SECTION 17000 - COMMUNICATIONS

PART 1 – GENERAL

1.1 SCOPE

A. The work covered by this section includes the furnishing of labor and materials, equipment, and incidentals and the performing of operations in connection with the "electrical work" as indicated on the drawings and/or specified herein and including incidental items to effect a finished, complete and operable system as indicated. The electrical work shall include but not be limited to: Computer/data infrastructure conduit, cabling, termination, patch panels, floor mounted racks, testing and labeling.

Work shall be subject to the conditions of the contract and shall be in strict accordance with these drawings and specifications.

B. Assume responsibility to have thoroughly examined the drawings and specifications including all addenda. Questions over conflicting information shown on the drawings and specifications shall be referred to the Architect for clarification.

C. The term "Contractor used hereinafter shall designate the Electrical Contractor.

1.2 RELATED DOCUMENTS

A. The General Conditions, Supplemental General Conditions, Instructions to Bidders and Section 16000 Electrical shall apply to this work. Read these to become familiar with conditions related to the installation of the work.

PART 2 – PRODUCTS

2.1 HORIZONTAL CABLING & ADMINISTRATION (I.E., CROSS-CONNECT HARDWARE)

The horizontal cabling connects the coverage area to the TC located on each floor. All horizontal cabling provided by the contractor shall consist of 24-AWG twisted pair and be wired in a star configuration from the TC to the device or branch locations. All 24-AWG unshielded twisted pair cables shall consist of solid copper conductors insulated with color coded Polyvinyl Chloride (PVC), and shall meet or exceed the following electrical specifications:

Maximum DC Resistance	28.6Ω/1000 ft (9.4Ω/100 m)
Mutual Capacitance @ 1.0 Khz	18nF/1000 ft (5.9 nF/100 m)
Mutual Capacitance Unbalance (pair to ground)	1000 pF/1000 ft (328pF/100 m)
Attenuation (dB/1000 ft, 305m)	@ 1.0 MHz 7.0 db @ 4.0 MHz 15.0 db @ 10.0 MHz 26.0 db @ 16.0 MHz 35.0 db
Characteristic Impedance	@ 1.0 MHz 100Ω ±15% @ 25.0 MHz 100Ω ±15%
Worst Pair Near-End Crosstalk (db/1000 ft, 305 m)	@ 1.0 MHz 42.0 db @ 4.0 MHz 34.0 db @ 10.0 MHz 31.0 db @ 16.0 MHz 28.0 db
CSA Certified Underwriters Laboratories (UL) Listed Manufactured by a Certified ISO 9001 Facility	

2.2 RISER & CAMPUS BACKBONE

The multi-pair riser cables supplied and installed by the contractor shall provide connectivity, via the cross-connect hardware, from the MC to the horizontal cabling terminated at the TC. It will consist of solid copper conductors insulated with expanded polyethylene covered by a PVC skin, and shall meet or exceed the following electrical specifications:

Maximum Average DC Resistance	6.5Ω/1000 ft (8.7Ω/100 m)
Mutual Capacitance @ 1.0 kHz	16nF/1000 ft (5.25 nF/100 m)
Mutual Capacitance Unbalance (pair to ground)	201pF/1000 ft (65.94pF/100 m)
Attenuation (dB/1000 ft, 305m)	@ 1.00 MHz 7.2 db @ 4.00 MHz 14.8 db @ 10.00 MHz 24.4 db @ 16.00 MHz 32.0 db
Characteristic Impedance	@ 1.00 MHz 100Ω ±15% @ 25.00 MHz 100Ω ±15%

Worst Pair Near-End Crosstalk (db/1000 ft, 305 m)	@ 1.57 MHz 41.0 db @ 3.15 MHz 36.0 db @ 10.00 MHz 28.0 db
CSA Certified Underwriters Laboratories (UL) Listed Manufactured by a Certified ISO 9001 Facility	

2.3 STATION CABLE

Category 5E UTP, 4 Pair

1. Category 5E UTP cables shall extend between the station location and its associated TC and consist of 4 pair, 24 gauge, UTP, and shall terminate on 8 pin modular jacks provided at each outlet. Cable jacket shall comply with Article 800 NEC for use as a plenum or non-plenum cable. The 4 pair UTP cable shall be UL® and c (UL®) Listed Type CMP (plenum) or CM (non-plenum).

2. All 4 pair Category 5E cables shall conform to TIA/EIA 568A Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL® LAN Certification and Follow-up Program. Applications standards supported should include, but not limited to, IEEE 802.3, 1Base5, 10BASE-T; IEEE 802.5, 4 Mbps, 16Mbps (328 ft [100m], 104 Workstations) and TP-PMD. In addition, cables shall be capable of supporting current and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes.

All Category 5E cables shall meet or exceed the following:

Electrical Characteristics:

Mutual Capacitance	Nominal: 14pF/ft. (46pF/m)
Characteristic Impedance	100 (± 6) Ohms 1-100 MHz
DC Resistance Max	28.6 Ohms/1000 Ft. (9.4 Ohms/100m)

Category 5E cables **guaranteed performance** to 350 MHz over Swept Frequency:

Frequency MHz	Attenuation dB/100m	*CAT 5E Standard Draft 11a*	Power Sum Near End Crosstalk dB	*CAT 5E Standard Draft 11a*	Pair to Pair Near End Crosstalk dB	*CAT 5E Standard Draft 11a*	Attenuation to Crosstalk Ratio dB/100m	*CAT 5E Standard Draft 11a*
0.772	1.7	≤ 1.8	67.0	64.0	70.0	67.0	68.3	n/a
1	2.0	≤ 2.0	65.3	62.3	68.3	65.3	66.3	n/a
4	3.9	≤ 4.1	56.3	53.3	59.3	56.3	55.4	n/a
8	5.6	≤ 5.8	51.8	48.8	54.8	51.8	49.2	n/a
10	6.3	≤ 6.5	50.3	47.3	53.3	50.3	47.0	n/a
16	8.0	≤ 8.2	47.3	44.3	50.3	47.3	42.3	n/a
20	9.0	≤ 9.3	45.8	42.8	48.8	45.8	39.8	n/a
25	10.1	≤ 10.4	44.3	41.3	47.3	44.3	37.2	n/a
31.25	11.4	≤ 11.7	42.9	39.9	45.9	42.9	34.5	n/a
62.5	16.5	≤ 17.0	38.4	35.4	41.4	38.4	24.9	n/a
100	21.3	≤ 22.0	35.3	32.3	38.3	35.3	17.0	n/a
155	27.2	n/a	32.5	n/a	35.5	n/a	8.2	n/a
200	31.4	n/a	30.8	n/a	33.8	n/a	2.4	n/a
220	33.2	n/a	30.2	n/a	33.2	n/a	0.0	n/a
300	39.7	n/a	28.2	n/a	31.2	n/a	n/a	n/a
350	43.5	n/a	27.2	n/a	30.2	n/a	n/a	n/a

Frequency MHz	Pr-to-Pr ELFEXT db/100m	*CAT 5E Standard Draft 11a*	Power Sum ELFEXT DB/100m	*CAT 5E Standard Draft 11a*	Return Loss dB/100m	*CAT 5E Standard Draft 11a*	Delay Skew ns	*CAT 5E Standard Draft 11a*
0.772	70.0	66.0	68.0	63.0	n/a	n/a	25.0	≤ 45
1	67.8	63.8	65.8	60.8	20.0	20.0	25.0	≤ 45
4	55.7	51.7	53.7	48.7	23.0	23.0	25.0	≤ 45
8	49.7	45.7	47.7	42.7	24.5	24.5	25.0	≤ 45
10	47.8	43.8	45.8	40.8	25.0	25.0	25.0	≤ 45
16	43.7	39.7	41.7	36.7	25.0	25.0	25.0	≤ 45
20	41.7	37.7	39.7	34.7	25.0	25.0	25.0	≤ 45
25	39.8	35.8	37.8	32.8	24.3	24.3	25.0	≤ 45
31.25	37.9	33.9	35.9	30.9	23.6	23.6	25.0	≤ 45
62.5	31.8	27.8	29.8	24.8	23.0	21.5	25.0	≤ 45
100	27.8	23.8	25.8	20.8	23.0	20.1	25.0	≤ 45
155	23.9	n/a	21.9	n/a	18.8	n/a	25.0	n/a
200	21.7	n/a	19.7	n/a	18.0	n/a	25.0	n/a
220	20.9	n/a	18.9	n/a	17.7	n/a	25.0	n/a
300	18.2	n/a	16.2	n/a	16.8	n/a	25.0	n/a
350	16.9	n/a	14.9	n/a	16.3	n/a	25.0	n/a

Category 5E cables **typical performance** to 350 MHz over Swept Frequency:

Frequency MHz	Attenuation dB/100m	*CAT 5E Standard Draft 11a*	Power Sum Near End Crosstalk dB	*CAT 5E Standard Draft 11a*	Pair to Pair Near End Crosstalk dB	*CAT 5E Standard Draft 11a*
0.772	1.7	≤ 1.8	70.0	64.0	72.0	67.0
1	1.9	≤ 2.0	68.3	62.3	70.3	65.3
4	3.8	≤ 4.1	59.3	53.3	61.3	56.3
8	5.4	≤ 5.8	54.8	48.8	56.8	51.8
10	6.0	≤ 6.5	53.3	47.3	55.3	50.3
16	7.7	≤ 8.2	50.3	44.3	52.3	47.3
20	8.6	≤ 9.3	48.8	42.8	50.8	45.8
25	9.7	≤ 10.4	47.3	41.3	49.3	44.3
31.25	10.9	≤ 11.7	45.9	39.9	47.9	42.9
62.5	15.8	≤ 17.0	41.4	35.4	43.4	38.4
100	20.4	≤ 22.0	38.3	32.3	40.3	35.3
155	26.1	n/a	35.5	n/a	37.5	n/a
200	30.2	n/a	33.8	n/a	35.8	n/a
220	31.8	n/a	33.2	n/a	35.2	n/a
300	38.1	n/a	31.2	n/a	33.2	n/a
350	41.7	n/a	30.2	n/a	32.2	n/a

(Continued) Category 5E cables **typical performance** to 350 MHz over Swept Frequency:

Frequency MHz	Attenuation To Crosstalk Ratio dB/100m	*CAT 5E Standard Draft 11a*	Pr-to-Pr ELFEXT db/100m	*CAT 5E Standard Draft 11a*	Power Sum ELFEXT DB/100m	*CAT 5E Standard Draft 11a*
0.772	70.3	n/a	78.0	66.0	76.0	63.0
1	68.4	n/a	75.8	63.8	73.8	60.8
4	57.5	n/a	63.7	51.7	61.7	48.7
8	51.4	n/a	57.7	45.7	55.7	42.7
10	49.3	n/a	55.8	43.8	53.8	40.8
16	44.6	n/a	51.7	39.7	49.7	36.7
20	42.2	n/a	49.7	37.7	47.7	34.7
25	39.7	n/a	47.8	35.8	45.8	32.8
31.25	37.0	n/a	45.9	33.9	43.9	30.9
62.5	27.6	n/a	39.8	27.8	37.8	24.8
100	19.9	n/a	35.8	23.8	33.8	20.8
155	11.4	n/a	31.9	n/a	29.9	n/a
200	5.6	n/a	29.7	n/a	27.7	n/a
220	3.4	n/a	28.9	n/a	26.9	n/a
300	n/a	n/a	26.2	n/a	24.2	n/a
350	n/a	n/a	24.9	n/a	22.9	n/a

2.4 CATEGORY 5 UTP, 25 PAIR

All 25 pair, Plenum and Non-plenum Category 5 cables shall be composed of 24 AWG bare solid copper conductors insulated with a suitable plastic dielectric material. The insulated conductors shall be twisted into pairs, and stranded into mini-units. The cable shall employ a honeycomb core construction, consisting of multiple three and four pair tightly stranded sub-units. A total of seven unjacketed sub-units (six around one), will be stranded to comprise the cable core. Cable shall have no internal sheath or subsheath. All 25 PAIR, Category 5 cables shall conform to TIA/EIA 568A Commercial Building Telecommunications Cabling Standard, Backbone Cable Section, and be part of the UL® LAN Certification and Follow-up Program.

The cable shall be capable of mixing any number of the following standard compliant signals with each other in the same 25 pair cable: 1 Mb/s, 1BASE5, 4 Mb/s Active Token Ring, 10 Mb/s 10BASET, and 16 Mb/s Active Token Ring. When mixing multiple dissimilar signals, the 25 pair Category 5 cable must support distances up 100 meters. In addition, cables shall support evolving high-end applications such as 155 Mbps ATM, 622Mbps ATM and shall meet or exceed the Electrical Specifications listed below:

Electrical Specifications:

Nominal Mutual Capacitance	14pF/ft (46pF/m)
Characteristic Impedance (1-100 MHz)	100Ω ± 15Ω
Maximum DC resistance	28.6Ω/1,000 ft (9.40Ω/100m)

Worst Pair Attenuation (dB/100m [328 ft]):

Frequency	Attenuation (Max)
1.00 MHz	2.0 dB
4.00 MHz	4.1 dB
8.00 MHz	5.8 dB
10.00 MHz	6.5 dB
16.00 MHz	8.2 dB
20.00 MHz	9.3 dB
25.00 MHz	10.4 dB
31.25 MHz	11.70 dB
62.50 MHz	17.0 dB
100.0 MHz	22.0 dB

Worst Pair Power Sum NEXT, dB @ 100 m (328 ft.):

Frequency	Power Sum NEXT (Max)
0.772 MHz	64 dB
1.00 MHz	62 dB
4.00 MHz	53 dB
8.00 MHz	48 dB
10.00 MHz	47 dB
16.00 MHz	44 dB
20.00 MHz	42 dB
25.00 MHz	41 dB
31.25 MHz	40 dB
62.50 MHz	35 dB
100.00 MHz	32 dB

Environmental:

Storage temperature	68° F to 122° F (20° C to 50° C)
Installation Temperature	32° F to 122° F (0° C to 50° C)
Operating Temperature	-4° F to 140° F (-20° C to 60° C)

UL® Verified for Category 5 Electrical Performance
UL® and c (UL®) Listed for Fire Safety
ISO 9001 Certified Manufacturer

2.5 525 CATEGORY 5, 25 PAIR CONNECTOR

Twenty-five (25) pair Category 5 cables shall terminate on 525 Category 5, 25 pair connectors. The connector shall be notched in the skirt to facilitate the use of keyed connectors on high-end LAN equipment preventing the possibility of connecting low-performing Category-3 cable assemblies to equipment designed to only work with Category-5 cable assemblies. Connector shall be backward compatible to current 25 pair "Telco" Connector, and comply with FCC Part 68 25 pair Plug Pinout Specification. The 525 Category 5, 25 pair connector shall conform to TIA/EIA 568A Commercial Building Telecommunications Cabling

Standard, Horizontal Cable Section, and be part of the UL® LAN Certification and Follow-up Program. All 525 Category 5, 25 pair connectors shall be installed and tested by the manufacturer.

The connector will consist of three main parts - the mandrel, the housing, and the hood. Cable pair twists will be maintained up to the edge of the mandrel. The Category 5, 25 pair Cable Connector assemblies will consist of 25-pair 1061C or 2061C cable with the Lucent Technologies 525, Category 5, 25 pair connector on one or both ends.

Mechanical Performance:

Meets FCC Part 68 Subpart F and Industry Canada CS-03 Part 3 mating area dimensional requirements

Contact plating in mating region	30 μin Gold over 50 μin Nickel
Operating temperature	-10° C to 60° C
Insertion Life	200 insertions Minimum
Contact force	100 grams minimum

Electrical Specifications:

DC Resistance (maximum)	0.3 Ω

Attenuation and Power Sum NEXT:

Frequency	Attenuation	Power Sum Next
1.00 MHz	< 0.1	> 80
4.00 MHz	< 0.1	> 74
8.00 MHz	< 0.1	> 68
10.00 MHz	< 0.1	> 66
16.00 MHz	< 0.2	> 62
20.00 MHz	< 0.2	> 60
25.00 MHz	< 0.2	> 58
31.25 MHz	< 0.2	> 56
62.50 MHz	< 0.3	> 50
100.00 MHz	< 0.4	> 46

2.6 FIBER OPTIC CABLING

Fiber optic cabling shall be provided between facilities and furnished with the quantity of fibers as designated on the contract drawings.

All fiber in a cable run shall be from the same manufacturer and shall be the same type. A mix of fibers from different manufacturers may not be used without written permission

A. Multimode Fiber Specifications

1. All fiber optic cables within the premises shall use multimode, graded-index fibers with 62.5 micron cores only.

2. Fibers must comply with EIA/TIA 492 specifications and IS 11801 standards.

3. Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.

4. All fibers shall be color coded to facilitate individual fiber identification. Fibers will have D-LUX ® coating or approved equivalent to ensure color retention, minimize microbending losses and improve handling. The coating shall be mechanically strippable.

Core	62 .5 μm ± 3 μm
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm
Numerical Aperture:	0.275 ± 0.015
Cladding diameter:	125 μm ± 1 μm
Cladding Non-Circularity:	<2.0%
Colored Fiber Diameter:	250 μm ± 15 μm
Buffering Diameter:	890 mm ± 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)
Cable Minimum Bending Radius: During Installation: After Installation:	 20 times cable diameter 10 times cable diameter
Operating Temp. Range:	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.4 dB/km at 850 NM (typical range 2.8 to 3.4 dB/km) 1.0 dB/km at 1300 NM (typical range 0.5 to 1.0 dB/km)
Minimum Bandwidth:	200 MHz at 850 NM 500 MHz at 1300 NM

2.7 CATEGORY 5 MODULAR PATCH CORDS

Provide Category 5 Modular Patch Cords for each assigned port on the patch panel. All cords shall conform to the requirements of EIA/TIA 568A Commercial Building Telecommunications Cabling Standard, Horizontal Cabling Section, and be part of the UL® LAN Certification and Follow-up Program. Cords shall be equipped with a 8 pin modular connector on each end and shall conform to the length(s) specified on the detailed drawing.

All Category 5 cordage shall be round, and consist of 24-AWG copper, stranded conductors, tightly twisted into individual pairs and shall meet or exceed the electrical specifications listed below:

DC Resistance per lead	9.4Ω/100m (328 ft), maximum
DC resistance unbalance	5%, Maximum
Mutual Capacitance	6.6 nF/100m (328 ft), maximum
Characteristic Impedance	100Ω ± 15% from 1 to 100 MHz

Worst Pair Near-End Crosstalk, Power Sum NEXT, attenuation and Structural Return Loss, dB/100 m [328 ft.]:

Frequency	**Pair-To-Pair NEXT (Max.)**	**Power Sum* NEXT**	**Attenuation (Max.) dB/100 m**	**SRL**
1.00 MHz	76.0 dB	73.0 dB	1.9 dB	36 dB
4.00 MHz	64.0 dB	61.0 dB	3.9 dB	36 dB
8.00 MHz	60.2 dB	57.0 dB	5.5 dB	30 dB
10.00 MHz	59.0 dB	56.0 dB	6.3 dB	30 dB
16.00 MHz	56.0 dB	53.0 dB	8.0 dB	31 dB
20.00 MHz	55.0 dB	52.0 dB	8.9 dB	29 dB
25.00 MHz	54.0 dB	51.0 dB	10.0 dB	30 dB
31.25 MHz	52.0 dB	49.0 dB	11.2 dB	31 dB
62.50 MHz	48.0 dB	45.0 dB	16.1 dB	27 dB
100.00 MHz	45.0 dB	42.0 dB	20.7 dB	25 dB

The Category 5 patch cord shall incorporate the "cross-over lead" concept. The patch cord shall have built-in exclusion features to prevent accidental polarity reversals and split pairs.

UL® Verified for EIA/TIA 568A Electrical Performance
UL® and c (UL®) Listed for Fire Safety
ISO 9001 Certified Manufacturer
Austel Approved
FCC Compliant

2.8 HORIZONTAL

The Horizontal provides connections from the horizontal cross connect to the information outlets (IOs) in the work areas. It consists of the horizontal transmission media, the associated connecting hardware terminating this media and IOs in the work area. Each floor of a building is served by its own Horizontal Subsystem.

A. Horizontal Cabling

1. Contractor shall supply horizontal cables to connect each information outlet to the backbone subsystem on the same floor.

2. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair unshielded twisted pair (UTP)

3. The 4-pair UTP cables shall be run using a star topology format from the administration subsystem (Telecommunications closet) on each floor to every individual information outlet. All cable routes to be approved by Owner prior to installation of the cabling.

4. The length of each individual run of horizontal cable from the administration subsystem (Telecommunications Closet) on each floor to the information outlet shall not exceed 295 ft (90 m).

5. Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP cable during handling and installation.

6. Each run of cable between the termination block and the information outlet shall be continuous without any joints or splices.

7. In suspended ceiling and raised floor areas where walker duct, cable trays or conduit are not available, the Contractor shall bundle station wiring with plastic cable ties at appropriate distances. The cable bundling shall be supported via "J" hooks attached to the existing building structure and framework. Plenum cable will be used in all appropriate areas.

8. If the interior of walls are not obstructed, the Contractor shall conceal horizontal distribution wiring internally within the walls. If such obstructions exist, Contractor shall secure approval by Owner prior to the use of an alternate method.

9. Every effort will be made to schedule the requirements under this Contract in such a manner so as to complete all above ceiling work prior to ceiling tile installation. In the event Contractor is required to remove ceiling tiles, such Work shall not break or disturb grid and must be coordinated with the General Contractor.

10. The 4 pair UTP cable shall be Underwriter's Laboratories (UL) listed type MPR, MPP, CMR, or CMP as stated later in this section.

11. Contractor shall provide Owner with detailed cable run diagrams for cable runs within raised floors detailing exact locations of cable for review and approval by Owner after coordination with other contractors, architect and general contractor.

12. Conduit runs installed by the contractor should not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull boxes.

13. Station cables and tie cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.

Campus Backbone

When a distribution system encompasses more than one building, the components that provide the link between buildings constitute the Campus Backbone. This subsystem includes the backbone transmission media, associated connecting hardware terminating this media, and electrical protection devices to mitigate harmful voltages when the media is exposed to lightning and/or power surges. It is normally a first-level backbone cable beginning at the main cross connect in the equipment room of the hub building and extending to the intermediate cross connect in the equipment room of a satellite building.

1. Contractor shall supply the transmission media and necessary electronic hardware to provide inter-building communications facility.

2. Contractor shall supply multi-pair copper cable, optical fiber cable and electrical protection devices that will prevent electrical surges on the cable from entering buildings.

3. The cable distribution system shall be aerial, buried or underground or any combination thereof.

4. The contractor shall be responsible for identifying the existing cable plant and providing records specifying the pair counts and services that are presently in use.

5. It shall be the responsibility of the contractor to secure any permits required for the construction of the outside plant.

6. It shall be the responsibility of the contractor to stake all areas along the cable route forty-eight hours prior to any trenching or digging.

7. The contractor shall be responsible for restoring any disturbed earth to its original condition. A reasonable effort shall include any landscaping, seeding, or replacement of shrubbery that may be required to properly restore the excavated area. If settling should occur, the installation contractor shall be responsible for any secondary restoration.

2.9 RACKS

Install (1) standard 19" black Ortronic rack compliant to EIA 464 data rack standards. The rack will be used to support the installation of the new network equipment. We assume that the new cabling/patch panels should not be terminated in the network equipment rack. All racks most be installed 4 feet from back wall and have 3 Feet unobstructed access to the front. All racks must be bolted to the floor and grounded. All station cabling terminated in one location with wire Management between it and the network equipment rack. Install Ladder Rack for cable management above Ortronic racks.

2.10 PATCH PANELS

Install Cat 5E patch panels in racks sufficient space for all data and tel terminations plus 25% extra capacity for future expansion. All station cabling will be Cat5e or Cat6 terminated on Certified 568b patch panel.

PART 3 - EXECUTION

3.1 TESTING/WARRANTY

A. Copper Cable testing

Testing of all copper wiring shall be performed prior to system cutover. 100

percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Voice and data horizontal wiring pairs shall be tested from the information outlet to the TC. The Category 3 cable runs shall be tested for conformance to the specifications of EIA/TIA 568A Category 3. The Category 5 cable runs shall be tested for conformance to the specifications of EIA/TIA 568A Category 5. Testing shall be done with a TIA/EIA TSB-67 UL Certified Level 2 test set. Test shall include length, mutual capacitance, characteristic impedance, attenuation, and near-end and far end crosstalk. Any pairs not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to Owner. Complete, end to end test results must be submitted to Owner.

B. Optical Fiber Cable Testing

All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in Section 3 of this RFP. Testing shall consist of a bidirectional end to end OTDR trace performed per EIA/TIA 455-61 or a bidirectional end to end power meter test performed per EIA/TIA 455-53A. The system loss measurements shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.

1. Preinstallation cable testing

   The Contractor shall test all lightguide cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.

2. Loss Budget

   Fiber links shall have a maximum loss of:

   a. (allowable cable loss per km)(km of fiber in link) + (.4dB)(number of connectors) = maximum allowable loss

      (i) a mated connector to connector interface is defined as a single connector for the purpose of this RFP

      (ii) loss numbers for the installed link shall be calculated by taking the sum of the bidirectional measurements and dividing that sum by two.

3. Any link not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to Owner.

4. Documentation shall be provided in both hard copy and 3 1/2 inch diskette to the point of contact.