SECTION 11 61 53B

COLLEGE OF SAN MATEO HOUSE & WORK LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes architectural lighting control equipment for operation of House and Work Lights in the Theater.

B. The work under this section shall be supplied by a qualified stage lighting contractor and installed per Division 26.

C. Contractor's Qualifications: The Contractor for the work of this Section shall:

1. Have been continuously in the business of supplying stage lighting control equipment for at least five years.
2. Maintain a shop adequately equipped and staffed for the fabrication and setup of the work of this Section.
3. Have successfully completed during the past five years five stage lighting controls projects of scope and complexity at least equal to this project.
4. Have in permanent employ or association engineers and other technical staff capable of the layout, detailing and engineering of the work of this section.
5. Have all licenses and local qualifications required to perform the work of this section in the project location.
6. Provide proof of qualification as part of bid submission which includes a list of similar projects completed, including names and current phone numbers of references.

D. The following companies shall be a standard of qualification for stage lighting contractors:

1. Musson Theatrical, 890 Walsh Avenue, Santa Clara, CA 95050, 408-986-0210, contact: David Rimerman
2. Holtzmueller Corporation, 1000 25th Street, San Francisco, CA 94107, 415-826-8383, contact: Jim Schelstrate.

1.2 SECTION INCLUDES

A. Provision of all equipment for control of house and work lighting in the theater, all complete and operative, including, but not limited to the following principal control items:

1. House lights control stations “HL” and “HLK”
2. Snapshot Control Stations “S”
3. Architectural Lighting Processor
4. House Lighting Dimmers & Relays.
5. Network gateway
6. DMX Jumper Cables

B. Furnish materials list, shop drawings, operation and service manuals.

C. Test and adjust installed equipment for specified performance.

D. Demonstrate and instruct Owner's personnel in operation and service.

1.3 RELATED SECTIONS

1.	General Requirements	Division 1
2.	Electric Basic Requirements	Section 26 00 00
3.	Low-Voltage Electrical Power Conductors & Cables	Section 26 05 19
4.	Hangers & Supports for Electrical Systems	Section 26 05 29
5.	Raceways	Section 26 05 33

6.	Boxes	Section 26 05 34
7.	Identification for Electrical Systems	Section 26 05 53
8.	Lighting	Section 26 51 00

1.4 DEFINITIONS

A. Contractor: Refers to the contractor responsible for the work of this Division.
B. Provide: Furnish item(s) in the lighting control system as enumerated under this Section.
C. Furnish: Deliver items to the site.
D. Consultant: Consultant responsible for design of house lighting system as described in this section: Landry & Bogan, 733 West Evelyn Ave., Mountain View, CA 94041 (650) 969-5195, fax (650) 969-4965. Contact: Heather McAvoy, heather@landb.com
E. Engineer: Electrical Engineer of Record for the project: Interface Engineering, 717 Market Street, Suite 500, San Francisco, CA 94103, (415) 489-7244. Contact: Jason Lau, jasonl@interfaceEng.com

1.5 GENERAL REQUIREMENTS

A. Electrical equipment and materials shall bear a UL label.

1.6 SUBMITTALS

A. Submit the following in accordance with Division 1 except as modified below.
B. Schedule and Review: Submit shop drawings and related documents for review in ample time for completion of the Work of the Contract. Prior to fabrication or delivery of equipment or materials to the site, receive submittals back from Consultant stamped "Reviewed - resubmission not required".
C. Materials and Equipment List: Submit complete systemized list of all equipment, catalog cuts, brochures, descriptive information, and performance data referenced either to applicable specification paragraphs or to item numbers shown on contract drawings.
D. Manufactured Items: See Division 1.
E. Deviations from requirements of contract documents: Bring all deviations (if any) to the Consultant's attention in writing at the time the drawings are submitted for review.
F. Drawings required:

1. Submit at least six black line prints (min. 11" x 17") for each item of equipment (electronic version via .pdf file is an acceptable substitution.)
2. Equipment shop drawings for each unit of control equipment.
3. Connection/installation drawings for each unit of equipment showing terminal markings corresponding to the as-built equipment.

G. Information on all drawings shall be complete, clear, and sufficient to make connections including wire count, wire gauge, wire type, and other information necessary for satisfactory interconnection between lighting control devices and building equipment.
H. Riser diagrams for control network:

1. The riser diagrams on the drawings show diagrammatically the intended conduit and other wireways for installation of control and signal conductors, including existing conduits.
2. Review the riser diagrams on the drawings, review the wiring listed, and develop riser diagrams as part of the required submittals. The submitted riser diagrams shall include the conduit and wireways shown on the contract drawings. Riser diagrams which do not include such conduit and wireways are not acceptable.
3. Where controls interconnect to building equipment, and devices, or where power is required, indicate clearly the source and destination of the interconnections.

1.7 OPERATION AND SERVICE MANUALS

A. Prepare one stage lighting system manuals for each venue, namely:

1. OPERATING INSTRUCTIONS

   a. Include table of contents and specific instructions for operating controls and functions for the following equipment:

      1. House Light control stations.
      2. Snapshot control stations
      3. Architectural Lighting Processor.
      4. DMX/Ethernet Gateway
      5. Dimmer & relay modules.

   b. Exclude operating instructions and diagrams which do not apply to the furnished equipment.

B. SERVICE AND MAINTENANCE

1. Include:

   1. Maintenance and service instructions for all equipment.
   2. Test procedures.
   3. Wiring diagrams with terminal designations.
   4. Data sheets (catalog cuts) for off-the-shelf units.
   5. Equipment parts lists with part numbers.
   6. Equipment fabrication drawings.
   7. Factory location and telephone number for trouble-shooting assistance.

2. Exclude data sheets, lists, and diagrams which do not apply to furnished equipment. If standard service and maintenance sheets include various models in addition to furnished model(s), clearly mark the particular reference to furnished unit.
3. Group sheets in a logical manner and separate groups with indexed divider sheets corresponding to the table of contents.
4. Fold large drawings to 8 1/2" x 11" for binding.
5. Reinforce binding holes to reduce tearout.
6. Place operating and service instructions in one heavy-duty 3-ring binder and label spine with the name of the Project, Venue, Owner, Consultant, Engineer, Manufacturer, and date of completion.
7. Delivery of Manuals:

   a. Email draft copy of manual to Heather McAvoy at heather@landb.com for comment before issuing preliminary manuals for comment. Do not include any pre-manufactured manuals but clearly note which manuals will be submitted separately.
   b. Deliver two copies of preliminary manuals not later than one month prior to initial power on of the lighting control system for review and approval prior to completion of the manuals. If the Consultant requires additions or if revisions are required, the Manufacturer shall make them and resubmit revised preliminary manuals. After approval in writing by the Consultant, deliver four final copies of the manuals to the Consultant. The system installation will not be considered complete and ready for inspection until the manuals have been submitted for review.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements

1. Conform to all current State rules and all local codes and ordinances, including but not necessarily limited to the following:

a. ANSI (American National Standards Institute).
b. IEEE (Inst. of Electrical & Electronic Engineers).
c. IPCEA (Insulated Power Cable Engineers Association.)
d. CEC (California Electrical Code).
e. NEMA (Nat'l Electrical Manufacturers Assoc.).
f. NFPA (National Fire Protection Association).

B. California Building Code

1. UL (Underwriters' Laboratories).

C. Where these Specifications call for a higher standard than the above-mentioned rules, the Specifications shall govern. Should there be any direct conflict between the above-mentioned rules and these Specifications, the rules shall govern.

D. Nothing in these Plans or Specifications is to be construed to permit work not conforming to Codes.

1.9 SUBSTITUTIONS

A. Manufacturers, trade names and model numbers are given for the purposes of identification, and are not intended to be exclusive of other items of equal suitability. However, the design is based on components of individual characteristics, in combinations proven in use.

B. Where a material is identified by trade name (e.g., Formica), the intent is to indicate in short form the type of material and a standard of quality. Where an item is identified by manufacturer or trade name, and a model number or catalog number, the intent is to establish a standard of quality and specific characteristics of design and performance.

C. Requests for substitutions will be considered if the request to substitute is reflected in a list of materials, catalog cuts, performance data, electrical characteristics submitted to the Consultant within the specified time.

D. The following criteria will govern the consideration of requests for substitutions:

1. The item considered must be on the whole equal to or better than the item specified and have a satisfactory field history at installed locations for at least 6 months of operation after date of acceptance of the installation.
2. The item must be equally suited to the design as a whole. If modification of the design is necessary to accommodate the item, it may be rejected on this ground alone.
3. If the item specified is a factory production standard, the Consultant may reject proposed substitutions which must be specially modified in order to be equal.

E. If in the opinion of the Consultant either the acceptance or the necessary evaluation of a proposed substitution may delay completion of the Work beyond the Contract Time, he may summarily reject it if sufficient technical data are not received within the specified time.

F. Materials specified by manufacturer or trade name are based on the manufacturer's ability and experience. In some cases, continued service beyond the warranty period and spare parts are a factor in the choice of a particular supplier. Proposed substitutions must be manufactured by a firm of equal reputation, qualifications and stability to the specified manufacturer.

1.10 CLOSEOUT SUBMITTALS (AS-BUILTS)

A. Provide project record drawings and specifications as required by other sections of the specifications and as outlined in the Operating and Service Manuals. Such drawings shall fully represent installed conditions including true panel board connections, correct conduit and wire sizing as well as routing of new runs, revised fixture scheduling listing the manufacturer and products actually installed and revised panel schedules.

B. All changes to drawings shall be made by qualified draftspersons to match existing line work and lettering as closely as possible.

1.11 BUILDING DRAWINGS AND SITE CONDITIONS

A. Accuracy:

1. Plans and specifications are complementary, what appears in one shall be binding in both.
2. Drawings for the work under this Division are diagrammatic.
3. Existing building conditions may not be documented in the drawings. Confirm site conditions before proceeding with work.

1.12 WARRANTY

A. Guarantee equipment against defective material and workmanship for one year from date of completed installation and completion of punch-list work (if any) except where longer periods are specified.

B. During the guarantee period, furnish emergency service without additional cost. The emergency service includes on-site adjustment, repair, and replacement of parts necessary to return the equipment to satisfactory operating status.

C. Provide the emergency service within 24 hours of notification (or a longer period if agreed to in advance by the Owner).

D. When any component fails at any time during the guarantee period, the guarantee period for replaced components and all other components which are inactive because of said failure shall be extended for a period as long as the inactivity or for two months, whichever is longer.

1.13 OWNER'S INSTRUCTIONS

A. Operation and service manual must be approved and delivered to the owner prior to owner instruction.

B. After completion of the installation, time shall be allotted by the Contractor for demonstrations and instructions for operating and maintenance personnel in the use of all systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with the manufacturer's representatives. The equipment manufacturers shall provide product literature and application guides for the users' reference.

C. Determine instruction schedule in cooperation with the Owner's Representative and the control equipment manufacturer. Allow one full 8-hour day for instruction.

D. Costs, if any, for the demonstration and instruction shall be the responsibility of the Contractor.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All major house and work lighting systems components (signal processors, control stations, and dimmers) shall be by the same manufacturer. In some cases, components require compatibility with existing equipment.

B. Current products:

1. Hardware: Should the manufacturer have developed a later model of specified units, the latest developed unit shall be provided without additional cost to the Owner. If the latest model of a unit exceeds the specifications (or the manufacturers' previously published specifications), manufacturer shall notify the Consultant and provide a list of differences for review and acceptance prior to delivery.

C. Load equipment and control equipment shall bear a UL label where UL procedures have been established.

2.2 MANUFACTURERS

A. Acceptable manufacturer for control and dimming equipment (to match existing equipment):

1. Electronic Theater Controls, Inc. (ETC West), 6640 Sunset Blvd, Ste. 200, Hollywood, CA 90028, Contact: Randy Pybas, (323) 461-0216

B. Other equipment manufacturers: As listed under specification paragraphs.

2.3 CONDUCTORS

A. In equipment: 600 v. rating unless low voltage wiring isolated from high voltage wiring. Conductors shall be UL listed for use within equipment enclosure and for the intended use.
B. Low voltage signal and control conductors where 300 v. insulation permitted: Shielded and unshielded multi-conductor signal and control cable, color coded tinned copper conductors, PVC insulated, and PVC outer jacket; Belden, Alpha, or equal.
C. Power conductors: THHN/THWN as specified elsewhere in Division 26.
D. All conductors UL listed for application.
E. Signal and control wiring types and wiring topography are specific to each stage lighting equipment manufacturer. Contractor must obtain specific recommendations of the manufacturer of lighting controls and dimmers.

2.4 CONTROL EQUIPMENT, GENERAL

A. Engrave and paint fill designations directly on control panels and signal receptacle panels as shown on plans and as required for identification. Unless noted specifically, separable nameplates attached to control panels are not acceptable.
B. Separate nameplates of aluminum, steel, or laminated phenolic may be employed on equipment other than control panels and signal receptacle panels. Anchor such nameplates with screws or adhesive and screws. Embossed tape markers are not acceptable.
C. Identify fuses and circuit breakers by function and capacity.
D. Provide overload and short-circuit protection for auxiliary and control circuits via circuit breakers or lamp indicating fuse holders; Buss HKL series, Littlefuse 344000 series, or equal.
E. Provide convenient access to circuit breakers, fuses, and other interior components via hinged doors or panels, or removable panels, and without interrupting operation of control panels. Support lift- type panels (if any) with hardware to prevent gravity closing and excessive travel.
F. Fabricate cabinets in modules, if necessary, to pass through doorways, corridors, stairs, and other restricted passageways on site.
G. Fabricate cabinets of welded steel structural members covered by panels of CRS (l6 ga. min.) or l/8" thick aluminum to form mechanically and electrically safe units.
H. Fabricate drawers, doors, etc., to conform to metal furniture standards to be quiet, easy to operate, to have no sharp corners or raw edges, and a generally professional appearance.
I. Treat steel cabinets with a phosphate type dip, and prime all surfaces with zinc chromate or similar rust inhibitor. Finish interior surfaces with one coat (min.) of enamel. Finish exterior of cabinets with two coats (min.) of solid color semi-gloss or gloss baked enamel or epoxy type finish.
J. Provide rubber silencers in the frames for swinging door panels in cabinets located in noise-sensitive areas (e.g., on the stage).
K. Control Panels: Fabricate panels of 14 ga. minimum CRS or .10”-.125” aluminum with hard, sealed black finish. Other panel finishes may be submitted for review and approval. If requested, submit two samples of panel finish to Consultant and obtain written approval prior to finishing. Mount components with dark color flush-head, or blind screws. Neither bright finish nor cut washers are acceptable on visible surface of panel.
L. Key Schedule: Key according to schedule and provide 6 keys for each lock or switch.

M.

LOCK	KEY
Signal Processor Door	A
Keyswitch Station	B

N. Equipment UL listed and labeled where listing procedures have been established by Underwriters Laboratories.

2.5 DIGITAL HOUSE AND WORK LIGHTS CONTROL SYSTEM

A. Description: System for control of Theater House Lights and worklights via remote stations. System shall operate through digital protocol via the signal processor Dimmers shall be controllable by designated control stations and by existing control console (ETC Ion) on a pile-on basis (highest-level signal takes precedence).

B. System setup: Manufacturer shall obtain data from the Consultant prior to the programming and system testing period as aid in initial configuring of the system to achieve the specified and implied operations.

C. System capacities and features:

1. Dimmers controlled: Minimum of 302.
2. Remote control sources: Minimum of 16.

D. Houselight Stations “HL”

1. Functions and operations:

a. Preset switches: When control is local, depressing switch initiates automatic fade into selected preset. Digital switch with raised button.
b. Raise and Lower buttons: Provides proportional adjustment of house light channels under manual control

2. Physical: 0.1” - 0.125” aluminum face plate with black semi-gloss finish and white screened (or engraved) characters to mount on existing recessed single gang back box.
3. Indicator lights: LED at 50% illumination in red in pilot light mode and 100% illumination in green to indicate active mode. .
4. Acceptable unit: ETC “Unison Paradigm” #UH10007-4-1F

E. Houselight Station “HLK

1. Functions and operations:
2. Preset switches: When control is local, depressing switch initiates automatic fade into selected preset. Digital switch with raised button.
3. Lock-out Key Switch:

a. Function: Lock-out operation of station.
b. Physical: 3-position, center-off, momentary contact rotary type.

4. Physical: 0.1” - 0.125” aluminum face plate with black semi-gloss finish and white screened (or engraved) characters to mount on existing recessed single gang back box.
5. Indicator light: LED at 50% illumination in red in pilot light mode and 100% illumination in green to indicate active mode. .
6. Acceptable unit: ETC “Unison Paradigm” #UH11K05-4-1F

F. Snapshot Stations “S”

1. Functions and operations:
2. Preset switches: When control is local, depressing switch initiates automatic fade into selected preset. Digital switch with raised button.
3. Physical: 0.1” - 0.125” aluminum face plate with black semi-gloss finish and white screened (or engraved) characters to mount on existing recessed single gang back box.
4. Indicator light: LED at 50% illumination in red in pilot light mode and 100% illumination in green to indicate active mode. .
5. Acceptable unit: ETC “Unison Paradigm” #UH100010-4-1F

2.6 HOUSE LIGHTING RELAY MODULES

A. Dual plug-in units compatible with existing ETC Unison DR12 dimmer rack utilizing mechanically held relays in the same form factor as the existing ETC D20 dimmer modules.
B. Design for operation at full load in an ambient temperature range of 0 degrees to 40 degrees C. and relative humidity range of 25% to 90% without exceeding stud temperature as specified by manufacturer.
C. Cast aluminum chassis, finished with textured epoxy paint and keyed to prevent insertion in inappropriately rated rack positions.
D. UL listed and labeled for continuous duty at 100% of rated load.
E. Power Input range: 90v to 140v 60Hz.
F. Protection:

1. High speed, magnetic circuit breaker for disconnect and overload protection, rated for:

a. 100% switching duty applications.
b. Inrush current of 20 times rated capacity without opening.
c. 125%, 10-120 seconds, must-trip rating.
d. 100,000A Short Circuit Current Rating
e. Modules withstand hot-patching of cold loads up to full rating.

2. Relays:

a. 20A, level activated mechanical relay rated for 200,000 full load activations and 5 million no load applications, minimum.
b. Rated for 1.50HP at 20.0A.

G. Relay Module quantities:
H. Theater: (6) six dual 20A relay modules.
I. Acceptable unit: ETC “Sensor” R20” series

2.7 ETHERNET/DMX GATEWAY

A. General: DMX data port smart nodes to permit DMX512 data to be encoded, routed and decoded over ACN compliant Ethernet network and to permit ACN compliant Ethernet data to be encoded, routed and decoded over DMX512 network.
B. Node shall incorporate four 5-pin XLR type female connectors and one XLR type RJ-45 female connector. (Nuetrik EtherCon or equal)
C. Node shall incorporate a backlit graphical LCD display for identification (soft-labeling) and status reporting. Labeling shall be user configurable.
D. Node shall provide routing and patching of a minimum of 2048 DMX address over 64 DMX universes.
E. All configuration data for each node shall be held at the node and system operation shall not require continuous on-line operation of network configuration software.
F. Power to DMX node shall be supplied via POE system without the additional need for any external power supply or additional wiring.
G. Rack mounted DMX node must be mountable into a standard EIA 19" rack.
H. Acceptable unit: ETC Net 3 Gateway.
I. Quantity: Provide one.

2.8 ARCHITECTURAL CONTROL PROCESSOR

A. Physical:

1. Surface mounted panel constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.
2. Enclosure door with opening to allow limited access to the control module face panel.
3. Convection cooled without the use of fans.
4. Capacity to accept one or two Control Processors and one or two Station Power Modules, including various options and accessories.

5. Supports a single Station Power Supply module.
6. All enclosure components shall be properly treated and finished.
7. Exterior surfaces finished in fine textured, scratch resistant, powder based epoxy paint.
8. Top, bottom, and side knockouts to facilitate conduit entry.
9. Enclosures designed to allow easy insertion and removal of all control and option modules without the use of tools.
10. Supports provided for precise alignment of modules into power and signal connector blocks.
11. With modules removed, enclosures shall provide clear front access to all power and control wire terminations.

B. Ethernet Switch

1. 5-port Ethernet Switch, with at least 4 ports supplying Power over Ethernet (PoE).
2. 100BaseTX, auto MDI/MDIX, 802.3af PSE compliant.
3. Power, status, and activity indicators. Indicators visible when the enclosure door is open.
4. A test switch/indicator shall be available without opening the rack door or removal of any modules/components.

C. Electrical

1. Available in 100, 120, 230 and 240 volt, single-phase configurations.
2. Pre-wired by the manufacturer. The contractor shall connect input and control wiring.
3. Support the following wire terminations:

   a. AC (single phase)
   b. Echelon link power (Belden 8471 or equivalent)
   c. 24Vdc (2- 16AWG Wire)
   d. DMX512A Port A (In or Out) (Belden 9729 or equivalent)
   e. DMX512A Port B (In or Out) (Belden 9729 or equivalent)
   f. RS232 Serial In/Out (Belden 9729 or equivalent)
   g. Unshielded Twisted Pair (UTP) Category 5 Ethernet
   h. Contact Closure In (14AWG to 26AWG Wire)
   i. Contact Closure Out (14AWG to 26AWG Wire)
   j. Contact Closure Out shall provide 1A @ 30vDC

D. Station Power Modules

1. Provide LinkPower for up to 32 stations and 1.5A@24VDC of Auxiliary (AUX) power.
2. Support over-current/short protection for LinkPower and Aux. LinkPower shall support fault detection on each leg of the balanced data bus.
3. All control wire connections terminated via factory provided connectors.

E. Thermal

1. Ambient room temperature: 0-40°C / 32-104°F
2. Ambient humidity: 10-90% non-condensing

F. Quantities: Provide (1) one

G. Acceptable unit: ETC “Unison” ERn2” with Unison Paradigm Architectural Control Processor, Station Power Module and 4-port Ethernet switch option.

2.9 DMX CAT5 JUMPER CABLES

A. Note: DMX over CAT5 cable shall only be used for permanently installed conditions. It is not to be used for direct connection to portable equipment or to non-DMX equipment such as Ethernet switches.

B. Comply with ANSI #1.27-2: Standard Wiring Practice for Permanently Installed Control Cables for use with ANSI E1.11 DMX512-A
C. Connector type: RJ45
D. Cable lengths and quantity as shown on the drawings

PART 3 - EXECUTION

3.1 GENERAL TESTS

A. At completion of installation, but prior to powering the lighting control systems, conduct tests to determine conformity with applicable codes and with these specifications. Where tests depend on energizing the lighting control systems, make such tests after confirmation by system manufacturer's on-site representative. Tests shall include, but are not limited to, the following:
B. Insulation Resistance: Perform 500-volt DC tests for one minute on all feeder and branch circuit conductors, including the neutral, and make a typed record of all readings to be included in the maintenance instructions. Repair or replace circuits showing less than 4 megohms resistance to ground. Make tests using Biddle Insulation Resistance Megger, or equal.
C. Circuits Conformity: Test all feeder and branch circuits for continuity. Test all neutrals for improper grounds.

3.2 INSTALLATION OF LIGHTING CONTROL EQUIPMENT

A. Obtain and follow equipment manufacturer's instructions for termination and connection of equipment. Manufacturer's instructions will be available without cost to the Contractor via telephone and shop and installation drawings.

B. Terminate all DMX signal wiring in compliance with industry wiring standards as described in "Recommended Practice for DMX512" by Adam Bennette, pub. USITT.

C. Terminate all house and work lighting control wiring.

3.3 TESTS OF HOUSE & WORK LIGHTING CONTROL SYSTEMS

A. Coordinate and request the services of field technician representing control equipment manufacturer for final checkout prior to system turn on.

B. Assist the manufacturer's field technician to test and adjust the operation of the lighting control system to conform to the contract documents and manufacturer's technical manuals.

C. Control and signal verification (after stage lighting systems are powered): It is the responsibility of the contractor to verify that all system functions are operating properly.

D. Contractor shall certify network to category 5 specifications utilizing a Fluke DSP LAN test meter or equivalent. Supporting documentation shall be turned over to the consultant upon request.

E. Assist the manufacturer's technician in verifying that all signal and control cables are as per manufacturer's recommendation and are installed as required for proper function.

F. After all tests show conformance, notify the Consultant in writing that the installation is complete, satisfactory, and ready for final inspection by the Consultant.

3.4 INSPECTION AND TESTS BY CONSULTANT

A. The Consultant will make final inspection and tests and prepare a punch list of corrective or incomplete work, if any, caused by the installation work.

B. When the conditions due to installation work which are cited on the punch list (if any) are corrected, notify the Consultant in writing that the work is completed and ready for a second inspection.

C. If the second inspection and tests show the need for corrective work of such an extent that additional visits to the site by the Consultant are required to verify completion of the work, such visits shall be at the expense of the Contractor.

D. If test reports and demonstrations are satisfactory, and the Consultant, upon inspection, finds the systems generally operable for the uses intended, the Consultant may elect to consider the work substantially complete and waive liquidated damages. The Contractor shall proceed immediately to correct conditions (if any) which do not conform to the Contract Documents.

END OF SECTION