10.06 Receptacles: (Verify colors)

Manuf:	DUPLEX	DUPLEX GFCI	DUPLEX ISOLATED	CLOCK GRD.
	(20A.125V)	(20A.125V)	(20A.125V)	(15A.125V)
P & S	5362A	2091S	IG6300	S3733-SS
Hubbell	HBL5362	GF5352	IG5362	HBL5235
Leviton	5362A	6899	5362-IG	5621-CH
Arrow-Hart	5362	GF5342	IG5362	5708

Once device manufacturer has been selected, all receptacles, switches, and plates in the project shall be by the same manufacturer, unless noted otherwise on the Drawings or in the Specifications.

10.07 Where tamperproof receptacles are indicated on the drawings to be provided, receptacles shall be equal to Hubbell #CSR20, 20 amp, 125 volt. Provide tamper proof receptacles in all areas indicated per 2017 NEC section 406.12.

10.08 Install receptacles to clear all cabinets, equipment, etc.

10.09 All receptacles shall have High-Impact Thermoplastic or Nylon (not Thermoset), smooth surface, wall plates. Where plates are noted to be engraved or labeled, provide stainless steel wall plates in color to match other plates and provide engraved filled letters. If approved by the Engineer, high-impact thermoplastic plates with filled letters may be used for engraving provided that a sample plate is submitted for approval. Plates shall be set plumb and parallel with the wall. Stainless steel plates where used or specified shall be .032" nominal thickness, non-magnetic.

10.10 Color of receptacles and plates as selected by the Architect. Verify color prior to ordering.

10.11 Provide duplex receptacle on separate circuit beside each telephone terminal board location and other communications equipment requiring 120 volt power.

10.12 Provide GFCI protection as required in 2017 NEC 210.8.

10.13 Combination USB/Duplex receptacle shown on floor plans shall be equal to Hubbell USBB20.

PART 11 - FLOOR BOXES

11.01 Unless noted otherwise on the drawings, flush floor boxes shall be equal to Steel City #68 Series floor box with P-60-DS cover plate for power and P-60-1/2-2 cover plate for telephone and data outlets. Provide with carpet flange for floors with carpet. Verify exact location with Architect prior to rough-in.

11.02 All floor boxes shall be cleaned of all construction debris and dirt.

11.03 Where fire rated 'poke-through' devices are specified, Contractor shall install devices after concrete pour and after final verification of location with Owner. Fire rated 'poke-through' devices shall be spaced apart from each other as required by the manufacturer and U.L.

PART 12 - CONTACTORS AND RELAYS

12.01 Shall be as manufactured by Cutler-Hammer, General Electric, Siemens, Allen Bradley, or Square "D". They shall be as sized on the drawings.

12.02 All contactors and relays shall be "T" (Tungsten) rated.

PART 13 - TIME SWITCHES

13.01 Time switches by Tork, Intermatic, or Paragon equal to those shown on the drawings or specified below, and approved by the Engineer, will be acceptable.

13.02 Exterior lighting or interior time switches shall be Intermatic ET90115C Series, 365 day with built in 100 hours super capacitor, unless specified otherwise. Set time switch per Owners Requirements.

13.03 All time switches shall be provided with momentary contacts if required.

13.04 All time switches shall be provided with manual bypass switches and standby battery systems.

PART 14 - PHOTO ELECTRIC CONTROLS

14.01 Photo Electric Controls by Tork, Intermatic, or Paragon equal to those indicated below and approved by the Engineer will be acceptable.

14.02 Photo Electric Controls (Photo Switches-Photo Cells) shall be Intermatic #EK4136S rated at 3,000W, 120-277V rated at 6A electronic ballast, 1,800W Tungsten, weatherproof. Mount on roof and orient photo electric controls to the north. Photo-electric controls supplied as a part of a fixture assembly shall be as provided by Fixture Manufacturer.

14.03 All photocell housings supplied as part of the light fixture assembly or mounted on the light fixture shall be painted to match the light fixture finish.

PART 15 - STARTERS (SEPARATELY MOUNTED)

15.01 Starters for all devices shown on all drawings shall be supplied by the Electrical Contractor unless specifically noted otherwise on the drawings.

15.02 Starters shall have melting alloy relays or bimetallic overload relays (as required for load served). Starter housing shall have NEMA rating for the location (general purpose, weatherproof, etc.). Each starter shall have an H-O-A switch in cover and control transformer (if required) for controls. See drawings for multispeed starter requirements.

15.03 Coil voltage shall be as required for controls as shown on all drawings and control power transformer size shall be adequate to provide control functions as shown.

15.04 Provide each starter with a spare set of auxiliary contacts. One closed when the starter is deactivated and one closed when the starter is activated.

15.05 Overload thermal units shall be sized on the basis of actual motor nameplate current. Overloads shall be non-adjustable NEMA standard trip and shall be available in sizes covering the complete NEMA horsepower. Starters shall be Class 20 (Class 10 not acceptable).

15.06 Starters shall be fully NEMA rated; I.E.C. design starters will not be acceptable.

15.07 Separately mounted starters shall be by the same manufacturer as the distribution equipment, or Allen Bradley or Furnas.

PART 16 - DISCONNECT SWITCHES

16.01 The Contractor shall furnish and install externally operated, non fused and/or fused (with Class R rejection features), heavy duty, horsepower rated, disconnect switches at all points indicated on the drawings or required by code. These switches shall be by the same manufacturer as the distribution equipment.

16.02 All disconnect switches shall be fused except for disconnect switches that have individual fuse protection at point circuit receives its supply.

16.03 Provide dead front type for all exterior disconnects on grade level when so required by local code.

16.04 All fused disconnect switches shall have a minimum rating of 100,000 A.I.C. with fuses installed unless noted otherwise on the drawings.

16.05 All disconnect switches shall be provided with grounding kits.

PART 17 - FUSES

17.01 Cartridge type fuses of proper size as required shall be furnished and installed for all switches and panelboards throughout, and an additional supply of three (3) spare fuses of each size shall be furnished in original packages to the Owner. Furnish a NEMA enclosure with hinged cover equal to Bussmann type SFC for storing all spare fuses and locate adjacent to main service equipment. Fuses for motor and mechanical equipment shall be sized from the nameplate data per N.E.C. requirements.

17.02 Fuses shall be manufactured by Bussmann Mfg. Co., Gould-Shawmut Co., Littelfuse or approved equal by Engineer. Fuse types shall be installed as follows:

Main Service and Distribution Feeder Protection:

	Bussman	Littelfuse	Gould Shawmut
601 amps and larger	KRP-C/KTN	KLPC	A4BQ
	Bussman	Littelfuse	Gould Shawmut
600 volts and less (Class L)			
600 amps and less	LPN-RK	LLN-RK	A2D-R
250 volts and less (Class RK1)			
600 amps and less	LPS-RK	LLS-RK	A6D-R
600 volts and less (Class RK1)			

Motors and Primary Feeders for Transformers:

250 volts and less (Class RK5)	FRN-R	FLN-R	TR-R
600 volts and less (Class RK5)	FRS-R	FLS-R	TRS-R

17.03 Class T fuses will not be accepted, unless they are a part of a manufacturers assembly or approved by the Engineer. Class J fuses may be used as an alternate to the Class R fuses listed above.

17.04 Fuses installed on project shall be by one manufacturer only. (Do not intermix Manufacturers.)

PART 18 - EQUIPMENT CONNECTIONS

18.01 For 120 volt motors 1/2 HP- and less, 15 amperes and less, Contractor shall provide Bussmann "SSY" box cover unit for indoor application and "SSN" box cover unit for outdoor applications, or equal by Perfect-Line, with fustat plug fuse and integral toggle switch for motors 1/2 HP-120V. and less. Fustats for cord and plug equipment with fuses 15 amperes and less shall be Bussmann "SRY" box cover unit, or equal by Perfect-Line, with fustat plug fuse. Mount fustats in housings of equipment served wherever possible. Plug fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.

18.02 For 3/4 HP-120V. motors, Contractor shall provide (1) 20 amp 1 pole 120 volt toggle disconnect switch with a Bussmann 'HPD' fuse holder and 'FNQ' fuse at each unit. Switch and fuse holder to be mounted in cover of a 4" square junction box at each unit. For 3/4 HP-120V. motors that are provided with cord and plug, Contractor shall provide 20 amp 120 volt duplex receptacle with (1) 20 amp 1 pole 120 volt toggle disconnect switch on line side of receptacle, and Bussmann 'HPD' fuse holder and 'FNQ' fuse on line side of receptacle. Switch, receptacle, and fuse holder to be mounted in cover of a 4" square junction box at each unit. Fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.

DIVISION 16 ELECTRICAL

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SECTION 16030

SERVICE AND DISTRIBUTION

PART 1 - MAIN SERVICE

1.01 Primary: See the plans.

1.02 Secondary: See the plans. Voltage will be, 277/480-volt, 3-phase, 4-wire, WYE, 120/208-volt, 3-phase, 4-wire, WYE, 240-volt, 3-phase, 3 wire Delta, or 120/240-volt, 1-phase, 3 wire.

1.03 Consult power company for their requirements and for coordinating with their installation. Contractor shall provide any work thus required beyond that indicated by drawings and/or specifications and pay for costs incurred for Utility Company to install both temporary and permanent service to the project. Verify costs with Utility Company prior to bidding. Contractor shall provide guard posts around electrical transformers and electrical pedestals per Utility Company standards.

PART 2 - DISTRIBUTION EQUIPMENT

2.01 Part 2 applies to all distribution equipment supplied on the Project.

2.02 All electrical distribution equipment (switchboards, panelboards, disconnect switches, transformers, starters, etc.) shall be of one manufacturer, unless specifically noted on the drawings, in the specifications, or approved by the Engineer. Intermixing of distribution equipment by different manufacturers will not be permitted.

2.03 If shown on the plans, provide surge arrester for lightning protection on main service entrance. Refer to drawings for voltage and phasing of service. Arrester shall be located within, or adjacent to, the main switch enclosure as indicated on the plans.

2.04 Equipment layouts on the drawings are based upon one manufacturer. Verify all actual equipment sizes with equipment manufacturer prior to bidding.

2.05 If layout changes are required due to other electrical manufacturers equipment size, they must be submitted to and approved by the Engineer prior to bidding. National Electric Code working clearances must be maintained at all times. In no case will extra remuneration be allowed for layout changes that differ from those shown.

2.06 Shop drawings shall be furnished for all distribution equipment indicating the following information:

A. Switchboard voltage/current rating.

B. Overall outline dimensions including weight, available conduit space.

C. Switching and protective device ampere ratings.

D. Bus ratings and material.

E. One line diagram.

F. Integrated short circuit rating.

G. Coordination of any ground fault system settings shall be as per the manufacturers requirements.

Adequate conduit space shall be provided to meet the requirements established on the drawings.

2.07 All items of distribution equipment required to be floor mounted shall be mounted on a minimum 3 1/2" concrete base above floor. Concrete base to be by Electrical Contractor.

2.08 All phase and neutral busing and all ground bars in panelboards and switchboards shall be copper only. All lugs shall be AL/CU rated. All panelboards supplied by 'K' factor transformers shall have 200% rated neutrals.

2.09 Arc flash mitigation shall be provided for overcurrent devices 1,200 amp and larger. The Arcflash Reduction Maintenance System shall allow the operator to enable a maintenance mode using a 5 position switch which enables a preset accelerated instantaneous override trip to reduce arc flash energy. A blue LED on the trip unit shall indicate the trip unit is in the maintenance mode. If required by code (1,200 amps on overcurrent devices on projects that are permitted under the 2017 NEC), the contractor shall provide Arcflash reduction maintenance system technology capability on those overcurrent devices regardless if it is shown on the drawings or not.

PART 3 - BRANCH CIRCUIT AND DISTRIBUTION PANELBOARDS

3.01 General:

A. All panels shall be provided with key locking door.

B. Panels shall have hinged covers with concealed trim clamps, doors shall have laser cut trims with concealed hinges, and flush lock, master keyed. Hinged cover shall have continuous piano hinge down one side with door opening by a single latch. Where multi-section panelboards are indicated on the drawings, panel enclosures and covers shall be of the same size for each section.

C. Key all doors alike and furnish two (2) keys for each lock. Doors over 48" high and double doors shall have 3-point latching per U.L. 50. Consult drawings for flush or surface mounting.

D. After wiring, label each circuit and provide under plastic in door of panel a typewritten schedule indicating load description of all circuits in panel. Mark spare breakers and provisions for future breakers in pencil on schedule for future circuit marking.

E. Breakers shall have individual plastic cases sized as scheduled on the plans. Two and three pole breakers shall have common trip (single pole units with tie bars are not acceptable). Main circuit breakers shall be vertically mounted. Back-fed main circuit breakers above 100 amps will not be acceptable. Where spaces are noted in the panel summary, provide all necessary bussing, device support, and connections for future circuit breakers. Provide blank cover for all spaces.

F. All panelboards shall have copper ground buses installed and grounded per the requirements of the N.E.C. All panelboards serving devices having isolated ground circuits shall be provided with an additional insulated copper ground bus for connection of isolated ground conductors. All neutral and ground bars shall have a minimum number of lugs equal to 66% of number of pole spaces in panel. In computer rated or isolated ground panelboards, all neutral, ground and isolated ground bars shall have a minimum number of lugs equal to 100% of number of pole spaces in panel

G. Where flush mounted panels occur on drawings Contractor shall stub into ceiling void for future use, (1) 1" empty conduit for every four spare 20A. breakers or unused panel spaces. On multi-story buildings, Contractor shall stub into ceiling void above panel and into ceiling void of floor below for future use, (1) 1" empty conduit for every four spare 20A. breakers or unused panel spaces Conduits stubbed into ceiling void below panel shall be provided with conduit cap and labeled 'To Panel Above".

H. All panelboards supplied from an emergency source shall have breakers provided with handle lock-offs for each breaker. Breaker handles to be set in the "ON" position.

I. All phase and neutral busing and all ground bars in branch circuit panelboards and circuit breaker distribution panelboards shall be copper only. All lugs shall be AL/CU rated. All panelboards supplied by 'K' factor transformers shall have 200% rated neutrals.

3.02 Branch Circuit Panelboards:

A. Panelboards rated up to 240V (400A. max) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 10,000 A.I.C. unless noted otherwise. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings. All breakers shall be of either the plug-in type or bolt-on type.

B. Panelboards rated over 240V and up to 480V (400A max) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 14,000 A.I.C. unless noted otherwise. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings. All breakers shall be of the bolt-on type only.

C. Branch Circuit Breaker Panelboards:

Panel Rating	Square D	Siemens	G.E. Cutler-Hammer	
240V (400A max)	NQOD	S1/S3	AL	PRL1
480V (400A max)	NF	S2/S3	AE	PRL2

3.03 Circuit Breaker Distribution Panelboards:

A. Panelboards rated up to 240V (600A. and above) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 10,000 A.I.C. unless noted otherwise on the drawings. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings

B. Panelboards rated over 240V and up to 480V (600A and above) shall have a short circuit current rating tested to U.L. Standards for a minimum rating of 14,000 A.I.C. unless noted otherwise on the drawings. Breaker rating with-in panel shall be equal to or greater than minimum integrated equipment rating. Series ratings will not be accepted, unless specifically noted otherwise on the drawings

C. Circuit Breaker Distribution Panelboards:

Panel Rating	Square D	Siemens	G.E. Cutler-Hammer	
All Raings	I-Line	S4/S5	Spectra	PRL4

D. Distribution panels located in finished rooms (other than mechanical, electrical rooms or janitor rooms) shall be provided with key locking doors.

DIVISION 16 ELECTRICAL

SECTION 16040

LIGHTING

PART 1 - LIGHTING FIXTURES

1.01 This work shall include all lighting fixtures and lamps as specified on the drawings and herein. Fixtures shall be completely free of defects, dents, rust or chipped surfaces. No cracked, broken, or chipped lenses will be acceptable. Fixtures that are cracked, broken, chipped, rusted, dented or otherwise damaged, shall be replaced without additional cost to the Owner. Fixtures shall be furnished complete including hickeys, suspension nipples, and all other materials and equipment as required for hanging and supporting fixtures in accordance with U.L. UBC, and NEC requirements. This Contractor shall furnish and install lamps for all fixtures and shall wipe fixtures and lamps before and after installation. All recessed mounted fixtures shall be mounted with the trim flush to the finish ceiling or wall surfaces, free of gaps or cracks.

1.02 Electrical Contractor shall verify exact ceiling types in all areas with architectural room finish schedule for exact fixture mounting (i.e., grid or flange type mounting) prior to ordering of fixtures. Electrical Contractor shall verify ceiling construction details in all areas and provide appropriate mounting hardware for installation of lighting fixtures. All surface mounted fixtures shall be supported independent from ceiling system and shall be securely mounted. Lay-in fixtures shall be supported directly from structure, unless ceiling system has been designed for support of such fixtures.

1.03 General Contractor shall provide fireproofing around recessed fixtures installed in fire-rated ceilings per U.L. requirements, Electrical Contractor shall coordinate.

1.05 Provide thermal switches on all recessed fixtures as required by N.E.C

1.06 Light fixtures supported by framing members of suspended ceiling systems shall be attached to the framing member by mechanical means. Clips identified for use with the type of ceiling framing member and fixture shall be provided.

1.08 All light fixtures (housing, door, etc) shall be provided with factory applied powder coat baked enamel finish, applied after final fabrication, unless specifically noted otherwise on the lighting fixture schedule or drawings. Fixtures using pre-painted metal components will not be acceptable.

1.11 Connections to all fixtures mounted in lay-in ceilings shall be as follows:

A. Provide J-Box on structure above fixtures for power circuit supply connections. Install U.L. listed 3/8" flexible (min.) steel conduit (whip) down to each fixture. Each whip shall be field cut to length to allow fixture to be relocated up to 4'-0" in any horizontal direction. Whips shall include (2) or (3) #12 AWG Copper, 90 degree rated, conductors (numbers as indicated) and a #12 AWG Copper ground conductor. Fixtures factory supplied with U.L. listed whip assemblies shall also be provided with the conductors as listed above. Tandem fluorescent fixtures shall have a factory supplied U.L. listed whip assembly with conductors as required to interconnect fixtures, and be of sufficient length to allow mounting fixtures 12'-0" on center in any horizontal direction.

B. Contractor may use a pre-manufactured flexible wiring system for light fixture connections. System shall be similar to "AFC" systems and shall not be used for switch drops or systems other than lighting.

C. If tandem wired fixtures are used, the maximum whip length between fixtures for electronic ballasts shall be 9 feet.

1.12 Where fixtures are mounted in continuous rows, each row shall be supplied with 2 #12 AWG & 1 #12 AWG "green" ground, 90 degree C. rated, Copper conductors, all within 1/2" flexible steel conduit. Feed through wiring shall also be #12 AWG. 90 degree C. copper. Where flexible steel conduit is to be used, all fittings shall be U.L. labeled for the purpose.

1.13 When different lamps or LED boards in the same fixture are controlled by separate switches (2 or 3 level lighting), the switches shall control the same lamp positions in all fixtures controlled by those switches. Arrangement of switching will generally be that one switch controls middle lamp or lamps, and other switch controls outside lamps unless noted otherwise on the drawings.

1.17 LED Lighting

a. Shall be Reduction of Hazardous Substance (RoHS) compliant, and comply with FCC 47 CFR Part 15, IES LM-79 & 80.

b. Minimum CRI of 80 with a color temperature of 3000-4000°K for interior fixtures and 4000-4500°K for exterior fixtures, unless otherwise noted in the Contract Documents.

c. Minimum rated life of 60,000 hours at 25°C ambient temperature.

d. LED driver shall have a THO of <20% and a power factor of 0.95 or higher with integral short circuit, open circuit and overload protection.

e. LED driver and LED module shall be accessible and replaceable from below.

f. LED lighting fixtures shall be assembled in the USA with minimum 80% materials content from the USA.

g. LED fixtures shall be provided with a minimum 5 year warranty on entire fixture (all components).

h. E.C. to provide all low voltage wiring for 0-10V dimmable fixtures.

1.18 Emergency operation of fixtures

1. Fixtures shown in the fixture schedule to contain a battery charger and battery shall be supplied with a factory installed sealed replaceable nickel cadmium battery and a solid state inverter charger and switch systems.

2. The emergency Battery Section shall be connected on the same circuit as the light ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times. Other lamps not on emergency system in same fixture will be switched with area lights. Lamp sockets in Emergency Fixtures shall be in the exact same position as lamp sockets in non-emergency fixtures of the same type and number of lamps. All components shall be contained within the fixture. The emergency battery system shall operate two lamp (1000 lumen minimum) for a minimum of 90 minutes. Battery charger shall be capable of recharging batteries to full charge within 24 hours after complete discharge. Fixture shall contain pilot light to indicate charger condition and a test switch to simulate power failure. Systems shall be unconditionally guaranteed for three (3) years by emergency unit. Units shall be manufactured by Bodine, Iota, or approved by Engineer.

1.19 Exit Signs and Other Emergency Fixtures

1. Provide emergency battery power packs on all exit signs and emergency fixtures that are not connected to an emergency generator.

2. Batteries shall be lead calcium, pure lead, or nickel cadmium as indicated on the drawings. Lead acid will not be accepted. Batteries shall be unconditionally guaranteed for 5 years with a 10 year prorated warranty from the factory. Units shall be Underwriter's Laboratory listed an labeled as an emergency unit. Batteries shall be provided as standard or as optional equipment of the same series of the specified fixtures.

3. The emergency Battery Section shall be connected on the same circuit as the area lighting, ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times.

SECTION 16741
COMMUNICATIONS SYSTEMS
(BASE BID)

PART 1 - GENERAL

1.1. SUMMARY:

A. Scope: Extent of communications systems work is indicated by drawings, specifications, and details, and as hereby defined to include, but not be limited to telephone, data, and CATV conduits, boxes, terminals, and other associated equipment and hardware.

B. All cabling materials, cabling, ends, jacks, patch panels and equipment racks will be provided by the contractor. All switches and servers to be provided by owner.

1.1. QUALITY ASSURANCE:

A. Codes and Standards: Conform to the following:

2. National Electrical Code (NEC): comply with applicable local code requirements of the authority having jurisdiction and NEC.

3. This installation must be done according to the requirements of the local system supplier and the general specifications contained herein. Consult the serving installers to verify all requirements.

PART 2 - PRODUCTS

1.1. TELEPHONE SYSTEM:

A. Outlets: All telephone outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim. Telephone coverplates to be as furnished by telephone system supplier unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, per Section 16110. All telephone outlet boxes to be located as directed. Telephone outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.

B. Each telephone outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. Where combination telephone/data outlets are noted on the drawings, provide only one 1" empty conduit with pull wire, unless noted otherwise on the drawings. Telephone conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. Telephone conduits shall be routed to the telephone terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the telephone terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

C. Provide telephone terminal board as shown on the drawings or as required by telephone system supplier. Board shall be 3/4" fire resistant plywood sized as required by telephone system supplier, minimum 4' x 4'. Telephone terminal board to be mounted on wall and painted with two coats of fire resistant non-conductive paint, color as selected by Architect.

D. The Telephone system shall be provided with a 2" minimum main service conduit from the Telephone terminal board to the property line unless a larger size is noted otherwise on the drawings or required by the Telephone company. Conduit to be routed per the requirements of the serving Telephone company. Verify conduit size with Telephone company prior to installation.

E. Provide duplex receptacle on separate circuit beside each telephone terminal board location and other communications equipment requiring 120 volt power.

2.1. DATA OUTLET SYSTEM:

A. Section 2.1 will only apply if there are data outlets shown on the drawings.

B. Outlets: All data outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim. Coverplates to be as furnished by data system supplier unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, per Section 16110. All data outlet boxes to be located as directed. Data outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.

C. Each data outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. Where combination telephone/data outlets are noted on the drawings, provide only one 1" empty conduit with pull wire, unless noted otherwise on the drawings. Data conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. Data conduits shall be routed to the data terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the data terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

D. Provide data terminal board as shown on the drawings or as required by data system supplier. Board shall be 3/4" fire resistant plywood sized as required by data system supplier, minimum 4' x 4'. Unless shown otherwise on the drawings, data terminal board to be mounted on wall adjacent to telephone terminal board and painted with two coats of fire resistant non-conductive paint, color as selected by Architect.

E. Provide duplex receptacle on separate circuit beside each data terminal board location and other communications equipment requiring 120 volt power.

2.3. CATV (TELEVISION) OUTLET SYSTEM

A Section 2.3 will only apply if there are CATV outlets shown on the Drawings.

B. Outlets: All CATV outlet boxes shall be installed with 4" square, minimum 2 1/8" deep box and trim, with separately mounted 20 amp 125 volt duplex grounded receptacle adjacent to CATV outlet. CATV coverplates to be as furnished by CATV system supplier unless noted otherwise on the drawings. All floor outlets shall be adjustable water-tight floor box, per Section 16110. All CATV outlet boxes to be located as directed. CATV outlet boxes not used shall be provided with blank cover plates to match switch and receptacle plates.

C. Each CATV outlet box location requires (1) 1" empty conduit with pull wire unless noted otherwise. CATV conduits shall be stubbed into ceiling void, if entire ceiling void is accessible and not an air return plenum. Install insulated bushing on end of conduit in ceiling voids. CATV conduits shall be routed to the CATV terminal board if ceiling void is not accessible, is an air return plenum, or ceiling void is not accessible for full distance to the CATV terminal board. Install insulated bushing on end of conduit at terminal board. Verify conditions of job prior to rough-in.

D. The CATV system shall be provided with a 2" minimum main service conduit from the CATV terminal board to the property line unless a larger size is noted otherwise on the drawings or required by the CATV company. Conduit to be routed per the requirements of the serving CATV company. Verify conduit size with CATV company prior to installation.

E. Provide CATV terminal board as shown on the drawings or as required by CATV system supplier. Board shall be 3/4" fire resistant plywood sized as required by CATV system supplier, minimum 2' x 2'. Unless shown otherwise on the drawings, CATV terminal board to be mounted on wall adjacent to telephone terminal board and painted with two coats of fire resistant non-conductive paint, color as selected by Architect.

F. Provide duplex receptacle on separate circuit beside each CATV terminal board location and other communications equipment requiring 120 volt power.

PART 3 - EXECUTION

A. Provide and install nylon pull wires in all Communication Systems conduits. Provide tags on all pull wires to indicate termination of wire or conduit.

B. Provide and install pull boxes at all locations as required by the Communication Systems system supplier.

C. Provide and install conduit sleeves thru floors and walls as required by the Communication Systems system supplier. Vertical conduits/sleeves through closets floors shall terminate not less than 3-inches above the floor and not less than 3-inches below the ceiling of the floor below.

D. All conduit ends shall be equipped with non-metallic insulated bushings.

E. Terminate conduit runs to/from the associated telephone, data, or CATV backboard in a closet or designated space at the top or bottom of the backboard. Conduits shall enter closets next to the wall and be flush with the backboard.

F. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

G. All empty conduits located in equipment closets or on backboards shall be sealed with a standard non_hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

H. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards.

SECTION 16742
DATA CABLING SYSTEMS
(ALTERNATE BID #5, REFER TO BID FORM FOR MORE INFORMATION)

PART 1 - GENERAL

3.1. SUMMARY:

A. Scope: Extent of data system work is indicated by drawings and details, and is hereby defined to include, but not by way of limitation, telephone wiring/cabling, terminals, connecting blocks, data wiring/cabling, data outlets and other associated equipment and hardware. Contractor to coordinate extent of all telecom scope with owner prior to rough in.

B. Provide submittals on all products specified with this section.

C. All cabling materials, cabling, ends, jacks, patch panels and equipment racks will be provided by the contractor. All switches and servers to be provided by owner. All test equipment shall be provided by the contractor and shall be prior approved with Owner's Network Engineering. Copper test equipment will be meet the minimum standards set forth for Level 3 hand held field test equipment per 568 B.1, section 11. The data system shall be CAT 6 enhanced, minimally swept out to 250 MHZ, and must strictly adhere to the requirements of EIA 568 B.2.1.

D. All cabling shall be installed per Section 16741 "Low Voltage Cabling" Specification. If conflicts exist, this Section supersedes Section 16741.

1.1. QUALITY ASSURANCE:

A. Installers Qualifications: Firms with at least 5 years successful installation experience with projects utilizing data systems and wiring similar to that required for this project. To ensure that the data distribution system is EIA 568 B.2.1 Category 6 compliant, the installer must maintain a current factory certification from a third party listed & verified manufacturer of copper connectivity products. Further, the installation company must be a Building Industry Consulting Service International (BICSI) member.

The Contractor shall provide three (3) references of data cabling installations as well as the name and telephone number of a contact person for each project.

B. Codes and Standards: Conform to the following:

1. National Electrical Code (NEC): comply with applicable local code requirements of the authority having jurisdiction and NEC, including 725, 770, 800 and OFNR Series articles as applicable to installation and construction of data systems.

2. Federal Communications Commission (FCC): Comply with part 68 and Subpart J of part 15, Federal Communications Commission Rules, pertaining to telephone equipment and Class A computer registration by manufacturer.

3. Institute of Electrical and Electronics Engineers (IEEE): Comply with Std 241 and 802, IEEE Recommended Practice for electric Power Systems in Commercial Buildings: pertaining to communication systems and Local Area Networks.

4. National Electrical Manufacturers Association (NEMA): Comply with NEMA's Pub No. 250, "Enclosures for Electrical Equipment".

5. Electronic Industries Association (EIA): Comply with EIA Standards RS-453, 455, 464 and EIA/TIA (Telecommunications Industries Association) Standards 568, 569, 570, 606, 607 and Technical Systems Bulletin 36, 40, and 53 of the Commercial Building Telecommunication Wiring Standards pertaining to categorizing and installation of data systems.

6. Underwriters Laboratories (UL): Comply with, specifically, subjects 444 and 13 (STP) as referenced UL ratings and/or classifications as mentioned in the above standards.

1.1. DELIVERY, STORAGE, AND HANDLING:

A. Delivery: Deliver equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.

B. Storage: Store equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.

C. Handling: Handle equipment and components carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

PART 2 - PRODUCTS

2.1. CABLING SYSTEM WARRANTY:

A. Selected vendor must provide an application independent data and telephone wiring system warranty for a minimum of 15 years from the date of final acceptance (Manufacturer's Warranty). The system warranty must guarantee the electrical performance of the installed system data, wiring and to meet or exceed the requirements as outlined in documents TIA/EIA 568b.2.1. The warranty must include complete parts and labor replacement of defective products by the installer for a period of 15 years, from the date of final acceptance by the owner. Warranty submittal is required to Engineer prior to installation.

2.1. MANUFACTURERS:

A. Data Cable and Cable Connectors: Provide twisted-pair, copper Data cable, and cable connectors, except where fiber optic is specified, in sizes and types indicated, and as recommended by telephone equipment manufacturer for indicated safety and applications. Mate and match connector materials to factory-installed equipment connectors. Submittal is required to Engineer prior to installation.

1. Cable (Horizontal to outlet):

(a) DATA: CommScope CS37P ETL, plenum unshielded four pair cable Category 6. Unless otherwise specified, all voice UTP cabling shall be Category 6, 100 mhz solid copper conductor, four pair, 23 AWG, and shall comply with ANSI/TIA 568A for Category 6 copper cable. The horizontal cable must consist of 4 wire pairs that are adjoined along their longitudinal axis to insure twists are maintained to the termination point. The cable must exhibit stable impedance over the entire frequency bandwidth from 1Khz to 250 MHz. Attenuation @ 250 mhz for 100 meters shall be no greater than 30.8db. Near End Cross Talk @ 250 mhz for 100 meters shall be no less than 44.3 db. Impedance traces of cables must be provided and impedance averaging will not be allowed. All copper communication products must be independently tested by a third party laboratory for verification of published results (UL or ETL ITS). Products must be verified & listed with the respective testing organization. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70. Data cable shall be white in color, utilize co-extruded colored stripes, and be sequentially marked 1000-0 feet. Manufacturer test reports for each reel of cable must be maintained and turned over to the owner at time of system acceptance. Submittal is required to Engineer prior to installation.

2. Cable (Fiber backbone): From Main Telecommunications Closet to all Interconnect locations)

FIBER: Equal to Corning FREEDM Series #012E8P-31131-A3. The fiber optic horizontal cable between the existing data rack and the new telecom rack racks (Refer to E2.0 and E2.1 for location) locations on fiber optic patch panel shall be a twelve (12) strand 50um laser optimized optical single mode fiber cable. Fiber shall be certified for supporting 10 gigabit transmissions up to 150 meter distances, and be tested per the Differential Delay Mode (DMD) testing standards. Fiber shall have the following minimum optical characteristics: Attenuation of 3.5db @850nm, Bandwidth (OFL) 700mhx.km @ 850nm The fiber optic horizontal cable shall conform to EIA/TIA 568A for fiber optic cable. Where required, cable shall be classified low smoke and low flame for use in air plenums in accordance with NFPA 70. The fiber cable shall contain twelve (12) fibers and shall be of continuous manufacture with no factory splices in the fiber. Cable construction shall be tight buffered type. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count and aggregate length at regular intervals. All Fiber cabling will be enclosed in an interlocking aluminum armor sheath, with an overall jacket rated suitable for the environment. Jacket colored per the 606 standards for identification of fiber type. Submittal is required to Engineer prior to installation.

(a) Materials used within a given cable shall be compatible with all other materials used in the same cable, when such materials come into intimate contact. All cable components used shall have no adverse affect on optical transmission or on the mechanical integrity characteristics of the fiber placed in the cable. All materials used shall be non_toxic, non_corrosive, and shall present no dermal hazard. The minimum required material components applied to fiber optic cable construction are: color_coded optical fibers, inner jacket, pulling strength members, and outer jacket.

(b) The 50 um multimode fiber shall be solid glass waveguides and shall have a core diameter of 62.5 micrometers, plus or minus 2.5 microns.

(c) The outside diameter of the glass_clad fiber shall be 125 microns, plus or minus one micron, and shall be nominally concentric with the fiber core consistent with the best commercial practice, utilizing DMD testing.

(d) The minimum tensile strength of the fiber short term shall be no less than 600 lbs / 2670 newtons, and long term of 180 lbs / 801 newtons.

(e) The optical fiber shall be coated with a suitable material to preserve the intrinsic high tensile strength of the glass fiber. The coating material shall be readily removable, mechanically or chemically, without damaging the optical fibers when the removal is desired.

(f) Fiber shall be OM3.

3. Terminal Blocks (Copper)

(a) DATA: 110 Patch Panel System Terminal Blocks (Category 6).

(1) Patch Panels. Category 6 Data cabling shall terminate directly on the back of 48 port Category 6 patch panels on Contractor provided equipment racks in the Computer Room and wall mounted units in the telecom interconnect locations or as indicated in the Drawings. Use PANDUIT DP48688TP, high density 2U 48 port CAT 6 patch panels. Provide (1) PANDUIT 3 ½" high cable management panel WMPH223 between each 48 port patch panel. Patch panel port label shall be 6 character label (Example "A2A05K") as follows, 1st character - Zone, 2nd character = Floor; 3rd -5th character - location in grid; 6th character - is the multiple jack designation at that location. Obtain drop ID's from Owner's Network Engineering.

(2) Termination Hardware , (High Density Patch Panels) Horizontal station cables will terminate on high density patch panels having a published Near End Crosstalk (NEXT) value of -42 dB or better. This product must provide plating in the contact area to reduce long term corrosion effects. Contacts must be oriented at 90 degrees to the axis of the conductor. Terminations must have color coding on the individual contacts. Products must provide 24 ports in 1 rack unit (1U) or 48 Ports in two rack units (2U) etc. Connectors shall be wired with 568B configuration. See plan details for pin-outs. One cable management organizer per 48 ports shall be provided by the Contractor on the Contractor provided equipment rack. All hardware shall be submitted for approval to Engineer prior to installation.

(b) Data Equipment Cross-connects. All connections between the data equipment terminations and the station terminations shall be done using Category 6 patch cords. These cords must meet the performance criteria of the warranty system being installed. All patch cords shall be factory terminated as recommended by TIA/EIA 568.2.1 in order to insure consistent quality and performance. The patch cords must have a latching mechanism to secure them to the termination block and must be keyed so they cannot be inserted upside down. Patch cords cannot exceed 6 meters in length. The contractor will provide two (2) patch cables for every individual cable installation. All patch cables must be provided from the same manufacturer as the manufacturer of jack and panel assemblies. For bidding purposes, Category 6 patch cables are generally specified as being yellow and between 7 and 10 feet long, depending on use and situation. Length shall be long enough to easily patch longest reaching opposite ports using cable management rings. All hardware shall be submitted for approval to Engineer prior to installation.

(c) EQUIPMENT RACK: Provide and install wall mounted equipment racks in quantities and type shown on plans and drawings. The full height Rack shall be PANDUIT R2P and the half height rack shall be R2P26. Racks shall be provided with a standard top crossmember, and pre_drilled base plate to allow floor fastening. The racks shall be provided with a lockable door. Each rack shall be provided with a quad 110 volt AC outlet, mounted in the bottom of the rack, as shown on project drawings. Grounding Requirements are required per manufacturers recommendations. Submittal is required to Engineer prior to installation.

4. Terminal Blocks (Fiber Optic):

(a) All Equipment Room and interconnect locations where fiber is used: Fiber Optic Interconnect Unit. Modular and enclosed. Must be able to provide cross-connect and/or interconnect, splicing and terminating capabilities. Interconnect Unit must be capable to terminate 24 fibers, splice up to 24 fibers, and splice/terminate up to 24 fibers with mechanical or fusion splices. Unit must be split in two sections; left side for terminating fibers and the right side for organizing jumpers. Each side has own door with locking capabilities. Different keys used for the locks on each door. Multiple top and bottom cable entry with knockout cable entry ports on each side. Slide out LC connector panel to be provided. Frame mountable. All hardware shall be submitted for approval to Engineer prior to installation.

(1) LC Connectors (50um Multimode) Loss: = 0.5dB, = 0.3dB. Field Terminated Epoxy Polish & Grind Style connector. Materials: Tip, cap, and body - reinforced engineering plastic. All hardware shall be submitted for approval to Engineer prior to installation.

5. Outlets to consist of the following:

(a) Information outlet terminations will utilize modular wall plates. Faceplates must be supplied with reversible ID Tabs (available in various colors).

Panduit (Yelow) P/N CJ688TPYL CAT 6 jack
Panduit (Electrical Ivory) P/N CJ688TPEI

Surface mounting will be allowed only where shown on the drawings. All jacks must exceed the Category 6 NEXT requirement TIA/EIA 568B.2.1. Jacks must be provided as individual units in order to provide the maximum flexibility. Jack or connector modules that contain more than one connector will not be accepted. The faceplates will be available in a variety of port sizes and styles (furniture, surface and flush mount) which will universally accept the individual jacks. Jacks must be available in at least 6 colors and wall plates must be available in a minimum of 4 colors. A minimum of 2 ports must be accommodated within a single gang wall plate. Terminations must support a minimum of 200 re-terminations and must allow for termination of stranded wire. The product must support termination of smaller gauge wires following insertion and removal of larger gauge wires without modification or adjustment. Quantity of jacks as needed plus an additional 5 complete sets of spare jacks to be given to Owner for future use. All hardware shall be submitted for approval to Engineer prior to installation.

6. Cable & Outlet Labeling:

(a) Labeling of data outlets shall consist of non-permanent lettering indicating a "data" port and extension located above the port. Numbering shall be as required by owner to coordinate with existing labeling schemes, and must meet the EIA / TIA 606 standards for documentation and labeling. Contractor shall coordinate exact labeling of outlets with Owner.

C. Tightening: Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturers' torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A and B, and the National Electrical Code.

D. Provide pathways for telecommunications to allow cabling to be installed for phone and data lines to all emergency phones, area of refuge phones, elevator equipment rooms and fire alarm panels. Provide cross-connect wires as indicated on the drawings and as required to form a complete and functioning telecommunications system. This includes extension of analog voice lines from the service provider demarcation point to the following connections:
1. Fire Alarm Control Panels
2. Elevator phones

2.2. Cable Supports: All cables above ceilings are to be supported by cable trays and/or J-Hooks located approximately 6" abovelay-in ceilings below all mechanical and other electrical equipment.

A. Contractor shall install cabling to maintain a twelve (12) inch minimum distance from all sources of Electrical Magnetic Interference (EMI), such as; fans, motors, fluorescent fixtures, transformers, etc. Engineer shall be notified in advance if these clearances cannot be met. Power cable must never reside in the same cable tray as the data cabling. No data cables will be spliced. Specifically all cabling installation procedures will also adhere to the recommended "do's and Don'ts in EIA/TIA 568B.

B. J Hooks: J-Hooks shall be used in common areas where cable trays are not available and/or as indicated on the plans. J-Hooks shall be located 6" maximum above ceilings with a maximum spacing of 4'-0" on center. J-Hook must be sized to support all cable plus 15% room for additional cable in the future. All hardware shall be submitted for approval to Engineer prior to installation

C. "D" Rings: "D" rings may be used in common areas in place of J-Hooks following the same installation requirements. "D" rings are to be provided to support all voice and data cables in telephone communications rooms, 6" on center maximum. "D" ring numbers 13A,B, and C. Size as required.

2.3. ADJUSTING AND CLEANING:

A. Cleaning: Clean equipment and components of dirt and construction debris upon completion of installation.

B. Touch-up: Touch-up scratched or marred enclosure surfaces to match original finishes.

C. Protection: Protect installed equipment and components from damage during remainder of construction period.

2.1. DEMONSTRATION / TESTING:

A. Minimum testing requirements for copper cabling is divided into the following conditions, keeping in mind that Attenuation and NEXT are the two most important factors and must be strictly adhered to by the installer. Test results/reports shall be provided by an experienced Test Agency and shall be provided to the Owner and the Engineer. All communications cable shall be tested using EIA 568 B.2.1 cabling specification.

B. Fiber Optic Testing : The Contractor shall test, verify, and document that the installed fiber optic cable meets all the essential cable parameters specified by EIA/TIA 455A, and the cable manufacturer. The tests shall be accomplished between each outlet drop and the associated telecommunications closet for multimode fiber.

(1) The optic fiber shall be optimized for lightwave transmission at nominal wavelengths of 850 nm and 1300 nm, plus or minus 30 nm. Numerical aperture for each fiber shall be a minimum of 0.275.

(2) Attenuation requirements are as follows:
3.0 dB/km or less @ 850 nm
1.0 dB/km or less @ 1300 nm

(3) The attenuation measurement method shall be in accordance with EIA/TIA 455A, FOTP_46 or FOTP_53.

(4) The bandwidth measurement shall be in accordance with EIA/TIA 455A, FOTP_30 frequency domain or FOTP_51 time domain.

(5) Minimum bandwidth requirements (3dB) are as follows:
700 Mhz_km @ 850 nm
500 Mhz_km @ 1300 nm

(6) The minimum tensile strength of the fiber after primary protective coating shall be at least than 600 lbs

PART 3 - EXECUTION

3.1 PROJECT OVERVIEW:

A. The scope of this project includes data cabling, passive equipment and labor necessary for cross-connect and patching of all cabling. The end product to be provided is a fully functional data, network cabling system for use by Owner and Owner provided telecom headend equipment at the time of Owner occupation of the facility.

1. One (1) RJ45 (Data) connector ports are to be provided at each typical information outlet unless indicated otherwise by the Drawings and these specifications. All Cables are to be distributed from the appropriate Data Equipment Room or Interconnect location to each individual information outlet, except where noted on the plans and these specifications. Termination is required at the Data Equipment Room and each of the fiber interconnect locations in the patch panels specified on Contractor provided equipment racks or wall mounted patch or termination blocks as shown in Drawings. All standards for Category 6 installation shall be adhered to. All cable runs are direct home runs to the appropriate distribution panel. Slack cable shall be provided for all cabling to ensure proper termination locations. Minimum of 1 foot of cable slack at each data/telephone and CATV outlet and 10 feet of cable at the termination/distribution panels.

2. In the Data Equipment Room and the Interconnect locations, on the Contractor provided Patch Panels, the data cable pairs shall be laid down on the blocks according to EIA/TIA color code standards color code starting with pair one on the blocks. The blocks shall also be labeled with cable and pair counts. The wiring standard shall be T568B. End to end testing of Data wiring to be provided by Contractor.

3. Between the Data Equipment Room and each information outlet, the contractor shall run the cables as specified in Section 16741.

B. EXAMINATION:

1. General: Examine areas and Conditions under which data systems are to be installed. Contractor shall notify in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner.

C. INSTALLATION OF DATA SYSTEMS:

1. Installation: Install systems as indicated, in accordance with manufacturer's written instructions and with recognized industry practices (BICSI); ensure systems comply with installation and operational requirements of EIA/TIA, NEC and the Federal Communications Commission.

D DATA CONNECTOR TERMINATION PRACTICES:

1. For Category 6 (Data) Cables; minimize the amount of untwisting in a pair as a result of connecting to hardware for all terminations. For Category 6 cabling the amount of untwisting must not exceed the requirements for TIA/EIA TSB-40.

E. INTERCONNECTION TO OWNER EQUIPMENT:

1. All interconnections between premise wiring and equipment (either existing or new) for data shall be coordinated with Owner to minimize any downtime as related to data service.

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END OF SECTION 16742

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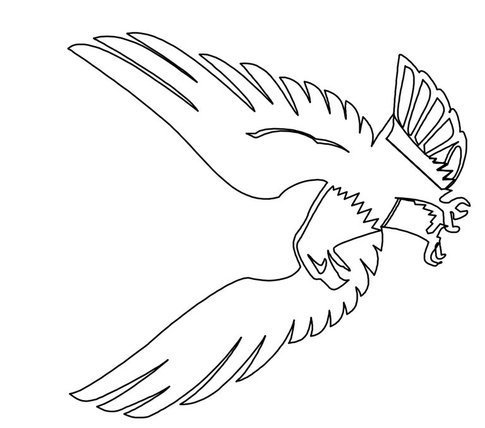

DRAWINGS ISSUED		
NO.	DATE	ITEM ISSUED
9	2/26	ADDENDUM 2
8	2/18	ADDENDUM 1
7	2/3	ISSUED FOR BIDS
6	1/11	BOE REVIEW
5	11/24	BOE REVIEW
4	11/9	BOE REVIEW
3	10/26	REVIEW
2	10/16	REVIEW
1	10/08	REVIEW

COMPUTER DRAWING

DATE: JANUARY 2021

DRAWN BY:	CHECKED BY:

SHEET

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OF 1 SHEETS

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