SECTION 27 51 19
SOUND MASKING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes electronic noise generators, amplifiers, wiring, loudspeakers, controls, and components to generate, amplify, distribute and reproduce digitally synthesized and stabilized background sound masking to improve speech privacy in new portion of building.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI S1.4 American National Standard Specification for Sound Level Meters
   2. ANSI S1.6 American National Standard Specification for Preferred Frequencies and Band Numbers for Acoustical Measurements
   3. ANSI S1.11 American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters

B. American Society for Testing and Materials (ASTM):
   1. ASTM E 1130-02 Standard Test Method for Objective MEasurementof Speech Privacy in Open Offices Using Articulation Index.

C. National Fire Protection Association:
   1. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 SYSTEM DESCRIPTION

A. All masking units must be UL listed for use in a ceiling plenum.

B. All equipment and associated hardware shall be fabricated and installed in accordance with the manufacturer’s written recommendations.

C. All wiring shall be minimum 18 gauge.

D. Location of grounding points shall be determined carefully to insure minimizing of system hum and elimination of ground loops. In addition, all connections of shields and conductors to equipment shall be in accordance with manufacturer's instructions and best professional practices.

E. In open areas and larger enclosed spaces, the overall sound level produced should have special uniformity of no more than ½ dB between any two sound generating units.
F. The sound generating units must have an adjustable sound spectrum shaping control in order to meet the varying spectral requirements of drywall ceilings; various types of ceiling tile, air return grills and openings around lighting fixtures, etc.

1. The spectrum shaping ability shall be variable within the accepted background sound masking range (acoustical preferred curve).
2. Units installed over drywall ceiling should be wired for spectrum control adjustment and remote sound level.
3. Sound-Power Level produced by system: Sound masking system must not exceed NC 40 contour between 400 and 2000Hz, and have smooth roll-off above and below those frequencies when measured 1 meter from speaker.
   a. Final adjusted level: Determine final level for each space individually by measurement as specified.
   b. Measurements: Made under Calibration conditions.

G. Maximum Average range of sound power level: 1 dB in the 250, 500, 1000, 2000, 4000 and 6000Hz range for 75 percent of the locations covered.

H. Spatial Uniformity (Directional Effect :) People in masked space under normal operating conditions cannot determine source of masking sound.

I. Temporal Uniformity: One minute time-averaged sound pressure level of any octave band of masking sound from 250 to 8000 Hz remains constant in any space to within a standard deviation of 2 dB when measured over a 30-minute period.

J. Sound Quality: No audible hum or noise, other than masking noise, from this system in masked spaces should be detected.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Prepare and submit detailed dimensioned shop drawings for conduit runs (if required) and other distribution services including elevations showing minimum clearances and installed features and devices for system components. Show types and locations of masking speakers and their wiring connections. Channel assignments, and axis orientations. Show ducts, beams. And other significant sound reflecting and absorbing elements in ceiling space and show locations of partitions below ceiling. Include a diagram showing interconnection of major system components for each zone and channel and indicating grounding connections.

C. Product Data: Submit catalog data showing specified ratings, colors, finishes, and physical dimensions.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit operating and programming instructions, and maintenance instructions for each component. Include data for each type of product, including all features and operating sequences. Both automatic and manual.
C. Manufacturer's Field Reports: Include report of final field testing and measurements after final adjustment of system.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

B. Obtain sound masking equipment components from a single source that assumes responsibility for compatibility of items used.

C. Components, speakers and power transformers must be UL listed for their appropriate use or listed as an equal to UL through another competent agency.

D. Perform a speech and privacy evaluation to provide an articulation index (AI) as per ASTM E1130-02. A report of the AI must be provided.

1.7 COORDINATION

A. Coordinate quantity and arrangement of speaker assemblies with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air distribution components, raceways, cable trays, recessed lighting fixtures and other item.

1.8 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of equipment for one year from Date of Substantial Completion.

1.9 WARRANTY

A. Provide a ten year full warranty on all equipment and installation.

PART 2 PRODUCTS

2.1 SOUND MASKING

A. Manufacturers:
   1. Cambridge Sound Management
   2. Lencore Acoustics Corp.
   3. Substitutions: Section 01 60 00 - Product Requirements

2.2 EQUIPMENT

A. The enclosure for the sound masking speakers shall consist of aluminum or electroplated steel, cylindrical housing.
B. Speakers: 5-1/4 inch units mounted on metal baffles and arranged for optimum, multi-directional, angular sound distribution. Arrange units for suspension from the building structure above the ceiling.

C. The system must be capable of being zoned on both a global and local level for sound. Local zoning will be designed in accordance with the space plan for those areas requiring special attention; i.e. reception areas, offices, clerical work areas, open areas, patient check in areas, special work areas. All zoning must allow both volume and frequency adjustments within each zone measured at 48” A.F.F. within +/- ½ dBA.

D. Loudspeaker
   1. Size: 5-1/4 inch wide dispersion
   2. Power Rating: 10 Watts
   3. Frequency Response: 50-12,000 Hz
   4. Pressure Sensitivity: SPL – at Watt/m – 90dB
   5. Impedance: 16 Ohms

E. Noise generator: Octave bands from 50Hz to 8000Hz
   1. Voltage: 16 to 24 Volts AC, 60 Hz
   2. Contour Adjustments
   3. Spectrum adjustment shall meet acoustical preferred curve
   4. Output adjustments
      a. 10 position step-volume control !1.5 dB per step
      b. Minimum 15 dB remote central volume control.

F. Wire: The speaker wiring shall be minimum 18 gauge, stranded, non-shielded, UL Listed, Plenum Rated.

G. Step Down Transformer:
   1. Power Requirement  120v AC, 60Hz
   2. Fuse  6-Amp Reset Circuit Breaker
   3. Power Rating  95VA
   4. Size  4 ¼” x 4 ¼” x 4”
   5. Transformer Specifications  16v/95va

H. Remote Central Volume Control:
   1. The Remote Central Volume Control unit must operate as a central volume control from which universal volume adjustments can be made remotely for a minimum 50 main units (150 total speakers) and covering up to 33,000 square feet system-wide.
   2. The unit must consist of an individual self-contained noise generator, audio amplifier, loudspeaker in a damped aluminum enclosure, powered by 16/18 volts AC and is capable of driving one secondary model in addition to the aforementioned.
   3. The central volume remote control unit must allow adjustment to the volume of sound masking system remotely.
   4. Volume adjustment: A rotating switch accompanied by a wall mountable plate and is adjusted by rotating the dial from 0 to 10.
   5. Each remote central volume remote control unit is solid state and consists of a CMOS/MSI digital random sequence noise generator, electronic amplifier, and filter for active spectrum
shaping and is equipped with a 10-step volume control, an additional continuous volume control, and the central volume remote adjustment control (as previously described above). Range of sound level: 41-86 dBA.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive work.

C. Verify raceways and boxes are ready for installation.

3.2 INSTALLATION

A. Mounting and Loudspeakers shall be concealed above the acoustical ceiling. The loudspeakers shall be suspended from the deck above by chain. The speaker face shall be located at a height equal to one-quarter of the ceiling plenum depth. Where possible, the bottom, of each speaker shall be located a minimum of 6" to 8" (150 to 200mm) above the acoustical ceiling tile. However, it is most important that all units hang at a uniform height throughout to insure a uniformity of sound when the system is turned on.

B. Wiring Method: Install wiring in accordance with all local electrical codes. Conceal cable in accessible ceilings, walls and floors where possible.

C. Pulling Cable: Do not exceed manufacturers’ recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between normal termination points. Remove and discard cable where damaged during installation and replace it with new cable.

D. Grounding: As recommended by manufacturers, unless more stringent requirements are indicated. Ground equipment and conductors to eliminate shock hazard and to minimize ground loops. Common mode returns, noise pickup, cross talk and other impairments. Install 5-Ohm ground at main equipment location. Measure, record and report ground resistance.

E. Impedance Matching: For systems components including connecting cable, provide end-to-end level and impedance matched signal paths. Use matching networks and balancing devices at connections where necessary to avoid mismatches.

F. Splices, taps and terminations: Make splices, taps and terminations on numbered terminal strips in junction, pull and outlet boxes; and equipment closures.

G. Identification: Identify system components, wiring, cabling, and terminals according to electrical specifications. Use color coded conductors and apply wire and cable marking tape to designate wires and cables so media are identified in coordination with system wiring diagrams.
H. All equipment and associated hardware shall be fabricated and installed in accordance with the manufacturer’s specified recommendations.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect system to assure proper operation.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturer’s field services.

B. Furnish services of technician to supervise installation, adjustments, final connections, system testing, and Owner training.

3.5 PRELIMINARY TESTS AND ADJUSTING

A. At the completion of installation of speakers, the Subcontractor shall perform initial tests and adjustment. It is suggested that, with the speakers installed in accordance with specified spacing and orientation, tests be conducted in an open area of maximum size. Tests shall indicate that all acoustical performance requirements described herein are satisfied.

B. All testing and adjusting of the system shall be accomplished in the absence of the eventual occupants whenever possible. These precautions are essential to insure that the attention of the occupants will not be unnecessarily drawn to the noise or to its source.

3.6 FINAL TESTS AND ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. The manufacturers’ agent with the support and cooperation of any Subcontractor installer shall perform the acceptance testing of the completed installation. These tests shall be performed to demonstrate that the equipment is fully furnished and installed in compliance with the terms of the Specifications in all Contract Documents. Except as otherwise specified, the Manufacturer or Subcontractor shall provide all instruments, equipment, labor and materials necessary to complete these tests.

C. Manufacturers Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation and connections. Report results in writing. Include the following:
   1. Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units and retest. Make initial sound spectrum and level adjustments for each zone.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
4. Sound Masking Power Level Adjustments: Adjust independently for each space to minimum level of 47dBA to ensure speech privacy between adjacent workstations while complying with other system requirements.

D. The Contractor shall project the completion date of tests and adjustments to give a minimum of one week’s notice to owner/architect.

E. Measurements of system performance shall be made using a calibrated ANSI precision sound level meter set for "slow" meter damping and ‘A’ scale filtering. The measurements shall be made at not less than twenty test positions at 4’ height above the floor level, with gain adjusted to provide the system design level. All interior finishes and furnishings shall be in place.

F. Retest: Correct deficiencies identified by tests and observations and retest until meeting specified requirements.

G. Recording Control Settings and System Adjustments: Record final control settings and programming and final tap setting of speaker matching transformers. Record final sound level measurements and observations.

H. Occupancy Adjustments: When requested within 12 months of date of substantial completion manufacturer is to provide on site assistance in adjusting system to suit actual occupied conditions. Provide one visit to site outside normal occupancy hours for this purpose without additional cost to the owner.

3.7 DEMONSTRATION AND TRAINING

A. Furnish training of system, to be conducted at project site with manufacturer's representative.

END OF SECTION