

SECTION 27 51 16 – PUBLIC ADDRESS SYSTEMS (PASs)

1.01 SUMMARY:

- A. ^{A17}**Scope:** Scope of work shall be in accordance with Paragraph 1.01 D. of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), as required, for general announcement of audible messages directed to Locks operating personnel throughout the Sites.^{A17} This Section of the Employer's Requirements shall be read in conjunction with the Sections listed in Table 27 51 16-1.

B. **Related Sections:**

Table 27 51 16-1: Related Sections			
1.	Section 01 81 16.16	-	Locks Appurtenances.
2.	Section 01 81 26	-	Communications, Control, Safety, and Security Systems.
3.	Section 27 11 16	-	Cabinets, Racks, Frames, and Enclosures.
4.	Section 27 21 00	-	Data Communications Equipment (DCE).
5.	Section 27 31 23	-	IP-based Telephone Systems.
6.	Section 28 50 00	-	Evacuation Systems.
7.	Section 40 95 13	-	Process Control Hardware.

1.02 REFERENCE:

- A. **Applicable Publications:** Refer to Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.02.

1.03 REQUIREMENTS:

A. **General Requirements:**

1. **General:**

- a. ^{A17}The Contractor shall meet all applicable requirements of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.03.^{A17}
- b. PASs shall operate on 70 volt line, and shall be capable of sending and receiving audio signals via pre-amplified signal line, LAN wiring, fiber optic cable, or a suitable combination of these.
- c. Audio sources shall include telephone sets, prerecorded announcement players, and a microphones located in locks control rooms and other designated areas.

- d. PASs shall have redundancy in the amplification, control, processing, and distribution of audio signals.
 - e. PASs devices and components shall be connected using fire retardant cabling to meet requirements of Section 28 50 00 (*Evacuation Systems*).
 - 2. **Uses:** PASs shall be provided for multiple uses:
 - a. Automated and manual playback of recorded emergency voice messages.
 - b. Lock operator live voice announcements.
 - c. Lockage automated warnings, such as ship approaching lock, hot ship, and others needed in the future, as specified in Section 40 95 13 (*Process Control Hardware*).
 - d. Plant personnel dial-up live voice announcements.
- B. **Equipment and Materials:**
 - 1. **Amplifiers:**
 - a. Amplifiers shall have adequate output power rated in RMS watts for the intended application, and shall be operated not to exceed 70% of its full power capacity. Units shall have an efficient cooling system, and a total harmonic distortion (THD) not to exceed 1.5%.
 - b. Amplifiers shall be rack mounted, and be protected against open and short circuits. Addressable and modular units are preferable.
 - 2. **Amplifier Network Monitors:**
 - a. Units shall provide input/output control and monitoring, load monitoring, and amplifier management features.
 - b. Units shall have LAN port for remote monitoring.
 - 3. **Audio Distribution Amplifiers (ADAs):** Shall be furnished as required.
 - 4. **Audio Mixers:** Shall be furnished as required.
 - 5. **Audio Processors:**
 - a. Processors shall be provided as required to delay audio so that adjacent speakers appear synchronized in order to prevent perception of sound with echoes and speech intelligibility problems.
 - b. Processors shall provide adjustable delay to live audio sources, including microphones and pre-recorded announcement players.

6. **Cables:**
 - a. **General:**
 - 1) Cables shall be suitable for required distance, impedances, signal levels, and allowable voltage drops.
 - b. **Preamp Level Cables:** Shall be pre-connectorized whenever possible.
 - c. **Speaker Cables:**
 - 1) Cable gauge shall be as required, and #18 as a minimum.
 - 2) Speaker cables shall be fire retardant in accordance with IEC 60332, adequate for evacuation systems, and shall continue operating circuits to loudspeakers for no less than 2 hours after the time a fire starts affecting the cables.
7. **Controllers:** Shall be furnished as required to decide which audio source has higher priority.
8. **Data Switches:** Shall be in accordance with Section 27 21 00 (*Data Communications Equipment*).
9. **Equalizers:** Shall be graphic type. Software based units are preferable.
10. **Microphones:**
 - a. Units shall be a gooseneck type, with desktop base, cable, logic functions, programmable switch, LED indicator, and a snap-fit foam windscreen.
 - b. Microphones shall have cardioid polar pick-up pattern and be tuned specifically for voice applications.
11. **Power Supplies:** Shall be redundant and sized as required for the load.
12. **Recorded Announcement Players:**
 - a. Units shall be provided as required to play back pre-recorded announcements related to warnings and emergency conditions.
 - b. The units shall have storage for no less than one (1) hour of recording.
 - c. Units shall support MP3 formatted files.

13. **Speakers:**

a. **General:**

1. Speakers shall have directivity as required to cover the areas^{A10} indicated in Section 01 81 36.13 (*O & M Buildings and Facilities – Space Programming*),^{A10} including all buildings, the entire lock chamber side walls, WSBs, Crossunders, rolling gate passageways, and all cable galleries.
2. Each unit shall include a matching transformer as required.
3. Speakers shall be equipped and ready for pole or wall mounting, as required.

b. **Speakers for Inside Use:** Shall have one or two cones and drivers, and handle a minimum of 15 watts RMS.

c. **Speakers for Crossunder and Exterior Use:**

1. Speakers shall be weatherproof and have single or dual horns (bidirectional or two cones and drivers), with dispersion as required.
2. Units shall have a power handling rating not to exceed a value that can cause intelligibility problems.
3. Mounting brackets, transformer boxes, and hardware to be used in exterior locations shall be of corrosion resistant materials.

14. **Telephone Interfaces:** A VoIP gateway shall be furnished as required.

15. **Tone Generators:** Shall be furnished as required.

C. **Software:** Shall be furnished as required for system management.

D. **Installation:**

1. **General:**

- a. Unless otherwise recommended by the Contractor and reviewed by the Employer's Representative or his authorized representative, amplifiers, controllers, and processors shall be rack mounted.

2. **Amplifiers:** Shall be rack mounted in an air conditioned area.

3. **Amplifier Network Monitors:** Shall be rack mounted in an air conditioned area, and provided with a unique IP address.

4. **Audio Processors:**

- a. Unless otherwise recommended by the Contractor and reviewed by the Employer's Representative,
 - 1) Time delay for live audio sources shall be set at 2 seconds.
 - 2) Adjacent speakers shall appear to be synchronized within a few milliseconds, so that the human ear does not discern objectionable echoes.

5. **Cables:**

- a. PA system copper cabling shall not go through the locks control room to avoid lightning induced surges.
- b. The contractor shall maintain polarity.

6. **Controllers:**

- a. The units shall be configured so that priorities for the audio sources are set as follows:
 - 1) **Highest Priority:** Recorded announcements related to evacuation systems.
 - 2) **Second Priority:** Microphone.
 - 3) **Third Priority:** Recorded announcements not related to evacuation system.
 - 4) **Lowest Priority:** Telephone calls to specific speed dialing number.

7. **Microphones:** Shall be on the [process control system \(PCS\)](#) consoles and other designated locations.

8. **Power Supplies:** Shall be rack mounted in an air conditioned area.

9. **Recorded Announcement Players:** Shall be installed in racks in the communications equipment room of the Main Control Building of each new locks site.

10. **Speakers:**

- a. Speakers shall be spaced from each other as required to enhance intelligibility considering their power handling capabilities.
- b. Units for exterior use shall be mounted on poles or station posts along the locks walls, and as specified on Section 01 81 16.16 (*Locks Appurtenances*).

- c. Speakers for Crossunder and inside use shall be wall mounted. The quantity of speakers in buildings shall be as required, with no less than one per floor at a central location.
- d. Speakers shall be distributed among amplifier channels in such a way that if a channel fails, adjacent speakers backup the area.

1.04 DESIGN CRITERIA/SYSTEM PERFORMANCE:

A. General:

- 1. **Problem to be Solved:** PASs shall solve the following business needs:
 - a. Provide means to broadcast audible live and prerecorded messages, including evacuation directives, paging, and warnings.
- 2. **Restrictions to be Considered:**
 - a. Mass notification services shall be in accordance with Section 28 50 00 (*Evacuation Systems*). This may require interfacing with PLCs.

B. Design Criteria:

- 1. ^{A10}PASs shall have high speech intelligibility and meet the applicable requirements of ANSI S3.5 and NFPA 72. Also, PASs shall meet the emergency requirements of ISO 7240-16 and ISO 7240-19. ^{A10}
- 2. Systems shall be modular in design facilitating component replacement and system expandability.

C. System Performance:

- 1. PASs shall provide audio signal control, distribution, transmission, amplification, processing and interfacing for communication with people in public, private, open and closed areas.
- 2. The transmitted messages and sounds shall be clearly understood and free from acoustic feedback, noise, or noticeable distortion effects.
- 3. Voice paging shall be one-way.
- 4. Frequency response shall be adequate for voice communications, 70 Hz to 4 kHz ± 3 dB, or better.
- 5. PASs shall prioritize and process audio signals from various sources, including a microphone, pre-recorded announcement player, and telephone patch.
- 6. PASs shall have volume control and be remotely manageable via Employer intranet.

7. Live audio sources shall have an adjustable time delay to prevent acoustic feedback.
8. Upon failure of any speaker, the remaining speakers shall continue operating.
9. PA systems shall have high intelligibility. Audio signals shall be processed as required to maximize intelligibility and minimize echoes.
10. There shall be no annoying or distracting clicks, hum, or pops.
11. PASs shall use DCE and networks for audio transport. Digital components shall process audio at 48 kHz or faster with 24 bit or better resolution. Latency shall not exceed 6 ms.
12. For evacuation purposes, PASs shall have backup equipment as well as standard sound or tones in accordance with international regulations.

1.05 SUBMITTALS: The following shall be submitted for substantiation purposes:

- A. **Design:** The following shall be in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), ^{A10}Subparagraph 1.05 D.: ^{A10}
 1. Calculations, including system availability and sound power requirements.
 2. CPM diagram, with monthly updates.
 3. Descriptive literature.
 4. Drawings, including one-line diagram and speaker layout in open and closed areas.
 5. Preliminary one-line diagram or sketch.
 6. Protection methods for corrosion, ESD, fungus/humidity, lightning/surge, power distortion and harmonics, [radio-frequency interference/electromagnetic interference \(RFI/EMI\)](#), thermal, and vibration.
 7. Quality assurance and control plans.
 8. Specifications.
 9. Any other data required for review.
- B. **Re-submittals Just Prior to Purchasing Materials:** All items in A. above that have changed from original submittal shall be resubmitted in a Design Conference in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.05.
- C. **Upon Receipt of Shipped Items in Panama:**
 1. Instruction manuals for administration, installation, maintenance, and operation.
 2. Packing lists.

D. Prior to Issuance of Taking Over Certificate:

1. As-built drawings.
2. List of recommended spare parts.
3. Software licenses.
4. Test reports, including SPL maps (theoretical and measured with test signal).
5. Training services.

1.06 QUALITY ASSURANCE: Shall include the following in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.06:

- A. Factory Quality Control Tests (FQCT).
- B. Final Field Inspection Tests (FFIT).
- C. Training Services.
- D. Warranty.

END OF SECTION