITERIA

The acoustic performance of the public address system shall meet guidelines for fire voice evacuation (EVAC) systems to support a possible future connection to the fire system. To meet the guidelines, the system has to be audible and intelligible.

The DB Entity shall meet the requirements of audibility and intelligibility per NFPA

- A. Audibility can be quantified by achieving an averaged announcement level of 15db greater than the ambient background noise level (or 5db above the maximum background noise level exceeded for more than 60 seconds).
- B. Intelligibility can be quantified by meeting the Speech Transmission Index (STI) of 0.5 (as referenced in the IEC 60849).
- C. DB Entity shall design and install a speakers & ambient sensing microphones to meet the specification provided by acoustic engineers.

## 1.4 EQUIPMENT CABINET

Equipment cabinet at the station shall contain the following devices:

- A. A control cabinet microphone for local "real time" announcements.
- B. A public address Station Controller Unit (SCU) for remotely controlled "prerecorded" announcements, system monitoring, diagnostics, and local station control.
- C. A monitor panel/keyboard for viewing/monitoring of the SCU.
- D. Multi-channel Digital Signal Processor (DSP) unit which shall accept various microphone and line level inputs, provide Pre-amplified outputs, provide Ethernet connectivity for remote

maintenance and diagnostics, audio matrix switching and provide high quality signal amplification necessary to drive station loudspeakers at desired sound pressure levels. Alarm monitoring shall provide notifications to the AIM PA/VMS Headend Software of service degradation and DSP health status.

- E. Two 800 watt four Channel Amplifiers with Ethernet connectivity protocol to allow local and remote control and monitoring from the local SCU & the OCC. Remote control abilities shall permit configuration and adjustments needed to provide high quality signal amplification necessary to drive station loudspeakers at desired sound pressure levels. Alarm monitoring shall provide notifications to the AIM PA/VMS Headend Software of service degradation and amplifier health status.
- F. Interconnection between DSP and amplifiers shall be capable of using Cobra Net VoIP.
- G. Ambient Noise Sensing Module: The Ambient Noise Sensing Module and Level Detector shall be integral to the DSP.
- H. An Ethernet interface module shall be included with the DSP and amplifiers for VoIP connection and monitoring functions.
- I. A two Port VoIP Gateway to provide live audio over the MBTA network. The VoIP Gateway shall be fully integrated into the MBTA PA/VMS virtual switching matrix and shall provide connectivity from the remote microphones located outside the local passenger station. Local gateways shall be controlled remotely through the PA/VMS AIM software.
- J. Ethernet Switches as necessary to support the Public Address System connectivity.
- K. A three port Router, if required, for network separation.
- L. All Ethernet networking equipment shall be SNMP Managed.
- M. Document Drawer.

## 1.5 QUALITY ASSURANCE

- A. DB Entity Qualifications
  - 1. Shall be primarily engaged in supply, installation, and maintenance of commercial duty sound systems.
  - 2. Shall be authorized by the manufacturer of equipment supplied for the supply, installation, and maintenance of that equipment.
  - 3. Shall be capable of providing a fully assembled, fully tested, and integrated PA/VMS cabinet.
  - 4. Shall employ factory-trained personnel for assembly, installation, and maintenance of this system.

5. Shall maintain a service facility stocked with spare parts, service manuals, and test equipment sufficient to efficiently repair this system and its comprising elements.
6. Shall maintain its service facility within 25 miles of Boston.

#### B. Manufacturer Qualifications

1. A firm whose primary function is to manufacture commercial duty sound products.
2. Pre qualifies DB Entity for supply, installation, and maintenance of products.
3. Furnish support services as follows:
  - a. DB Entity training;
  - b. Periodic DB Entity review for technical performance;
  - c. Service and maintenance manuals, including schematic information and parts lists;
  - d. Factory stock of replacement parts;
  - e. Factory repair service.

#### C. Equipment requirements

1. Shall be standard products employed in similar installations.
2. Shall have been available for installation over a period of two years or more.
3. Shall be factory tested before assembly into system to confirm products meet or exceed manufacturer parameters for:
  - a. Functional capability and control range;
  - b. Electrical gain;
  - c. Self-generated noise;
  - d. Frequency response;
  - e. Distortion;
  - f. Free from RFI and EMI.
4. Exception: DB Entity fabricated assemblies shall be exempted from requirements of 1 and 2 above. Only assemblies specifically designated herein, as "DB Entity Fabricated" shall be exempted.
5. Equipment rack and control panel sub-assemblies shall be fully integrated and tested before delivery to installation site. Test result shall be provided prior to installation. Testing shall include audio, control, Ethernet, and matrix switching functions. Testing shall include both local and remote functionality with the AIM PA/VMS Head End.

#### D. References

1. National Electrical Code.
2. Massachusetts Electrical Code.
3. EIA/TIA
4. NFPA

## 5. IEEE

**1.6 SUBMITTALS**

- A. Submit the following to the MBTA for acceptance before commencing acquisition or assembly of materials:
1. Certification that the installing DB Entity maintains a fully equipped service organization within 25 miles of Boston.
  2. Bill of materials proposed for this project, to include:
    - a. Item's specification reference number;
    - b. Item's specification description;
    - c. Item's manufacturer and model number;
    - d. Manufacturer descriptive literature for each item;
    - e. Quantity of each item proposed;
    - f. Underline all items proposed as alternates to that equipment specified.
- B. DB Entity shall submit the following before commencing acquisition or assembly of materials:
1. AC power requirements for all equipment; Heat generated by all equipment when operating at 10 dB below full rated output, in BTU HRS. Heat dissipation calculations for all equipment installed within equipment case showing rise above ambient temperature;
  2. Block diagrams showing proposed equipment interconnection;
  3. Proposed rack elevation;
  4. Details for DB Entity fabricated items, to include:
    - a. Drawings or samples illustrating proposed size, shape, panel layout, color, finish, labeling, and or pertinent characteristics;
    - b. Electrical schematics and parts list;
    - c. Technical descriptions of parts comprising fabrication.
- C. DB Entity shall submit four copies of following information upon completion of installation:
1. Functional flow diagrams illustrating component connections, with switches, relays, controls, and cable designations referenced by number;
  2. Rack elevation;
  3. Nominal control settings illustrated as pictorial representations of equipment items' control panels.
  4. Fabrication details, with switches, relays, controls and or devices referenced to functional flow diagram.
  5. Data describing manufacturer-produced equipment, to include four bound copies of following:
    - a. Manufacturer's descriptive literature;

- b. Manufacturer's operating manuals;
- c. Manufacturer's servicing information including schematics and parts lists.
- 6. System test and measurement data described in this specification.
- 7. Proposed mounting methods for loudspeakers and or items of substantial weight;
- 8. Loudspeaker orientations;
- D. The DB Entity shall submit a plan to comply with the Audibility/Intelligibility system design provided herein for acceptance to the MBTA. Any exceptions or alternate installation plans shall be submitted prior to start of construction.
- E. DB Entity shall provide 2 sets of, complete passenger station drawings and cabinet drawings along with maintenance manuals to be provided with cabinet at the time of installation. One set shall be turned over to the project manager or his designate the other is remain with the public address cabinet as part of the installation. OEM Manuals and as built drawings to be provided on CD. As built drawings shall also be provided in a hard copy format.

## 1.7 TRAINING

- A. None required.

## PART 2 - EXECUTION

## 2.1 GENERAL

- A. Equipment specified herein shall be as manufactured by Crown, Lyle, Shure, Bogen, Cisco, Mulit Tech, Atlas, or approved equal.
- B. Procedures for submitting proposals for DB Entity fabricated assemblies are described above.
- C. Loudspeaker Cable shall be one-pair, 16 AWG, copper stranded, nominal O.D. 0.255 inch.
- D. Microphone/Control Cable shall be: 4 conductors, 16 AWG, copper stranded, twisted pair aluminum polyester foil-shielded with drain wire, overall PVC jacket, and nominal O.D. 0.355 inch.
- E. Cable shall employ identical color-coding throughout system.
- F. Cable types as accepted by the MBTA.
- G. The Amplifier shall conform to UL 1480 for speaker circuit line monitoring.
- H. The overriding requirement is that the station PA/VMS rack and equipment shall fully integrate, interface and work with the existing Rockwell Collins (formerly ARINC) PA/VMS Head End hardware and software system.
- I. Local microphones shall be installed under this project for local announcements: one in each of the Communications Room cabinets that house PA equipment and one in a location that an in-station agent can access on the platform.

## 2.2 FOUR CHANNEL POWER AMPLIFIER

A. Rated Output:	150 W per channel 70.7 Volt
B. Frequency Response:	$\pm 0.25$ dB. At 1 watt 20Hz to 20KHz
C. Signal to Noise Ratio (20 Hz to 20 kHz):	>105 dB A-weighted.
D. Total Harmonic Distortion from 20 Hz to 20 kHz:	< 0.35%.
E. Damping Factor:	10 Hz to 100 Hz: > 1000.
F. Input Impedance (nominal):	10 kilohms balanced, 5 kilohms unbalanced.
G. Maximum Input Level:	+20 dBu input compression, +32 dBu maximum
H. Load Impedance	2/4/8/16 ohms, Bridge Mono: 4/8/16 ohms
I. Required AC Mains	100- 230Vrms 50/60 Hz.
J. Dimensions:	19 in. W x 3.5 in. H x 14.25 in. D.

**Amplifier shall be Crown Dci 4|600N or equivalent.**

## 2.3 DIGITAL SIGNAL PROCESSOR (DSP)

A. Power Requirements:	100VAC to 240 VAC, <35W
B. Data Communication:	Ethernet
C. Data Format:	CobraNet
D. Analog Inputs:	Up to 16
E. Input Gain Range:	0 to +48 dB, in 6 dB steps
F. Max Input Level:	+20dBu with 0dB input gain,+8dBu with 12dB gain
G. Input Impedance:	3.5kOhms
H. Dynamic Range:	Greater than 100dB (A-weighted, 20 Hz-20kHz)
I. Frequency Response:	20Hz-20kHz, +0.5dB, -1dB
J. Weight:	9 pounds (4.1 kg)
K. Dimensions:	19" W, 12.5" D, 1.75" (1U) H

**DSP shall be BSS BLU-800 or equivalent.**

## 2.4 AUDIO CODEC

A. Analog I/O	Balanced stereo XLR line-level audio (0dBu)
B. Digital I/O	AES3 XLR Digital audio
C. Connection	1, 2 RJ.48
D. Interface	1000 Base-T
E. Format	Ethernet
F. Power	External supply (24VDC 20 Watts)
G. Dimensions	8.5"W x 1.75"H x 6.25"D

**Audio CODEC shall be Comrex Bric Link II or equivalent.**

H. For Dispatcher Workstations only, each Audio Codec requires:

1. Mic Level Distribution Amplifier **RDL Model STM-DA3 or equivalent**
  - a. Input Impedance 1.2kohm
  - b. Gain Range -5 to 12 dB
  - c. Frequency Response 30 Hz to 20 kHz
2. Power Supply **RDL Model PS-24AS or equivalent**

- |           |                |
|-----------|----------------|
| a. Input  | 100 to 240 VAC |
| b. Output | 24 VDC, 500 mA |

## 2.5 CISCO 2960 SERIES INTELLIGENT ETHERNET SWITCHES

- A. Model number WS-2960+24TC-L or equivalent

## 2.6 STATION CONTROLLER

- A. The Station Control Units shall be a microprocessor controlled, modular system using passive backplane technologies with the following specification:
1. Rugged Industrial Rack Mount Computer or approved equal
  2. Industrial 2U 19" Rack \ Desk Mount Case
  3. Riser Card: 2U Riser Card - x8/x4, x16, x8/x4
  4. 550 Watt Power Supply, 115-240V 47-63HZ
  5. Integrated Video Card
  6. 6<sup>th</sup> Generation Intel dual core Processor (3M Cache, 3.7 GHz)
  7. Memory - DDR3/DDR4: 16 GB DDR4 Unbuffered NON-ECC
  8. 2.5" - 500GB Solid State Drive
  9. DVD/RW SATA combo drive (reads CD and writes to DVD/CD)
  10. Microsoft Windows 10 Professional 64-bit
  11. ARINC's AIM PA/VMS SCU software as required

**SCU shall be Industrial Computers, Inc., 2U-MS98H9 or equivalent.**

## 2.7 ROUTER

- |                   |   |
|-------------------|---|
| A. LAN Interfaces | 1 GE + 4-port 10-/100-Mbps managed switch |
| B. Power          | 100 to 240 VAC, 50/60 Hz                  |
| C. Dimensions     | 9.5"W x 1.75"H x 9"D                      |

**Router shall be Cisco C867VAE-K9 or equivalent.**

## 2.8 AMBIENT MICROPHONE - PRESSURE ZONE MICROPHONE

- |                        |   |
|------------------------|---|
| A. Operating voltage   | 12-24 volts AC/DC or phantom power                |
| B. Frequency           | 80 Hz to 10 kHz                                   |
| C. Power sensitivity   | +8 dBm/Pa   |
| D. Connector           | Screw terminals labeled AUDIO+, AUDIO- and GROUND |
| E. Impedance           | 75 ohms, balanced                                 |
| F. Current drain       | 4ma   |
| G. Sound Pressure      | 100 dB SPL/3% THD                                 |
| H. Dimensions (approx) | 4.5" x 2.8" x 2.0"                                |

**Ambient Microphone shall be Crown model PZM-11LLWR or equivalent.**

## 2.9 UNIDIRECTIONAL MICROPHONE

- |                       |  |
|-----------------------|--|
| A. Type               | Dynamic  |
| B. Frequency Response | 100 Hz to 6000 Hz                              |
| C. Power sensitivity  | -56.5 dBV/Pa                                   |
| D. Cable              | Attached, 1.5 m(5 Ft), 4 conductor(2 shielded) |

**Microphones shall be Shure 514B or equivalent**

## 2.10 CONNECTOR BLOCKS

- A. Connector blocks shall be Phoenix Contact Model 3036356 Din Rail Mounted 2.5 Twin MT

## 2.11 LOUDSPEAKERS

### Type I Loudspeaker

- A. The loudspeaker shall be an Atlas Model C803A (70.7v) or approved equivalent, with line matching transformer.
- |                        |                 |
|------------------------|-----------------|
| 1. Speaker Size        | 8" diameter     |
| 2. Power Rating        | 16 watts RMS    |
| 3. Frequency Response  | 70Hz – 15.5 KHz |
| 4. Sensitivity         | 98db peak       |
| 5. Impedance           | Nominal 8 ohms  |
| 6. Cone Material       | Treated Paper   |
| 7. Flex Density        | 10,600 Gauss    |
| 8. Voice Coil Diameter | 1.0"            |
| 9. Weight              | 2.4 lbs.        |

### Type II Loudspeaker

- A. The loudspeaker shall be a Electro-Voice EVID-S5.2X (70V), or approved equivalent,
- |                        |                                 |
|------------------------|---------------------------------|
| 1. Speaker Size        | 10.0" h x 7.1" w x 5.8"d        |
| 2. Power Rating        | 75 watts RMS                    |
| 3. Frequency Response  | 90 Hz – 20 KHz                  |
| 4. Sensitivity         | 89db peak                       |
| 5. Impedance           | Nominal 8 ohms                  |
| 6. Cone Material       | weather-resistant polypropylene |
| 7. Environmental       | IP-65                           |
| 8. Voice Coil Diameter | 1"                              |
| 9. Weight              | 7.1 lbs.                        |
- B. The loudspeaker shall be a surface mount, two-way, full-range system, with an internal passive crossover. The loudspeaker's low-frequency transducer shall be a 5.25" (133 mm) woofer, with a weather resistant poly propylene cone, and a 1" (25 mm) voice-coil. The loudspeaker's high-frequency transducer shall be a 0.75" (20 mm) Ferro fluid cooled driver, coupled to a baffle-integrated waveguide.
- C. The loudspeaker system shall meet the following performance criteria: Power handling, 75 W of IEC 60268-5 continuous pink noise (6 dB crest factor); Frequency response, 55 Hz - 20 kHz (-10

dB from rated sensitivity); Sensitivity, 89 dB at one watt, 100 Hz – 10 kHz at one meter; Impedance, 8 Ohm nominal, 6.5 Ohm minimum. The loudspeaker shall have a transformer suitable for use on 70 V or 100 V distributed lines. The transformer shall have taps ranging from 7.5 W to 60 W, plus an 8 Ohm bypass, selectable using a switch on the rear of the enclosure. The 8 Ohm bypass selection shall be protected by a safety screw. The high-frequency transducer shall drive a waveguide to cover evenly 90° horizontally by 90° vertically.

- D. The loudspeaker should include an IP65 weather cover for the input panel. The system shall be weather resistant to IEC 60068-2-5 Solar Radiation, IEC 60068-2-11 Salt Mist, IEC 60068-2-42 SO2, IEC 60068-2-60 Chlorine, and IEC 60529 IP64 test conditions. The mounting system shall be EIA 636 tested, at a safety factor of 8:1 or better. The
- E. The grille shall be marine grade aluminum. The loudspeaker shall be adjustable over a range of 90° vertically, using a U-Bracket. The loudspeaker shall have an included U-Bracket. The U-Bracket shall be marine grade aluminum.
- F. Electrical connections shall be through a 4-pin detachable Euroblock connector on the input panel. enclosure shall be molded of UL UL94-5VB fire rated ABS plastic.
- G. The DB Entity shall be required to adapt the speaker, if needed, to the Design Documents with the acceptance of the MBTA.

**Type III Loudspeaker**

- A. The loudspeaker shall be a Bogen Model SPT3OA, or approved equivalent, reentrant type horn loudspeaker. The frequency response shall be 225Hz to 14kHz. Rated power output shall be 30 watts, RMS continuous. Dispersion shall be 100°. Sound pressure level, measured four feet on axis with 30watt input @ 1000Hz, shall be at least 125dB.
- B. The unit shall incorporate a seven-position weather-sealed switch, to allow matching the loudspeaker to a 25V or 70V constant-voltage line. Power handling capacity shall be adjustable at 70V to 1.8, 3.7, 7.5, 15, or 30 watts, and at 25V to 1.8, 3.7, 7.5, or 15 watts. Impedance shall be adjustable to 2500, 1300, 666, 333, 167, 89, or 45 ohms.
- C. The loudspeaker shall include a self-aligning, field-replaceable diaphragm. Screw terminals shall be provided for connection to the audio line. A plastic cover shall be provided to protect the connectors and impedance selector switch, and provide strain relief for the audio line. An all-purpose mounting bracket shall provide precise positioning in the vertical and horizontal planes with a single adjustment. The bracket shall include banding slots to permit mounting the loudspeaker on beams or pillars. Bracket and loudspeaker shall be finished in textured mocha enamel. The unit shall measure 11” in diameter by 10-1/2”D.

1. Power Rating (RMS):	30 watts continuous, 40 watts equalized
2. Frequency Response	225Hz to 14kHz
3. Impedance:	25/70 volts
4. Sound Pressure Level	125dB ~ four feet on axis with 30 watt
6. Dimensions	11” Diameter x 10-1/2”d

- D. Weatherproof Equipment: Where equipment is exposed to the weather, provide items specifically designed and listed for such duty.

## 2.12 EQUIPMENT RACK CONTROL PANEL

- A. Furnish and install paging selector switch, to monitor zone output audio.
- B. Furnish and install 19" x 5-1/4" x 1/8" aluminum rack mounted panel which meets or exceeds following requirements:
1. Finish -brush texture and black anodized.
  2. Microphone - close-talking, hand-held, low impedance, push to talk, with normally shorted microphone element and normally open DC control contacts: Altec D9IP, Electro-Voice, Turner or approved equal.
  3. Microphone - right angle cord-mounting Connector XLR-3M type: Switch craft R3M, Cannon, AKG, or approved equal.
- C. Assembly shall be as follows:
1. Bolt barrier strip to rear of panel.
  2. Mount microphone clip with tamperproof hardware.
  3. Bolt microphone receptacle to panel.
  4. Terminate DC status indicators to barrier strip and microphone and DC control wiring to barrier strip. Terminate wiring to barrier strips with spade lugs. Solder all other connections

## 2.13 PRIORITY AND MUTING CIRCUIT

- A. Priority and muting circuit shall sense triggering voltage from the Public Address Computer Control Circuits and Equipment Rack Control Panel. All priority muting shall be accomplished and configured through the DSP
- B. Priority and muting circuit shall prioritize audio inputs as determined by the MBTA.
- C. In the absence of a page announcement, DSP priority and muting circuit shall:
1. Lift all source lines from local inputs
  2. Short all local input lines;
  3. Reduce all local input gains to 60 dB below full output.
- D. In presence of a page announcement, DSP priority and muting circuit shall:
1. Terminate paging source to assigned local input;
  2. Lift short from assigned local input line;
  3. Restore gain of assigned local input channel.
- E. Upon conclusion of a paging announcement, priority and muting circuit shall restore amplifier to idle state.

**2.14 AC POWER SUPPLY**

- A. Conductors - Furnish and install single conductor electrical wires, type THHW, moisture and heat resistant insulation, rated at 600 VAC, with Underwriter's Laboratories (UL) label, and printed throughout entire length, at two-foot intervals, with permanent identifying markers, indicating manufacturer's name, size, type and voltage.
- B. Raceways - Furnish and install electrical feeders installed in galvanized rigid steel conduit.
- C. Circuit Breakers - Furnish and install non-magnetic, molded case type circuit breakers, rated at 600 VAC, with current rating and number of poles.
- D. Power Distribution Panels – Power shall be provided to each equipment case and PA equipment from a MBTA provided distribution system.
- E. AC Power Outlets - Furnish and install 2 rack mounted multi-outlet strips providing 120 VAC, 60 Hz power within each equipment case.

**2.15 EQUIPMENT CASE**

- A. Furnish and install public address equipment housed in an equipment case.
- B. Furnish and install public address equipment case with a thermostatically controlled and vent fan.
- C. Power to the heater and vent fan to be provided on separate circuits from the power distribution panel.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Where conduit is required under this Project, furnish and install separate conduit for the following:
  - 1. AC Power
  - 2. Control Cable.
- B. Cable Dressing
  - 1. Cross power wiring only at right angles and with loop providing separation of at least six inches.
  - 2. Support lateral wiring to prevent contact with station appurtenances and to prevent stress.
  - 3. Protect connections within junction boxes with waterproof electrical tape.
- C. Public Address system circuits shall be run in dedicated conduits.
  - 1. No other circuits may share a public address conduit.
  - 2. All conduits for the public address system shall be a minimum of 1 inch (1") diameter.
  - 3. Public Address system conduits shall originate and terminate in the communications room

**3.2 GROUNDING**

- A. Provide equipment-grounding connections as required. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Equipment rack ground shall be less than 1-ohm from central ground point. Measure, record, and report ground resistance.

**3.3 TESTING**

- A. Test each device in presence of a manufacturer's representative. Upon completion of test, submit a certified test report to the MBTA.
- B. Any system deficiencies observed under testing shall be noted in certified test report. All deficiencies shall be corrected and system shall be retested. Submit a sequential certified test report to the MBTA.
- C. Test the complete system for audibility and intelligibility per NFPA 72 with the MBTA.
- D. Test the complete system in the presence of the MBTA. If any deficiencies are observed, correct same as described herein. Submit as-built drawings, maintenance manuals, and spare parts to the MBTA one-week prior to final scheduled testing.
- E. The MBTA and DB Entity shall conduct final Audibility and Intelligibility acceptance testing of Public Address System on a date established by the MBTA.

**END OF SECTION**