
Part 1 General

1.1 REFERENCES

- .1 ASTM E1374-06 (11) – Standard Guide for Open Office Acoustics and Applicable ASTM Standards.
- .2 ASTM E1573-09 – Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels.
- .3 ASTM E1130-08 – Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index.
- .4 ASTM E2638 – Standard Test Method for Objective Measurement of Speech Privacy Provide by Closed Rooms.
- .5 Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274).

1.2 SHOP DRAWINGS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instruction, printed product literature and data sheets for Sound Masking Systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Include single line diagram, sound masking speaker layout of complete Sound Masking System.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Include:
 - .1 Operation and Maintenance Data: submit operation and maintenance data for Sound Masking Systems for incorporation into manual.
 - .2 Include parts list using component identification numbers standard to electronics industry.
 - .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

Part 2 Products

2.1 MATERIALS

- .1 Conduits: size as indicated, in accordance with Section 26 05 00 – Common Work Results-Electrical.
- .2 Communication conductors: type and size as indicated, in accordance with manufacturer's cable type and sizes, shall be CMP or FT6 rated.

2.2 SYSTEM DESCRIPTION

- .1 The contractor shall supply and install a complete and operational Sound Masking System as indicated on the plan.
- .2 The sound masking speaker shall be direct field type, radiating directly into space.
- .3 The sound masking system shall automatically adjust based on the room's ambient noise level or timer-based system.
- .4 System Architecture:
 - .1 The system shall be of a networked decentralized architecture with addressable masking devices distributed throughout the installation areas.
 - .2 The sound masking system shall be arranged into zones from 1 to 6 speakers.
 - .1 Each zone shall be individually addressable and controllable for both volume and spectrum for fine tuning of the system.
- .5 Sound Masking Generating System:
 - .1 The system shall use digital signal processing (DSP) technology for masking sound generation and output adjustment of masking signals.
 - .2 Sound masking generator shall include an automatic calibration process on 340 narrow bands or third-octave bands from 100Hz to 6.3kHz based on DSP technology.
 - .3 The system shall provide independently controllable masking zones that efficiently allow the ability to control and monitor the operation of each zone and provide:
 - .1 A third-octave equalizer per zone with minimum 18 bands, ranging from 100Hz to 6 300Hz.
 - .2 Ability to select specific spectrum for each masking zone.
 - .3 Definition of sound masking spectrum by increment of 0.1dB in each 1/3 octave band.
 - .4 An independent masking volume control providing minimum 0.1dBA volume increments and an output range of 35 to 85dBA @ 1m from the loudspeaker.
 - .5 A temporary mute function for the masking output.
 - .6 The ability to completely disable the masking output.
 - .7 Ability to provide a masking volume ramp-up function of up to four (4) weeks to facilitate the introduction of the system in the buildings that are already occupied.

- .8 The system shall provide a function to allow a gradual ramp-up of masking volume each time power is applied.
- .6 System Control and Software:
 - .1 The configuration and the adjustment of the system shall be made with a PC or a tablet connected by a wireless connection. The wireless connection is required only during the configuration of the system.
 - .2 The sound masking system shall include graphical software interface that integrates the design, setup, and calibration stages directly on the office layout plan.
 - .3 When adjustment needs to be made on the sound masking system, the operator shall be able to make the changes directly from the area that needs modification. The operator control PC or tablet shall be able to communicate with the system by wireless.
- .7 Sound Masking Systems Acoustical Performance:
 - .1 The preferred target sound masking frequency spectrum to be used shall be as per Table 1 and as per Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274) for each zone.
 - .1 The frequency contour provided shall be maintained at different dBA target levels by equally applying the positive or negative difference, between the nominal 45 dBA level and the target dBA level, to each of the one-third frequency band's dB level, so as to equally shift the entire contour. (E.g. a target level of 42dBA, will require shifting the entire 45dBA spectrum down equally by 3dB in each of the 1/3 octave frequency bands).

Table 1: Optimal Sound Masking Spectrum (ref. Bradley, NRCC-46274 report)
- Nominal 45 dBA Contour

1/3 Octave Band Centre Frequency	1/3 Octave dB Sound Levels (Overall = 45dBA Nominal)
Hz	dB
100	42.5
125	42
160	41.5
200	41.5
250	41
315	40.5
400	39.5
500	38.5
630	37.5

1/3 Octave Band Centre Frequency	1/3 Octave dB Sound Levels (Overall = 45dBA Nominal)
Hz	dB
800	37
1,000	35.5
1,250	33.5
1,600	31
2,000	28.5
2,500	26.5
3,150	23.5
4,000	21.5
5,000	19.5

- .2 Provide adaptive volume control adjustment. Masking sound levels for each location type shall be as follows:
 - .1 45dBA in open plan areas.
 - .2 45 +/- 2dBA in open areas with the adaptive volume control adjustment option.
 - .3 42dBA in enclosed rooms.
- .3 The supplier shall setup the sound masking system to meet acoustical performance requirements when HVAC systems are functioning under what is considered a "normal" mode of operation for occupied periods.
 - .1 It is the Owner's Representative's responsibility to ensure HVAC systems are operating as required during sound masking system's scheduled commissioning.
 - .2 The supplier shall not be responsible to meet acoustical performance requirements in locations where, existing background noise exceeds sound masking spectrum levels, and/or where building design details or other constraints prevents its proper installation, setup and operation.
- .4 The spectrum should be verified and adjust to match target spectrum for every 100 to 150 square meters in open area and in 20% of enclosed rooms. The measurement shall be performed at representative locations 1.5m above floor level 1m away from demising partitions and walls or large reflecting surfaces, in concordance with ASTM E1573 measurement procedures.
- .5 After adjustment, the system shall provide spatial uniformity within the tolerances provided below:
 - .1 Overall dBA levels measured within zones and in enclosed rooms shall be within +/- 1 dBA, of the specified target level for the combined mechanical and sound masking level.
 - .2 Uniformity in any third-octave band shall vary no more than +/- 2dBA, from the 1/3 octave band contour levels indicated in Table 1.
 - .3 In the situation where building background noise exceeds the target spectrum, special attention should be taken to identify the source.

- .6 To meet the above requirement, and follow flexible adjustments of the masking level, each 100 to 150 square meters of an open area shall have an independent adjustment capability.
- .7 Upon completion of installation, and final setup the supplier shall provide a report to the Owner's Representative of the sound masking systems acoustical performance.
- .8 Adaptive Volume Control Adjustment in Open Areas:
 - .1 The adaptive volume control system provides a real-time volume adjustment of the masking sound level based on the level of distracting noise in a zone.
 - .2 The ambient noise shall be measured with sensors installed in the ceiling.
 - .3 The adaptive adjustment system shall be based on the latest DSP technology.
 - .4 Sensitivity of the active volume control shall be programmable to adapt masking level with ambient noise increase.
 - .5 Level variation rates shall be adjustable with 0.1dB steps, updated every 15s.
 - .6 The minimum and maximum sound masking level and the sensitivity of the active volume control shall be programmable.
 - .7 It shall be possible to control the masking sound volume in each zone independently.
 - .8 History of the active volume control shall be recorded on a 7 day period to allow the performance of the system to analyzed.
- .9 Timer Performance:
 - .1 The system shall provide a timer function allowing masking volume levels to be automatically adjusted according to a programmed schedule.
 - .2 The system shall provide a calendar-based programmable timer function. Time schedules shall be assigned to an individual or group of sound masking zones.
- .10 Security Performance:
 - .1 The system shall provide
 - .1 Password protected access to the project manager software.
 - .2 Storage of settings in memory in each networked masking device, which shall be maintained during power outages.

2.3 REGULATORY TESTING AND CERTIFICATIONS

- .1 The relevant system components shall conform to:
 - .1 UL 60065/ULC 60065 – Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General.
 - .2 FCC – EN 55103-1&2 – Audio, Video and Entertainment Lighting Control.

2.4 WARRANTY AND MAINTENANCE

- .1 Provide a written warranty that the system components installed shall be free from defects in parts or assembly for a 5-year period from date of substantial inspection.

Part 3 Execution

3.1 INSTALLATION

- .1 Install system equipment as indicated and in accordance with manufacturer's instructions.
- .2 Interconnect system components.
- .3 Follow all applicable codes and standards for the area.
- .4 Follow manufacturer's recommendations regarding installation.
- .5 Follow the system design for location of loudspeakers and wiring.
- .6 Record any necessary changes to the system design on the plan.
- .7 Ensure that supplementary material used meet applicable safety standards.

3.2 EXAMINATION

- .1 Verification of conditions: verify that conditions of substrate previously installed under other sections or contracts are acceptable for intercommunications systems installation in accordance with manufacturer's written instructions.
 - .1 Ensure that facility build out is at a stage suitable for the system installation.
 - .2 Ensure that facility is constructed according to plans, including wall locations, ceiling types and plenum barriers.
 - .3 Ensure power requirements have been provided as per plan.
 - .4 Ensure sufficient space for centrally located components is available as per plan and manufacturer's specifications.
 - .5 Ensure any third-party components required to be interfaced with the system have been provided.

3.3 FIELD QUALITY CONTROL

- .1 Ensure that loudspeakers are installed in ceiling tiles in a level manner.
- .2 Ensure cables are properly supported in the ceiling.
- .3 Ensure cables are securely terminated.
- .4 Ensure cables are plenum rated.

3.4 SYSTEM CONFIGURATION AND ADJUSTMENT

- .1 Follow manufacturer's recommendations for system settings as found in the User Manual.

3.5 DEMONSTRATION AND TRAINING

- .1 Demonstrate operational system to the Departmental Representative.

- .2 Demonstrate functionality of the system to the Departmental Representative.
- .3 Provide any training to the Departmental Representative that may be required under the terms of the contract to maintain and/or operate the system or any optional devices (e.g. in room controls).
- .4 Provide one (1) two (2) hour training session for users and one (1) two (2) hour training session for maintenance personnel.

3.6 TESTS

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results-Electrical.
- .2 Conduct intelligibility performance test.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by intercommunications and program systems installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 – Common Work Results - Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect communication raceway systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.
- .2 Cable tray distribution system.

2.2 MATERIAL

- .1 Conduits, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .3 Junction boxes, cabinets type E: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .4 Outlet boxes: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

- .5 Fish wire: polypropylene type.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install empty raceway system, distribution system, fish wire, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 27 05 14 – Communications Cables Inside Building
- .2 Section 26 05 00 – Common Work Results – Electrical
- .3 Section 01 74 19 – Waste Management and Disposal

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA-C22.2 No. 214-17, Communications Cables (Bi-National standard with UL 444).
 - .2 CAN/ULC C102.4M (1987) Test for Fire and Smoke Characteristics of Electrical Wiring and Cable.
 - .3 CAN/CSA-C22.2 No. 182.4-M90 (R2020) Plugs, Receptacles and Connectors for Communication Systems.
 - .4 CAN/CSAT529-91, Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-568-B.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - .2 TIA/EIA-568-B.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - .3 TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - .4 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.
 - .5 TIA/EIA-607 (CSA T527) Grounding and Bonding
 - .6 TIA/EIA TSB-67 UTP End-to-End System Testing
 - .7 TIA/EIA Bulletin TSB-36 Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables, Electronic Industries Association (USA), November 1991.
 - .8 TIA/EIA Telecommunications Systems Bulletin TSB40, Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware, Telecommunications Industry Association, August 1992.
- .3 Uniform International Conference of Building Officials Building Code (ICBO).
- .4 BICSI Telecommunications Distribution Method Manual 13th Edition.
- .5 BICSI Information Transport System Manual 4th Edition.

- .6 Treasury Board Information Technology Standard (TBITS) No. 6.9 Profile for the Telecommunications Wiring System in Government Owned and Leased.

1.3 SYSTEM DESCRIPTION

- .1 Structured system of telecommunications cables (copper) installed within renovation area for distributing video signals for A/V connections, sound masking component connections and connections to lighting control system.

Part 2 Products

2.1 HORIZONTAL CABLING, SOUND MASKING AND AUDIO VISUAL

- .1 Cable supplied for sound masking equipment and audio-visual connections shall be Category 6, UTP- 4 Pair, 24 AWG, CMP rated cable, FT6 rated.
- .2 Category 6 Electrical Specifications
 - .1 DC Resistance @ 20C, Maximum: 9.8 Ohm/100meters
 - .2 DC Resistance Unbalance, Maximum: 5%
 - .3 Mutual Capacitance, Maximum: 5.6 nF/100meters
 - .4 Capacitance Unbalance Pair to Ground, Maximum: 330pF/100meters
 - .5 Input Impedance: 100+/- 15 Ohms from 1 Hz to 100MHz 100+/- 22 Ohms from 100MHz to 200MHz
 - .6 Nominal Velocity of Propagation: NVP Plenum 72% @ 10MHz
 - .7 Propagation Delay (Skew), Maximum: 20 ns/100meter
 - .8 Blue in color.

Maximum Attenuation Values, Worst Pair and Cross Talk (NEXT Min).

Frequency (MHz)	Attenuation (dB/100m)	Next (dB Min.)
1	2.0	74.3
4	3.8	65.3
8	5.4	60.8
10	6.0	59.3
16	7.6	56.3
20	8.5	54.8
25	9.6	53.3
31.25	10.7	51.9
62.5	15.5	47.4
100	19.9	44.3
200	29.2	39.8
250	33	38.3
300	36.6	37.2
350	40.0	36.2
400	43.2	35.3

2.2 HORIZONTAL CABLING, LIGHTING CONTROL

- .1 Cable supplied to all voice outlets shall be Category 5e, UTP – 4 Pair, 24 AWG, CMP rated cable, FT6 rated.
- .2 Category 5e Electrical Specifications
 - .1 DC Resistance @ 20C, Maximum: 90 Ohm / 1000 meters.
 - .2 DC Resistance Unbalance, Maximum 3%.
- .3 Mutual Capacitance, Maximum: 5.6 nF/100 meters.
- .4 Capacitance Unbalance Pair to Ground, maximum: 66 pF / 100 meters.
- .5 Input Impedance: 100 +/- Ohms from 1 Hz to 100 MHz, 100 +/- 18 Ohms from 100 MHz to 200 MHz.
- .6 Nominal Velocity of Propagation: NVP Plenum 72% @ 10 MHz.
- .7 Propagation Delay (skew), Maximum: 25ns / 100 meter.
- .8 White in color.

Maximum Attenuation Values, Worst Pair and Cross Talk (next min).

Frequency (MHz)	Attenuation (dB/100m)	Next (dB Min.)
1	2.0	69.3
4	4.0	60.3
8	5.7	55.8
10	6.4	54.3
16	8.1	51.3
20	9.1	49.8
25	10.2	48.3
31.25	11.4	46.9
62.5	16.4	42.4
100	21.0	39.3
200	26.6	36.4
250	30.4	34.8
300	34.4	32.3
350	41.4	28.1
400	44.5	27.1

2.3

WALL MOUNT RACK

- .1 Shall be utilized for wireless lighting control system components.
- .2 One piece back and side frame construction. Black, painted steel.
- .3 Hinged bracket on one side and standard drilled hole configuration on opposite side.
- .4 475mm wide, 610mm deep.
- .5 Minimum 12U height.
- .6 Provide one full depth shelf for each 12U of rack height.

2.4

FLOOR MOUNT ENCLOSED RACK

- .1 Fully enclosed, 44U high rack, 610mm wide, 900mm in depth.
- .2 Stand alone or gangable configuration.
- .3 Fully welded frame.
- .4 14-gauge steel bottom.
- .5 16-gauge steel, solid side panels.
- .6 Single lockable front door complete with 25% venting.
- .7 Double lockable solid rear doors complete with 4U vented panels at bottom.

- .8 Top panel complete with two (2) 95 CFM fans controlled from an internally mounted thermostat. Top panel also to include a removable 150mm x rack width panel to allow cable entry.
- .9 Provide pre-drilled and threaded rack rails. Rails shall be threaded to 10/32 holes front and back.
- .10 Internally mounted vertical power strip complete with twenty (20) 5-15R receptacles, 1800mm in length and direct connection. Power bar shall be configured for one (1) 20A circuit. Power cord shall be minimum of 1800mm in length and located at bottom when mounted.
- .11 Provide all required fastenings, supports and fittings to give a complete factory assembly.

Part 3 Execution

3.1 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

- .1 Install horizontal cables between equipment components and at audio visual outlets.
- .2 Plastic tie – wraps, ‘C’ clamps, ‘D’ rings are not permitted for use with communications cabling. Only hook and loop straps are permitted, and are to be utilized every 610mm.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .1 The Departmental Representative/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
 - .2 Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable for all copper plant wiring.
 - .3 When errors are found, the source of each error shall be determined, corrected and the cable re-tested. All defective components shall be replaced and re-tested. Defective components not corrected shall be reported to the Departmental Representative/Engineer with explanations of the corrective actions attempted.
 - .4 Test results for each UTP cable must be submitted with identification to match labels on all patch panel ports and 8 position modular jacks, and identification to match as-built associated with that cable.
 - .5 Departmental Representative will observe and verify the accuracy of test results submitted.
- .2 UTP cable installations tests:
 - .1 Contractor to show evidence of channel bandwidth performance by submitting to the Engineer “Testing Certificate” of manufacturer’s product evaluated by independent testing authority or agency to TIA/EIA-568-B.

- .2 The installed channel must pass all Category 5e and 6 tests using a high-performance level tester equipped with a compatible link interface adapter. Testing capability shall be up to 350 MHz including verification for Cable length, Wire Mapping , Cross-Talk (NEXT), Equal Level Far-End Cross-Talk (ELFEXT) , Power Sum Cross-Talk (PSNEXT) , Power Sum Equal Level Far-End Cross-Talk (PSELFEXT), Attenuation, Attenuation to Cross- Talk Ratio (ACR), Propagation Delay , Return Loss, and Delay Skew.
- .3 For each network drop installed the following documentation must be provided on a CD:
 1. Room # of installation
 2. Cable ID
 3. Length of cable in metres
 4. Wall plate ID
 5. An indication of what test type was used and whether the test was a PASS or FAIL.
 6. Output from cable tester showing attenuation on each pair, and NEXT for all pair combinations. Complete output of the test result is desirable.

The test results from the cable tester should also be included in electronic form on a compact disk in PDF format.

3.3 LABELING

- .1 Label each cable within 50mm of terminations.
- .2 Use permanent, wrap around, self-adhesive labels employing individual characters. Characters shall be minimum 14 point, bold, Arial font, black on white background.
- .3 Prior to labelling, coordinate with the Shared Services Canada personnel to determine the exact labelling standard. Allow for 10 characters per label.

3.4 GROUNDING AND BONDING

- .1 Racks shall be grounded using #6 AWG insulated copper conductor. Provide all required bonding material and hardware and bond to insulated ground bar with Room 150.7. ANSI/TIA/EIA 607 Grounding and Bonding requirements must be met.

3.5 “AS BUILT” RECORDS

- .1 Provide as built drawings detailing the terminations and connections for all communication conductors. As built drawings shall include label names for all terminations and connections as installed on site. Provide in hard copy format.

END OF SECTION