PART 1 - GENERAL

1.1. SUMMARY

A. The work covered under this Section shall consist of a testing, documenting, and commissioning of an operable end to end structured cabling system.

B. Complete installation shall comply with the campus or owner's latest telecommunication and IT standards documents.

1.2. RELATED SECTIONS

A. Division 27

1.3. PROJECT AS-BUILT AND CLOSEOUT DOCUMENTS

A. Accurately record exact sizes, locations, heights and quantities of cables and Information Outlets.

B. As-built drawings shall indicate all final cable routes and final outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

C. Drawings shall indicate final TR & ER locations along with their final build out conditions at end of the project.

D. Submit bound folders of product used in the project for record.

E. Submit cable tester calibration reports.

F. Submit all copper and fiber optic test results as indicated in Part 3 of this specification. This should include every cable channel installed in the project.

G. Plans shall be provided in full size PDF, AutoCAD or REVIT format within a CD or DVD along with hard copies.

PART 2 - PRODUCTS

2.1. NOT USED

PART 3 - EXECUTION

3.1. GENERAL

A. Contractor shall follow standard industry installation practices as described in the latest release of the BICSI TDMM.

3.2. IDENTIFICATION AND LABELING

A. All backbone and station cables, faceplates and termination components shall be clearly labeled in accordance with EIA/TIA 606-B.

B. The Contractor shall obtain the labeling scheme from the Owner.

C. Labels strips shall be covered with a protective plastic coating. Labels shall be machine printed. No handwritten label shall be accepted. Stick-on labels are not acceptable.

D. Components

1. The labeling made for each component should be:

   a. Unique, to prevent confusion with similar components.
   b. Legible and permanent enough to last the lifecycle of the component.
   c. The following infrastructure components should be labeled:

1) Telecommunications spaces
2) Telecommunications pathways
3) Telecommunications cables
4) Zone boxes
5) Connecting hardware
6) Grounding (earthing) system

E. Telecommunications Spaces

1. Telecommunications spaces include:

a. Equipment rooms (ERs)
b. Telecommunication rooms (TRs)
c. Telecommunication enclosures (TEs)
d. Work areas

2. Spaces should be labeled at their entrances, as follows:

a. In small, single-story buildings, a simple sign on the door is sufficient.
b. In larger buildings, the labeling should provide a unique identifier, since there may be a number of telecommunications spaces.

F. Telecommunications pathways

1. Labeling of pathways helps prevent inadvertent installation of cables from systems that may interfere with each other.
2. When labeling pathways, the following guidelines should be met:

a. Labeling should be affixed at the ends of each pathway.
b. Pathways should be labeled at regular intervals and wherever they are accessible.
c. In a basic system, the conduits should be marked from the main ER by painting or using a permanent-colored tape-wrap made for this purpose.
d. In systems utilizing zone boxes for consolidation or distribution of low-voltage systems, each box label should include the information about the room of origin and system usage.
e. In complex systems or large buildings:

1) A striped tape should wrap pathways with the base color identifying them as telecommunications pathways and tracer color identifying the individual uses.
2) Each pathway should be assigned a unique alphanumeric identifier.
3) All wall or floor penetrations should be labeled.

3. Telecommunications cables

a. When labeling telecommunications cables:

1) Cables should be identified at each end with a permanent label or physical/electronic tag. The same alphanumeric identifiers should be used at both ends of the cable.
2) Cable should be identified at regular intervals throughout its length with its alphanumeric identifier when cables are rearranged, rerouted, or removed in spite of the added cost.

b. In systems that are:

1) Basic, the labeling scheme can be a simple number sequence.
2) Complex, the labeling may indicate the type, function, and terminating position.

G. Connecting hardware

1. Connecting hardware items (e.g., cross-connect fields and telecommunications outlet/connectors) require a unique, alphanumeric identification such as the following three-level scheme:

a. First level – Termination field or patch panel. Color-coding or other labeling should be used to uniquely identify each termination field on a common mechanical assembly.
b. Second level – Terminal block within a given field or patch panel, which could be a row of insulation displacement connectors (IDCs), optical fiber connectors, or modular jacks.
c. Third level – Defines the individual position within a given terminal block or patch panel.

H. Grounding (Earthing)

1. Grounding system components (e.g., ground bars and grounding conductors) require special labeling for safety and noise control purposes and for simplifying and expediting ground system audits.
2. All equipment grounding conductors should be labeled to indicate the:

a. Grounded rack, cabinet, or shelf.
b. Ground bar to which the grounding conductors are connected.

3. Each grounding conductor in a building should be labeled, including those connecting building steel, grounding electrodes, water pipes, radio towers, and telecommunications structural components.

3.3. TESTING AND COMPLIANCE

A. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Testing shall be executed by technicians holding proof of successful installation certification from the system manufacturer.

B. Cable testers are to be calibrated within four (4) months of use.

C. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type including equipment to use, set-up, test frequencies or wavelengths, results format, etc.

D. 100% of the installed cabling links must be tested in accordance with ANSI/TIA/EIA-568-B standard and must pass the requirements described under the heading for each cable type. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

E. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

F. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Owner. Representatives of the Owner shall be invited to be in attendance to witness the test procedures. The contractor shall provide a minimum of one (1) week advance notice to the Engineer as to allow for such participation. The notification shall include a written description of the proposed conduct of the tests including copies of blank test result sheets to be used.

G. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences. A representative of the Owner reserves the right to select a random sample of up to 5% of the installed links for retesting. The Contractor shall re-test these randomly selected links and the results are to be stored in the tester. The results obtained shall be compared to the original test data provided by the Contractor. If more than 2% of the sample pass/fail results differ from the original test data, the installation contractor under supervision of the Owner's representative shall repeat 100% testing and the cost shall be borne by the Contractor.

3.4. CABLING ADMINISTRATION DRAWINGS

A. Prepare Cabling Administration Drawings showing building floor plans with cable administration-point identification labeling. Depict all telecommunications outlets and their associated label, provide callouts indicating locations of telecom rooms and spaces and, where applicable, indicate zone line demarcations denoting areas served by each respective telecom room. Coordinate drawing features with shop drawing requirements outlined in Section 270000.

B. Prepare Drawings for use as part of cabling installation work. Periodically update Drawings to reflect constructed conditions, including any moves, changes or additions to the communications infrastructure. At completion, Cabling Administration Drawings shall reflect as-built conditions.

C. Interim Submission: Issue two (2) half-size printed copies of in-progress draft Cabling Administration Drawings to Owner no later than five (5) weeks prior to Substantial Completion, for Owner's use in preparation of patch schedules and to support other internal move-in planning processes. Coordinate exact timing with Owner's IT personnel.

3.5. TEST RESULTS DOCUMENTATION

A. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The test result records saved by the tester shall be transferred into a spreadsheet or database that allows for the maintenance, inspection and archiving of these test records. Provide the database for the completed job on CD-ROM. If the results cannot be viewed by Microsoft Excel or Microsoft Access, the Contractor shall provide one licensed copy of a software package suitable to view and print reports of the test results.

B. Upon completion of the installation, the contractor shall provide three (3) full electronic documentation sets to the Consultant for approval.

C. Documentation shall be submitted within ten (10) working days of the completion of the testing phase. This includes draft as-built drawings. Draft drawings may include annotations done by hand.

D. Machine generated final copies of all drawings shall be submitted within 30 working days of the completion of the testing phase. Final copies shall have all annotations in CAD format.

E. All documentation, including hard copy and electronic forms shall become the property of the Owner.

F. A paper copy of the test results shall be provided that lists all the links that have been tested along with the following summary information:

1. The identification of the customer site as specified by the end-user.
2. The identification of the link in accordance with the naming convention defined in the overall system documentation.
3. The overall Pass/Fail evaluation of the link-under-test.
4. The date and time the test results were saved in the memory of the tester.

G. The following information shall be provided in the electronic database of the test results information for each link:

1. The identification of the customer site as specified by the end-user.
2. The identification of the link and/or fiber in accordance with the naming convention defined in the overall system documentation.
3. The overall Pass/Fail evaluation of the link-under-test.
4. The date and time the test results were saved in the memory of the tester.
5. The name of the standard selected to execute the stored test results.
6. The cable type and the value of NVP or index of refraction used for length calculations.
7. The brand name, model and serial number of the tester.
8. The identification of the tester interface.
9. For fiber tests, the identification of each link/fiber in accordance with the naming convention defined in the overall system documentation
10. For fiber tests, the insertion loss (attenuation) measured at each wavelength, and the test limit calculated for the corresponding wavelength.
11. For fiber tests, the link length shall be reported for each optical fiber for which the test limit was calculated based on the formulas above.

12. The revision of the tester software and the revision of the test standards database in the tester.

H. The test results information must contain information on each of the required test parameters in accordance with the descriptions above. For each of the frequency-dependent test parameters, the value measured at every frequency during the test shall be reported.

3.6. CATEGORY 6A CABLING

A. Each category 6A cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA-568-C.2 “Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard”

B. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 500 MHz) must meet or exceed the limit value determined in the above-mentioned standard.

C. The test equipment (tester) shall comply with the accuracy requirements for level IIIe field testers as defined in ANSI/TIA-1152. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of ANSI/TIA-1152.

D. The following parameters shall be tested for each cable:

1. Wire Map – Shall report Pass if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.
2. Length – The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for NVP (1). The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.
3. Insertion Loss (Attenuation) – Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through 500 MHz in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency.
4. NEXT Loss – Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through 500 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the standard. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case NEXT margin (2) and the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
5. PS NEXT Loss – Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link under-test (a total of eight results). PS NEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 500 MHz and the step size may not exceed the maximum step size defined in the standard. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS NEXT. These wire pairs must be identified for the tests performed from each end. Each

reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

6. ACR-F, pair-to-pair – Attenuation Crosstalk Ratio Far-end is calculated from the pair-to-pair FEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ACR-F Loss that must be evaluated and reported in the test results. ACR-F measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-F is to be measured from 1 through 500 MHz and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the standard. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case margin and the wire pair combination that exhibits the worst value for ACR-F. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
7. PS ACR-F Loss – Power Sum Attenuation Crosstalk Ratio Far-end is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through 500 MHz in frequency increments that do not exceed the maximum step size defined in the standard. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
8. Return Loss – Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured form 1 through 500 MHz in frequency increments that do not exceed the maximum step size defined in the standard. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
9. Propagation Delay – Propagation delay is the time required for the signal to travel from one of the link to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.
10. Delay Skew – This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.
11. PS ANEXT – Pair-to-pair Alien NEXT (ANEXT) contributions is measured by applying the stimulus signal at the near end to one wire pair of a disturbing link and measuring the coupled signal at the near end of a wire pair in a disturbed link. This process is repeated for every wire pair in a disturbing link. The PS ANEXT for each wire pair in a disturbed link is obtained by the power sum addition of all the pair-to-pair ANEXT results to that wire pair from all wire pairs in disturbing links. All the links that are bundles with the disturbed link need to be included as disturbing links. In addition, links that are terminated in adjacent positions in a patch panel or interconnect panel should also be included as disturbing links in this test. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS ANEXT. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
12. PS AACR-F – The pair-to-pair Alien Far End crosstalk (AFEXT) contributions is measured by applying the signal at the near end to one wire pair of a disturbing channel or permanent link and measuring the coupled signal at the far end of a wire pair in a disturbed channel or permanent link. This process is repeated for every wire pair in a disturbing link and for all links in close proximity. A normalization, which is dependent on

the relative length of disturbing and disturbed link, is applied to each pair-to-pair alien FEXT measurement. Then the PS Alien Attenuation-to-Crosstalk Ratio from the Far end (PS AACR-F) for each wire pair in a disturbed channel or permanent link is obtained by the power sum addition of all the normalized pair-to-pair far end alien crosstalk results to that wire pair from all wire pairs in disturbing links in close proximity. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS AACR-F. if the link or channel connects two patch panels (data center), these wire pairs must be identified for the tests performed from both ends. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

Frequency Range (MHz)	Maximum Step size (MHz)
1 – 31.25	0.15
31.26 – 100	0.25
100 – 250	0.50
250 – 500	1.00

E. In addition to testing the “In-link” performance parameters detailed in D above, Alien Crosstalk testing or “Between-link’ testing shall be carried out in accordance with Section 4.7 of ANSI/TIA-1152. Alien crosstalk testing includes the PS ANEXT and PS AACR-F (Power sum alien attenuation-to-crosstalk ratio from the far end) performance parameters. The standards refer to the link-under-test for Alien Crosstalk as the disturbed link.

F. PS ANEXT and PS AACR-F shall meet or exceed the limits defined in Section 6 of the TIA Cat 6A Standard.

G. Selection of disturbed links: 1 % of the links in the cabling installation or 5 links, whichever is more. Chose short, medium and long links equally.

H. Selection of disturber links. Select all of the links that are in the same cable bundle and the most consistently positioned relative to the disturbed link as disturbing links.

I. If the margin of PS ANEXT and PS AACR-F exceeds 5 db for the first three short, medium and long links (nine in total), further alien crosstalk testing can be discontinued.

3.7. BACKBONE COPPER CABLE TESTING

A. Backbone Voice cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity and conductor position on the termination blocks. Any incorrectly positioned pairs must be identified and corrected. The percentage of “bad” pairs shall not exceed 3% in any backbone cable based on total pair count. All bad pairs must be identified and documented.

B. The Contractor shall be responsible to test the entire system from each voice outlet to the building Main Crossconnect (MC). If more than a 1% failure on the cross-connects occur the contractor will be required to provide mapping of the system.

3.8. FIBER OPTIC CABLE TESTING

A. Every fiber optic cabling link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.

B. ANSI/TIA/EIA-568-B, defines the passive cabling network, to include cable, connectors, and splices, between two optical fiber patch panels. A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

C. 100% of the installed cabling links shall be tested. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the

performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

D. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by the manufacturer of the fiber optic cable and/or the fiber optic connectors or the manufacturer of the test equipment used for the field certification.

E. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap with a Category 1 light source.

F. Field test instruments for single mode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

G. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

H. The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

J. ANSI/TIA/EIA standard 568-B prescribes that the single performance parameter for field testing of fiber optic links is insertion loss. The insertion loss shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B:

1. Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn
2. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
3. The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation Coefficient (dB/km)
Multimode 50/125 µm	850	3.0
	1300	1.0
Single-mode (Inside plant)	1310	0.5
	1383	0.5
	1550	0.5
Single-mode (Outside plant)	1310	0.5
	1383	0.5
	1550	0.5

4. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
5. Maximum allowable individual connector_loss = 0.75 dB
6. Splice_Attn (dB) = number of splices (S) * splice_loss (dB)
7. Maximum allowable splice_loss = 0.3 dB

K. Additional 40GB/100GB requirements for multimode fiber:

1. Maximum MPO and individual connector loss = .35 dB
2. Maximum total connector loss per 150 meters = 1 dB
3. Maximum total channel insertion loss per 150 meters = 1.5 dB

L. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e., link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

M. Link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1

N. The acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum 90 m (295 ft) distance. The horizontal link should be tested at 850 nm or 1300 nm in

one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper. The horizontal link shall be tested using a fixed upper limit for attenuation of 2.0 dB.

O. Multimode backbone links shall be tested in one direction at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A. The link attenuation equation above shall be used to determine limit values.

P. Single mode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper. All single mode links shall be certified with test tools using a Category 2 laser light sources at 1310 nm and 1550 nm.

3.9. COAX CABLE TESTING

A. A Time Domain Reflectometer (TDR) shall be used to verify cable length and to test for cable faults and breaks. A step-function high resolution Time Domain Reflectometer shall be employed for this test. The TDR will sweep the cable at a rate no greater than 50' per second, or such lower rate as necessary to resolve cable faults to the 1" and .001 VRC level.

B. The cables shall be terminated with its characteristic impedance, and in the case of nominal 75 ohm cable, an appropriate matching pad shall be used to match the analyzer to the cable. Cable shall be rejected if any single fault is observed of amplitude greater than .003 voltage reflection coefficient. Characteristic impedance shall also be measured at 5% of nominal value.

C. Cyclic faults (such as cable reel stress and die drawdown) shall be limited to a voltage reflection coefficient of .005.

3.10. WARRANTY

A. The Contractor shall guarantee all materials, equipment, etc., for one year from date of substantial completion of this work. This guarantee shall include all labor, material and travel time. This warranty is in addition to the cabling system manufacturer’s warranty.

END OF SECTION