PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete and operational sound system as described in Contract Documents.
   2. Assist Sound / Acoustical Consultant with final inspection and equalization of system and provide necessary test equipment for sound system and partition noise isolation tests. Correct problems found at time of final inspection of system.

B. Related Sections:
   1. Section 06 2221: Field-fabricated speaker enclosures with fiberglass insulation.
   2. Division 26:
      a. Raceways, equipment and control cabinets, pre-fabricated speaker enclosures, fittings, and audio cables.
      b. Power to equipment location and power relay wiring.
   3. Sound / Acoustical Consultant will perform final inspection, system balance, equalization, and instruct local leaders in operation of system.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Installations with equalizers shall meet following performance parameters:
      a. From 100 Hz to 2 kHz, flat within plus or minus 2 dB.
      b. Above 2 kHz, slope down along an approximate 3 dB per octave slope to 8 kHz.
   2. No noise, hum, RFI pickup or distortion shall be audible under normal operating conditions.
   3. Sound systems shall reproduce program material at level of 80 to 85 dBA without audible distortion.
   4. All input levels shall be pre-set so system may be operated without going into feedback under normal conditions.
   5. Seat-to-seat variations in the 4kHz octave band shall not exceed plus or minus 2 dB in the Chapel or Cultural Center.
   6. Sound masking system shall provide adequate speech privacy in Corridor when set between 42 dBA and 46 dBA so conversation in Office at slightly raised voice levels cannot be understood in Corridor.

1.3 SUBMITTALS

A. Quality Assurance / Control: Itemized list of equipment to be supplied.

B. Closeout:
   1. Operations And Maintenance Data:
      a. Equipment Manufacturer's manuals and warranty information.
      b. Include following items supplied by Sound / Acoustical Consultant at time of final inspection:
         1) Sound system operation and maintenance instructions.
         2) List of equipment provided, including portable equipment, showing make, model, and serial number.
1.4 WARRANTY

A. Provide complete warranty repair or replacement for one year at no cost to Owner, except in case of obvious abuse. If failure causes Chapel or Cultural Center sound system to be inoperative or unusable for its intended purpose, Installer, when notified of problem before Wednesday, shall repair system so it will be operational and usable by following Sunday. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.

B. Honor component warranties for term established by Manufacturer, if greater than one year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Category Four components as shown on Drawings from following Manufacturers. No substitution allowed without approval of written request submitted to Sound / Acoustical Consultant through Architect. See Section 01 6000 for definition of Categories.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Category Four Approved Installers. Specified installers are to both furnish and install components of sound system. See Section 01 6000 for definitions of Categories.
1. <Insert Specified Installer>
2. <Insert Specified Installer>

3.2 PREPARATION

A. Verify compliance with following items before beginning work of this Section.
1. No cables spliced.
2. Isolated ground run back to electrical panel from all equipment cabinets.
3. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.
4. Location and angle of speaker cabinets.

B. Ensure that no solid structural or decorative member impedes sound propagation from speakers and that no member with cross section greater than 3/4 inch 19 mm is placed in front of speakers.

C. Verify installation of fiberglass insulation in field-fabricated speaker enclosures.

### 3.3 INSTALLATION

#### A. Speakers:
1. Maintain uniform polarity in speakers and wiring.
2. Employ no positive stop in rotation of speaker volume controls. Controls shall be capable of continuous rotations in either direction.
3. Mount transformers with screws securely to speaker brackets or enclosures. Adjust torsion springs as necessary to securely support speaker assembly.
4. Neatly mount speaker grilles, panels, connector plates, control panels, etc., tight, plumb, and square unless indicated otherwise on drawings.
5. Provide brackets, screws, adapters, springs, rack mounting kits, etc, recommended by manufacturer for correct assembly and installation of speaker assemblies and electronic components.
6. Line factory-fabricated speaker back boxes with one inch 25 mm minimum fiberglass if not done by Back box Manufacturer.

#### B. Equipment Cabinet:
1. Install vent panels at top and bottom of equipment cabinets and between components where possible for maximum ventilation. Locate amplifiers at top of cabinet. Locate equalizers below amplifiers, separated by several vent panels.
2. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of cabinet.
3. Securely fasten in place equipment that is not rack mounted, including relays and other small components. Do not use sticky-back tape.
4. Install balancing / isolation transformer when balanced and unbalanced components are connected.
5. Wire XLR-type connections with pin 2 hot, pin 1 shield.
6. Connect powered components to 120 VAC outlets on voltage suppressor power bars. Do not connect to outlets on other components.
7. Identification:
   a. Legibly identify user-operated system controls and system input / output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label equipment and controls within equipment cabinets using similar labels or printed labels from a label maker or laser printer.
   b. Affix label to rack panel inside cabinet listing name and telephone number of installer. Appropriate warranty instructions may be included.

#### C. Pulpit:
1. Install pulpit microphone pre-amplifier to be accessible below lectern. Do not alter factory supplied microphone cable and connectors.
2. Install pulpit microphone so tip of microphone head is 2 inches 50 mm inside edge of lectern when microphone is tilted down to maximum extent.

#### D. Cables:
1. Leave sufficient service loops of uniform length on cables to allow for future equipment replacement.
2. Make parallel connections or splices on standard barrier terminal blocks using spade lugs, or on equipment terminals using appropriate connection type. Do not attach more than three spade lugs under any one screw terminal.
3. Strip wires installed in Euroblock or Phoenix connectors so 1/16 inch 2 mm of wire is exposed outside connector when wire contacts back of connector. Secure wires using screwdriver with blade of same width as screw slot and handle 3/4 inch 19 mm minimum diameter and of length to allow applying sufficient torque to prevent wires from becoming disconnected.
4. Terminate conductors with proper mating connectors. Do not use adapters. Use proper crimp tool as recommended by Connector Manufacturer. Use controlled duty cycle ratcheting crimp tools of proper size for spade lugs and Molex pins.
5. Male CAT-5 connectors shall be grey-smoked or blue-smoked RJ-45's. After installing RJ-45 connectors, test CAT-5 cables for shorts, opens, and cross-pairing with two-piece wire-mapping continuity tester.
6. Secure cables to equipment cabinet with wire ties to ensure neat installation. Secure sticky-back wire tie mounts with screw. Keep speaker cables and video cables separate from other cable types.
7. Ground both ends of each shielded cable within equipment cabinet only. Ground microphone cables only at mixer.
8. Label both ends of cables with source and destination. Use HellermannTyton Tag 49L-105 or similar label types.
   a. Example 1: PULPIT MIC: MIXER IN 1.
   b. Example 2: DSP OUT B: CC1 AMP IN.

3.4 FIELD QUALITY CONTROL

A. Installer Testing:
   1. After completion of installation but before inspection by Sound / Acoustical Consultant, perform following:
      a. Conduct system tests and make necessary corrections for proper system operation including, but not limited to, following:
         1) Output level uniformity.
         2) Polarity.
         3) Shock, strain excited hum, and oscillation.
         4) Clipping, hum, noise, and RFI in all system configurations.
         5) Speaker line impedances.
         6) Loose parts and poor workmanship or soldering.
      b. Sweep speaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to speakers or enclosures. Notify Contractor and Sound / Acoustical Consultant of external causes of buzzes or rattles.
      c. Rough Balance: Balance system well enough that it can be used for meetings before final inspection.
   2. Complete documentation required by Sound / Acoustical Consultant and submit to consultant within 5 days of Substantial Completion.

B. Sound / Acoustical Consultant Inspection And Equalization:
   1. Coordinate final inspection schedule with Sound / Acoustical Consultant two weeks minimum before Consultant's final inspection.
   2. Have copy of redlined record documents available at time of inspection.
   3. Have loose equipment (microphones, cables, etc.) available at time of inspection.
   4. Assist Sound / Acoustical Consultant in final inspection of completed system.
   5. Assist Sound / Acoustical Consultant in noise isolation testing of folding partitions and office doors.
   6. Provide following test equipment in good working order:
      a. Laptop computer, 100 MHz Pentium or better, with 16 bit sound card, software, and interfacing adapters for microprocessor controlled equipment in system.
      b. 1/3 octave real-time audio spectrum analyzer with SPL meter, and precision microphone.
      c. Digitally generated random pink noise generator, 20Hz-20kHz, minimum 2 hour repetition rate or 10 minutes minimum of equivalent signal recorded on compact disc.
d. Direct reading audio impedance meter, minimum 3 frequencies, and 10 percent accuracy.

e. Digital Volt-Ohmmeter.

f. Audio oscillator, variable frequency, 20Hz-20KHz.

g. Compact disc player, or equal, with pre-recorded speech and music program material.

h. Necessary chargers, cables, test leads, adapters, and other accessories for test equipment.

i. Tools and spare parts for making adjustments and corrections to system.

j. Blank cassette tape for testing cassette recorder.

k. CAT-5 / RJ-45 continuity tester similar to Ideal 62-200 or Amprobe DCT-300.

7. Correct minor items so Sound / Acoustical Consultant may certify satisfactory completion during his visit.

END OF SECTION