

## SECTION 27 53 14

### ~~~ PROJECT NOTE ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

### ~~~ END OF PROJECT NOTE ~~~~~

## CLOCK SYSTEMS

### ~~~ PROJECT NOTE ~~~~~

UTILIZE THIS SPECIFICATION FOR RENOVATION AND ADDITION PROJECTS ONLY.

### ~~~ END OF PROJECT NOTE ~~~~~

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Clock system requirements.
- B. Equipment and materials.
  - 1. Admin Master Station.
  - 2. Speaker Call Stations.
  - 3. Call-Switch Unit.
  - 4. Amplifiers
  - 5. Speakers.
  - 6. Conductors and cables.
  - 7. Auxiliary Components.

### 1.02 DEFINITIONS

- A. Refer to Section 27 05 03 - Communications General Requirements for definitions.

### 1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. City of Chicago Building Code - Municipal Code of Chicago for the Building Industry; 2017.
- C. City of Chicago Electrical Code - National Electrical Code with Chicago Amendments; 2017.
- D. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 27 05 03 - Communications General Requirements.
- B. Shop Drawings: Submit six (6) complete sets of shop drawings including:

1. Manufacturer's product data for each type of product specified.
2. Details of master clock system including, but not limited to the following:
  - a. Console layouts.
  - b. Control panels.
  - c. Rack arrangements.
  - d. Include dimensional information.
  - e. Submit scaled system layouts drawings using architectural floor plans for Master Clock System equipment indicating transmitters, repeaters, programming configurations, clocks, etc., for this project. Include coverage of signal.
- C. Wiring diagrams detailing wiring for power, signal, and control differentiating clearly between manufacturer-installed wiring and field installed wiring. Identify terminal numbers and wiring color codes to facilitate installation, operation, and maintenance. Identify interface to other systems.

#### **1.05 INFORMATIONAL SUBMITTALS**

- A. Field Testing Data.
- B. Identify frequency operating range of system and indicate any interference from other sources that could disrupt system.
  1. Submit copy of application for FCC operating license.

#### **1.06 CLOSEOUT SUBMITTALS**

- A. Record Documents:
  1. Provide record documents in accordance with 01 78 00 - Closeout Submittals and 27 08 00 - Commissioning of Communications Specification Sections.
  2. FCC operating license.

#### **1.07 QUALITY ASSURANCE**

- A. Comply with the following:
  1. City of Chicago Electrical Code.
  2. Applicable TIA/EIA standards.
- B. Conform to requirements of City of Chicago Building Code.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 50 miles of Project.
- D. Supplier Qualification: Authorized distributor of product manufacturer with a minimum of three years documented experience.
  1. Engage an experienced product supplier who is a factory-authorized sales and service representative regularly engaged in the design and installation of such systems to oversee the installation, trouble-shoot and make final connections at head end equipment. The supplier must be located within fifty (50) miles of the end user.
  2. Supplier shall have represented the product and components being installed for a minimum of three (3) years.
- E. Installer Qualifications:
  1. Firm with at least five (5) years of successful installation experience with projects installing wireless clocks similar to that required for this project.
  2. The installer shall have a minimum of two (2) factory certified technicians. Copies of each technician's factory certification must be included with the submittal.
- F. Products: Listed, classified, and labeled as suitable for the purpose intended.
- G. All system and components shall be Underwriters Laboratories listed and labeled.
- H. All systems and components shall comply with FCC regulations.
- I. EIA Compliance: Comply with the following Electronics Industries Association Standards:
  1. Racks, Panels, and Associated Equipment, EIA/ECA-310.
  2. UL Compliance: Comply with requirements of UL 50.

J. Warranty:

1. The entire system and its components shall be covered by a three (3) year labor warranty from date of acceptance. Acceptance will be provided in writing by Engineer after system is installed, programmed and tested to the satisfaction of the Board.
2. The warranty period shall start at date of acceptance. Acceptance will be provided in writing by Engineer of Record after system is installed, programmed and tested to the satisfaction of the Board.
3. Manufacturer agrees to repair, restore or replace the master clock system components that fail in materials or workmanship with the specified warranty period.
4. Warranty work shall be performed during normal working hours. Emergency call back service shall be provided, at additional costs, within the following response times. High Schools four (4) hours or less and Elementary Schools eight (8) hours or less.

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

**PART 2 PRODUCTS**

**2.01 SYSTEM DESIGN**

- A. General: Furnish and install all equipment, accessories, and materials to provide a complete and operating wireless master clock system.
- B. Wireless clock system shall continually synchronize all clocks throughout the facility. The system shall utilize NTP technology to provide atomic time, the most accurate and reliable time. Clocks shall automatically adjust for daylight savings time. The system shall be upgradeable to allow for changes in daylight savings time. The system shall include an internal clock reference so that failure of the NTP signal shall not cause the clocks to fail in indicating time.

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*~~~ END OF PROJECT NOTE ~~~~~*

- C. Integrate with the existing master clock system and provide signaling to unit for a consistent time base for existing and new secondary clocks.
- D. Remove the existing master clock system, wiring, clocks, etc. Include all necessary patching, filling, painting as required to match existing room interior.
- E. Provide wireless clocks as shown on Drawings.
- F. Include wireless repeaters as required based on site survey of building conditions, building expansion, construction methods, design criteria and manufacturer's recommendations at no additional cost to the Board.
- G. Coordinate installation into existing combination clock/speaker backboxes.
- H. The system shall incorporate a "fail-safe" design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.
- I. All equipment with digital Apparatus (microprocessors) that generate and utilizes timing signals at a rate in excess of 10,000 pulses per second to compute and operate, must be Federal Communications Commission (FCC) and "DOC" CSA Standards C108.8 (electromagnetic emissions) approved. Any equipment supplied or installed without the above approvals will not be accepted.
  1. Compliance with Government Regulations and Guidelines: FCC Class A part 15. Transmitter and receiver shall comply with part 90 of FCC.
  2. Provide operating licenses for a minimum of ten years.
  3. Ensure notification of renewal requirements are distributed to the Board.

## 2.02 SCOPE OF WORK

- A. Description:
  - 1. Provide a complete wireless master clock system with secondary clocks.
  - 2. Supply clocks that use 120-Volt plug-in power to keep time. Provide 120-Volt power for the clocks as shown in the construction documents. Batteries within each clock are not acceptable.
  - 3. The clocks shall maintain correct synchronized time and transmit time-correction signals wirelessly from a clock transmitter to the secondary clocks. Example: Analog Synchronous Clocks should correct for minute and second hand synchronization at least once each hour.
  - 4. The clock system is independent from the intercom and bell program equipment.
  - 5. Provide for manual control of the programmed signal to the equipment.
  - 6. Regulate system timing functions backed up for power outages by an internal battery power, temperature-compensated crystal-controlled oscillator.
  - 7. Daylight Saving Time Correction done automatically.
- B. System shall be integrated and synchronized with Ethernet-Based Network Time Protocol (NTP) to reference atomic time base.

## 2.03 CLOCK SYSTEM REQUIREMENTS

- A. Provide new clock system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

## 2.04 MANUFACTURERS

- A. It is the intent of this specification to establish a standard of quality, features and functionality. In addition, it is intended to standardize on one manufacture for the master clock system. Acceptance of manufacture does not exempt them from meeting the specification in its entirety. Acceptable manufacturers are:
  - 1. Sapling; [www.sapling-inc.com](http://www.sapling-inc.com).
  - 2. Primex; [www.primexinc.com](http://www.primexinc.com).
  - 3. Rauland-Borg Corporation; [www.rauland.com](http://www.rauland.com).
  - 4. American Time and Signal Company - [www.american-time.com](http://www.american-time.com).
  - 5. DuKane; [www.dukane.com](http://www.dukane.com).
  - 6. National Time and Signal; [www.natsco.net](http://www.natsco.net).

## 2.05 SYSTEM REQUIREMENTS

- A. Wireless master clock system with wireless transmitter, wireless repeater, wireless analog clocks. System shall have the ability to interface to the following systems:
  - 1. Data network servers for network time synchronization.
- B. The clocks shall use 120-Volt plug in electrical power. No Batteries.

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**EDIT BELOW IF NOT SUITED TO PROJECT**

**~~~ END OF PROJECT NOTE ~~~~~**

- C. The system shall work as a standalone system in conjunction with the existing wired system.
- D. Transmitters shall be sized to provide a signal throughout the building.
  - 1. Provide calculations from the manufacturer verifying transmitter size and wattage to allow coverage of the entire building.

## 2.06 SYSTEM OPERATION

- A. Wireless Master Clock System:

1. Facilities for a master clock system which shall provide class change signaling and shall serve as controller to ensure that a consistent time base is maintained throughout the Facility.
2. Facilitate operation and adjustment of secondary clocks located throughout the Facility.

## **2.07 SYSTEM HEAD-END EQUIPMENT**

### **A. Master Clock System:**

1. The system shall be microprocessor based multi-functional clock controller.
2. The master clock shall allow for the programming of up to eight (8) simultaneously synchronized time zone groups. The Master Clock System shall provide the ability to distribute class change signals to any or all of the zones.
3. The clock system shall provide Automatic Daylight Savings Time change. Provide the ability for two (2) daylight savings time changes to be programmed into the system.
4. LCD display that shows time, date and signal verification.
5. The system shall provide a GUI based software for the ability to review, edit and delete events. Provide connection to customer LAN for remote editing capability.
6. It shall be possible to access the master clock active schedule via a telephone (pin) and schedule of the master clock. It shall also be possible to review and change programmed time events.
7. The system shall provide the ability to test all output zone circuits.
8. Interface with all types of secondary slave clocks.
9. The system shall provide a crystal-controlled time base for assured accuracy.
10. The system's time base shall include a Lithium battery which will provide not less than 10 years battery back-up of the time keeping function.
11. Scheduling Software - Provide to the Board, Windows based system software to interface with the Master Clock to schedule tones in specific zones as required. Install software on two (2) computers.
12. The wireless clock system shall include a transmitter to a network connection for deriving time from the network system.
13. Primary Transmitter shall be a wireless transmitter, a surge suppressor/battery backup and a mounting shelf. The clock system shall transmit time continuously to all clocks in the system.
14. Synchronizes virtually any vendor's secondary clocks
15. Corrects up to three different vendors clocks simultaneously
16. Can interface with a PC for remote programming and diagnostics.
17. Mounts in two rack units.
18. Provide and install Surge protector / Battery Backup input 120-Volt AC 60 Hz, output 120-Volt AC, 500 VA, 300 Watts and Surge Energy Rating of 365 joules.
19. Each secondary clock is designed for use with a 120-Volt AC clock application.
20. Can receive up to ten pre-programmed SNTP servers.

### **B. Equipment Mounting:**

1. Master clock shall be rack mountable in a standard 19-inch rack. Provide all necessary power, cable and connections as recommended by the manufacture for proper installation.

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**SPECIFY LOCATION OF SYSTEM EQUIPMENT. SPECIFY RACK IF NECESSARY.**  
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2. Master clock shall be installed in as indicated on floor plans.
3. Cable Connection Sealant: Radio Shack coaxial cable connector sealant 278-1645, or comparable electrical grade silicone sealant, subject to approval by the Architect/Engineer of Record.

## **2.08 WIRELESS TRANSMITTER / TRANSCEIVER**

- A. The wireless transmitter shall be microprocessor based and integrated for time signal generation. The transceiver shall transmit time signals to wireless secondary clocks throughout the facility.
  - 1. Transmit minimum distances of 1000 meters.
  - 2. Inputs: RS485, 59 minute, 58 minute, sync wire.
  - 3. Ten (10) year battery backup.
  - 4. Power Input 35 Watts.
  - 5. Voltage Inputs 85-265 Volt AC, 50/60 Hz.

## **2.09 COMPUTER SYNCHRONIZATION UNIT**

- A. Utilize network time protocol for time basis.
- B. Software shall be Linux, Windows, Mac Client compatible.

## **2.10 PERIPHERAL EQUIPMENT**

- A. Wireless Analog Secondary Clocks:
  - 1. The Wireless analog clocks shall receive signal from the master clock wireless transmitter and receive time signals which automatically correct time and will also adjust itself automatically twice a year for Daylight Savings time and Standard Savings Time. The clock shall have a black, low profile, smooth, high impact poly-styrene case. The crystal shall be high impact styrene with UV inhibitor. The clock shall have a white dial with black numerals, black hour, minute and second hands. The clock shall have an atomic movement with a battery life of five years.
    - a. Wireless device.
    - b. Power:
      - 1) 120-Volt AC with Transformer, compatible with the Master Clock.
    - c. Analog clock shall be capable of synchronization; each hour-minute hand correction, 12-hour - hour hand correction, and second hand correction.
      - 1) Each hour; Minute hand correction.
      - 2) Each 12-hour; Hour hand correction.
    - d. Sweep second hand; color shall be black.
    - e. Round face.
    - f. Standard 12-hour display with 1-1/4-inch black numerals and white dial.
    - g. Internal receiver and transmitter.
    - h. Shatterproof lens.
    - i. Low-profile, semi-flush metal housing.
    - j. 12-inch diameter standard dial. Single face and Double face.
      - 1) Provide 15 or 16-inch diameter dial in Gymnasiums, Natatorium, and Auditoriums.
    - k. Provide a tamper-proof/theft resistant clock lock mounting.
    - l. Provide wire guards for clocks in Gymnasium, Natatorium areas, Locker Rooms and Lunch Room.
    - m. Clocks in Natatorium and Locker Rooms shall be gasketed and treated for the environment.
- B. Quantity and types of clocks as shown on Drawings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine building conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the wireless master clock system work. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.
- B. Notify Architect/Engineer of Record of conditions that would adversely affect installation or subsequent use.

- C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of substrate conditions and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

### 3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. General: Install system in accordance with City of Chicago Electrical Code and other applicable codes. Install equipment in accordance with manufacturer's recommendations and written instructions.
- C. Wiring Methods: Install wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces, where open cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal wiring.
  - 1. Provide separate pathway for clock system cabling from other electrical systems. Do not run sound cabling in close proximity to telecommunications cabling.
  - 2. Comply with requirements for raceway and boxes and their installation as specified in the CPS Standards Sections 26 05 33.13 - Conduit for Electrical Systems, 26 05 33.16 - Boxes for Electrical Systems, and 26 05 33.23 - Surface Raceways for Electrical Systems.
  - 3. Comply with requirements for cabinets and racks as specified in the CPS Standards Section 27 11 16 - Communications Cabinets, Racks, and Enclosures.
- D. Route cabling parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps or similar fittings so designed and installed as not to damage the cables. Secure cable at intervals not exceeding 30 inches and not more than 6 inches from every cabinet, box, or fitting.
  - 1. Route conduit above structural steel to best conceal conduit.
- E. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- F. Control Circuit Wiring: Install control circuits in accordance with City of Chicago Electrical Code and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
- G. Wiring Within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars. Velcro straps to be used for bundling cables, plastic tie wraps not permitted.
- H. Provide physical isolation from each other for microphone, line level, speaker, and power wiring. Run in separate raceways or provide 12-inch minimum separation where exposed or in same enclosure. Provide additional physical separation as recommended by equipment manufacturer.
- I. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures.
- J. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- K. Weatherproofing: Weatherproof units to be mounted out-of-doors or exposed to weather in any degree.
- L. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.
- M. Clocks shall not be installed until painting and other finish work in each room is complete.
- N. Observe clock until valid time signals are received and clock adjusts itself to correct time.
- O. Install clocks on the wall in indicated position, plumb, level and tight against the wall. Attach using clock-lock hanging method and suitable fasteners as approved by manufacturer.
- P. Wire Guards: Secure to wall, using approved theft-resistant fasteners.

- Q. Analog Clocks: Full-size, functioning clocks equal to 10 percent of quantity installed, but not more than five clocks.
- R. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.
- T. Identify system wiring and components in accordance with Section 26 05 53 - Identification for Electrical Systems.

### **3.03 PROGRAMMING REQUIREMENTS**

- A. Manufacturers shall identify, initiate, coordinate and complete all required programming of the clock system as listed in the specification and required for proper use and secure operation of the system from tampering.

### **3.04 GROUNDING**

- A. Provide equipment grounding connections for master clock system as indicated. Tighten connections to comply with tightening torques specified in UL 486A-486B 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. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

### **3.05 FIELD QUALITY CONTROL**

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Program system parameters according to requirements of Board.
- C. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- D. Submit detailed reports indicating inspection and testing results and corrective actions taken.
- E. Manufacturer Field Services: Provide the services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- F. Before final acceptance of the system, manufacturer-supplier of system shall, in presence of Electrical Contractor, Board Representative, test each and every component and device in the system. Test shall be documented with signed copy submitted to the Electrical Contractor, the Board and Architect/Engineer of Record.
- G. The system shall be physically inspected by the Board Representative and the Architect/Engineer of Record to assure that all equipment is installed in a neat and workmanlike manner as called for in the plans and specifications.

### **3.06 SYSTEM TESTING, ADJUSTMENTS, AND CLEANING**

- A. Upon completion of the system installation, and after circuitry has been energized with the normal power source, the manufacturer/supplier shall test the system to verify the following:
  - 1. All components are operational and functioning properly to the system designs intent.
  - 2. System Shutdown Test: Verify correction of all connected master and secondary clocks on the system after system has lost power.
  - 3. The complete system is free from grounds, open and shorts except for made grounds required by the system installation.
  - 4. Correct all of the above and retest to demonstrate compliance where required by Architect/Engineer of Record.
  - 5. All testing shall be documented. Provide a signed copy to the Board and Architect/Engineer of Record verifying the system is complete and fully functional.

- B. The manufacturer/supplier shall set all field adjustable components to optimize the system. Balance all signals, adjust and verify input voltages, current settings and frequency settings. All devices must be tested at their operational location under normal operational conditions to assure reception of signal.
- C. Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by clock manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

### **3.07 TRAINING**

- A. Provide on-site training on the use of the master clock system to the Board's selected personnel.
  - 1. Provide a minimum of six (6) hours of training to selected personnel. Training shall be completed in 3-hour increments. Training shall include programming, adjustment, troubleshooting, and replacement of components including batteries and preventative maintenance of the system.
  - 2. Schedule training with the Board at least seven (7) days advance notice.
  - 3. Provide laminated instruction sheets to all users with all commonly used procedures for operating the system.
  - 4. Provide the Board with three (3) DVDs of the on-site training.
- B. Occupancy Adjustments: When requested by the Board within one year of date of Preliminary Acceptance/Substantial Completion, provide on-site assistance in changing system programming (bell schedules) at no additional cost to the Board.

### **3.08 OPERATION AND MAINTENANCE MANUALS**

- A. Equipment Manuals:
  - 1. Approved copy of system submittal.
  - 2. Provide a complete set of equipment cut sheets, parts list, including maintenance criteria, "trouble-shooting" guide, distributor information and service information for all equipment provided.
  - 3. Provide a complete set of instruction manuals; including complete written programming instructions, programming documentation and system set-up documentation.
    - a. Provide an additional quick-start guide with all commonly used procedures for operating the system. Laminate and provide copies to all offices.
  - 4. Provide all test results performed. Include manufacturer's certifications that installed system complies with specification requirements.
- B. Operating License: Submit evidence of application for FCC radio station authorization prior to installing equipment. Furnish the license to the Board prior to operating the equipment. The original license must be delivered to the Board.

### **3.09 CLEANING AND PROTECTION**

- A. Prior to final acceptance, protect clean system components from damage and deterioration.

**END OF SECTION 27 53 14**