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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
**OFFICE OF THE SECRETARY**
Manila

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**DEPARTMENT ORDER** )
**No. 232** )
**Series of 2016** ) 19.XII.16

**SUBJECT: DPWH Standard Specification for ITEM 1213 – Public Address System**

In line with the mandate of the Department in providing effective standard specifications in the implementation of various infrastructure projects and in view of the need of setting a standard specification for public address system, the **DPWH Standard Specification for Item 1213 – Public Address System** is hereby prescribed, for the guidance and compliance of all concerned.

The specification shall form part of the on-going revision of the DPWH Standard Specifications for Public Works Structures (Buildings, Ports and Harbors, Flood Control and Drainage Structures and Water Supply Systems), Volume III, 1995 Edition.

This Order shall take effect immediately.

**RAFAEL C. YABUT**
Senior Undersecretary
Officer-in-Charge

Department of Public Works and Highways
Office of the Secretary
WIN6U01401

**DPWH Standard Specification for**
**Item 1213 – Public Address System**

## 1213.1 Description

This Item shall consist of furnishing all materials and supplies, tools, and equipment including all labor and the orientation as required in undertaking the complete installation of the Public Address (PA) System as shown on the approved Plans and in accordance with this Technical Specification. The system shall consist of, but not limited to, the following:

Management system amplifier, power amplifier, mixer pre-amplifier with equalizer, voice announcement board, remote microphone, ceiling speaker, wall mount speaker, CD/DVD player, AM/FM tuner, fabricated rack/cabinet rack, pre-standing loudspeaker booster transformer, conduits and wiring.

### 1213.1.1 Definitions

For the purpose of this Item, the following definitions shall apply.

**Amplifiers.** Amplifier, Audio Amplifier or Pre-Amplifier is an electronic equipment that increases or boosts the direct current or voltage, or both, potential of an audio signal intended for use by another piece of audio equipment.

**Loudspeaker.** An equipment that converts an AC electric signal into an acoustic signal. The term speaker is commonly used to mean loudspeaker.

**Decibel (dB).** Originally a measuring system developed and used by the telecommunications industry, referring to one-tenth of a Bel. It has no units, and always must be related to some reference point, which is designated by a letter following the "dB" indication. 0 dBu is a voltage reference point equal to 0.775V rms.

**Distortion (Electronics).** Refers to a measure of the difference between the output and input signals in a linear component, such as an amplifier.

**Distortion (PA).** An undesirable, audible effect, usually due to the overloading of one or more components of the PA system.

**Sound Pressure Level (SPL).** Sound level is a logarithmic measure of the effective pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standards reference level.

**Audio Power Rating.** The measure of continuous power in watts that an amplifier can deliver, or a loudspeaker can handle in root mean square value (RMS).

### 1213.1.2 System Description

The PA System shall be designed to serve the multi-purpose of making general announcement, playing music, or transmitting fire tone under fire condition.

A specially designed PA System is a Voice Alarm System that can be seen in many situations, especially in public assembly areas such as schools, stations, airports, shopping centers and similar locations. The PA System shall be integrated with the fire detection and alarm system

to provide the specified cause and effect/alarm sequencing in the event of a fire being detected within the building. Typical voice evacuation messages shall be played to provide clear instructional information about the alarm, emergency and evacuation procedures. Fire alarm shall be announced immediately on receipt of fire signal from the panel to all zones.

### 1213.1.3 Quality Assurance

All products/equipment shall be brand new, of a single manufacturer and conforming to the recognized internationally accepted standards.

Installation of the system shall be governed by the provision of the latest edition of the Philippine Electronic Code (PEC) and other existing rules and regulations of the locality and governing agencies. Where applicable codes and standards differ, apply the more stringent requirement. Where codes and standards conflict, consult with Engineer for proper resolution prior to action.

The Contractor shall be responsible for all supervision, commissioning, tests and adjustment for the system. Such work shall be performed by or under direct supervision of a duly-licensed/registered Electronics Engineer.

Upon completion, of the work, the Contractor shall present documentation to the Owner before testing/commissioning and orientation of the system.

### 1213.1.4 Submittals

The Contractor shall submit all related documents which shall be subjected to the approval of the Designer or Engineer. The final documentation shall be submitted by the Contractor based on the Engineer's comments.

#### 1213.1.4.1 Product Data

The contractor shall provide two (2) sets of documents with the following information:

1. User's Manuals and Installation Manuals.
2. Manufacturer's original catalog and technical data sheets for all components that provides details for all proposed products/equipment, wire and conduit, and others. Where a page shows more than one type of product, identify the intended item to be used for the project.
3. Identification of items or components furnished on the job by tag number, model numbers, manufacturer.
4. Complete description, function, specifications and statement as to whether the item is "as specified" or "equivalent".

One (1) copy shall be for the Engineer and one (1) for the end user. One (1) set of soft copy shall also be submitted for backup. Submitted manuals must be up-to-date reflecting any changes which occurred during installation.

### 1213.1.4.2 Shop Drawings

The Contractor shall submit complete shop drawings for the whole system and not pieces of equipment from various systems subject for review and approval prior to purchase or installation. Shop drawing shall include, but not limited to, the following:

1. Floor plans of the building identifying locations of all pertinent equipment and loudspeakers.
2. Riser diagram of the system, including wire count and conduit sizes.
3. Direct voltage or power supply calculations/voltage calculation analysis.
4. Loudspeakers installation details plan or shop drawing.
5. Sequence of operation of the system.

### 1213.1.4.3 As-Built Drawings

The Contractor shall submit Record Drawings of work as actually constructed, as specified in this Section, prior to system acceptance, with the following information:

1. Schematics, wiring diagrams, installation drawings and other pertinent details.
2. Floor plans of the building identifying locations of all pertinent equipment and loudspeakers.
3. Identifying and tag system riser and branch conduits, and junction and pull boxes.
4. Riser diagram of the system, including wire count and conduit size installed.

### 1213.1.4.4 Operation and Maintenance Manuals

1. As-Built Drawings/Plans.
2. Product Submittal for all installed equipment.
3. Manufacturer's Maintenance Manual and Procedures.
4. Complete Operating Instructions or User's Manual.

### 1213.1.4.5 Certificates

1. System Certificate signed by Contractor certifying that the system complied with Contract Documents and applicable codes.
2. Product Certificate signed by manufacturers of equipment certifying that products furnished comply with specified requirements.
3. Installer Certificates signed by manufacturer certifying that installers or technicians are capable of complying with requirements.
4. Manufacturer Certificates signed by manufacturers certifying that they comply with requirements.

## 1213.2 Material Requirements

### 1213.2.1 System Management Amplifier

It shall be a multifunctional amplifier mountable in an EIA-standard equipment rack (3-unit size). It shall have four (4) audio inputs including background music (BGM) input, and a speaker output section which has an internal attenuator and zone selector.

General-purpose broadcast can be made from a remote microphone or from the amplifier. It shall be also capable of emergency broadcast, linked in fire alarm system, that gives pre-recorded voice instructions/chime through a Voice Announcement Board as specified in Section 1213.2.3.

**Table 1. Technical Specification of System Management Amplifier**

| Property | Requirement |
|---|---|
| Frequency Response | 40 Hz to 16 kHz ± 2dB at 240W rated output |
| Distortion | Less than 1% (at rated output F=1KHz) |
| Signal to Noise (S/N) | 60 dB or more |
| Tone Control | Bass: 100Hz ± 10dB (Inputs 1-3 and BGM individually adjustable) |
| Output Voltage/ Impedance | 100V/42Ω<br>(selectable by the internal wiring change) |
| Power Source | Operate on both 230V AC and 24V/15A DC |
| Cable Diameter | AWG22 – AWG14 |
| Microphone Connection/ Expansion Amplifier Connection | Connector: 2 RJ45 female connectors for microphone and expansion amplifier<br>Total maximum distance: 800m<br>Linked cable: Category 5 Shielded<br>Number microphone slot connection: up to 4<br>Twisted-Pair straight cable: TIA/EIA-568A standard |

### 1213.2.2 Power Amplifier

The power amplifiers can be a single or multi-channel amplifier. It shall have adequate continuous RMS power output to meet the requirement of the configuration. The output voltage and impedance shall meet with the system requirements. It shall have a built-in transformer for 50V, 70V or 100V line operation. Amplifiers shall be protected against over loads and output shorts and a special thermal overload on the heat sink.

The front panel shall provide indication of program and unit status. Output connection shall be by screw terminal block mounted at the rear of the unit. For multi-channel amplifier, there shall be a priority function.

The system shall have an Input Selector Module which shall accept different audio sources such as microphones, AM/FM Radios, CD/DVD Players and other similar devices. The program of audio sources can be user selected. The module shall have priority settings so that a priority signal will mute all other signals.

The distributed audio amplifiers shall be magnetically coupled switch mode type with two input signal sources selectable manually or automatically by the fire alarm system. Output wattage shall be as shown in the schedule of work or as required to meet the needs of the PA system.

Power amplifier/audio amplifier shall be mounted in suitable wall mounted / floor standing enclosures.

**Table 2. Technical Specification of Power Amplifier**

| Property | Requirement |
|---|---|
| Distribution Line | 50V, 70V, or 100V |
| Power Amplifiers / Mixer Power Amplifiers | Fully transistorized and capable of delivering 120, 60, 30 watts (RMS) audio power |
| Output Power | 100V / 8 Ohm |
| Frequency Response | 40 Hz to 16 KHz ± 2dB at rated output |
| Distortion | Less than 1% (at rated output F=1KHz) |
| Input | 2 program and 2 priority inputs with program input muting during priority operation |
| Power Source | Operate on both 230V AC mains and 24V DC |
| Housing | compact 19", 2U & 3U high housing for tabletop use and rack mounting |

### 1213.2.3 Voice Announcement Board

It shall have a single source playback mode, with a total number of eight (8) playback programs. It shall offer two (2) emergency announcements, five (5) commercial announcements, and one (1) chime.

### 1213.2.4 Remote Microphone

Input microphone shall be gooseneck-type and have zone-selector, press-to-talk switched, and all-call buttons. It shall have a reset button to deactivate initiated zones and its locations shall be found in the Plans. Additional extension units can be connected, however, the maximum number of extensions may differ per system type.

**Table 3. Technical Specification of Desk Microphone Assembly**

| Property | Requirement |
|---|---|
| Design Suitability | Designed to suit the number of zones required (24 zones) |
| Remote Controls | 12 individual controls and 1 all-call control |
| Distortion | Less than 1% |
| Signal to Noise (S/N) | 60 dB or more |
| Microphone | Unidirectional dynamic microphone with sensitivity -76 dB ± 3 dB |
| Program Function | 2-user programmable function (first in, first served) priority |
| Connector | RJ 45 connector |

### 1213.2.5 CD/DVD Player, MP3 Player, USB and AM/FM Tuner

This unit shall consist of CD/DVD player, MP3 Player, USB and digitally controlled FM/AM tuner housed in a 19-inch, 2U high housing. FM/AM tuner shall have 10 presets and digital control and remote control. The operator shall be able to operate the player and tuner simultaneously.

There shall be a separate outputs and levels for player and tuner and provides player priority for the combined CD/DVD-Player / Tuner output.

### 1213.2.6 Speakers

It shall be especially designed for broadcasting high quality, integrated emergency fire alarm signals and voice communications and approved by an appropriate authority for use in such situations.

The speakers shall be distributed in the entire floor and shall be interconnected in the different zone configuration. The announcement can be made in zone wise or to all the speakers simultaneously in All-Call mode.

It can be either ceiling mounted or wall mounted as shown in the schedule of work and shall have a dynamic loudspeaker driver. The ceiling unit shall be a spring-mount type while the wall-mounted unit shall have an appropriate enclosure made of rigid material and both shall have complete mounting brackets and other accessories.

**Table 4. Technical Specification of Ceiling and Wall Mount Speaker**

| Property | Requirement |
|---|---|
| Capacity (Ceiling Mounted) | 6 W capacity |
| Capacity (Wall Mounted) | 20 W to 10 W capacity as specified indoor type |
| Input | Rated 6 W, maximum 9 W |
| Frequency Response | 40 Hz to 16KHz, or better |
| Sound Pressure Level | 90dB at 1W/m (minimum) |
| Effective Coverage Angle | 90° (minimum) |
| Usable Voltage Line | 100 V line |
| Line-matching Transformer | Provided with multiple power taps at 50V, 70V or 100V line operation. |
| Casement/mounting of Ceiling Mounted | 19 cm baffle gray HIPS case cone speaker with silver aluminum punching<br>For recessed round type, appropriate fire-resistant enclosure (back-box)<br>Rugged metal housing with vandal resistant grille if specified |
| Casement/mounting of Wall Mounted | Metal case type or rugged metal housing with vandal resistant grille if specified |

### 1213.2.7 Fabricated Rack

Fabricated or Equipment Rack shall be a 48.26cm rack mountable that comply with Electronics Industries Association (EIA) (universal spacing) and IEC mounting pitch and shall have Pale Ivory (Off-white) leather tone color.

It shall have sufficient air ventilation fan(s), mounting brackets, blank panels, terminal boards, and other necessary equipment.

### 1213.2.8 Booster Transformer

Audio transformers and autotransformers shall be used only for audio signals in a manner so as not to exceed the manufacturer's stated input or output voltage, impedance, or power limitations. The input or output wires of an audio transformer or auto-transformer shall be allowed to connect directly to the amplifier or loudspeaker terminals. No electrical terminal or lead shall be required to be grounded or bonded.

### 1213.2.9 External Volume Control

This shall be able to control up to ten (10) speakers and shall have a minimum input capacity of one watt (1W). At minimum, it shall have three steps of attenuation control.

## 1213.3 Construction Requirements

### 1213.3.1 Power Supply

A. Primary Power Supply shall be from a dedicated branch circuit with emergency power and shall be used for Public Address System only.

B. Secondary Power Supply Module shall be capable of AC/DC switching with voltage level and input supply failure monitoring. Upon loss or even drop of main supply, the module will switch to the secondary source for continued function. Battery capacity shall be computed in order to support the system for two (2) hours. Computations shall be submitted to support that the calculated rating complies with the minimum requirement.

### 1213.3.2 PA System Wiring

PA system wiring shall be done with Twisted wire (black/red) 1.6mm2 or TF wire cable in 20 mm diameter PVC conduit including termination, complete as required.

The speakers in each zone are connected in parallel and are connected to the respective output. The cables from each zone are separately routed and terminated in the Panel.

Wiring methods shall be in accordance to the requirements of Philippine Electrical Code (PEC).

## 1213.4 Delivery, Storage, and Handling

PA System shall be delivered, handled and stored manufacturer's instruction together with the following provisions:

1. It shall be transported, handled and stored carefully in such a way which avoids product damage.
2. It shall not be stored directly on floor store room. Adequate support shall be provided. Amplifiers, loudspeakers, and other equipment shall be so located and protected as to guard against environmental exposure or physical damage, such as might result in fire, shock, or personal hazard.
3. It shall be covered as directed by the Engineer.
4. It shall be inspected upon delivery and any damage shall be reported to the Engineer.

a. Any equipment damaged during delivery, storage or installation shall be marked and set aside.
b. Proposals for repair of any damaged equipment shall be submitted in writing to the Engineer for approval.
c. No repairs to damaged equipment shall be attempted without the Engineer's approval.
d. Any damaged equipment deemed unsuitable for repair according to the Engineer shall be removed from site and replaced at the Contractor's expense.

## 1213.5 Test and Acceptance

Upon completion of the installation of this Item, the Contractor shall test and verify that the installed system is working properly and as intended. Testing shall be comprehensive and sufficient to demonstrate compliance with each requirement and as per system manufacturer recommendations. A written report of tests and verification shall be submitted to the Engineer and shall be approved by the Engineer for final acceptance. The written report shall include, but not limited to the following:

1. The power and data conduits and cables are routed to the correct terminal cabinet.
2. Adequate room is available for installation of the master controller and that there is room to open the cabinet door.
3. The Contractor has protected the installed cables and speaker units from physical and water damage.
4. The installation meets minimum code requirements of PEC/NEC and NFPA 70.
5. The Contractor has corrected all punch list items prior to beginning the tests.
6. The PAS mounting channel is square and level.
7. The data wiring has been terminated in the terminal cabinet in the proper manner.
8. The Contractor has recorded the results of performed tests for Public Address System as required by the specifications to check its functionality, such as:
    a. acceptable audibility in all spaces
    b. sound pressure levels of the Public address such as the ambient noise levels
9. Combined systems has been tested for the overriding feature for prioritizing fire alarm and life safety requirements.

## 1213.6 Warranty

The Contractor shall guarantee that the electrical installation is done in accordance with the approved Plans and Specifications.

The Contractor shall provide warranty for the entire Public Address System for a period of one (1) year or twelve (12) months from the date of final acceptance of the system by the Engineer.

The warranty includes, but not limited to the following:

1. All components shall be free of defects in materials and in workmanship. Defective components shall be replaced or repaired as required without cost to the Owner.

2. There shall be a response team that will respond to service request on-site, if required.
3. There shall be assigned personnel responsible for routine and breakdown maintenance of the equipment during the warranty period.

The Contractor shall provide training course for the operator conducted by the qualified/trained professional instructor, at no additional cost.

### 1213.7 Method of Measurement

The work under this Item shall be measured either by lump sum, meter, unit and set of what is actually placed and installed as shown on the approved Plans and accepted to the satisfaction of the Engineer. In computing the quantity, the dimensions shall be those as measured in place and completed based on the preceding requirements.

### 1213.8 Basis of Payment

All works performed, accepted quantity measured as prescribed in Section 1213.7 and as provided in the Bill of Quantities, shall be paid for at the Contract Unit Price for Public Address System which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

| Pay Item Number | Description | Unit of Measurement |
|---|---|---|
| 1213 (1) | Public Address System | Lump Sum |
| 1213 (2) | System Management Amplifier | Set |
| 1213 (3) | Power Amplifier | Set |
| 1213 (4) | Voice Announcement Board | Set |
| 1213 (5) | Remote Microphone | Set |
| 1213 (6) | Ceiling Speaker | Set |
| 1213 (7) | Wall Mount Speaker | Set |
| 1213 (8) | CD / DVD Player | Unit |
| 1213 (9) | AM / FM Tuner | Unit |
| 1213 (10) | Fabricated Rack | Set |
| 1213 (11) | Booster Transformer | Set |

*References:*

1. *Philippine Electrical Code (2009). Part 1 Volume 1.*
2. *National Electrical Code (2005). 10th Edition.*
3. *Internet: http://www.lopol.org [Public-address-system-in-electrical-construction-contract]*
   *http://www.toa.jp [VM-2240 System Management Amplifier | TOA Products] &*
   *http://www.toa.jp [VM-2000 Series Integrated Voice Evacuation System]*
   *http://www.boschcommunications.com.au [PA_catalogue_2010_-WEB.pdf]*