REQUEST FOR PROPOSAL
MIDWESTERN STATE UNIVERSITY
PURCHASING & CONTRACT MANAGEMENT DEPARTMENT
3410 Taft Blvd., Daniel Bldg., Rm. 202
Wichita Falls, TX. 76308

BID NUMBER	BID TITLE
735-16-8161	**Studio Lighting Grid Mounting Hardware System & Studio Lighting Fixtures, Accessories, & Controls System**

BIDS WILL BE RECEIVED BY SEALED BID OR EMAIL UNTIL:
2:00 P.M.,
August 23, 2016:
the office's of the Director of Purchasing & Contract Management,
3410 Taft Blvd., Daniel Bldg., Rm. 202
Wichita Falls, TX. 76308

GENERAL TERMS AND CONDITIONS

These General Terms and Conditions apply to all offers made to Midwestern State University (herein after referred to as "University") by all prospective vendors (herein after referred to as "Bidders") on behalf of Solicitations including, but not limited to, Invitations to Bid and Request for Quotes.

INSTRUCTIONS FOR SUBMITTING BIDS

Review this document in its entirety. Be sure your bid is complete, and double check your bid for accuracy.

Questions requiring only clarification of instructions or specifications will be handled through the email process. If any questions results in a change or addition to this Bid, the change(s) and addition(s) will be addressed to all vendors involved as quickly as possible in the form of an addendum. It is the responsibility of the bidder to view the posting on the MSU purchasing web page located at http://mwsu.edu/purchasing/.

Sign the **Vendor's Affidavit Notice** and return with your bid.

BIDDERS SHALL SUBMIT BID ON THE FORM PROVIDED, SIGN THE VENDOR AFFIDAVIT, AND RETURN ENTIRE BID PACKET. In the event of inclement weather and the University Offices are officially closed on a bid opening day,

bids will be received until 2:00 p.m. of the next business day. At which time said bids will be privately opened.

BIDS SUBMITTED AFTER THE SUBMISSION DEADLINE SHALL BE RETURNED UNOPENED AND WILL BE CONSIDERED VOID AND UNACCEPTABLE.

SUCCESSFUL VENDOR WILL BE NOTIFIED BY EMAIL OR MAIL. All responding vendors will receive written notification regarding the outcome of the award. Bid tabulations will be posted to the MSU Purchasing we page.

PLEASE NOTE CAREFULLY

THIS IS THE ONLY APPROVED INSTRUCTION FOR THIS BID. ITEMS BELOW APPLY TO AND BECOME PART OF TERMS AND CONDITIONS OF BID. ANY EXCEPTIONS THERETO MUST BE IN WRITING.

1. Each bid shall be emailed or placed in a separate envelope completely and properly identified with the name and number of bid. Bids must be in the Purchasing Office **BEFORE** the hour and date specified.

2. **QUOTE F.O.B. DESTINATION.** If otherwise, show exact cost to deliver. Bid unit price on quantity specified – extend and show total. In case of errors in extension, UNIT prices shall govern. Bids subject to unlimited price increase will not be considered.

3. Bids **MUST** give full firm name and address of the bidder. Failure to manually sign bid will disqualify it. Person signing bid should show TITLE or AUTHORITY TO BIND HIS FIRM IN A CONTRACT.

4. Bids **CANNOT** be altered or amended after opening time. Any alterations made before opening time must be initialed by bidder or his authorized agent. No bid can be withdrawn after opening without the approval by the Vice-President of Administration & Finance based on a written acceptable reason.

5. The University is exempt from State Sales Tax and Federal Excise Tax. **DO NOT INCLUDE TAX IN BID.**

6. Any catalog, brand name or manufacturer's reference used in a bid invitation is descriptive-**NOT** restrictive-it is to indicate type and quality desired unless otherwise indicated. Bids on brand of like nature and quality will be considered. If bid is based on other than referenced specifications, proposal must show manufacturer, brand or trade name, lot number, etc., of article offered. If other than brand(s) specified is offered, illustrations and complete description should be made part of the bid. If bidder takes no exception to specifications or reference data, he will be required to furnish brand names, numbers, etc., as specified.

7. Samples, when requested, must be furnished free of expense to the University. If not destroyed in examination, they will be returned to the bidder on request, at his expense. Each sample should be marked with bidder's name, address, and University bid number. **DO NOT ENCLOSE OR ATTACH SAMPLE TO BID.**

8. **Delivery:** Bid must show number of days required to make delivery to place material in receiving agency's designated location under normal conditions. Failure to state delivery time obligates bidder to complete delivery in 14 calendar days. A five-day difference in delivery promise may break a tie. Un realistically short or long delivery promises may cause bid to be disregarded. Consistent failure to meet delivery promises without valid reason may cause removal from bidder list. Delivery shall be made during normal working hours only, 8:00 a.m. to 5:00 p.m., unless prior approval for late delivery has been obtained from the Director of Purchasing.

9. If delay is foreseen, contractor shall give written notice to Director of Purchasing. The University has the right to extend delivery date if reasons appear valid. Contractor must keep University advised at all times of status of order. Default in promised delivery (without accepted reasons) or failure to meet specifications, authorizes the University to purchase supplies elsewhere and charge full increase in cost and handling to defaulting contractor.

10. All items proposed shall be new, in first class condition suitable for shipment and storage (Midwestern State University prefers recycled packaging whenever possible), unless otherwise indicated in bid. Verbal agreements to the University will not be recognized. All materials and services shall be subject to Purchaser's approval. Unsatisfactory materials will be returned at Seller's expense.

11. Written and verbal inquires pertaining to bids must give Bid Number and Commodity.

12. No substitutions or cancellations permitted without written approval of Director of Purchasing.

13. The University reserves the right to accept or reject all or any part of any bid, waive minor technicalities and award to the Bidder that bids to the Best Value to the University. The University reserves the right to award by item or by total bid. Prices should be itemized.

14. Consistent and continued tie bidding could cause rejection of bids by the University and/or investigation for Anti-Trust violations.

15. The contractor agrees to protect the University from claims involving infringement of patents or copyrights.

16. This is a Quotation inquiry only and implies no obligation on the part of the University. All costs quotations must include all the various features needed to

satisfy the requirements. Note: No amounts will be paid for the items in this BID in excess of the amounts quoted.

17. **Award:** A written purchase order or notice of award mailed or otherwise furnished to the successful bidder within the time of acceptance specified in this package results in a binding contract without further action by either party.

18. **Variation in Quantity:** The University assumes no liability for commodities produced, processed or shipped in excess of the amount specified herein.

19. **Invoicing:** Bidder shall submit two (2) copies of an itemized invoice shoeing bid number and purchase order number to:

Midwestern State University
Accounts Payable
3410 Taft Blvd.
Wichita Falls, TX. 76308

20. **Payments:** The University, after receipt of completed order will make payment to the contractor within 30 days from the receipt of goods or invoice which ever is later. All partial shipment must be pre-approved by the Director of Purchasing. In the event of partial shipments the University is not required to make payments until the order is complete. Acceptance of and final payment for the item will be contingent upon satisfactory performance of the product received by the University.

21. **Discrimination:** In order to comply with the provisions of fair employment practices, the contractor agrees as follows; 1.) the contractor will not discriminate against any employee or applicant for employment because of race, sex, religion, handicap, or national origin; 2.) in all solicitations or advertisements for employees, the contactor will state that all qualified applicants will receive consideration without regard to race, color, sex, age, religion, handicap or national origin; 3.) the contractor will furnish such relevant information and reports as request by the University for the purpose of determining compliance with these regulations; and 4.) failure of the contractor to comply with these laws will be deemed a breach of contract and it may be cancelled, terminated or suspended in whole or in part.

22. **Assignment:** Any contract entered into pursuant to this request is not assignable, nor the duties thereunder, by either party without the written consent of the other party in the contract.

23. **Other Remedies:** In addition to the remedies stated herein, the University has the right to pursue other remedies permitted by law or in equity.

24. E-Verify: Contractor is responsible to verify all employees are approved by The Homeland Security E-Verify program.

REQUEST FOR PROPOSAL

STUDIO LIGHTING GRID MOUNTING HARDWARE SYSTEM & STUDIO LIGHTING FIXTURES, ACCESSORIES, & CONTROLS SYSTEM
MIDWESTERN STATE UNIVERSITY

It is the intent of these specifications to describe the minimum requirements for **the above titled project** at Midwestern State University in sufficient detail to secure comparable bids.

Each bidder must confirm he fully understands these specifications and the University's needs and satisfies himself that he is cognizant of all factors relating to requirements contained in these specifications.

The bid analysis will include compliance to bid specifications, past performance with vendor, references, delivery time, which will have a weighted average of 30 percent and the overall cost to the university, which will have a weighted average of 70 percent. Midwestern State University reserves the right to consider deviations from these specifications.

Award of this bid will be contingent on availability of Midwestern State University funds.

References shall be included on this bid form. Three current customers with a comparable purchase shall be listed with complete name, address, telephone number and contact person.

Bids must be submitted on this form and the bidder shall return the entire bid/specification package which will constitute a contract equally binding between the bidder and Midwestern State University if bids accepted by the University. Each bid shall be placed in a sealed envelope or emailed, signed by a person having the authority to bind his/her firm in a contract.

This contract shall remain in effect until completion and acceptance by the University. Midwestern State University reserves the right to enforce the performance of this contract in any manner prescribed by law or deemed to be in the best interest of the University in the event of breach or default if this contract. Midwestern State University reserves the right to terminate the contract immediately in the event the successful bidder fails to make delivery in accordance with the specifications.

Questions concerning these specifications should be directed via email no later than August 15, 2016 to:

Stephen Shelley, Director of Purchasing and Contract Management
3410 Taft Blvd. Daniel Bldg. Rm. 202
Wichita Falls, TX. 76308
stephen.shelley@mwsu.edu
(940) 397-4110

Midwestern State University may in it's sole discretion respond in writing to questions concerning this bid request. Only MSU responses made by formal written addendum to this proposal shall be binding and shall be posted on the MSU purchasing web site located at http://mwsu.edu/purchasing/. Oral or other written interpretations or clarifications shall be without legal effect.

All bids meeting the intent of this invitation to bid will be considered for award. Bidders taking exception to the specifications, or offering substitutions, shall state these exceptions by attachment as part of the bid. The absence of such a list shall indicate that the bidder has not taken exception and shall hold the bidder responsible to perform in strict accordance with the specifications of the invitation. Midwestern State University reserves the right to accept any and all or none of the exception(s) / substitution(s) deemed to be in the best interest of the University.

PRE-BID MEETING: There is no pre-id meeting scheduled for this RFP.

Proposals are to be sent via email (preferred) or hand delivered to:

Stephen Shelley, Director of Purchasing and Contract Management
3410 Taft Blvd. Daniel Bldg. Rm. 202
Wichita Falls, TX. 76308
stephen.shelley@mwsu.edu
(940) 397-4110

SPECIFICATIONS
RFP #735-16-8161

Midwestern State University in constructing a 30'X40' broadcast production studio. The studio will include a studio lighting pipe grid hardware system that will support a series of LED light fixtures, accessories, and control panel.

This scope of work includes a system that consists of the following materials and installation: pipe grid; the structural attachments necessary to support the pipe grid; electrical distribution; curtains and track. All components shall be designed and engineered for the specific loading of the building ceiling structure.

The complete grid hardware system is comprised of all necessary equipment for mounting and support of the overhead lighting equipment for the video/film industry. The overhead lighting equipment is not include in this scope of work.

Contractor will be required to coordinate installation of lighting grid mounting system with other trades constructing the studio.

The studio will also include a studio lighting pipe grid hardware system that will support a series of LED light fixtures, accessories, and control panel.

This scope of work includes the purchase and installation of the overhead lighting fixtures, accessories and control system outlined in the attached BOM and Lighting Control System Riser drawing.

Please see specifications and drawing at the below Link under current bid opportunities listed under the RFP number:
http://mwsu.edu/purchasing/

Please supply a HUB Subcontracting Plan with your bid, which can be found at the below listed link:
http://www.window.state.tx.us/procurement/prog/hub/hub-subcontracting-plan/

Please supply schedule and lead time for project with bid:

Supply a W-9 With your Bid if new to Midwestern State University.

2005 Uniform General Conditions apply to this Bid and can be found at the below listed link:
http://mwsu.edu/purchasing/contract-management

SCHEDULE:
Phase one of the project, the "studio lighting grid mounting hardware system", will have a notice to proceed starting September 6, 2016, shop drawings, submitted by September 30, 2016, and construction beginning by October 15, 2016, with completion by January 15, 2017.

Phase two of the project, the "studio lighting fixtures, accessories and controls system, will have a notice to proceed issued by October 1, 2016, construction to begin by February 1, 2017, and construction completed by March 15, 2017.

INSURANCE:
The insurance policies provided by the Construction Manager @ Risk (CMAR) will only afford coverage to the CMAR, not to any *SEPARATE CONTRACTOR*. This includes CMAR's Builder's Risk policies. MSU and/or the *SEPARATE CONTRACTOR* will need to arrange Builder's Risk policies for the work being performed outside of the prime contract with the CMAR.
The CMAR requests that since the scopes of work will overlap, and that the *SEPARATE CONTRACTOR* will be onsite and inside a building under construction, that the *SEPARARTE CONTRACTOR* add the CMAR, Buford Thompson Construction Company as an additionally insured with a waiver of subrogation on the General Liability policy.

BID SHEET
RFP #735-16-8161

The pricing will need to be broken down into two bids based on two separate funding sources. The project will be contracted as one project.

BASE BID FOR THE STUDIO LIGHTING GRID MOUNTING HARDWARE SYSTEM:

$ _____

BASE BID FOR THE STUDIO LIGHTING FIXTURES, ACCESSORIES AND CONTROLS SYSTEM:

$ _____

TOTAL PROJECT PRICING: $_____

Company Name:_____

Signature:_____

Printed:_____

Email:_____

Telephone:_____

VENDOR REFERENCES

Please list three (3) references of current customers who can verify the quality of service your company provides. The University prefers customers of similar size and scope of work to this proposal. ***THIS FORM MUST BE RETURNED WITH YOUR PROPOSAL.***

REFERENCE ONE

Government/CompanyName:_____

Address:_____

ContactPersonandTitle:_____

Phone:_____ Fax:_____

Contract Period:_____ ScopeofWork:_____

REFERENCE TWO

Government/CompanyName:_____

Address:_____

ContactPersonandTitle:_____

Phone:_____ Fax:_____

Contract Period:_____ ScopeofWork:_____

REFERENCE THREE

Government/CompanyName:_____

Address:_____

ContactPersonandTitle:_____

Phone:_____ Fax:_____

Contract Period:_____ ScopeofWork:_____

AFFIDAVIT

The undersigned certifies that the bid prices contained in this proposal have been carefully checked and are submitted as correct and final and if bid is accepted (within 90 days unless otherwise noted by vendor), agrees to furnish any and/or all items upon which prices are offered, at the price(s) and upon the conditions contained in the Specifications.

STATE OF TEXAS
COUNTY OF WICHITA

BEFORE ME, the undersigned authority, a Notary Public in and for the State of Texas, on this day personally appeared

_____

_

who, after having first been duly sworn, upon oath did depose and say;

That the foregoing proposal submitted by _____

_____

_ hereinafter called "Bidder" is the duly authorized agent of said company and that the person signing said proposal has been duly authorized to execute the same. Bidder affirms that they are duly authorized to execute this contract, that this company, corporation, firm, partnership or individual has not prepared this bid in collusion with any other Bidder, and that the contents of this bid as to prices, terms or conditions of said bid have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this bid.

Name and Address of Bidder:

_____

_____

_____

Telephone number_____

_____
Signature

Email_____

Name:_____

Title:_____

SWORN TO AND SUBSCRIBED BEFORE ME THIS _____day of _____,
20 _____.

_____
Notary Public in and for the
State of Texas.

SECTION 26 00 00

ELECTRICAL SYSTEMS

1.0 GENERAL

1.1 DESCRIPTION

A. The work under this Section shall conform to the requirements of "Division 1, General Requirements," "Conditions of the Contract" and "Supplementary Conditions." Specific attention is called to the "Division 26 General Requirements" located in Section 26001.
B. It is the intent of these Specifications for the Contractor to provide an electrical system complete, fully operational, fully adjusted, and ready for use.

1.3 PARTIAL LIST OF WORK NOT INCLUDED IN DIVISION 26

A. Equipment pads:
B. Installing access doors:
C. Painting (except as otherwise specified herein):
D. Furnishing of motors: Division 23.
E. Furnishing of individual motor controllers that are factory-mounted and integral parts of pieces of equipment: Division 23.
F. Furnishing, installing, and connecting telephone wiring, cables, and equipment:
G. Compaction testing:
H. Division 23 shall furnish and install control wiring and conduit for the following:
   1. Motor control interlock wiring for automatic temperature control of pumps, WCU's, AHU's, and fans including chilled, heating hot water and condenser water system controls, flow switches, pressure differential controls, compression tank alarms, nitrogen pressurization system, water treatment system, etc.
   2. Sewage ejector and sump pump controls and alarms.
   3. Water system controls and alarms including but not limited to: Domestic water pumps, fire pumps, house pumps, surge tanks, etc.
   4. Wiring for central alarm panel (CAP).
   5. Interlocking of pumps, WCU's, AHU's, and fans to building management system relays.
   6. Connection of all safety devices, alarms and control wiring for air compressors including controls for air dryers.
   7. Any control wiring for thermostats, direct digital controls, control valves, dampers, ATC cabinets, etc. for automatic temperature control. Control wiring shall be considered both "line 120 & 277V." and "low" voltage wiring.

   Any control wiring not listed above shall be furnished and installed under Division 26, including but not limited to conduit, other raceway components, and control wiring between water meters and remotely mounted water meters.
I. Unit Pricing and Budgetary Cost Estimate
   The Contractor shall provide unit prices and budgetary cost estimates as indicated in the Architectural Documents, as specified herein, and as indicated on the Drawings.

1.4 DIVISION 23 REQUIREMENTS

It shall be the responsibility of the Electrical Contractor to review the following Division 23

Specification Sections to determine the complete scope of Division 26 work:

Division 21	Fire Protection System
Section 230900	Building Management System

2.0 PRODUCTS

2.1 EQUIPMENT

A. General: All equipment shall be new, of the capacity and type specified herein, and as shown on the Drawings. Equipment shall be of a listed manufacturer and model number and shall be in accordance with the space limitations of the project.

B. Single Source: To maximize ease of maintenance and part replacement, equipment of a similar nature shall be provided by a single manufacturer.

C. Approved Equal: Equipment and materials selected by the Contractor within the context of "equal as approved by the Engineer", "approved equal", "equivalent as determined by the Engineer" and similar terminology shall be submitted to the Engineer for review, approval and inclusion into the Contract Documents prior to the finalization of the contract between the Owner and the Contractor, and prior to the shop drawing submittal phase of the Project. All equipment and materials submitted to the Engineer under the terms of "approved equal" during the shop drawing phase of the Project without prior review and approval shall be returned to the Contractor without review under the status of "No Action".

2.2 MATERIAL

All material required for a complete and proper installation shall be as specified and as selected by the Contractor subject to the approval of the Architect. Material shall be new, listed and approved by UL, and bear the inspection label if subject to such approval.

3.0 EXECUTION

3.1 CONDITIONS

A. Inspection: Prior to proceeding with the work of this Division, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Division may be completed in strict accordance with all pertinent codes and regulations, the reviewed shop drawings, and the manufacturers' recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Owner's Representative. Do not proceed in areas of discrepancy until all such discrepancies have been resolved. If there is a discrepancy between the Drawings and the Specifications, the Specifications shall typically govern. However, any discrepancy of this type shall be immediately brought to the attention of the Owner's Representative for formal interpretation prior to proceeding with the work.

C. Interpretation of Documents: Any and all contractual requirements may be indicated solely on the Drawings, solely in the Specifications, in both the Specifications and on the

Drawings, in reference standards indicated in the Specifications and/or in the Owner's and Contractor's Contract. If Contract requirements are indicated in both the Specifications and the Drawings, the Contractor shall comply with both requirements unless the requirements are mutually exclusive of each other. If Contract requirements are indicated in both a reference standard and the Specifications, the more stringent requirement shall apply. Any and all contractual requirements shall be interpreted within the overall context of the complete scope of work. All materials, equipment, systems and installation methods shall be suitable for the intended service, coordinated with other trades and be complete, fully operational, adjusted, tested and ready for use by the Owner.

3.2 INSTALLATION OF EQUIPMENT

A. Locations: Install all equipment in the locations shown on the approved shop drawings, except where specifically approved otherwise on the job by the Architect and/or Owner's Representative.

B. Interferences: Avoid interference with structure and with work of other trades, while preserving adequate headroom and clearing all doors and passageways to the approval of the Architect and/or Owner's Representative.
Where busway is installed on a job, Electrical Contractor shall coordinate location early with other trades. Horizontal runs of bus shall be run above all piping and ductwork so as to maximize clear headroom below busway and maintain manufacturer's recommended access clearances to all sides of busway. All section joints shall be accessible.

C. Inspection: Check each piece of equipment in the system for defects. Verify that all parts are properly furnished and installed, function properly, and that all adjustments have been made.

3.3 CONNECTIONS TO EQUIPMENT

A. Mechanical Equipment: The Contractor shall make final electrical connections to all items of mechanical equipment, including all motors and unit heaters for a complete and operational system.

B. Elevator Connections: The Contractor shall make final connections to the elevator control panel(s) and provide the required outlets for the elevator accessories as required by the elevator manufacturer. Padlocking hardware will be provided for all circuit breakers or disconnects in elevator machine room(s). Enclosed fused disconnects or circuit breakers will be provided for all elevators within the elevator machine room "in sight" of elevator controllers. Contractor shall provide a 160° heat detector independent of the fire alarm system hard wired to the 120 volt standby power system with 120V., 20A. rated contact(s). Control wiring shall be provided such that upon activation of detector, a standby powered 120V., 20A. circuit shall be completed which shall shunt trip "off" main line power to elevator controllers. All work for the elevator installation shall be in accordance with applicable requirements of the ANSI Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks, A17.1, published by the American Society of Mechanical Engineers.

3.4 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause any of the work of this Division to be covered up or enclosed until it has been inspected, tested, and approved by the Architect and/or Owner's Representative and by the authorities having jurisdiction.

B. Uncovering: Should any of the work of this Division be covered up or enclosed before it

has been completely inspected, tested and approved, the Contractor shall provide all services, labor, materials and equipment necessary to uncover such work without additional cost to the Owner. After the work has been completely inspected, tested, and approved, the Contractor shall provide all services, labor, materials and equipment to make all repairs necessary to restore the work to its original and proper condition at no additional cost to the Owner.

3.5 COOPERATION WITH OTHER TRADES

Coordinate and cooperate with other trades in order that all systems in the scope of the Contract may be installed in the best arrangement. Coordinate and cooperate as required with all other trades which share space in common areas and maximize the access to each system and their respective components.

3.6 CLEANING

It is the intent of these Specifications that all work, including the inside of equipment, be left in a clean condition. All construction dirt shall be removed from material and equipment. Level of cleanliness shall be defined as "broom" clean unless noted otherwise. All exterior surfaces of Division 26 equipment shall be wiped down and cleaned of all dust and dirt. All interior surfaces of electrical equipment including but not limited to switchboards, motor controllers, and panelboards shall be wiped down and vacuum cleaned. Surfaces to be painted shall be cleaned and prepared in accordance with architectural division of the contract and as noted in other sections herein.

3.7 COMPLETENESS

It is the intent of these Specifications to provide a complete system. Completeness shall mean not only that all material and equipment have been installed properly, but that all material and equipment have been installed and have been adjusted, and that, in the opinion of the Architect, all material and equipment are operating as designed.

3.8 ADJUSTMENT OF CONTROLS

The Contractor shall provide the personnel and equipment to completely adjust the controls to the satisfaction of the Architect. At the completion of the project, the Architect will arrange a meeting at the job site to allow the Contractor to demonstrate the proper operation of the electrical controls.

3.9 NOISE

It is the intent of these Specifications to provide a system free from objectionable noise. Any equipment that is generating objectionable noise, in the opinion of the Architect, shall be corrected and other noises shall be dampened as directed.

END OF SECTION

SECTION 26 00 01

DIVISION 26 GENERAL REQUIREMENTS

1.0 GENERAL

1.1 DESCRIPTION

A. General
The work required under this Section shall conform to the requirements of "Division 1, General Requirements," Conditions of the “Contract" and "Supplementary Conditions".

B. Work Included
The work included in this Section consists of the general requirements for the work more specifically described in Division 23 and Division 26 where referenced.

C. Definitions
The Contractor shall provide all supervision, labor, material, equipment, machinery, and any and all other items necessary to complete the mechanical and electrical systems. All items of equipment are specified in the singular; however, the Contractor shall provide the number of items of equipment as indicated on the Drawings, and as required for complete systems.

D. Intent
It is the intention of these Specifications and Drawings to call for finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready to use."

All labor, materials, apparatus, and appliances essential to the complete functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Drawings and Specifications or not, shall be furnished and installed by the Contractor.

In cases of doubt as to the Work intended, or in the event of need for explanation thereof, the Contractor shall request supplementary instructions from the Architect.

E. Codes, Rules, Regulations, Permits and Fees
The Contractor shall give all necessary notices, obtain all permits and pay all government sales taxes, fees, and other costs, including utility connections or extensions, in connection with the Contractor's work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection of the Contractor's work and deliver same to the Architect before request for acceptance and final payment for work.

The Contractor shall comply with the most recently revised versions of all applicable laws, rules, regulations, and ordinances of Federal, State, and Local Authorities. Modifications required by the above said Authorities shall be made without additional charge to the Owner.

All equipment shall comply with all applicable requirements of laws, codes,

ordinances, legislation, etc., of all Federal, State and Local Authorities, whether indicated on the Contract Documents or not.

Where Contract Drawings and Specifications requirements are in excess of Code requirements and are permitted under the Code, the Contract Drawings and Specifications shall govern.

All rules and regulations of the State Fire Insurance Regulatory Body, Underwriters Laboratories, the Local Building Code, Americans with Disabilities Act (ADA), and National Electrical Code (NEC), shall be complied with whether indicated in the Contract Drawings and Specifications or not.

Where alterations to and/or deviations from the Contract Drawings and Specifications are required by the above authorities, report the requirements to the Architect and secure Architect's approval before starting the alterations.

1.2 QUALITY ASSURANCE

A. Surveys and Measurements
The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the Drawings and Specifications, the Contractor shall notify the Architect, and shall not proceed with the work until instruction has been received from the Architect.

B. Drawings
Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Drawings are not to be scaled. The Architectural Drawings and Details shall be examined for exact location of fixtures and equipment. Where they are not definitely located, this information shall be obtained from the Owner's Representative.

The Contractor shall follow Drawings in laying out work and check Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Owner's Representative shall be notified before proceeding with installation.

If directed by the Owner's Representative, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work, if such directions are made prior to the performance of the affected work.

C. Cooperation with Other Trades
The Subcontractors shall give full cooperation to other trades and shall furnish in writing to the General Contractor any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

Where Division 23 and 26 work will be installed in close proximity to, or will interfere

with work of other trades, coordination among trades in working out space conditions to make a satisfactory adjustment shall be accomplished.

The Contractor shall prepare composite shop drawings and sections at a suitable scale not less than 1/4" = 1'0", clearly showing how work of all affected trades is to be installed. If work is installed before coordinating with other trades, or so as to cause any interference with work of other trades, then the necessary changes in work shall be made to correct the condition without extra charge.

The Contractor shall obtain and transmit between affected trades, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

Where busway is installed on a job, Electrical Contractor shall coordinate location early with other trades. Horizontal runs of bus shall be run above all piping and ductwork so as to maximize clear headroom below busway and maintain manufacturer's recommended access clearances to all sides of busway. All section joints shall be accessible.

D. Protection

The Contractor shall protect all work and material from damage by the Contractors' work or workmen, Subcontractors' work or workmen, and shall be liable for all damage thus caused.

The Contractor shall be responsible for work and equipment until work is final inspected, tested, and accepted; the Contractor shall protect work against theft, injury or damage; and shall carefully store material and equipment received on site which are not immediately installed. The Contractor shall close open ends of work with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

E. Material and Workmanship

Work shall be executed in strict accordance with the best practice of the trades in a thorough, substantial, workmanlike manner by competent workmen.

The Contractor shall furnish the services of a full-time, experienced superintendent, who shall be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, welders, helpers, and laborers required to unload, transfer, erect, connect, adjust, start, operate, and test each system.

F. Manufacturer's Recommendations

With exceptions as specified and/or indicated on the Drawings or in the Specifications, apply, install, connect, erect, use, clean, and condition manufactured articles, materials, and equipment in accordance with manufacturer's current printed recommendations. Keep copies of such printed recommendations at job site and make them available as required. When product conditions are not covered by the manufacturer's printed recommendations, at the discretion of the owner's representative, it may be necessary for the manufacturer's representative to review the product conditions and provide written supplemental recommendations to address the special situation.

G. Space Limitations

Equipment has been chosen which will fit into the physical spaces provided and indicated, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with the Code requirements and the requirements of the local inspection department.

In the preparation of Drawings, a reasonable effort to accommodate approved equipment manufacturer's space requirements has been made. However, since space requirements and equipment arrangement vary according to each manufacturer, the responsibility for initial access and proper fit rests with the Contractor. The Contractor will be responsible for obtaining approvals from the Engineer and Local Authority where equipment the Contractor is providing on the Project differs in size or space considerations from that shown on Contract Documents.

Physical dimensions and arrangements of equipment to be installed shall be subject to the Architect's review.

H. Coordination Between Divisions 23 and 26
The Division 26 contractor shall cooperate with the general contractor and the Division 23 contractor to provide coordination between the Division 23 and 26 trades. For all equipment requiring electrical service provided under Division 23, it shall be the responsibility of the Division 26 contractor to acquire from the Division 23 contractor the electrical characteristics of the actual equipment to be provided. Should there be a discrepancy between the electrical service characteristics of the equipment to be provided and what is indicated on the documents, the contractor shall obtain written direction from the Owner's representative prior to proceeding. This coordination and transfer of information shall take place prior to the purchasing and installation of the electrical service.

1.3 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. After the Contract is awarded, but prior to proceeding with the Work requiring final reviewed shop drawings, product data and samples, the Contractor shall obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, Subcontractors, and Sub-Subcontractors for all materials, systems and equipment specified herein; and submit data and details of such materials, systems and equipment for review by the Architect and Engineer. Prior to submittal of the shop drawings, product data and samples to the Architect and Engineer, the Contractor shall review and certify that the shop drawings, product data and samples are in compliance with Contract Documents. Further, the Contractor shall check all materials and equipment after their arrival on the job site and verify their compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required in the Engineer's office each time a shop drawing, product data and/or samples are submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling the Work.

B. The Architect's approval and Engineer's review of shop drawings, product data, and samples shall not relieve the Contractor of the responsibility for dimensions or errors that may be contained therein, or for deviations from requirements in the Contract Documents. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents shall govern the Work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

C. Before submitting shop drawings, product data and samples the Contractor shall certify that data and details set forth on each shop drawing, product data, or samples for each item of equipment and materials complies with the Contract Documents for this Project. Such certification shall be made by the Owner, a Partner, a Corporate Officer of the Contractor, or by a person duly authorized to sign binding agreements for the Contractor. Unless certified, shop drawings, product data and samples will not be reviewed, and will be returned unchecked to the Contractor. Certifications shall be in the form of rubber stamp impressions which state:

> I hereby certify that this shop drawing, product data, and/or sample has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Documents and physical space limitations for the Project.
>
> (Name of the Electrical Subcontractor)
>
> Signed:_____
>
> Position: _____
>
> Date: _____

D. The Contractor shall submit shop drawings, product data and/or samples equipment and other items listed in Section 26900 and for any other equipment for which such submittals may be required in various Sections of the Specifications.

E. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed by the Architect or the Engineer and shall be returned to the Contractor for resubmittal.

F. The Contractor shall observe the following rules when submitting shop drawings, product data and samples:

1. Each shop drawing shall indicate in the lower right hand corner, and each product data brochure shall indicate on the front cover the following: title of the sheet or brochure; name and location of the Project; names of the Architect and Engineer, Contractor, Subcontractor, manufacturer, supplier, vendor; the date of submittal; and the date of each correction and revision. So far as is practical, each shop drawing, product data and/or sample shall bear a cross-reference note to the page number or numbers of sheets of the Drawings and/or Specifications showing the Work. Unless the above information is included, the submittal will be returned for resubmittal.
2. Shop drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections and schematics to clearly describe the apparatus. Drawings shall be prepared by an engineer-draftsman skilled in this type of work. All bus duct layouts and similar shop drawings shall be drawn to at least 1/4" = 1'-0" scale. The Contractor shall submit shop drawings as described below. Shop drawings which do not comply with these requirements will be returned for resubmittal.

a. The submittal shall consist of two prints and one sepia of the shop drawing. The Architect and Engineer will each retain one print, and should the shop drawing receive a "RESUBMIT" status the sepia will be returned to the Contractor. Should the submittal receive a status of "FINAL REVIEW" or "REVIEWED, EXCEPTIONS NOTED", the sepia will be returned to the Contractor with the appropriate action indicated. Should the submittal be market "RESUBMIT", it shall be resubmitted in accordance with the Contract Documents. If marked "FINAL REVIEW", no resubmittal is required, and if marked "REVIEWED, EXCEPTIONS NOTED", documentation in the form of a letter or complete resubmittal of shop drawing shall be forwarded to the Owner and Engineer for record purposes only.

b. If the copy stamped "FINAL REVIEW" is altered for any reason after it has been stamped, the "FINAL REVIEW" shall automatically be voided.

c. All work shall be done in accordance with shop drawings stamped "FINAL REVIEW" or "REVIEWED, EXCEPTIONS NOTED", insofar as these are in agreement with the Contract Documents. Wherever differences occur between the shop drawings and the Contract Documents, the Contract Documents shall govern the Work.

3. Product data to be submitted shall be published by the manufacturers and shall contain complete and detailed engineering and dimensional information. The Contractor shall submit product data as described below. Product data which does not comply with these requirements will be returned for resubmittal.

a. Product data submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is clearly marked out, or unless relevant information is clearly marked. Product data from each manufacturer shall be identified and submitted separately.

b. The submittal shall consist of product data from each manufacturer. Product data will be returned marked "FINAL REVIEW", "REVIEWED, EXCEPTIONS NOTED", or "RESUBMIT". If stamped "RESUBMIT", the product data so marked shall be returned and the submittal repeated in accordance with Contract Documents. If marked "REVIEWED, EXCEPTIONS NOTED" the submittal shall be corrected as noted and returned for Owner's and Engineer's permanent record. If marked "FINAL REVIEW" no additional submittal will be required.

c. If the product data stamped "FINAL REVIEW" are altered for any reason after they have been stamped, the "FINAL REVIEW" shall automatically be voided.

d. All work shall be done in accordance with product data stamped "FINAL REVIEW" or "REVIEWED, EXCEPTIONS NOTED" insofar as these are in agreement with the Contract Documents. Wherever differences occur between the product data and Contract Documents, the Contract Documents shall govern the Work.

e. The Contractor shall submit eight (8) copies of each product data brochure. The Architect and Engineer will each retain one copy of the submittal and six (6) copies will be returned to the Contractor.

G. Equipment Deviations

Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical, structural, or architectural layout, all such redesign, and all new drawings and detailing required therefore, shall be prepared by the Contractor at the Contractor's own expense as approved by the Owner's Representative.

Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring, and conduit, and any other additional equipment required by the system, at no additional cost to the owner.

1.4 WARRANTY

All equipment supplied for this Contract shall be free from defects in material, workmanship, and title, and shall be of the kind and quality described herein. If it appears within one year from date of building final acceptance by the Owner that the equipment does not meet the warranties specified above, the Contractor shall correct any defect, including nonconformance with these Specifications, at the Contractor's option, either by repairing any defective part or parts or by making available at the Contractor's plant a repaired or replacement part.

1.5 CONFERENCE PRIOR TO START OF WORK

A. Immediately upon the award of this Contract, but prior to commencing any Work, the Contractor together with designated major Subcontractors shall confer with the Owner's Representative, the Architect and Engineer concerning the Work under this Contract.

B. Contractors and Subcontractors attending this meeting shall include but not be limited to the following: General; Mechanical; Plumbing; Fire Protection ; Automatic Temperature Controls and Building Management; Sheet Metal; Insulation; Electrical; Fire Alarm; and Testing, Balancing and Adjusting. Contractor and Subcontractor representatives shall be familiar with the Drawings, Specifications and shop drawing submittal requirements and be prepared to intelligently discuss the project requirements.

C. The conference shall be as determined by Architect.

2.0 PRODUCTS

2.1 MATERIALS

A. Materials and equipment shall be new and in good condition. The commercially standard items of equipment and the specific names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the Work.

B. Since manufacturing methods vary, reasonable minor variations are expected; however, performance and material requirements specified are the minimum standards acceptable. The Engineer retains the right to judge equality of equipment that deviates from the Contract Drawings and Specifications.

2.2 EQUIPMENT PADS AND ANCHOR BOLTS

A. Concrete pads for various pieces of equipment will be provided under another Division. Pads shall be provided in main switchboards rooms, all areas with floors below grade, penthouse equipment rooms and electrical closets and any other locations as shown on the drawings. This shall include floor mounted equipment, equipment mounted on legs and pipe support stands. Unless otherwise noted, equipment pads shall generally conform to the shape of the piece of equipment it serves with a minimum 3" margin around the equipment and supports. Pads shall be a minimum of 4" high and made of a minimum 28 day, 2500 psi concrete reinforced with 6" x 6" 6/6 gauge welded wire mesh. Tops and sides of pad shall be troweled to smooth finishes, equal to those of the floors, with all external corners bull-nosed to a 3/4" radius. Shop drawings stamped "FINAL REVIEW" or "REVIEWED EXCEPTIONS NOTED" shall be used for dimensional guidance in sizing pads.

B. Unless otherwise noted furnish and install galvanized anchor bolts for all equipment placed on concrete equipment pads or on concrete slabs. Minimum dimension between anchor bolts and edge of slab shall not be less than 3". Bolts shall be of the size, type and number recommended by the manufacturer of the equipment and shall be located by means of suitable templates provided by the equipment manufacturer.

2.3 EQUIPMENT MOUNTING/SUPPORT DEVICES

A. All floor, wall or ceiling mounting/support devices shall be factory fabricated devices as provided by the equipment manufacturer for the intended application unless otherwise indicated on the Drawings.

B. The Engineer retains the right to judge the quality of the design, application, and installation of all field fabricated mounting/support devices using steel angle, steel channels, Uni-Strut, brackets, all-thread rods, etc. Any mounting or support devices that will rust, corrode or in the opinion of the Engineer become unsightly or a maintenance problem will not be acceptable.

C. Support devices not factory finished shall be hot dipped galvanized or properly primed and painted with a minimum of two coats of rust inhibiting paint. Refer to the Architectural Painting Systems for additional requirements.

D. All-thread rods shall be galvanized or cadmium plated.

E. All plywood used as mounting boards in association with Division 26, unless specified otherwise by the Architect, shall be APA C-D plugged interior 5/8" to 3/4". All plywood used shall be painted (front, back and edges) with a minimum of one prime coat and one finish coat prior to equipment installation. Refer to the Architectural Specifications for additional requirements. Color shall be determined by the Architect.

2.4 ACCESS DOORS

Wherever access is required through walls, ceilings or fire-rated enclosures to concealed equipment installed under this Division, the Contractor shall furnish a hinged access door and frame as follows:

A. Drywall construction--Milcor Style DW.

B. Finished acoustical tile ceiling--Milcor Style AT.

C. Finished plaster ceiling--Milcor Style AP.

D. Finished plaster walls or ceramic tile--Milcor Style M.

E. Plaster or masonry walls and ceilings outside offices and in other finished areas exposed to view--Milcor Style K or M.

F. Access doors shall be "B" label fire construction where required.
G. Access doors shall be installed under another Division.

H. No access door shall be installed until location and type have been approved by the Architect.

2.5 ESCUTCHEONS

Furnish and install heavy chrome-plated or nickel-plated steel plates of approved pattern on all conduit passing through walls and ceilings in finished areas. Escutcheons shall be B & C No. 10 or approved equal with concealed hinges. Pattern shall be approved by the Architect.

3.0 EXECUTION

3.1 SCAFFOLDING, RIGGING, HOISTING

The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery of any equipment and apparatus furnished to the job site. Remove same from job site when no longer required.

3.2 SLEEVES, CUTTING, AND PATCHING

A. The Contractor shall be responsible for the timely placing of openings and sleeves for all conduit passing through walls, partitions, beams, floors, and roof while the same are under construction. A conduit sleeve shall be one size larger than the size of conduit it serves, except where "Link Seal" casing seals are used in sleeves through walls below grade. Sleeves set in concrete floor construction shall be 18 gauge galvanized steel. Sleeves shall extend two inches above the finished floor. All conduit passing through concrete or masonry walls shall have standard weight galvanized steel sleeves. Sleeves shall be set flush with finished wall. Caulk around conduit penetrating floors and roof with sufficient layers of fire safing insulation and further seal off opening between conduit and sleeve with a fire rated non-hardening mastic. The fire rating shall equal rating of floor sleeve penetrates.

B. Sleeves penetrating walls below grade shall be standard weight black steel pipe with 1/4" thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be four inches wider all around than the sleeve it encircles. The entire assembly shall be hot dipped galvanized after fabrication. Seal off annular opening between conduit and sleeve with "Link Seal" casing seal as manufactured by Thunderline Corporation, Wayne, Michigan. The sleeve shall be sized to accommodate the Thunderline casing seal. Casing seals shall be Series 300 for conduit sizes 3/4" through 4" and Series 400 for pipe conduit 5" and larger.

C. If holes and/or sleeves are not properly installed and cutting and patching becomes necessary, it shall be done at no expense to the Owner. The Contractor shall undertake no cutting or patching without first securing the Architect's written approval.

3.3 EXCAVATION AND BACKFILL

A. The Contractor shall make all necessary excavations, cutting of paving, concrete, etc., and do all backfilling and paving repairs necessary for the proper execution of the Work. Remove all dirt and debris out of and away from the building as directed. Backfill shall be mechanically compacted to a density of 95% of the maximum dry density at optimum moisture content as determined by the Standard Proctor Compaction Test.

B. Backfill shall be compacted and repairs to paving or concrete shall be accomplished to the satisfaction of the Architect and the Local Authorities.

C. See the various Sections of the Division for additional excavation and backfill requirements.

3.4 PAINTING

A. Painting, except as specified or indicated otherwise, shall be done under another Division. This Division shall cooperate with the other Division to determine the size of equipment, sizes and lengths of pipes, etc., to be painted.

B. Equipment furnished under this Division shall be factory-finished. If the factory finish is damaged during shipment, installation, etc., it shall be repainted subject to the Architect's approval.

3.5 DRAYAGE AND HAULING

Include all drayage, hauling, hoisting, and placement in the building of equipment specified herein. The Contractor shall be responsible for the timely introduction of equipment to the Project. If any item of equipment is received prior to the time it is required, the Contractor shall be responsible for its proper storage and protection until such time as it may be required. The Contractor shall pay for all cost of demurrage or storage.

3.6 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Electrical equipment shall be identified by means of nameplates permanently attached to the equipment. Refer to Section 26195 for additional requirements.

B. Cardholders and directory cards shall be provided for circuit identification in panelboards. Cardholder shall be located on inside of panel door. Directory cards shall be typewritten. Circuit descriptions shall include locations and names of items of equipment served.

C. Circuits and pull wires in empty conduit shall have tags attached to wiring at points where runs are interrupted at junction boxes or terminated in panels, boxes, etc. Feeder or branch circuit numbers shall be indicated.

D. Tag symbols shall correspond to the identifications on the record drawings.

3.7 PROHIBITED LABELS AND IDENTIFICATIONS

A. Prohibited Markings
Unless otherwise prohibited by applicable codes, in all public areas, tenant areas and similar locations within the Project, the inclusion or installation of any item, element of assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited. Also prohibited is the inclusion or installation of any article which bears visible evidence that an insignia, name, label, or other device has been removed.

B. Exception
Required Underwriters Laboratory labels shall not be removed nor shall identifications specifically required under the various technical sections of the Specifications be removed.

3.8 EQUIPMENT NOISE AND VIBRATION

A. It is the intention to specify and for the Contractor to provide equipment and systems that, as defined herein, shall be quiet and free of apparent noise and vibration in operation.

B. It shall be the responsibility of the Contractor to obtain equipment that is quiet in operation as compared to the other available equipment of its size, capacity, and type, and to install equipment so that a minimum amount of noise and/or vibration is transmitted to the building.

C. Any additional precautions deemed necessary to provide a quiet installation shall be done as part of the Work of the Contractor, subject to review by the Engineer, without additional cost to the Owner. After the system is in operation, it shall be the responsibility of the Contractor to make any changes to equipment or Work installed as may be required to provide a system which is quiet in operation as defined herein.

3.9 DATE OF COMPLETION AND TESTING OF ELECTRICAL SYSTEMS

A. The date for the final acceptance test shall be sufficiently in advance of the Contract completion date to permit the execution of the test prior to the expiration of the Contract. Any adjustments and/or alterations which the final acceptance tests indicate as necessary for the proper functioning of all equipment shall be completed prior to the expiration of the Contract. Re-tests shall not relieve the Contractor of completion date responsibility. See individual Sections for extent of testing required.

B. The contractor shall provide a detailed schedule of completion indicating when each system is to be completed and outlining when tests will be performed.

3.10 OPERATING INSTRUCTION

A. The Contractor shall provide the services of a factory trained specialist to supervise the operation of all equipment specified herein and to instruct the Owner's operators for a five-day, eight hours per day, operating instruction period. The operating instruction period shall be defined as straight time working hours and shall not include nights, weekends, or travel time to and/or from the Project. See individual Sections for

additional instructions by manufacturer's trained specialists.

B. The Owner shall be notified in writing at least five days before each operating instruction period begins. The Contractor shall not commence instruction period until the Owner has issued a written acceptance of the starting time.

3.11 OPERATING AND MAINTENANCE BOOKS

A. The Contractor shall provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.

B. Submit six copies of operating and maintenance data books for review at least four weeks before final review of the Project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.

C. Maintenance instruction manuals shall include complete oiling, cleaning, and servicing data compiled in clearly and easily understandable form. Data shall show all model numbers of each piece of equipment, complete lists of replacement parts, motor ratings, and actual loads.

D. Include the following information where applicable:
1. Identifying name and mark number as indicated on the Drawings and in the Specifications.
2. Locations (where several similar items are used, provide a list).
3. Complete nameplate data.
4. Certified record drawings and "Final Reviewed" or completely corrected shop drawings.
5. Parts lists.
6. Performance curves and data.
7. Wiring Diagrams.

Manufacturers' recommend operating and maintenance instructions with all nonapplicable information deleted.

3.12 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, and all changes and deviations in the electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of black line prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work, the Contractor shall purchase from the Architect or Engineer a set of black line prints to be used for the "Record Drawings".

B. Record dimensions shall clearly and accurately delineate the Work as installed; locations shall be suitably identified by at least two dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner

with a rubber stamp impression that states the following:

"RECORD DRAWINGS (3/8 high letters)
To be used for recording Field
Deviations and Dimensional Data
Only".(5/16" high letters)

D. Upon completion of work, the Contractor shall certify the "Record Drawings" for correctness by signing the following certification:

CERTIFIED CORRECT (3/8" high letters)

(Name of Electrical Subcontractor)

By: _____

Date: _____

E. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified "Record Drawings" to the Architect for review and shall make changes, corrections, or additions as the Architect may require to the "Record Drawings".

3.13 FINAL REVIEW

A. At a time designated, the entire system shall be reviewed for compliance with the Contract Drawings and Specifications. The Contractor shall be present at this review.

B. The entire system shall be operating properly with all systems balanced and all controls adjusted. All prohibited markings shall be removed from all switchboards, panelboards, switches, etc., and the equipment shall be clean and in operating condition.

C. Certificates and Documents required herein shall be in order and presented to the Architect at least two weeks prior to the review.

D. After the review, any changes or corrections noted as necessary for the Work to comply with these Specifications and the Drawings shall be accomplished without delay in order to secure final acceptance of the Work.

E. The removal of panel covers, junction box covers, etc., for visual observation of the wire, busbars, etc., will not be required at the time of the Final Review if prior review is accomplished during construction.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Grout.
4. Common electrical installation requirements.
5. Energy Management System
6. Thermographic Testing
7. Ampacity Test Report

B. Related Sections:

1. Section 27 05 00 – Common Work Results For Communications
2. Section 28 05 00 – Common Work Results for Electronic Safety and Security

1.3 SUBMITTALS

A. Product Data: None.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

1.5 RECORD DOCUMENTS

A. Record Drawings: Maintain a clean, undamaged set of blue or black line white prints of Contract Drawings and Shop Drawings as required in Division 1 of these specifications. As the work progresses mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings. Include all change order items, bulletins, addenda, or field changes.
2. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set. Submit the record drawings as part of the project closeout package.
3. Conduit routing on interior and exterior of building for main feeders and ductbanks.
4. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
5. Approved substitutions, contract modifications, and actual equipment and materials installed.
6. Include all “Corrected For Record” shop drawings to reflect approvals received.

B. Engage the services of a Land Surveyor or Professional Engineer to record the locations and invert elevations of all underground installations.

C. Mark Specifications to indicate approved substitutions and actual equipment and materials used.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.3 ENERGY MANAGEMENT SYSTEM

A. The Contractor shall provide an Energy Management System as purchased by the Contractor from the following Midwestern State Vendor, with supplementary work by the Contractor:

Andover Controls

B. The Contractor shall provide the following:

1. Savvy 15 with Baseplate
2. Outdoor Sensor Assembly, including Outdoor Temperature Sensor and Outdoor Analog Light Sensor
3. CBL-2020 7ft RJ11CS Phone Cable
4. Button Override Panel
5. CP-1 Panel, including 24 Volt Power Transformers and Interface Relays
6. Phase Loss Module
7. The Contractor shall provide an 18/8 (18 guage – 8 conductor) wire from the Andover Controls unit to each of the Lighting Control Panels. This cable will provide for control of the lighting and signage.

C. Andover Controls will provide the following:

1. Andover equipment shipping.
2. System programming and download.
3. On-site system start-up.
4. On-site quality assurance test.
5. Telephone verification of remote communications.
6. File transfer final program to MWSU.
7. Warranty of all Andover furnished components for one (1) year from the system start date.
8. CTM Module, 40 VA Transformer.
9. CO2 Sensors.

D. The Contractor shall provide a wire (Belden 8761 or equal) from the electric meter to the Andover Control unit to monitor energy consumption.

E. The Contractor shall provide a wire (Belden 8761 or equal) from the unit heater located in the receiving area to the Andover controller in the electric room. This will allow control for enabling and disabling the unit heater. Temperature settings will be controlled by a wall mounted thermostat.

F. The Contractor shall provide two (2) wires (Belden 8761 or equal) from the outside air assembly mounted on one of the Rooftop Heating/Cooling Units to the Andover control unit in the electric room.

G. The Contractor shall provide a wire (Belden 8761 or equal) from each Rooftop Heating/Cooling Unit to each respective Temperature Sensor mounted in the space.

H. The Contractor shall provide a wire (Belden 8761 or equal) that will be installed from the Andover Control unit in the electric room in a “daisy chain” fashion to each Rooftop Heating/Cooling Unit. That is, the wire will leave the electric room and be run to the next unit and so forth, until all of the Rooftop Heating/Cooling Units have been connected.

I. The Contractor shall coordinate with and pay Andover to arrange system start-up and testing. A Andover representative will make one trip to the job site for system start-up and testing. If for any reason the Andover Technician is unable to complete this work, the Contractor will be billed for travel, expenses, and hourly charges associated with a return visit to the job site for this purpose.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2” above finished floor level.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using stee pipe sleeves and mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 00

SECTION 26 05 13

MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes cables and related splices, terminations, and accessories for medium-voltage electrical distribution systems.

1.3 DEFINITIONS

A. NETA ATS: Acceptance Testing Specification.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cable indicated. Include splices and terminations for cables and cable accessories.

B. Samples: 16-inch lengths of each type of cable indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each cable and accessory type, signed by manufacturers.

C. Source quality-control test reports.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain cables and accessories through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with IEEE C2 and NFPA 70.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

   1. Notify Architect and Owner no fewer than five days in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Architect's and Owner’s written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Insulated Wire Corp.; a Leviton Company.
b. General Cable Technologies Corporation.
c. Kerite Co. (The); Hubbell Incorporated.
d. Okonite Company (The).
e. Pirelli Cables & Systems NA.
f. Rome Cable Corporation.
g. Southwire Company.

2. Cable Splicing and Terminating Products and Accessories:

a. Engineered Products Company.
b. G&W Electric Company.
c. MPHusky.
d. Raychem Corp.; Telephone Energy and Industrial Division; Tyco International Ltd.
e. RTE Components; Cooper Power Systems, Inc.
f. Scott Fetzer Co. (The); Adalet.
g. Thomas & Betts Corporation.
h. Thomas & Betts Corporation/Elastimold.
i. 3M; Electrical Products Division.

2.2 CABLES

A. Cable Type: MV105

B. Comply with UL 1072, AEIC CS 8.

C. Conductor: Copper or Aluminum.

D. Conductor Stranding: Concentric lay, Class B.

E. Strand Filling: Conductor interstices are filled with impermeable compound.

F. Conductor Insulation: Crosslinked polyethylene.

G. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 15 kV.
2. Insulation Thickness: 133 percent insulation level.

H. Shielding: Copper tape helically applied over semiconducting nsulation shield.

I. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

J. Three-Conductor Cable Assembly: Three insulated, shielded conductors cabled together with ground conductors.

1. Circuit Identification: Color-coded tape (black, red, blue) under the metallic shielding.

K. Cable Armor: Interlocked aluminum or Interlocked galvanized steel applied over cable.

L. Cable Jacket: Sunlight-resistant PVC or Chlorosulfonated polyethylene, CPE.

2.3 SPLICE KITS

A. Connectors and Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.

B. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
3. Premolded, cold-shrink-rubber, in-line splicing kit.
4. Premolded EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

2.4 SOLID TERMINATIONS

A. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.

1. Compound-filled, cast-metal body, metal-clad cable terminator for metal-clad cable with external plastic jacket.
2. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
3. Heat-shrink sheath seal kit with phase- and ground-conductor rejacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
4. Cast-epoxy-resin sheath seal kit with wraparound mold and packaged, two-part, epoxy-resin casting material.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
3. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
4. Class 1 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, compression-type connector, and end seal.
5. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
6. Class 3 Terminations: Kit with stress cone and compression-type connector.

C. Nonshielded-Cable Terminations: Kit with compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.

2.5 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

C. Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

D. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.

1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

F. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.

G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.6 ARC-PROOFING MATERIALS

A. Tape for First Course on Metal Objects: 10-mil thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, compatible with cable jacket.

C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch wide.

2.7 FAULT INDICATORS

A. Indicators: Manually reset fault indicator, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.

B. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

2.8 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-94-649 before shipping.

B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

D. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

E. Install direct-buried cables on leveled and tamped bed of 3-inch thick, clean sand. Separate cables crossing other cables or piping by a minimum of 4 inches of tamped earth. Install permanent markers at ends of cable runs, changes in direction, and buried splices.

F. Install "buried-cable" warning tape 12 inches above cables.

G. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.

H. Install cable splices at pull points and elsewhere as indicated; use standard kits.

I. Install terminations at ends of conductors and seal multiconductor cable ends with standard kits.

J. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: Three.
3. Standoff Insulator: Three.

K. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10-mil pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with 1-inch wide bands of half-lapped, adhesive, glass-cloth tape 2 inches o.c.

L. Seal around cables passing through fire-rated elements according to Section 078413 "Penetration Firestopping."

M. Install fault indicators on each phase where indicated.

N. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

O. Identify cables according to Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 13

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

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

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Insulated Wire Corp.
2. General Cable Corporation.
3. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and SO**.**

D. Multiconductor Cable: Comply with NEMA WC 70 for Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Power Systems, Inc.
2. O-Z/Gedney
3. 3M; Electrical Products Division.
4. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

D. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits in Cable Tray: Type SO.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

K. Class 1 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6” of slack.

3.5 CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications**:**

1. Common ground bonding with lightning protection system.
2. Raised Floor

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells NFPA 70B.

a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8” wide and 1/16” thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8” wide and 1/16” thick.

C. Grounding Bus: Rectangular bars with insulators as indicated in detail on plans.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4” diameter by 10’-0” in length.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4” will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2” above to 6” below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install a minimum of two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6” from the foundation. Coordinate exact requirements with local Power Company.

E. Raised Floor: Bond from ground bar in space to raised floor pedestal or stringer in one location.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2” below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12” deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60’-0” apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24” from building foundation.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at ground test wells. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order,

and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4" in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4" thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4" thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Refer to Structural Plans and Specifications for large equipment pads and supports.

B. Construct concrete bases of dimensions indicated but not less than 4” larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

C. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

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

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene propylene diene monomer (M-class) rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

2. For handholes and boxes for underground wiring, including the following:

   a. Duct entry provisions, including locations and duct sizes.
   b. Frame and cover design.
   c. Grounding details.
   d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
   e. Joint details.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Allied Tube & Conduit; a Tyco International Ltd. Co.
   2. O-Z Gedney; a unit of General Signal.
   3. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. EMT: ANSI C80.3.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CANTEX Inc.
2. RACO; a Hubbell Company.
3. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.

2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

C. Description: Comply with UL 2024; flexible type, approved for plenum or riser installation based on the installation.

2.4 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finishes in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Thomas & Betts Corporation
   b. Walker Systems, Inc
   c. Wiremold Company (The)

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Hubbell Incorporated; Wiring Device-Kellems Division.
   b. Panduit Corp.
   c. Walker Systems, Inc.
   d. Wiremold Company (The)

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: refer to plans.

F. Nonmetallic Floor Boxes: refer to plans.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC"
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Quazite

2.9 QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: Plenum-type, optical fiber/communications cable raceway.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
4. Warning Planks: Bury warning planks approximately 12” above direct-buried conduits on 24” centers. Align planks along the width and along the centerline of conduit.

B. Concrete-Encased Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.
2. Install conduit in configuration with conduit supports as indicated in the section as shown on the plans.
3. Backfill with concrete per the detail on the plans.
4. Warning Planks: Bury warning planks approximately 12” above direct-buried conduits on 24” centers. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances. Refer to plans for detail.

B. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

C. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes steel cable trays and accessories.

1.3 SUBMITTALS

A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
2. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.

a. Design Calculations: Calculate requirements for selecting seismic restraints.
b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

C. Field quality-control reports.

D. Operation and Maintenance Data: For cable trays to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store indoors to prevent water or other foreign materials from staining or adhering to cable tray. Unpack and dry wet materials before storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. MONO-SYSTEMS, Inc.

2.2 WIRE BASKET SECTIONS AND COMPONENTS

A. Provide wire basket of types and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additions construction features.

B. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.

C. General: Provide wire basket of types and sizes indicated; with connector assemblies, tool less clips, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

2.3 MATERIALS AND FINISHES

A. Cable Trays, Fittings, and Accessories: Steel, complying with NEMA VE 1.

1. Electrogalvanized before fabrication, complying with ASTM B 633; with hardware galvanized according to ASTM B 633.

B. Sizes and Configurations: Refer to the Drawings for specific requirements for types, materials, sizes, and configurations.

1. Center-hanger supports may not be used.

2.4 WIRE BASKET SUPPORT SYSTEM

A. All straight section longitudinal wires shall be straight (with no bends).

B. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All wire ends along wire basket sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

C. Wire basket sizes shall conform to the following nominal criteria:

1. Straight sections shall be furnished in standard 12 inch lengths.
2. Wire basket transition sections shall be flat sections 12 inches wide.
3. Wire basket shall have a 6 inch usable loading depth by 12 inches wide, unless indicated otherwise on the plans.

D. All fittings shall be field formed as needed.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts or using a tool less spring steel fastener hold-down clip at support location.

F. Under Floor: Wire Basket Supports shall be floor stands that are completely independent of the floor structure requiring no tools for assembly. These can be vertically adjustable stands or one piece static stands. Vertically adjustable floor stands shall also have the ability to be stacked on top of each other to allow for multiple tiers of wire basket while still remaining independent of the floor structure. The under floor system is based on the B-Line F.A.S.T. system.

G. Above Ceiling: Provide supports for wall mounted or overhead as dedicated by installation area.

H. Tool less spring steel fastener hold down clips shall be used to secure the wire basket to the support stand and splice wire basket sections together at this support location.

I. Special accessories shall be furnished as required to protect, support multiple runs of wire basket tray and install a wire basket support system.

2.5 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Barrier Strips: Same materials and finishes as cable tray.

C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

D. Ground Clamp: Provide a stand-off clamp for ground conductor where indicated on plans.

2.6 WARNING SIGNS

A. Lettering: 1-1/2-inch-high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

B. Materials and fastening are specified in Division 26 Section "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

A. Perform design and production tests according to NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

B. Remove burrs and sharp edges from cable trays.

C. Fasten cable tray supports to building structure and install seismic restraints.

1. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Place supports so that spans do not exceed maximum spans on schedules.
3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
4. Support bus assembly to prevent twisting from eccentric loading.
5. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
6. Locate and install supports according to NEMA VE 1.

D. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1. Space connectors and set gaps according to applicable standard.

E. Make changes in direction and elevation using standard fittings.

F. Make cable tray connections using standard fittings.

G. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

H. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

I. Workspace: Install cable trays with enough space to permit access for installing cables.

J. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

K. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

3.2 CABLE INSTALLATION

A. Install cables only when cable tray installation has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. On vertical runs, fasten cables to tray every 18 inches. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

D. In existing construction, remove inactive or dead cables from cable tray.

E. Install covers after installation of cable is completed.

3.3 CONNECTIONS

A. Ground cable trays according to manufacturer's written instructions.

B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

3.4 FIELD QUALITY CONTROL

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

3.5 PROTECTION

A. Protect installed cable trays.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.
3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION 26 05 36

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Section 26 05 29 - Hangers and Supports for Electrical Systems

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

a. Component Importance Factor: 1.0.
b. Component Response Modification Factor: 1.5.
c. Component Amplification Factor: 1.0.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.278.

4. Design Spectral Response Acceleration at 1.0-Second Period: 0.096.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
   b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

   a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 48

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch-thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR XX INCHES." XX refer to the minimum clearance descripted in NEC Table 110-26(A)(1).

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Exterior concrete and masonry primer.
2) Finish Coats: Exterior semigloss acrylic enamel.

2. Exterior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Exterior semigloss acrylic enamel.

3. Exterior Ferrous Metal:

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Exterior ferrous-metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

4. Exterior Zinc-Coated Metal (except Raceways):

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Exterior zinc-coated metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior concrete and masonry primer.
2) Finish Coats: Interior semigloss alkyd enamel.

6. Interior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Interior semigloss acrylic enamel.

7. Interior Gypsum Board:

   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

      1) Primer: Interior gypsum board primer.
      2) Finish Coats: Interior semigloss acrylic enamel.

8. Interior Ferrous Metal:

   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

      1) Primer: Interior ferrous-metal primer.
      2) Finish Coats: Interior semigloss acrylic enamel.

9. Interior Zinc-Coated Metal (except Raceways):

   a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

      1) Primer: Interior zinc-coated metal primer.
      2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

   1. Fire Alarm System: Red.
   2. Fire-Suppression Supervisory and Control System: Red and yellow.
   3. Security System: Blue and yellow.
   4. Mechanical and Electrical Supervisory System: Green and blue.
   5. Telecommunication System: Green and yellow.
   6. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Electrical substations.
f. Emergency system boxes and enclosures.
g. Motor-control centers.
h. Disconnect switches.
i. Enclosed circuit breakers.
j. Motor starters.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Battery inverter units.
p. Battery racks.
q. Power-generating units.
r. Voice and data cable terminal equipment.
s. Master clock and program equipment.
t. Intercommunication and call system master and staff stations.
u. Television/audio components, racks, and controls.
v. Fire-alarm control panel and annunciators.
w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
x. Monitoring and control equipment.
y. Uninterruptible power supply (UPS) equipment.
z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
aa. Power Distribution Units (PDU)

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 26 05 53

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The contractor shall provide an engineering analysis and coordination study for the entire electrical system. The basic analysis shall include a short-circuit analysis with protective device evaluation, a protective device coordination study and an Arc Flash study.

B. The project shall begin at the point of utility service for the facility and continue down through the system, to all downstream distribution and branch panelboards, motor control centers and significant motor locations.

C. The project shall include any generators and any associated emergency power distribution equipment, including automatic transfer switches and generator ground fault protection.

D. The project will be built in multiple stages. The study shall be performed based on full build-out (i.e. four (4) electrical services, four (4) generators, two (2) UPS systems each with three (3) modules, etc.) and for the equipment being purchased and installed under this contract. The results shall be compared and plan implemented to result in the correct coordination for both stages of build.

1.3 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop drawings for equipment effected by the coordination study will not be reviewed until the coordination study has been submitted and approved.

C. Qualification data for firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineer and Owner, and other information specified.

D. A one-line diagram of the system shall be included.

E. The final report shall be bound in a three-ring binder.

F. The final report shall contain individual, tabbed sections for each section. Each tabbed section shall contain the information as outlined in Part 2 of this document. Tab 1 shall list the manufacturer's name, address, general business phone number, after-hours service phone number, spare parts phone number, distributor's name, address, general business phone number, after hours service phone number and spare parts phone number. Tab 2 shall contain Section 2.2's short-circuit analysis with protective device evaluation. Tab 3 shall contain Section 2.3's protective device coordination study. Tab 4 contains Section 2.4's information and so on.

G. Electronic SKM files with all libraries, at project completion.

1.4 QUALITY ASSURANCE

A. Preparer Qualifications: Firm experienced in the analysis, evaluation, and coordination of electrical distribution systems and similar to the system for this project. Firm must have at a minimum a 4 year record of successful in-service performance.

B. The study shall be prepared in accordance with the latest edition of NETA Std. ATS, NFPA 70B, the "National Electrical Code", ANSI C2" National Electrical Safety Code", and ANSI/IEEE Guidelines, as well as manufacturer's recommendations.

C. Short-Circuit Analysis and Coordination Study shall be performed by a registered Professional Engineer. Study shall be signed and sealed by the Engineer. The Engineer shall have a minimum of eight years of experience in the analysis, evaluation, and coordination of electrical distribution systems.

D. The firm conducting the study shall have one million worth of Professional Liability Insurance in addition to standard general insurance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The study shall be performed by the manufacturer of switchboards, switchgear, panelboards, etc. provider:

1. Square D
2. Eaton

2.2 SOFTWARE

A. All studies shall be performed by means of SKM software.

2.3 SHORT-CIRCUIT ANALYSIS WITH PROTECTIVE DEVICE EVALUATION

A. Systematically calculate fault currents based on the available fault current at the facility service entrance. Study preparer shall obtain the available fault current from the local utility.

B. Short-circuit calculations shall be prepared by means of software. Motor contribution shall be incorporated in determining fault levels. Results of short-circuit calculations shall be presented in tabular form and shall include momentary and interrupting fault values for three-phase and phase-to-ground faults.

C. Short-circuit calculations shall be done for every operating scenario possible including, but not limited to, on normal power, on generator power, single ended normal power, generator tied to utility (if applicable) and other possible configurations. Provide short-circuit ratings for worst case scenario used. Issue prior to submittals.

D. Analyze the short-circuit currents by preparing a tabulation comparing the fault levels to the device interrupting ratings. Indicate areas in which integrated/series ratings are utilized. The following information shall be included in the tabulation:

1. Bus identification number.
2. Location identification.
3. Voltage
4. Manufacturer and type of equipment.
5. Device rating.
6. Calculated short-circuit current.

E. Provide short-circuit ratings for worst case scenario used. Issue prior to submittals.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location. Limit the number of devices to six (6) per curve. If curve requires more than six (6) devices, split into two (2) curves.

B. A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-color for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. System coordination, recommended ratings, and setting of protective devices shall be accomplished by a registered professional electrical engineer with a minimum of eight years of current experience in the coordination of electrical power systems.

C. The following information shall be provided on all curve sheets.

1. Device identification and associated settings/size.
2. Voltage at which curves are plotted.
3. Current multiplier.
4. ANSI frequent fault damage curve.
5. Cable insulation damage curves.
6. Transformer inrush point.

7. Single-line for the portion of the system.
8. Motor starting profiles (where applicable).

2.5 ARC FLASH ANALYSIS

A. An arc flash analysis will be performed in conjunction with a short circuit study. The results from the short circuit study will be used to determine arc energy levels at each defined location in the facility for a specified working distance. Based on the arc energy at each defined point, the proper PPE will be determined and if the arc energy level exceeds available PPE ratings, the locations will be noted. Analysis will be provided to determine if any changes can be made in protection system to reduce arc energy levels.

B. Labels: Provide labels for each evaluated location that lists the hazard levels along with the required PPE while working in that area. Provide labels based on the worst case of all study scenarios and 50% of the available fault current on normal power. Labels shall be thermoset nylon, sunlight resistant, multi-color labels. Provide Orange for Category 5 or less and Red for Dangerous.

2.6 SINGLE-LINE DIAGRAM

A. The final report shall include a multi-color single-line diagram of the electrical distribution system within the scope of the project. The single-line shall include:

1. Transformer rating, voltage ratio, impedance, and winding connection.
2. Feeder cable phase, neutral and ground sizes, length of cable, conductor material, and conduit size and type.
3. Switchgear, switchboards, panelboards, MCC's, fuses, circuit breakers, ATS's and switches continuous current ratings.
4. Protective relays with appropriate device numbers and CT's and PT's with associated ratios.
5. Detailed legend indicating device type identification and other significant details.

PART 3 - EXECUTION

3.1 SUMMARY

A. The results of the system studies shall be summarized in a final report.

B. Where required, copies of the final report shall be submitted to the power company for their review and approval. Approved copies or the report shall be submitted to the Design Engineer.

3.2 FIELD SETTINGS

A. The contractor shall engage the manufacturer's service group or alternately a qualified independent testing firm to perform field adjustments of the protective devices as required for placing the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study and protective device evaluation/coordination study.

B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study, shall be carried out by manufacturer's service group.

END OF SECTION 26 05 73

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements that apply specifically to the commissioning process for electrical systems.

B. The electrical (Divisions 26, 27, 28) contractor's responsibilities are defined in Section 019113 of these specifications. These responsibilities apply to all specialty sub-contractors and major equipment suppliers within Divisions 26, 27 and 28. Each contractor and supplier shall review Section 019113, and their bids shall include for the carrying out of the work described, as it applies to each Section within the Division 26 specifications, individually and collectively.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 SUBMITTALS

A. Draft Prefunctional Checklists. Starting 4 weeks before substantial completion, submit weekly progress copies of the prefunctional checklists to the Owner.

B. Final Prefunctional Checklists. Complete and submit a copy of the final prefunctional checklists a minimum of 3 days before the scheduled functional test date.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide test equipment as necessary for start-up and testing of electrical equipment as described in Section 019113. Test equipment shall be of sufficient quality and accuracy to test and/or measure system performance

B. Load Banks: Load banks, including temporary wiring, shall be provided by the electrical contractor to test and commission the PDU's as described in Section 019113. These load banks shall simultaneously provide the load to test and

commission the mechanical systems. Coordinate with the mechanical contractor.

PART 3 - EXECUTION

3.1 SCHEDULING

A. Functional testing shall begin after Prefunctional Checklists are completed, submitted to the Owner, and approved.

3.2 PARTICIPATION IN COMMISSIONING

1. Designate Contractor team members to participate in the Prefunctional Checklists and the Functional Tests as specified in Section 019113.

3.3 ADDITIONAL COMMISSIONING

A. Additional commissioning activities may be required after system adjustments, replacements, and similar activities are completed. The Contractor, suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Intermatic, Inc.
2. Leviton Mfg. Company Inc.
3. Square D; Schneider Electric.
4. TORK.
5. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Rating: 30-A inductive or resistive, 600-V ac.
2. Programs: 8 channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
4. Astronomic Time: All channels.
5. Battery Backup: For schedules and time clock.
6. Override: Input for override of schedule by Novar System.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Intermatic, Inc.
2. Novitas, Inc.
3. Square D; Schneider Electric.
4. TORK.
5. Watt Stopper (The).

B. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 30-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. Sensor Switch, Inc.
6. TORK.
7. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in, and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

2.4 LIGHTING CONTACTORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASCO Power Technologies, LP; a division of Emerson Electric Co.
2. Eaton Electrical Inc.; Cutler-Hammer Products.
3. GE Industrial Systems; Total Lighting Control.
4. Square D; Schneider Electric.
5. TORK.
6. Watt Stopper (The).

B. Description: Electrically operated and electrically held combination type with non-fused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. DCIM Interface: Provide hardware interface to enable the DCIM to monitor and control lighting contactors.

1. Monitoring: On-off status
2. Control: On-off operation

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 09 23

SECTION 26 12 19
MEDIUM-VOLTAGE TRANSFORMERS

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes distribution and power transformers with medium-voltage primaries. Types of transformers specified in this Section include three-phase pad-mounted transformers with separable high voltage connectors (dead front)

1.3 DEFINITIONS

A. Listed: As defined in the "National Electrical Code," Article 100.
   1. Nationally Recognized Testing Laboratory (NRTL): A testing agency qualified as defined in OSHA Regulation 1910.7.
A. Pad-mounted, compartmental-type transformer shall consist of a transformer tank and two cable terminating compartments, one each for high and low voltage. Transformer tank and compartments shall be assembled as an integral unit for mounting on a pad.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division1 Specification Sections.
B. Product data for each product specified, including dimensioned plans, sections, and elevations. Show minimum clearances and installed devices and features.
C. Wiring diagrams of transformers and accessory components, differentiating between manufacturer-installed and field-installed wiring.
D Product certificates signed by manufacturers certifying that their products comply with the specified requirements.
E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of relevant completed projects with project names and addresses, and names and addresses of the respective Architects and Owners.
F. Product Test Reports: Certified copies of manufacturer's design and routine factory tests required by the referenced standards.
G. Sound Level Test Reports: Certified copies of manufacturer's sound level tests applicable to equipment for this Project.
H. Operation and maintenance data for materials and products to include in the "Operating and Maintenance Manual" specified in Division1.
I. Field test reports of tests and inspections conducted according to Part 3 of this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer of medium-voltage electrical distribution equipment to perform the installation specified in this Section. Refer to Division1 Section "Reference Standards and Definitions" for definition of an experienced Installer.
B. Field Testing Agency Qualifications: To qualify for acceptance, the testing agency must demonstrate, based on evaluation of agency-submitted criteria conforming to ASTM E699,

that it has the experience and capability to satisfactorily conduct the testing indicated.

1. Comply with NFPA 70 "National Electrical Code."
2. Comply with IEEE C2 "National Electrical Safety Code."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's recommendations within enclosure of each indoor ventilated dry-type transformer throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.
B. Deliver, store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
C. Deliver each transformer on individual shipping skids for ease of handling.
D. Inspect and report concealed damage to carrier within specified time.
E. Handle in accordance with manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

2.0 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. General Electric Co.
2. Siemens.
3. Square D Co.

2.2 TRANSFORMERS, GENERAL

A. Windings: Two-winding type, designed for operation with high-voltage windings connected to a 3-phase, 3-wire, 60-Hz, grounded neutral distribution system.
B. Low-Sound Level Transformers: Units with a sound level rating a minimum of 3 dB less than NEMA TR 1 standard sound levels for the transformer type and rating.
C. Full-height, air-filled incoming and outgoing terminal compartments with hinged doors and separated by a steel barrier shall be located side-by-side. Incoming compartment shall be on the left, outgoing compartment on the right.
D. High-voltage compartment shall be accessible only after door to low-voltage compartment has been opened.
E. Compartment hood shall be removable for pulling cables and making connections. Compartment door sills shall be removable to permit rolling or skidding unit into place over conduit studs in foundation.
F. Compartments hinged doors shall be equipped to latch in open position. High-voltage compartment door shall have a fastening device that is accessible only through low-voltage compartment.
G. Door hinge assemblies shall be made of corrosion-resistant material. 3/8 inch (minimum) diameter stainless-steel hinge pins shall be used.
H. Both compartment doors shall be able to be locked with a single padlock having a maximum 1/2-inch diameter shackle.
I. Provide lifting provisions in accordance with ANSI Standards, as well as jacking and rolling provisions.
J. Instruction nameplate shall be located in low-voltage portion of compartment and shall be readable with cables in place. Where the nameplate is mounted on a removable part,

manufacturer's name and transformer serial number shall be permanently affixed to a non-removable part.

K. Transformer tank shall be sealed-tank construction with a welded main cover.
L. A bolted tamper-resistant handhole shall be provided in tank cover for access to internal connections.
M. Provisions for tank grounding shall be supplied in both high- and low-voltage compartments. These provisions shall consist of:
N. For 500 KVA and below, 1/2-13 UNC tapped hole 7/16-inch deep;
O. For 750 KVA and above: 2, 1/2-13 UNC tapped holes 1/2-inch deep.
P. Low voltage bushings shall be tinned, spade-type with 9/16-inch holes spaced on 1-3/4-inch centers in accordance with latest revisions of applicable ANSI standards.
Q. For wye-wye connected units, high- and low-voltage neutrals shall be connected internally and brought out through a bushing in secondary compartment.
R. Unless otherwise specified, incoming primary section shall be equipped with six, 600-ampere bushing wells in accordance with ANSI C119.2 for loop feeds.

2.4 LIQUID-FILLED PAD-MOUNTED TRANSFORMERS

A. Comply with IEEE C57.12.22 and C57.12.28 and with the following features and ratings.
B. Insulating Liquid: Silicone fluid, NRTL listed as a "Less Flammable" transformer insulating liquid. Liquid has the ability to extinguish small arcing and has a minimum fire point of 330 deg. C, a minimum thermal conductivity of 0.00036 Cal/(Sec x sq. cm. x deg. C) at 25 deg. C and a minimum dielectric strength of 35 kV.
C. Insulation Temperature Rise: 65 degC.
D. Full-Capacity Voltage Taps: Four nominal 2.5-percent taps, 2 above and 2 below rated high voltage, with externally operable tap changer for deenergized use, with position indicator.
E. High-Voltage Switching: Arranged for radial feed with 3-phase, 2-position, gang-operated, load-break switch, oil-immersed in transformer tank, with hook-stick-operated handle in the primary compartment.
F. Primary Fuse: Current limiting type in dry-fuse holder wells, mechanically interlocked with liquid immersed switch in transformer tank to prevent disconnect under load.
G. Surge Arresters: Distribution class, one for each primary phase. Comply with NEMA Standard LA 1 "Surge Arresters." Support from tank wall within high-voltage compartment.
H. High-Voltage Terminations and Equipment: Dead-front with universal-type bushing wells for dead-front bushing well inserts. Include the following:
    1. Bushing Well Inserts: One for each high-voltage bushing well.
    2. Lightning Arrestors: Dead-front elbow-type MOV units.
    3. Parking Stands: One for each high-voltage bushing well.
I. Accessories: Provide the following accessories:
    1. One-inch (25-mm) drain valve with sampling device.
    2. Dial-type thermometer.
    3. Liquid level gage.
    4. Pressure-vacuum gage.
    5. Pressure-Relief Device: Self-sealing with indicator.
    6. Alarm contacts for above gages.

2.5 FINISHES

A. Enclosure Coating System for Outdoor Units: Comply with IEEE Standard C57.12.28 "Pad-Mounted Equipment-Enclosure Integrity," regardless of transformer type.

2.6 SOURCE QUALITY CONTROL

A. Factory Tests: Design and routine tests conform to the referenced standards.
B. Factory Sound-Level Tests: Conduct sound level tests on equipment for this Project where specifying sound levels below the standard ratings.

3.0 EXECUTION

3.1 INSTALLATION

A. Comply with IEEE Standard C2, "National Electrical Safety Code" and the manufacturer's written installation instructions:
B. Identify transformers and install warning signs according to Division16 Section "Electrical Identification."
C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 GROUNDING

A. Ground transformers and systems served by transformers according to Division16 Section "Grounding."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Arrange and pay for the services of a factory-authorized service representative to supervise the field assembly and connection of components, and the pretesting and adjustment of transformer components and accessories.
B. Pretesting: After completing system installation, perform the following preparations for tests:
   1. Make insulation-resistance tests for transformers.
   2. Make a continuity test for windings and remote alarm circuits.
   3. Provide a set of Contract Drawings to the testing agency.
   4. Provide manufacturer's installation and testing instructions to the testing agency.
C. Independent Testing Agency: Provide services of an independent electrical testing agency according to the requirements of Division1 Section "Quality Control Services" to perform tests on medium-voltage transformer installations.
D. Test Objectives: To ensure transformer installation complies with Contract Documents, is operational within industry and manufacturer's tolerances, and is suitable for energizing.
E. Test Labeling: Upon satisfactory completion of tests for each transformer, attach a dated and signed "Satisfactory Test" label to the unit.
F. Schedule tests and provide notification at least one week in advance of test commencement.
G. Report: Submit a written report of observations and tests. Report defective materials and workmanship.
H. Tests: Include the following minimum inspections and tests according to the manufacturer's instructions. For test method and data correction factors, conform to IEEE Standard
   1. Test Codes C57.12.90 for liquid-filled units, and IEEE C57.12.91 for dry-type units.
I. Inspect accessible components for cleanliness, mechanical, and electrical integrity, for presence of damage or deterioration, and to ensure removal of temporary shipping bracing. Do not proceed with tests until deficiencies are corrected.
J. Dry-Type Transformers: Include internal inspection through access panels and covers. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, where not available, those of UL Standards 486A and 486B.
K. Insulation Resistance: Perform megohmmeter test of primary and secondary winding-to-winding and winding-to-ground according to the following:

WINDING RATING (VOLTS)	MINIMUM TEST VOLTS(d.c.)	MINIMUM INSULATION RESISTANCE (MEGOHNS) LIQUID FILLED
0 - 600	1,000	100
601 - 5,000	2,500	1,000
5,000 - 35,000	5,000	5,000

Duration of Each Test: 10 minutes.

Temperature Correction: Correct results for test temperature deviation from 20 degC standard.

Turns Ratio: Measure between windings at each tap setting. Measured ratios deviating more than 0.5 percent from the calculated ratio or the measured ratio for adjacent coil are not acceptable.

Winding Resistance: Measure for winding at nominal tap setting. Measured resistance deviating more than 1 percent from that of adjacent winding is not acceptable.

Overpotential Tests: Apply between high and low voltage and ground at not over 85 percent of factory test value for 1 minute.

Liquid-Filled Transformer Insulation Power Factor Test: Determine overall dielectric loss and power factor for winding insulation. Limit test voltage to the line-to-ground voltage of the winding being tested. Measured values exceeding the following are unacceptable:

Oil-Filled Units: 1.0 percent.
Silicone-Filled Units: 0.5 percent.
High-Fire-Point Hydrocarbon-Filled Units: 1.0 percent.

Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.4 ADJUSTING

A. After completing installation and cleaning, touch up scratches and mars on finish to match original finish.

B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout the normal operating cycle of the facility. Record voltages and tap settings to submit with test results.

3.5 DEMONSTRATION

A. Training: Arrange and pay for the services of a factory-authorized service representative to demonstrate transformers and accessories and train Owner's staff. Include a minimum of 8 hours of training in operation and maintenance. Provide both classroom training and hands-on equipment operation covering the following:

1. Safety precautions.
2. Features and construction of project transformers and accessories.
3. Routine inspection, test and maintenance procedures.

4. Routine cleaning.
5. Features, operation, and maintenance of integral disconnect and protective devices.
6. Interpretation of readings of indicating and alarm devices.
7. Fuse selection.
8. Protective relay setting considerations.
9. Features, operation and maintenance of separable insulated connector system.
10. Tap-changing procedures.

B. Schedule training with at least 7 days' advance notice.

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Transformers shall be of the same manufacturer as the UPS and Generator switchgear. Subject to compliance with requirements, provide products by one of the following:

1. Square D
2. Eaton

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

F. Taps for Transformers Smaller than 3 kVA: None.

G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

J. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

L. Wall Brackets: Manufacturer's standard brackets.

M. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Perform the infrared scan tests and inspections and prepare reports as stated in Section 26 05 00 “Common Work Results for Electrical”.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 00

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.

C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 23°F to plus 104°F.
   b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTUERS

A. Manufacturers: Panelbaords shall be of the same manufacturer as the UPS and Generator switchgear. Subject to compliance with requirements, provide products by one of the following:

1. Square D
2. Eaton

2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. Refer to plans where required.
4. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.3 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

C. Mains: See plans.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: See plans.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Shunt Trip: 120V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    e. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
    f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    i. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    j. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    k. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim to ensure the operating handle of top-most switch or circuit breaker, in on position, is not higher than 79 inches above finished floor or grade.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the infrared scan tests and inspections and prepare reports as stated in Section 26 05 00 “Common Work Results for Electrical”.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Snap switches and wall-box dimmers.
4. Pendant cord-connector devices.
5. Cord and plug sets.
6. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 RELATED SECTIONS

A. Section 26 09 23 - Ligjhting Control Devices

1.4 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.7 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

C. Pilot Light Switches, 20 A:

1. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable toggle switch with slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.10 FLOOR SERVICE FITTINGS

A. Refer to plans.

2.11 POKE-THROUGH ASSEMBLIES

A. Refer to plans

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.

2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, and enclosed switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.
2. Other Branch Circuits: Class RK1, time delay.
3. Control Circuits: Class CC.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Molded-case switches.
6. Enclosures.

1.3 RELATED SECTIONS

A. Section 26 24 16 - Panelboards

1.4 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event".

1.6 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than -22°F and not exceeding 104°F.
2. Altitude: Not exceeding 6600 feet.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Enclosed switches and circuit breakers shall be of the same manufacturer as the UPS and Generator switchgear. Subject to compliance with requirements, provide products by one of the following:

1. Square D
2. Eaton

2.2 FUSIBLE SWITCHES

A. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

A. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Refer to Section 26 24 16 - Panelboards.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the infrared scan tests and inspections and prepare reports as stated in Section 26 05 00 “Common Work Results for Electrical”.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 26 28 16

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:

1. Across-the-line, manual and magnetic controllers.
2. Reduced-voltage controllers.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each enclosed controller.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Nameplate legends.
c. Short-circuit current rating of integrated unit.
d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around enclosed controllers where pipe and ducts are prohibited. Show enclosed controller layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosed controllers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

H. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.6 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicating Lights: Two of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Enclosed controllers shall be of the same manufacturer as the UPS and Generator switchgear. Subject to compliance with requirements, provide products by one of the following:

1. Square D
2. Eaton

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."

1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.

B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 tripping characteristic. Provide with heaters or sensors in each

phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.

C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

2.3 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

A. Star-Delta Controller: NEMA ICS 2, closed transition with adjustable time delay.

B. Part-Winding Controller: NEMA ICS 2, closed transition with separate overload relays for starting and running sequences.

C. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition.

D. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

1. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.
2. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
3. LED indicators showing motor and control status, including the following conditions:

a. Control power available.
b. Controller on.
c. Overload trip.
d. Loss of phase.
e. Shorted silicon-controlled rectifier.

2.4 ENCLOSURES

A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.5 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Elapsed Time Meters: Heavy duty with digital readout in hours.

F. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

2.6 FACTORY FINISHES

A. Finish: Manufacturer's standard Gray paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Install freestanding equipment on concrete bases.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.4 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

3.5 IDENTIFICATION

A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.6 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.7 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Assist in field testing of equipment.
3. Report results in writing.

C. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the infrared scan tests and inspections and prepare reports as stated in Section 26 05 00 “Common Work Results for Electrical”.

3.9 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 29 13

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Section 26 09 23 – “Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 26 27 26 - "Wiring Devices" for manual wall-box dimmers.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Life, output, and energy-efficiency data for lamps.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

B. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: One year(s) from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: One for each emergency lighting unit.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.85 or higher.
7. Power Factor: 0.95 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 or higher.

C. Ballasts for Low-Temperature Environments:

1. Temperatures 0°F and Higher: Electronic type rated for 0°F starting and operating temperature with indicated lamp types.
2. Temperatures -20°F and Higher: Electromagnetic type designed for use with indicated lamp types.

D. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Sound Rating: A.
3. Total Harmonic Distortion Rating: Less than 15 percent.
4. Transient Voltage Protection: IEEE C62.41, Category A or better.
5. Lamp Current Crest Factor: 1.5 or less.
6. Power Factor: .90 or higher.
7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
8. Protection: Class P thermal cutout.
9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.

2.7 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500K, and average rated life 20,000 hours, unless otherwise indicated.

C. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500K, and average rated life of 20,000 hours, unless otherwise indicated.

D. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 45.2 inches 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500K, and average rated life of 20,000 hours, unless otherwise indicated.

E. T5HO rapid-start, high-output low-mercury lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500K, and average rated life of 20,000 hours, unless otherwise indicated.

F. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.8 HID LAMPS

A. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

B. Related Sections include the following:

1. Section 26 51 00 - "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Pole: Luminaire support structure, including tower used for large area illumination.

E. Standard: Same definition as "Pole" above.

1.4 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.

5. Photoelectric relays.
6. Ballasts, including energy-efficiency data.
7. Lamps, including life, output, and energy-efficiency data.
8. Materials, dimensions, and finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.3 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures -20°F and higher.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
5. Case Temperature for Compact Lamp Ballasts: 65°C, maximum.
6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures -20°F and higher.

D. Fluorescent Lamps: refer to Section 26 51 00 – Interior Lighting

2.4 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: -22°F.
3. Normal Ambient Operating Temperature: 104°F.
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

2.5 HID LAMPS

A. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.

2.6 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.

B. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

2.7 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 12 inches above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass cover that when mounted results in NEMA 250, Type 3R enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole, unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 56 00

REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

No.	Date
Revisions	

Project No. 21503.00

Drawn

Architect

Checked

Approved

Engineer

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title: COVER SHEET

Scale: 12" = 1'-0"

Drawing No.

G-000

Issue Date
9.21.15 BID DOCUMENTS
10.7.2015 ADDENDUM 01
10.21.2015 ADDENDUM 02
03.07.2016 VALUE ENGINEERING 03

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CONTRACT DOCUMENTS

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WICHITA FALLS, TEXAS

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main
AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Abbreviations

ACCES.	ACCESSIBLE
ACOUS.	ACOUSTICAL
AFF	ABOVE FINISHED FLOOR
A.D.	AREA DRAIN
ADJ.	ADJUSTABLE
ADMIN.	ADMINISTRATIVE
AEWC	ACCESSIBLE ELEC. WATER COOLER
ALUM.	ALUMINUM
ALT.	ALTERNATE
ANCIL.	ANCILLARY
APPROX.	APPROXIMATE
ARCH.	ARCHITECT (URAL)
BD.	BOARD
BLDG.	BUILDING
BLK.	BLOCK
BLKG.	BLOCKING
BM.	BEAM
BOT.	BOTTOM
BRG.	BEARING
CAB.	CABINET
C.A.F.	COMPUTER ACCESS FLOORING
CEM.	CEMENT
CER.	CERAMIC
CFCI	CONTRACTOR FURNISHED CONTRACTOR INSTALLED
C.I.P.	CAST IN PLACE
C.J.	CONTROL JOINT
CLG.	CEILING
CLO.	CLOSET
CLR.	CLEAR
C.M.U.	CONCRETE MASONRY UNIT
COL.	COLUMN
COMP.	COMPOSITION
CONC.	CONCRETE
CONT.	CONTINUOUS
CORR.	CORRIDOR
C.R.	CARD READER
CTSK	COUNTERSUNK
CNTR.	COUNTER
CTR	CENTER
CU. FT.	CUBIC FOOT
CU.YD.	CUBIC YARD
D.B. SINK	DOUBLE SINK
DBL.	DOUBLE
DEPT.	DEPARTMENT
D.F.	DRINKING FOUNTAIN
DET.	DETAIL
DIA.	DIAMETER
DIM.	DIMENSION
DISP.	DISPENSER
DN.	DOWN
DR.	DOOR
DWG.	DRAWING
D.W.	DUMB WAITER
E.	EAST
EA.	EACH
EIFS	EXTERIOR INSULATION & FINISH SYSTEM
E.J.	EXPANSION JOINT
ELAST.	ELASTOMERIC
EL.	ELEVATION
ELEC.	ELECTRICAL
ELEV.	ELEVATOR
EMER.	EMERGENCY
ENCL.	ENCLOSURE
ES	EXPOSED TO STRUCTURE
EQ.	EQUAL
EQPT.	EQUIPMENT
E.W.C.	ELECTRIC WATER COOLER
EXST.	EXISTING
EXPO.	EXPOSED
EXP.	EXPANSION
EXT.	EXTERIOR
F.A.	FIRE ALARM
F.C.	FIBER CEMENT
F.D.	FLOOR DRAIN
F.F.	FINISHED FLOOR
FDN.	FOUNDATION
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
FIN.	FINISH
FL.	FLOOR
FLASH.	FLASHING
FLEX.	FLEXIBLE
F.O.B.	FACE OF BRICK
F.O.S.	FACE OF STUD
FT.	FOOT OR FEET
FTG.	FOOTING
FURR.	FURRING
F.R.	FIRE RATED
F.V.	FIELD VERIFY
GA.	GAGE
GALV.	GALVANIZED
G.B.	GRAB BAR
GL.	GLASS
GLAZ.	GLAZING
GND.	GROUND
GR.	GRADE
GRFC	GLASS FIBER REINFORCED CONCRETE
GEJ	GUTTER EXPANSION JOINT
GYP.	GYPSUM
H.C.	HOLLOW CORE
HDWD.	HARDWOOD
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
HT.	HEIGHT
H.V.A.C.	HEATING/ VENTILATION/ AIR CONDITIONING
I.D.	INSIDE DIAMETER
INSUL.	INSULATION
INT.	INTERIOR
JAN.	JANITOR
JST.	JOISTS
JT.	JOINTS
LAB.	LABORATORY
LAM.	LAMINATE
LAV.	LAVATORY
LEV.	LEVEL
LT.	LIGHT
L.S.D.	LIQUID SOAP DISPENSER
MACH.	MACHINE
MATL.	MATERIAL
MAX.	MAXIMUM
MDF	MEDIUM DENSITY FIBERBOARD
MECH.	MECHANICAL
MED. PREP.	MEDIAN PREPARATION
MEMB.	MEMBRANE
MET.	METAL
MFR.	MANUFACTURER
MH.	MANHOLE
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
MTD.	MOUNTED
MUL.	MULLION
M.R.	MOISTURE RESISTANT
N.	NORTH
N.I.C.	NOT IN CONTRACT
NO. OR #	NUMBER
N.T.S.	NOT TO SCALE
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED
O.T.O.	OUT TO OUT
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OFF.	OFFICE
OPER.	OPERABLE
OPNG.	OPENING
OPP.	OPPOSITE
PAT.	PATIENT
PL.	PLATE
P.LAM.	PLASTIC LAMINATE
PLAS.	PLASTER
PLYWD.	PLYWOOD
PR.	PAIR
P.T.D.	PAPER TOWEL DISPENSER
P.T.D./R.	PAPER TOWEL DISPENSER & RECEPTACLE
PTN.	PARTITION
Q.T.	QUARRY TILE
R.	RISER
RAD.	RADIUS
R.D.	ROOF DRAIN
RE., REF.	REFERENCE
RESIST.	RESISTANT
REV.	REVISION
REFR.	REFRIGERATOR
REINF.	REINFORCED/ REINFORCING
REQ.	REQUIRED
RESIL.	RESILIENT
RM.	ROOM
R.O.	ROUGH OPENING
R.J.	RUSTICATION JOINT
S.	SOUTH
S.C.	SOLID CORE
SCHED.	SCHEDULE
S.D.	SOAP DISPENSER
SECT.	SECTION
S.F.	SQUARE FEET
SH.	SHELF
SHR.	SHOWER
SHT.	SHEET
SIM.	SIMILAR
S.N.D.	SANITARY NAPKIN DISPENSER
S.N.R.	SANITARY NAPKIN RECEPTACLE
SP.	SPACES
SPEC.	SPECIFICATION
SQ.	SQUARE
S/S	STAINLESS STEEL
S.SK.	SERVICE SINK
STA.	STATION
STD.	STANDARD
STL.	STEEL
STOR.	STORAGE
STR.	STRUCTURAL
SUPER.	SUPERINTENDENT
SUSP.	SUSPENDED
SYM.	SYMMETRICAL
T.	TOILET
T.B.	TOWEL BAR
T.C.	TOP OF CURB
TEL.	TELEPHONE
TEMP.	TEMPERED
TER.	TERRAZZO
T.& G.	TONGUE AND GROOVE
THK.	THICK
T.P.	TOP OF PAVEMENT
T.P.D.	TOILET PAPER DISPENSER
T.W.	TOP OF WALL
TYP.	TYPICAL
T.O.B.	TOP OF BEAM
T.O.C.	TOP OF CONCRETE
T.O.P.	TOP OF PARAPET
T.O.R.	TOP OF ROOF
T.O.S.	TOP OF STEEL
T/S	TOILET/SHOWER
UNF.	UNFINISHED
U.O.N.	UNLESS OTHERWISE NOTED
U.R.	URINAL
VERT.	VERTICAL
VEST.	VESTIBULE
W.	WEST
W/	WITH
W.C.	WATER CLOSET
WD.	WOOD
W/O	WITHOUT
WSCT.	WAINSCOT
WT.	WEIGHT

Material Legend

EARTH
SAND
CONCRETE
STEEL
WOOD
WOOD BLOCKING
PLYWOOD
GYP. SHEATHING
BATT INSULATION
PLASTER
ACOUSTICAL TILE
RIGID INSUL.
GRAVEL
CONC. MASONRY UNIT
BRICK
MOLDED PLASTIC
EIFS

Section / Detail Mark

DIRECTION OF VIEW
1 SECTION NUMBER
1.1 SHT. NO. ON WHICH SECTION IS DETAILED

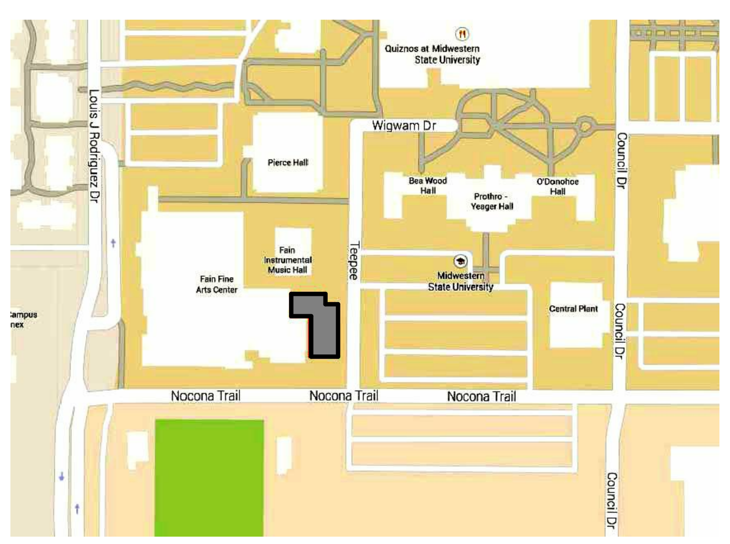
MILLWORK ELEVATION
001 MILLWORK ELEVATION OR DETAIL NUMBER

100 DETAIL NUMBER

NUMBERING SYSTEM FOR DETAILS

100'S	ARCHITECTURAL SITE WORK & LANDSCAPE DETAILS
200'S	WALL SECTION DETAILS
300'S	PLAN DETAILS
400'S	WINDOW & EXTERIOR LOUVER DETAILS
500'S	DOOR DETAILS
600'S	BORROWED LIGHT DETAILS
700'S	STAIR, LADDER, ELEVATOR & ROOF DETAILS
800'S	REFLECTED CEILING DETAILS
900'S	MILLWORK SECTIONS/ DETAILS & INTERIOR FINISHES DETAILS
1000'S	EQUIPMENT & MISC. DETAILS

Vicinity Map



Project Information

Proposed project will be locate on the campus of Midwestern State University and will be adjacent to the Fain Fine Arts Building. The project is a two story structure at around 14,775 grosse sq.ft. The programmed spaces include offices, open newsroom, edit rooms, storage spaces, photo space, restrooms, commons area, circulation and elevator.

APPLICABLE CODES AND STANDARDS

BUILDING CODE:	INTERNATIONAL BUILDING CODE	2009 EDITION
ACCESSIBILITY:	TEXAS ACCESSIBILITY STANDARDS	2010 EDITION
MECHANICAL CODE:	INTERNATIONAL MECHANICAL CODE	2009 EDITION
PLUMBING CODE:	INTERNATIONAL PLUMBING CODE	2009 EDITION
ELECTRICAL CODE:	NATIONAL ELECTRIC CODE	2014 EDITION
THE AUTHORITY HAVING JURISDICTION IS	MIDWESTERN STATE UNIVERSITY	
FIRE PROTECTION:	NFPA 13 INTERNATIONAL FIRE CODE	2003 EDITION 2009 EDITION
LIFE SAFETY:	NFPA 101 LIFE SAFETY CODE	2003 EDITION
OTHER CODES:	TEXAS ACCESSIBILITY CODE	2012 EDITION
ENERGY CODE:	INTERNATIONAL ENERGY CODE	2009 EDITION

OCCUPANCY CLASSIFICATION & BUILDING TYPE

BUILDING CODE

USE GROUP B, BUSINESS , EDUCATIONAL ABOVE 12TH GRADE
USE GROUP A-3, ASSEMBLY
USE GROUP S-1, STORAGE

CONSTRUCTION TYPE - II-B

FIRE PROTECTION - FULLY SPRINKLED

PARKING

PARKING PROVIDED: 00
ACCESSIBLE PARKING PROVIDED: 0

TOTAL ON-SITE PARKING PROVIDED: 00

BUILDING SQUARE FOOTAGE

BUILDING AREA (INCLUDES EXTERIOR WALL)
FIRST FLOOR: 8,122 S.F.
SECOND FLOOR: 6,623 S.F.

TOTAL: 14,775 S.F.

Index

GENERAL

Sheet Number	Sheet Name
G-000	COVER SHEET
G-001	SHEET INDEX, LEGENDS, SYMBOLS & ABBREVIATIONS
G-002	1ST & 2ND FLOOR LIFE SAFETY PLAN
G-003	WALL PENETRATION DETAILS / ACOUSTICAL PENETRATION DETAILS
G-003.A	ACOUSTICAL DETAILS
G-004	PARTITION TYPES AND DETAILS
G-005	TEXAS ACCESSIBILITY STANDARDS

CIVIL

C0.0	DEMOLITION PLAN
C1.0	SITE PLAN
C2.0	GRADING PLAN
C3.0	PAVING PLAN
C4.0	UTILITY PLAN & PROFILES
C5.0	EROSION CONTROL PLAN
C5.1	EROSION DETAILS
C6.0	CIVIL DETAILS
C6.1	CIVIL DETAILS

STRUCTURAL

S-101	STRUCTURAL NOTES
S-102	STRUCTURAL NOTES
S-103	STRUCTURAL NOTE AND ABBREVIATIONS
S-104	SPECIAL INSPECTION TABLES
S-201	FOUNDATION PLAN
S-202	SECOND LEVEL FRAMING PLAN
S-203	ROOF LEVEL FRAMING PLAN
S-301	TYPICAL CONCRETE DETAILS
S-302	TYPICAL CONCRETE DETAILS
S-303	CONCRETE DETAILS
S-304	CONCRETE DETAILS
S-401	TYPICAL MASONRY DETAILS
S-501	TYPICAL STEEL DETAILS
S-502	TYPICAL STEEL DETAILS
S-503	TYPICAL STEEL DETAILS
S-504	STEEL DETAILS
S-505	STEEL DETAILS
S-506	STEEL DETAILS
S-510	BRACE ELEVATIONS AND DETAILS

ARCHITECTURAL

A-100	FIRST FLOOR DEMO PLAN/GENERAL DEMO NOTES/DEMO NOTES BY SYMBOL
A-101	FIRST FLOOR PLAN / PLAN NOTES / LEGEND /DOOR CLR DETAIL
A-102	SECOND FLOOR PLAN / PLAN NOTES / LEGEND / DOOR CLR DETAIL
A-103	FIRST FLOOR RCP / RCP NOTES / RCP LEGEND
A-104	SECOND FLOOR RCP / RCP NOTES / RCP LEGEND
A-105	ROOF PLAN
A-201	EXTERIOR ELEVATIONS
A-301	NOT USED
A-302	NOT USED
A-303	WALL SECTIONS
A-304	WALL SECTIONS
A-305	WALL SECTIONS
A-306	WALL SECTION DETAILS
A-308	TYPICAL SINGLE PLY ROOF DETAILS / ROOF DETAILS
A-310	PLAN DETAILS
A-311	PLAN DETAILS
A-401	ENLARGED STAIR AND ELEVATOR PLANS
A-402	STAIR AND ELEVATOR SECTIONS
A-403	STAIR AND ELEVATOR DETAILS
A-501	EXTERIOR WINDOW, LOUVER AND BORROWED LIGHT ELEVATIONS
A-502	EXTERIOR WINDOW AND LOUVER DETAILS
A-503	BORROWED LIGHT DETAILS
A-505	DOOR DETAILS
A-507	CEILING DETAILS
A-601	FIRST AND SECOND FLOOR DOOR SCHED./LEGEND/DOOR REMARKS/FRAME TYPES/DOOR TYPES
A-701	FIRST FLOOR MILLWORK, EQUIPMENT / FURNITURE PLAN
A-702	SECOND FLOOR MILLWORK, EQUIPMENT / FURNITURE PLAN
A-703	ENLARGED EQUIPMENT / TOILET PLANS
A-704	MILLWORK ELEVATIONS / SECTIONS / INTERIOR ELEVATIONS

INTERIORS

Sheet Number	Sheet Name
I-101	1ST FLOOR FINISH PLAN
I-102	SECOND FLOOR FINISH PLAN
I-601	PRODUCTS / MATERIALS / COLORS SCHEDULE / LEGEND
I-602	FIRST AND SECOND FLOOR ROOM FINISH SCHEDULE / INTERIOR DETAILS

PLUMBING

P-101	FIRST FLOOR-PLUMBING PLAN
P-102	SECOND FLOOR-PLUMBING PLAN
P-103	ROOF PLAN-PLUMBING
P-401	PLUMBING SCHEDULES AND DETAILS
P-501	PLUMBING RISERS, DETAILS, AND MECHANICAL ROOM PLAN

MECHANICAL

M-001	MECHANICAL SYMBOLS, ABBREVIATIONS AND GENERAL NOTES
M-100	SITE PLAN-MECHANICAL
M-101	FIRST FLOOR-MECHANICAL PLAN
M-102	SECOND FLOOR-MECHANICAL PLAN
M-201	ROOF PLAN-MECHANICAL
M-301	MECHANICAL SCHEDULES
M-401	MECHANICAL DETAILS

ELECTRICAL

E-001	ELECTRICAL LEGEND, ABREVATIONS AND GENERAL NOTES
E-101	FIRST FLOOR POWER / SPECIAL SYSTEMS PLAN
E-102	SECOND FLOOR -POWER / SPECIAL SYSTEMS PLAN
E-201	FIRST FLOOR LIGHTING PLAN
E-202	SECOND FLOOR LIGHTING PLAN
E-301	FIRST FLOOR-HVAC POWER PLAN
E-302	SECOND FLOOR-MECHANICAL POWER PLAN
E-303	ROOF PLAN-ELECTRICAL
E-401	ELECTRICAL RISER DIAGRAM AND PANEL SCHEDULES
E-401A	ELECTRICAL PANEL SCHEDULES
E-402	DETAILS-TELECOM
E-403	ELEVATIONS AND RISER DIAGRAM-TELECOM

Symbol Legend

REES SYMBOL	REES	IBC 2006	LIFE SAFETY 2006 NFPA 101
C C C C C C	SMOKE CONTROL CORRIDOR PARTITION	407.3 AND 710 SMOKE PARTITION, LIMITS TRANSFER OF SMOKE	18-3.6.2 AND 8.4 SMOKE PARTITION, LIMITS TRANSFER OF SMOKE NON-RATED
1 1 1 1 1 1 1	1-HOUR WALL	706 FIRE BARRIER, 1-HOUR RATED	8.3 & NFPA 90A FIRE BARRIER, 1-HOUR RATED
2 2 2 2 2 2 2	2-HOUR WALL	706 FIRE BARRIER, 2-HOUR RATED	8.3 & NFPA 90A FIRE BARRIER, 2-HOUR RATED
S S S S S S S	SMOKE PARTITION	701 SMOKE PARTITION NON-RATED	8.4 SMOKE PARTITION LIMITS THE TRANSFER OF SMOKE, NON-RATED
1S 1S 1S 1S 1S	1-HOUR SMOKE BARRIER	407.4 SMOKE BARRIER, 1-HOUR RATED	8-5 SMOKE BARRIER 1-HOUR RATED
2S 2S 2S 2S 2S	2-HOUR WALL AND SMOKE BARRIER	709 SMOKE BARRIER AND A 706 FIRE PARTITION, 2-HOUR RATED	8.5 SMOKE BARRIER AND AN 8.3 FIRE BARRIER, 2-HOUR RATED
2F 2F 2F 2F 2F	2-HOUR FIRE WALL	705 FIRE WALL 2-HOUR RATED	8.2.2.4 STD. FOR FIRE WALLS, 2-HOUR RATED
2FS 2FS 2FS 2FS	2-HOUR FIRE WALL AND SMOKE BARRIER	705 FIRE WALL AND A 709 SMOKE BARRIER, 2-HOUR RATED	8.2.2.4 FOR FIRE WALLS, 8.3 FIRE BARRIER AND AN 8.5 SMOKE BARRIER, 2-HOUR RATED

Symbol Legend

00 WINDOW TYPE
101A DOOR NUMBER
ROOM NAME 101 — ROOM NAME & NUMBER
XX MILLWORK ELEVATION
XX INTERIOR ELEVATION
T00 TOILET ACCESSORIES
0000 EQUIPMENT NUMBER
00 PARTITION TYPE
000 CEILING TYPE
ELEVATION
TEST BORING

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY
WICHITA FALLS, TEXAS
1922

No. Date
Revisions
Project No. 21503.00
Drawn
REGISTERED ARCHITECT ROBERT W. GENTER 22105 STATE OF TEXAS
3.7.16
Architect
Checked
Approved
Engineer
Key:
PLAN NORTH NORTH

CONTRACT DOCUMENTS

CONSTRUCTION DOCUMENTS

Title: SHEET INDEX, LEGENDS, SYMBOLS & ABBREVIATIONS

Scale: 12" = 1'-0"

Drawing No.
G-001

Issue Date
9.21.15 BID DOCUMENTS
10.7.2015 ADDENDUM 01
10.21.2015 ADDENDUM 02
03.07.2016 VALUE ENGINEERING 03

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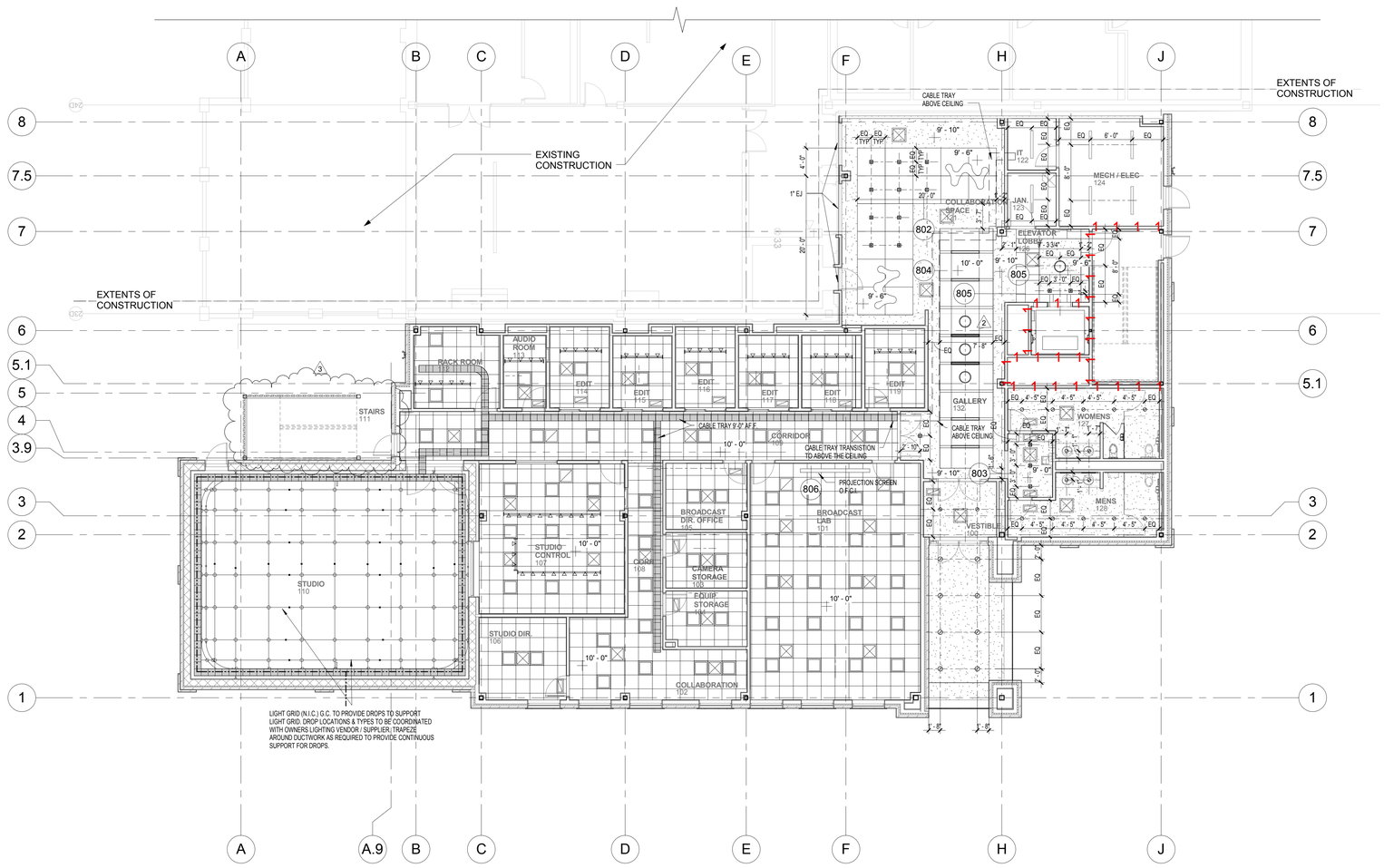
REFLECTED CEILING LEGEND

SUPPLY AIR GRILL / DIFFUSER	WALL PACK FIXTURE
RETURN AIR GRILL	STEP LIGHT
EXHAUST AIR GRILL	
SLOT DIFFUSER	GYP. BOARD CEILING
8' & 4' LINEAR FIXTURE	
ACCESS DOOR	2 x 2 LAY-IN CEILING
LIGHT STRIP	
DOWNLIGHT	2 x 4 LAY-IN CEILING
WALL MOUNTED FLUORESCENT FIXTURE	
LIGHTED EXIT SIGN	LAY-IN CEILING WITH GYP BOARD CEILING ABOVE
2 x 2 FLUORESCENT LIGHT	EXPOSED STRUCTURE
2 x 4 FLUORESCENT LIGHT	
1 x 4 FLUORESCENT LIGHT	HARDWOOD
VANITY LIGHT	EJ EXPANSION JOINT
RECESSED EMERGENCY LIGHT FIXTURE	GYP GYP BOARD
TRACK LIGHTS	FINISHED CEILING HEIGHT
WALL SCONCE	
SPEAKER	STUDIO LIGHT GRID 14'-0" A.F.F. (BY OWNER N.I.C.)
PENDANT LIGHT	LIGHT GRID DROPS (BY G.C.)
RECESSED WALL FIXTURE	

GENERAL NOTES:
1. ALL CEILINGS ARE AT 9'-0" AFF UN0.
2. THE CONTRACTOR SHALL FULLY COORDINATE CEILING INSTALLATION OF MEP INFRASTRUCTURE AND LIGHTING INSTALLATION. THE CONTRACTOR SHALL REFERENCE MEP DOCUMENTS FOR SPECIFIC INFORMATION ON LIGHTING FIXTURES.
3. LOCATIONS OF ALL TRACK LIGHTING TO BE CONFIRMED WITH OWNER BEFORE INSTALLATION.
4. NOT USED. /2\
5. G.C. TO COORDINATE SUPPLY AIR DIFFUSERS SO THEY ARE CENTERED IN THE OPEN ARES OF THE PIPE GRID IN PRODUCTION STUDIO 110.
5. CABLE TRAY 9'-0" AFF UNO



1 **FIRST FLOOR REFLECTED CEILING PLAN**
1/8" = 1'-0"

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main
AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
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Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Colt Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

No.	Revisions	Date
2	ADDENDUM 02	10/21/2015
3	VALUE ENGINEERING	03/07/2016

Project No. 21503.00
Drawn
Checked
Approved
Architect
Engineer

Key:
PLAN NORTH
NORTH

CONSTRUCTION DOCUMENTS

Title: FIRST FLOOR RCP / RCP NOTES / RCP LEGEND

Scale: As indicated

Drawing No.
A-103

Issue Date
9.21.15 BID DOCUMENTS
10.7.2015 ADDENDUM 01
10.21.2015 ADDENDUM 02
03.07.2016 VALUE ENGINEERING 03

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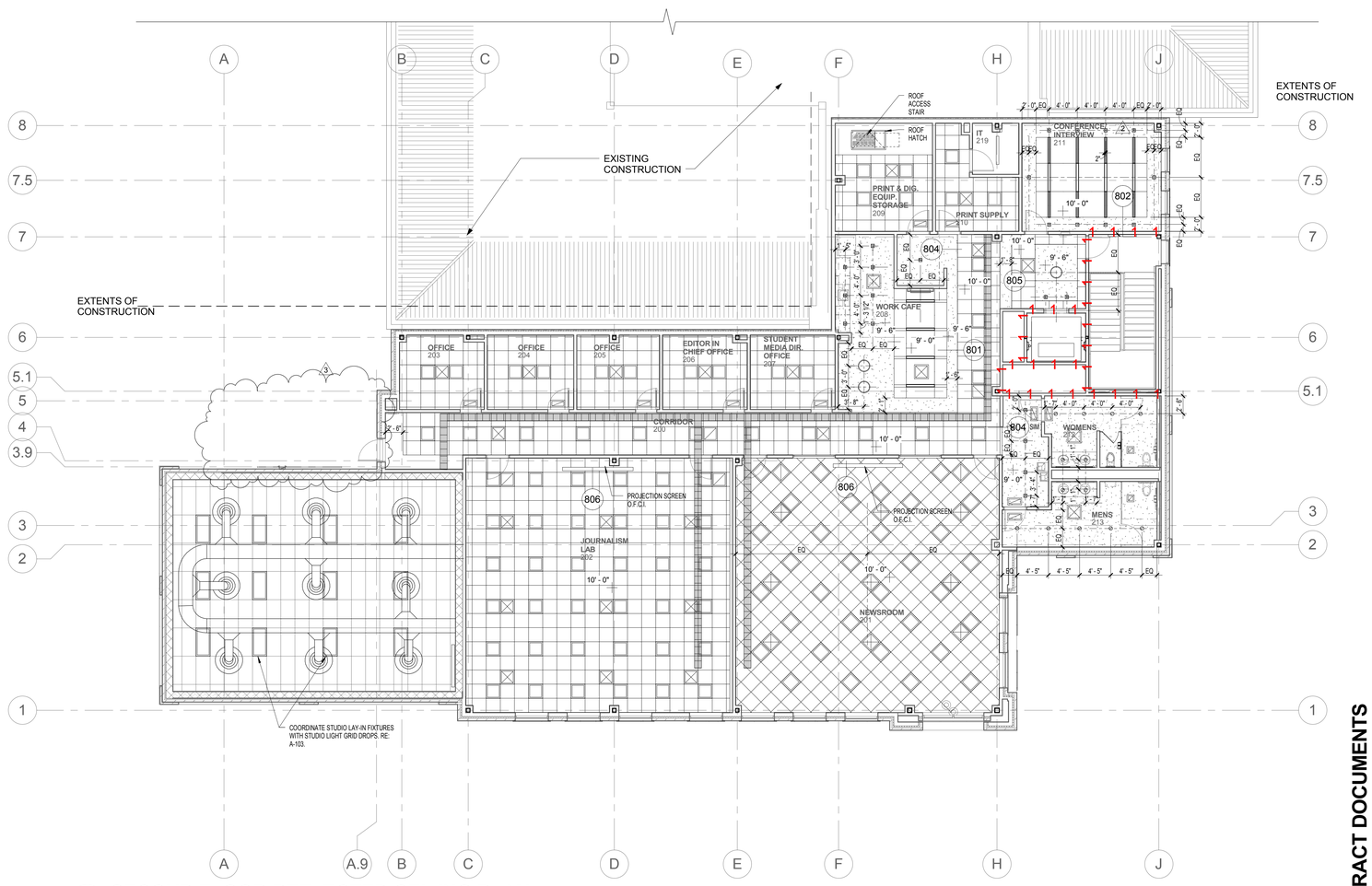
REFLECTED CEILING LEGEND

- SUPPLY AIR GRILL / DIFFUSER
- RETURN AIR GRILL
- EXHAUST AIR GRILL
- SLOT DIFFUSER
- 8' & 4' LINEAR FIXTURE
- ACCESS DOOR
- LIGHT STRIP
- DOWNLIGHT
- WALL MOUNTED FLUORESCENT FIXTURE
- LIGHTED EXIT SIGN
- 2 x 2 FLUORESCENT LIGHT
- 2 x 4 FLUORESCENT LIGHT
- 1 x 4 FLUORESCENT LIGHT
- VANITY LIGHT
- RECESSED EMERGENCY LIGHT FIXTURE
- TRACK LIGHTS
- WALL SCONCE
- SPEAKER
- PENDANT LIGHT
- RECESSED WALL FIXTURE
- WALL PACK FIXTURE
- STEP LIGHT
- GYP. BOARD CEILING
- 2 x 2 LAY-IN CEILING
- 2 x 4 LAY-IN CEILING
- LAY-IN CEILING WITH GYP BOARD CEILING ABOVE
- EXPOSED STRUCTURE
- HARDWOOD
- EJ EXPANSION JOINT
- GYP GYP BOARD
- FINISHED CEILING HEIGHT
- STUDIO LIGHT GRID 14'-0" A.F.F. (BY OWNER N.I.C) LIGHT GRID DROPS (BY G.C.)

GENERAL NOTES:

1. ALL CEILINGS ARE AT 9'-0" AFF UN0.
2. THE CONTRACTOR SHALL FULLY COORDINATE CEILING INSTALLATION OF MEP INFRASTRUCTURE AND LIGHTING INSTALLATION. THE CONTRACTOR SHALL REFERENCE MEP DOCUMENTS FOR SPECIFIC INFORMATION ON LIGHTING FIXTURES.
3. LOCATIONS OF ALL TRACK LIGHTING TO BE CONFIRMED WITH OWNER BEFORE INSTALLATION.
4. NOT USED. (2)
5. G.C. TO COORDINATE SUPPLY AIR DIFFUSERS SO THEY ARE CENTERED IN THE OPEN ARES OF THE PIPE GRID IN PRODUCTION STUDIO 110.
5. CABLE TRAY 9'-0" AFF UNO



1 **SECOND FLOOR REFLECTED CEILING PLAN**
1/8" = 1'-0"

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main
AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Colt Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

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Approved

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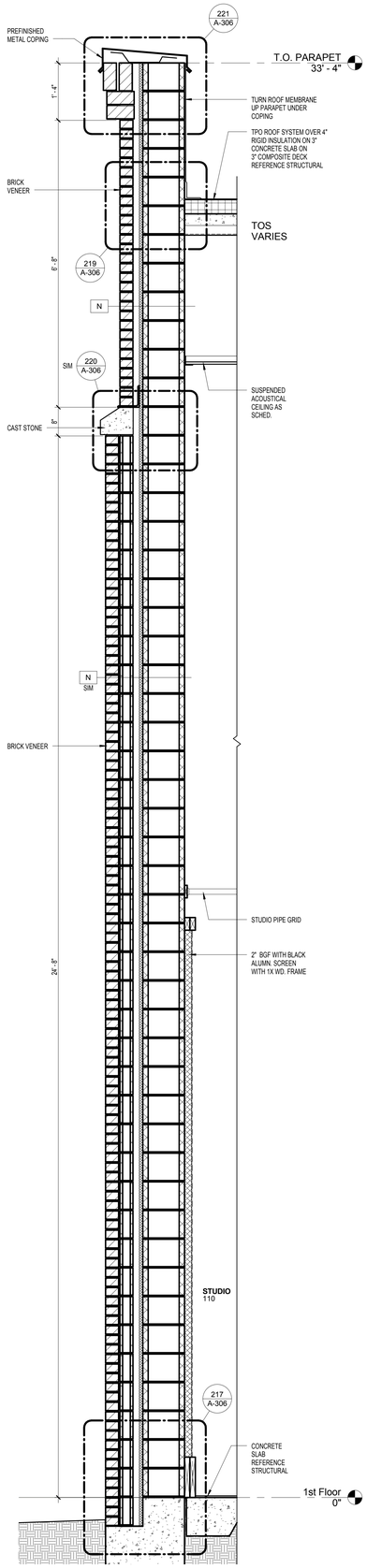
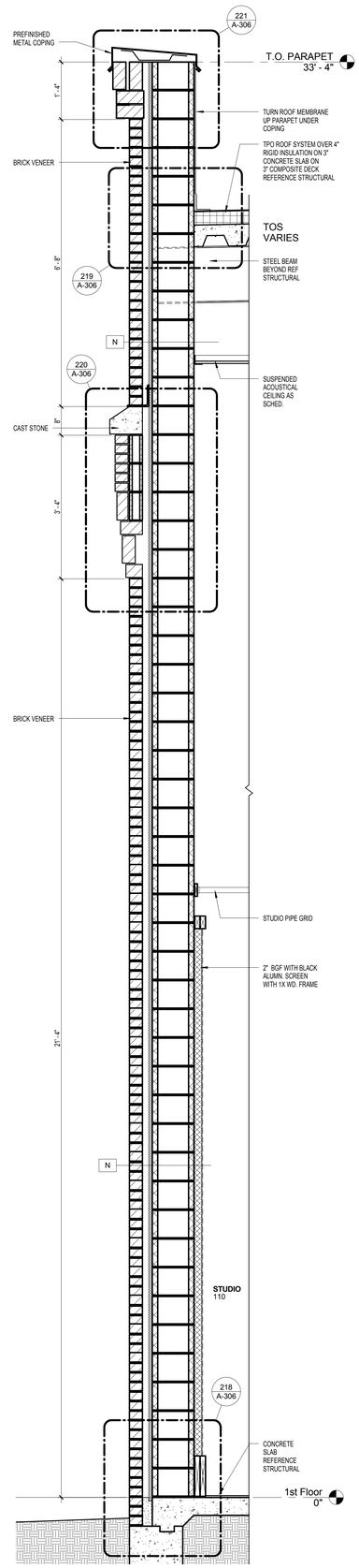
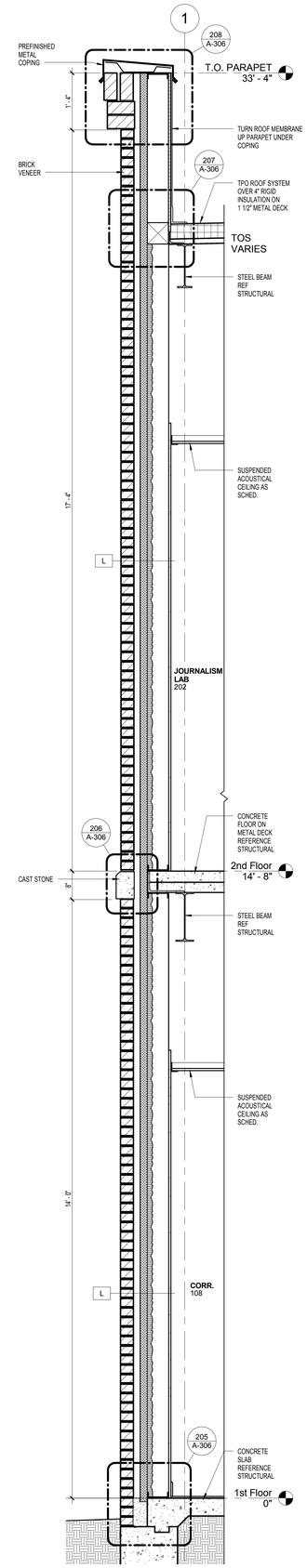


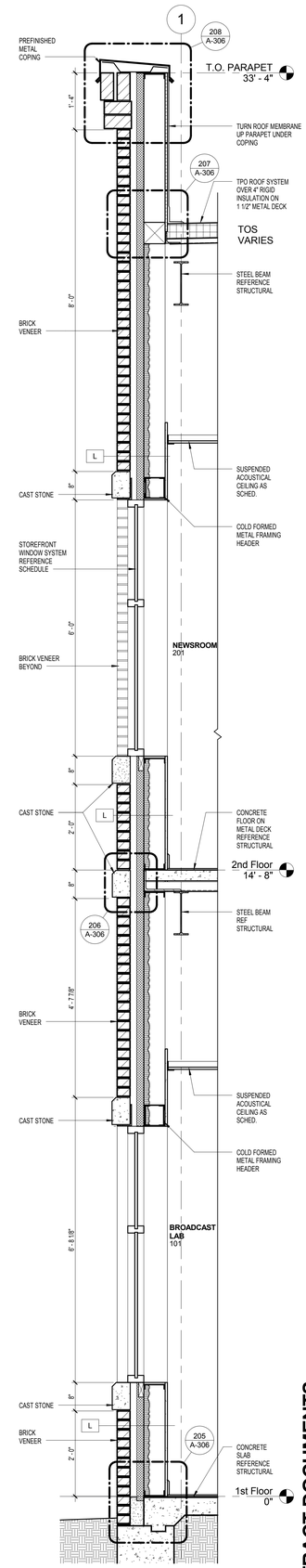
08 **WALL SECTION**
3/4" = 1'-0"



07 **WALL SECTION**
3/4" = 1'-0"



06 **WALL SECTION**
3/4" = 1'-0"



05 **WALL SECTION**
3/4" = 1'-0"

CONTRACT DOCUMENTS

REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
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817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

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John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
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2105 Commerce Street
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Mechanical, Electrical, Plumbing Engineer
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Bob Castro
972.644.8830
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201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

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Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

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Revisions

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Drawn

Architect

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Approved

Engineer

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title: WALL SECTIONS

Scale: 3/4" = 1'-0"

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ABBREVIATIONS

(NOT ALL ABBREVIATIONS ARE USED.)

A	AMPERE(S)
AC	ALTERNATING CURRENT
ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY (SYMMETRICAL ROOT MEAN SQUARE)
AWG	AMERICAN WIRE GAGE
BFC	BELOW FINISHED CEILING
BLDG	BUILDING
C	CONDUIT
CB	CIRCUIT BREAKER
CLG	CEILING
DWG	DRAWING
ECB	ENCLOSED CIRCUIT BREAKER
EF	EXHAUST FAN
EGS	ENGINE-GENERATOR SET
EMERG	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
EQUIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EX	EXISTING
F	FUSE OR FUSIBLE
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
FLA	FULL LOAD CURRENT
FMC	FLEXIBLE METAL CONDUIT
FSS	FUSIBLE SAFETY SWITCH
FT	FOOT OR FEET
FVNR	FULL-VOLTAGE, NON-REVERSING
FVR	FULL-VOLTAGE, REVERSING
G	GROUND, GROUNDED, OR GROUNDING
GFI	GROUND FAULT CIRCUIT INTERRUPTER/INTERRUPTING
HID	HIGH INTENSITY DISCHARGE
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
IG	ISOLATED GROUND
KCMIL	THOUSANDS OF CIRCULAR MILS
KV	KILOVOLTS
KVA	KILOVOLT-AMPERE(S)
KVAR	KILOVOLT-AMPERE(S) REACTIVE
KW	KILOWATT(S)
LSI	LONG-TIME, SHORT-TIME, INSTANTANEOUS
LSIG	LONG-TIME, SHORT-TIME, INSTANTANEOUS, GROUND FAULT
LTFMC	LIQUID-TIGHT FLEXIBLE METAL CONDUIT
LTG	LIGHTING
MAX	MAXIMUM
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MTD	MOUNTED
MTG	MOUNTING
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFSS	NON-FUSIBLE SAFETY SWITCH
NO	NORMALLY OPEN
P	POLE(S)
PA	PUBLIC ADDRESS
PNLBD	PANELBOARD
PVC	POLYVINYL CHLORIDE
PWR	POWER
REC	RECEPTACLE(S)
REQD	REQUIRED
RGS	RIGID GALVANIZED STEEL
RTU	ROOFTOP UNIT
RVSS	REDUCED VOLTAGE, SOLID-STATE
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TA	TRIP AMPERES
TYP	TYPICAL
UH	UNIT HEATER
UG	UNDERGROUND
UNO	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT(S) OR VOLTAGE
VA	VOLT-AMPERE(S)
VFD	VARIABLE FREQUENCY DRIVE
W	WATT(S) OR WATTAGE
W/	WITH
W/O	WITHOUT
WP	WEATHERPROOF
XFMR	TRANSFORMER

GENERAL NOTES

1. GENERAL NOTES APPLY TO ENTIRE ELECTRICAL DRAWING SET. DRAWING NOTES APPLY TO ASSOCIATED DRAWINGS. PLAN KEYED NOTES APPLY WHERE INDICATED.
2. DO NOT SCALE OR DIMENSION FROM THESE DRAWINGS.
3. "FURNISH" SHALL MEAN TO SUPPLY AND DELIVER TO PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, INSTALLATION AND SIMILAR OPERATION. "INSTALL" SHALL MEAN OPERATIONS AT PROJECT SITE, INCLUDING UNLOADING, TEMPORARY STORING, UNPACKING, ASSEMBLING, ERECTING, PLACING, ANCHORING, WORKING TO DIMENSION, FINISHING, PROTECTING, CLEANING, AND SIMILAR OPERATION. "PROVIDE" SHALL MEAN TO FURNISH AND INSTALL, COMPLETE AND READY FOR INTENDED USE.
4. REFER TO ARCHITECTURAL, ELECTRICAL, AND MECHANICAL PLANS, ELEVATIONS, AND DETAILS FOR LOCATIONS OF CEILING ELEMENTS (LIGHTING FIXTURES, DIFFUSERS, ETC.) AND WALL MOUNTED DEVICES. IF LOCATION FOR ITEM IS NOT SHOWN ON ABOVE LISTED DRAWINGS, VERIFY CRITICAL AREAS WITH FIELD PROJECT MANAGER.
5. ELECTRICAL SYSTEMS INDICATED ON DRAWINGS ARE DIAGRAMMATIC AND ADDITIONAL WORK, INCLUDING NECESSARY CIRCUITRY, SHALL BE PROVIDED TO MAKE SYSTEMS COMPLETE AND IN SAFE WORKING ORDER. COORDINATE WORK WITH OTHER TRADES.
6. INDICATED CIRCUIT RUNS ARE DIAGRAMMATIC. SIZE AND LOCATE PULL BOXES PER NATIONAL ELECTRICAL CODE AND COORDINATE WITH OTHER DISCIPLINES. BUILDING CONDITIONS SHALL DETERMINE ACTUAL CONDUIT RUNS.
7. UNLESS OTHERWISE INDICATED, BRANCH CIRCUITS SHALL BE 2#12 AWG, 1#12G, 3/4"C.
8. 120-VOLT CIRCUIT WIRING INSTALLED OVER 65 FEET LONG SHALL BE 10 AWG.
   120-VOLT CIRCUIT WIRING INSTALLED OVER 110 FEET LONG SHALL BE 8 AWG.
   277-VOLT CIRCUIT WIRING INSTALLED OVER 150 FEET LONG SHALL BE 10 AWG.
   277-VOLT CIRCUIT WIRING INSTALLED OVER 250 FEET LONG SHALL BE 8 AWG. SIZE RACEWAY ACCORDING TO NATIONAL ELECTRICAL CODE.
9. INDIVIDUALLY MOUNTED CIRCUIT BREAKERS IN NEMA ENCLOSURES, FUSIBLE OR NON-FUSIBLE DISCONNECTS SWITCHES, MOTOR STARTERS AND RELATED CONTROLS COMPONENTS SHALL BE MOUNTED 48 INCHES ABOVE FINISHED FLOOR UNLESS OTHERWISE INDICATED. COORDINATE LOCATION AND ELEVATION OF EACH ITEM OF EQUIPMENT WITH WORK OF OTHER DIVISIONS BEFORE ROUGH-IN.
10. OUTLETS SHALL NOT BE MOUNTED BACK-TO-BACK. MINIMUM OF ONE STUD-WIDTH SHALL BE MAINTAINED BETWEEN OUTLETS.
11. PROVIDE DUCT SMOKE DETECTOR IN SUPPLY AIR DUCT OF NEW HVAC UNITS AS NOTED. PROVIDE NECESSARY HARDWARE NEEDED TO SHUTDOWN UNIT IN EVENT OF SMOKE DETECTION IN SUPPLY AIR DUCT.
12. PROVIDE AN ADD ALTERNATE FOR LIGHTNING PROTECTION SYSTEM FOR BUILDING, BUILDING ELEMENTS, AND BUILDING SITE COMPONENTS. LIGHTNING PROTECTION SHALL BE CONNECTED TO SITE GROUND RING. REFER TO PERFORMANCE SPECIFICATION.
13. COORDINATE UTILITY WORK WITH OWNER BEFORE ROUGH-IN.
14. UNDERGROUND CONDUITS SHALL BE CLEANED WITH MANDREL BEFORE INSTALLING CABLES, WIRES, OR PULL WIRE. PROVIDE THREADED BRASS END CAP ON SPARE CONDUIT STUB-UP FLUSHED TO ADJACENT SURFACE OR END CAP ON SPARE CONDUIT STUB-UP 12" ABOVE FINISHED FLOOR.
15. CONDUITS TERMINATING IN CABLE TRAY SHALL TERMINATE WITH BUSHINGS.
16. PROVIDE STRUCTURAL METAL FRAMING AS REQUIRED TO SUPPORT EQUIPMENT.
17. UPON JOB COMPLETION, PROVIDE AS-BUILT DRAWINGS ACCURATELY DEPICTING FINAL CONSTRUCTION.
18. ALL CONDUIT, WIRING AND BOXES RUN IN FINISHED AREAS SHALL BE CONCEALED WITHIN THE FINISHED WALLS.
19. ELECTRICAL CONTRACTOR SHALL COORDINATE PROPER FUSE SIZING WITH MECHANICAL CONTRACTOR AND EQUIPMENT MANUFACTURER.
20. SECURE ALL FLOOR MOUNTED EQUIPMENT TO HOUSEKEEPING PAD PER MANUFACTURES RECOMMENDATIONS.
21. ALL RECEPTACLES SHALL BE LABELLED WITH P-TOUCH TYPE LABEL ON COVER INDICATING PANEL AND CIRCUIT FEEDING THE RECEPTACLE. ALL SWITCHES SHALL ALSO BE LABELLED ON THE INSIDE OF THE COVER PLATE.

TELECOMMUNICATIONS GENERAL NOTES

1. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY EXISTING CONDITIONS BEFORE BIDDING. FAILURE TO VISIT THE SITE(S) WILL NOT BE JUST CAUSE FOR A CHANGE REQUEST.
2. THE CONTRACTOR IS RESPONSIBLE FOR INTERFACING WITH THE GENERAL CONTRACTOR AND OTHER TRADES TO PROVIDE AND/OR ALTER SYSTEMS AS REQUIRED BY THE DRAWINGS AND/OR SPECIFICATIONS.
3. CONTRACTOR SHALL REPLACE IN-KIND ALL CEILING TILE DAMAGED DURING INSTALLATION AT NO ADDITIONAL COST.
4. CONTRACTOR SHALL REPAINT AND/OR REPAIR ANY AREA IN-KIND IF INSTALLATION DEFACES EXISTING WALLS, FLOORS OR CEILINGS PAINTED AREAS.
5. THESE DRAWINGS MAY NOT SHOW ALL REQUIRED CONNECTIONS, PATCH CORDS, INTERCONNECTING CABLES, ETC. IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE IN HIS BID PRICE, ALL APPURTENANCES FOR A COMPLETE AND OPERATIONAL SYSTEM THAT MEETS THE SYSTEM DESIGN REQUIREMENTS, WHETHER OR NOT SHOWN ON THE DRAWINGS OR CALLED OUT IN THE SPECIFICATIONS.
6. ALL STATION JACKS, DROPS, CABLES, AND PATCH PANELS SHALL BE LABELED/IDENTIFIED TO MEET THE EIA-TIA/606 LABELING REQUIREMENTS. THE CONTRACTOR IS REQUIRED TO SUBMIT A LABELING SCHEME AND SCHEDULE FORMAT FOR APPROVAL BY THE ENGINEER.
7. ALL COMMUNICATIONS DATA, VIDEO AND VOICE CABLES INSTALLED ON THIS PROJECT SHALL BE SUPPORTED WITH CABLE TRAY, CONDUIT AND J-HOOKS, AS CALLED OUT ON THE DRAWINGS AND IN SPECIFICATIONS. FURNISH AND INSTALL ALL REQUIRED CABLE SUPPORTS AND APPURTENANCES FOR A COMPLETE AND FUNCTIONAL SYSTEM.
8. ALL HORIZONTAL DATA DROPS FROM OUTLET TO PATCH PANEL SHALL NOT EXCEED 295'-0". INSTALL AS REQUIRED TO MEET LENGTH REQUIREMENTS TO THE ASSIGNED "IDF"/"MDF".
9. AT A.D.A. LOCATIONS CONTRACTOR SHALL CONFORM TO ALL LOCAL, STATE AND NATIONAL CODES.
10. THE CONTRACTOR SHALL REVIEW ALL DRAWINGS BEFORE BIDDING. FAILURE TO DO SO WILL NOT BE JUST CAUSE FOR A CHANGE REQUEST.
11. ALL SYSTEM WIRING INSTALLED ON THIS PROJECT SHALL BE SUPPORTED WITH CONDUIT STUBS AND J-HOOKS AT INTERVALS OF 4'-0" MAXIMUM. FURNISH AND INSTALL ALL REQUIRED CABLE SUPPORTS AND APPURTENANCES FOR A COMPLETE AND FUNCTIONAL SYSTEM.
12. COORDINATE WITH E.C. FOR ADDITIONAL 1" CONDUIT STUB-UPS FROM ANY LOCATION THAT CONTAIN OVER 6 COMMUNICATIONS CABLES.
13. NO BRIDLE RINGS, 'LB-FITTING', OR PLASTIC WIRE TIES SHALL BE USED.
14. ALL NEW STRUCTURED CABLING SHALL COMPLY WITH ANSI/TIA 606B.

ELECTRICAL SYMBOLS

NOT ALL SYMBOLS APPEAR ON DOCUMENTS

SYMBOL	DESCRIPTION	MOUNTING HT. UNO
	LIGHTING FIXTURES	
	FLUORESCENT FIXTURE, 2'x4'	SEE FIX. SCH.
	FLUORESCENT FIXTURE, 2X4 WITH BATTERY BACK-UP	SEE FIX. SCH.
a,b	FLUORESCENT FIXTURE W/INNER LAMPS ON ONE SWITCH AND OUTER LAMPS ON ANOTHER, 2'x4'	SEE FIX. SCH.
	FLUORESCENT FIXTURE, 1'x4'	SEE FIX. SCH.
	FLUORESCENT FIXTURE, 1'x4' WITH BATTERY BACK-UP	SEE FIX. SCH.
	PENDANT FIXTURE SUSPENDED	SEE FIX. SCH.
	PENDANT FIXTURE – SUSPENDED WITH BATTERY BACK-UP	SEE FIX. SCH.
	FLUORESCENT FIXTURE, 2'x2' WITH BATTERY BACK-UP	SEE FIX. SCH.
	FLUORESCENT FIXTURE, 2'x2'	SEE FIX. SCH.
	FLUORESCENT FIXTURE, STRIP	SEE FIX. SCH.
	WALL WASHER LIGHT FIXTURE CEILING MTD.	SEE FIX. SCH.
	DOWN LIGHT FIXTURES CLG. OR WALL MTD.	SEE FIX. SCH.
	DOWN LIGHT FIXTURES ON EMERGENCY CIRCUIT CEILING OR WALL MOUNTED.	SEE FIX. SCH.
	EXIT LIGHT CEILING OR WALL MTD., SHADING INDICATING SINGLE OR DOUBLE FACE, DIRECTION AS INDICATED	9" BFC
M	OCCUPANCY/MOTION SENSOR	CEILING
	WIRING DEVICES	
$	WALL SWITCH SPST	48" AFF
$2	DOUBLE POLE TOGGLE SWITCH	48" AFF
$3	3-WAY WALL SWITCH	48" AFF
$4	4-WAY WALL SWITCH	48" AFF
$D	WALL DIMMER SWITCH, WATTAGE AS REQUIRED	48" AFF
$K	KEY OPERATED WALL SWITCH	48" AFF
$P	WALL SWITCH WITH PILOT LIGHT	48" AFF
	SIMPLEX RECEPTACLE	AS NOTED
	DUPLEX RECEPTACLE	18" AFF
EM	DUPLEX RECEPTACLE ON EMERGENCY CIRCUIT,	18" AFF
GFI	DUPLEX RECEPTACLE, GFI	AS NOTED
	QUADRAPLEX RECEPTACLE (TWO DUPLEX RCPTS. UNDER ONE COVERPLATE)	18" AFF
	20A DUPLEX RECEPTACLE WITH TWO USB CHARGING PORTS.	18" AFF
	QUAD. RECEPTACLE DEDICATED CIRCUIT. (TWO DUPLEX RCPTS. UNDER ONE COVERPLATE) NEMA 5-20R	–
	DUPLEX RECEPTACLE DEDICATED CIRCUIT, NEMA 5-20	–
EM	DUPLEX RECEPTACLE DEDICATED CIRCUIT ON EMERGENCY CIRCUIT (RED IN COLOR)	18' AFF
	FLOOR MTD. DUPLEX RECEPTACLE, FLUSH MTD. UNO	–
	SPECIAL PURPOSE RECEPTACLE (NEMA NO. AS INDICATED)	AS NOTED
J	JUNCTION BOX – SIZE & MOUNTING AS REQUIRED	AS REQD.
	MULTIOUTLET ASSEMBLY – LENGTH AND OUTLET SPACING AS INDICATED	AS NOTED
	PUSHBUTTON – NOTE 3	48" AFF
	CARD READER – NOTE 3	48" AFF
	GROUND BAR	AS NOTED
	TELEPHONE AND DATA SYSTEM	
	DATA OUTLET, NOTE 1	18" AFF
	COMBINATION TELEPHONE/DATA OUTLET, NOTE 1	18" AFF
	FLOOR MOUNTED DATA OUTLET (TYPE AS NOTED, FLUSH MOUNTED UNO.) – NOTE 1	18" AFF
	TELEPHONE OUTLET, WALL MOUNTED – NOTE 1	18" AFF
W	TELEPHONE OUTLET, WALL MOUNTED – NOTE 1	48" AFF
	TELEPHONE OUTLET, FLOOR MOUNTED, (FLUSH MOUNTED UNO.) – NOTE 1	–
P	PAY TELEPHONE OUTLET, WALL MOUNTED. STUB 3/4"C FROM OUTLET TO ACCESSIBLE CLG – NOTE 1	48" AFF
WI	WIRELESS IN ROOM INDICATED, WI-FI CONNECTION	IN CEILING SPACE

NOTES

1. PROVIDE 1"C. FROM TELEPHONE AND DATA OUTLETS TO ABOVE NEAREST ACCESSIBLE LAY-IN CEILING.
2. MOUNT FIRE ALARM AUDIBLE/VISUAL AND VISUAL ONLY DEVICES ON THE WALL AS INDICATED UNLESS OTHERWISE REQUIRED BY AMERICANS WITH DISABILITIES ACT REQUIREMENTS.
3. SINGLE GANG BOX WITH A 3/4" EMTC TO ABOVE NEAREST ACCESSIBLE CEILING SPACE.

SYMBOL	DESCRIPTION	MOUNTING HT. UNO
	FIRE ALARM SYSTEM	
FACP	FIRE ALARM CONTROL PANEL	–
FAAP	FIRE ALARM ANNUNCIATOR PANEL	–
F	FIRE ALARM PULL STATION	48" AFF
F	FIRE ALARM AUDIBAL SIGNAL – NOTE 2	80" AFF
F	FIRE ALARM VISUAL SIGNAL – NOTE 2	80" AFF
F	FIRE ALARM AUDIBLE VISUAL SIGNAL – NOTE 2	80" AFF
FS	FIRE ALARM SPRINKLER FLOW SWITCH	–
TS	FIRE ALARM SPRINKLER TAMPER SWITCH	–
PS	FIRE ALARM SPRINKLER PRESSURE SWITCH	–
S S	SMOKE DETECTOR, CEILING OR WALL MOUNTED	12" BFC
S P	SMOKE DETECTOR – PATIENT SLEEPING ROOM	–
H H	HEAT DETECTOR, CEILING OR WALL MOUNTED	12" BFC
S D	DUCT SMOKE DETECTOR	–
F	FIRE ALARM AUDIBLE & VISUAL, CEILING MOUNTED	9" BFC
	SMOKE DOOR HOLDER	–
XFMR CMX FP	F/A & HVAC INTERFACE (TRANSFORMER, CONTROL MODULE, PNEUMATIC)	ABV. CEILING
	CLOCKS, TELEVISION, INTERCOM/PAGING	
C	CLOCK HANGER OUTLET RECEPTACLE	80"
	SECONDARY CLOCK	80"
ET	ELAPSE TIME CLOCK	80"
	TELEVISION SYSTEM OUTLET	18" AFF
M	MICROPHONE OUTLET	18" AFF
	INTERCOM OUTLET	48" AFF
S P S P	P.A SPEAKER, CEILING OR WALL MOUNTED	9" B.F.C
	DISCONNECTS AND MOTORS	
J 30/--/3	DISCONNECT SWITCH – 30/--/3 INDICATES 30A., 3-POLE, NONFUSED; 30/30/3 INDICATES 30A., 3-POLE, 30A. FUSE	AS REQD.
CB J 30/--/3	CIRCUIT BREAKER DISCONNECT SWITCH – THERMAL MAGNETIC CB IN NEMA 1 ENCLOSURE; AMPS/POLES AS INDICATED	AS REQD.
2	MOTOR STARTER FVNR UNO; NUMBER INDICATES NEMA SIZE	AS REQD.
CB J J	COMBINATION MOTOR CONTROLLER/DISCONNECT SWITCH	AS REQD.
$M	MANUAL MOTOR STARTER SWITCH WITH THERMAL OVERLOAD AND PILOT LIGHT	48" AFF
	MOTOR	–
	MISCELLANEOUS	
	120/208V PANELBOARD	–
	277/480V PANELBOARD	–
	GROUND ROD	–
	EQUIPMENT CONNECTION	–
	CIRCUIT CONDUCTOR INDICATING (NEUTRAL, PHASE EQUIPMENT GROUND, ISOLATED GROUND, SWITCH LEG) (NO INDICATION REPRESENTS 2#12, 1#12G. 3/4"C. UNO)	–
	CIRCUIT HOMERUN TO PANELBOARD (2#12, 1#12G., 3/4"C. 20A/1P CB UNO)	–
x,x,x	THREE SINGLE POLE DEVICE CIRCUIT NUMBERS	–
x/x/x	MULTI-POLE DEVICE CIRCUIT NUMBERS	–

LIGHTING FIXTURE SCHEDULE

MARK	DESCRIPTION	LIGHT FIXTURE MFG.	LIGHT FIXTURE MODEL #	MOUNTING	QTY. OF LAMPS	VOLTS	WATTS	NOTES
A	2X2, DIRECT/INDIRECT, 2 LAMP, T5 FLUORESCENT	LITHONUIA LIGHTING	2AVG-2-14T5-NDR-MVOLT-GEB10PS	RECESSED	2	UNV	28	
AE	2X2, DIRECT/INDIRECT, 2 LAMP, T5 FLUORESCENT W/BATTERY BACK-UP	LITHONUIA LIGHTING	2AVG-2-14T5-NDR-MVOLT-GEB10PS-EL14	RECESSED	2	UNV	28	
B1	4', 4 HEAD, MR 16 TRACK LIGHTING	CAPRI LIGHTING	HEAD:CV7017-BK-CF41 TRACK:CT4-BK	TRACK	4	120V	50	
B2	8', 9 HEAD, MR 16 TRACK LIGHTING	CAPRI LIGHTING	HEAD:CV7017-BK-CF41 TRACK:CT8-BK	TRACK	1	120V	50	
C	DECRETIVE, MODULAR, PENDANT	VIBIA	AMEAB: (2) 2205, (1)2210	PENADNT	9	277	162	PROVIDE WALL MOUNTING ACCESSORIES
D	19" DECRETIVE LED PENDANT	LZF	SATURNIA: SAT-22-277	SUSPENDED	4	277	72	
E	16" DECRETIVE LED PENDANT	LZF	NUT-22-277	SUSPENDED	1	277	18	PROVIDE GU-24 18W CFL QUAD TUBE
F	4X4, CFL DOWNLIGHT	FOCAL POINT	FC44-26TT-S-277-SF-T-L835-SQ-C-WH	RECESSED	1	277	26	
FE	4X4, CFL DOWNLIGHT WITH BATTERY BACK-UP	FOCAL POINT	FC44-26TT-S-277-SF-T-EM-L835-SQ-C-WH	RECESSED	1	277	26	
G	4'X6", RECESSED FIXTURE	FOCAL PONT	FAV6-CR-2T5-UNV-S-XX-WH-4'	RECESSED	2	277	56	
GE	4'X6", RECESSED FIXTURE WITH BATTERY BACK-UP	FOCAL PONT	FAV6-CR-2T5-UNV-S-XX-EM-WH-4'	RECESSED	2	277	56	
H	6", CFL DOWNLIGHT	FOCAL PONT	FC6D-26TT-S-277-RO-T-L835-DN-CD-NP	RECESSED	1	277	26	
HE	6", CFL DOWNLIGHT WITH BATTERY BACK-UP	FOCAL PONT	FC6D-26TT-S-277-RO-T-L835-EM-DN-CD-NP	RECESSED	1	277	26	
I	2X4 SURFACE MOUNT	LITHONIA	2ES8X-232-MVOLT-BILP-L84HT8	SURFACE	2	UNV	64	
IE	2X4 SURFACE MOUNT WITH BATTERY BACK-UP	LITHONIA	2ES8X-232-MVOLT-BILP-L84HT8-EL14	SURFACE	2	UNV	64	
J	4' WALL MOUNT WITH BATTERY BACK-UP	LITHONIA	WC-2-28T5-FAC12-MVOLT-EL	WALL	2	UNV	56	
K	6", CFL DOWNLIGHT EXTERIOR	LITHONIA	LF6N 1/33TRT-FB5-MVOLT-WLP	WALL	1	UNV	32	
KE	6", CFL DOWNLIGHT EXTERIOR WITH BATTERY BACK-UP	LITHONIA	LF6N 1/33TRT-FB5-MVOLT-EL-WLP	WALL	1	UNV	32	
L	4' CHAIN HUNG STRIP	LITHONIA	2UN-2-28-MVOLT-GEB10	WALL	2	UNV	56	
LE	4' CHAIN HUNG STRIP WITH BATTERY BACK-UP	LITHONIA	2UN-2-28-MVOLT-GEB10-EL	WALL	2	UNV	56	
XE	WALL MOUNT, WET LOCATION EGRESS LIGHTING	LITHONIA	WLTU LED	WALL	2	UNV	7.5	

REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY 1922 WICHITA FALLS, TEXAS

No.		Date
1	ADDENDUM 01	10/07/2015
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Revisions

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Drawn

Architect

Checked

Approved

Engineer

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 10-21-15

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title: ELECTRICAL LEGEND, GENERAL NOTES AND ABBREVIATIONS

Scale: AS INDICATED

Drawing No.

E-001

Issue Date
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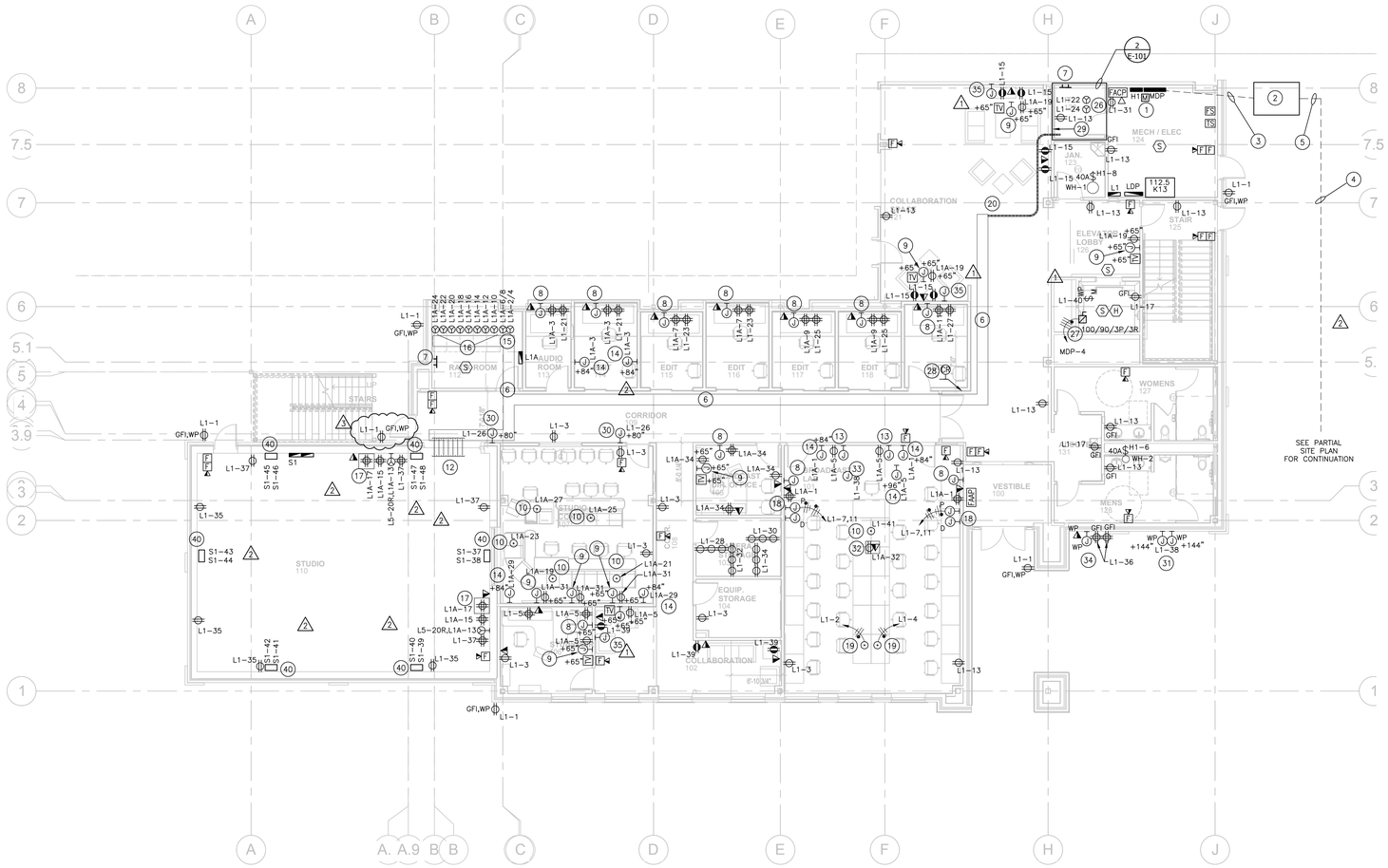
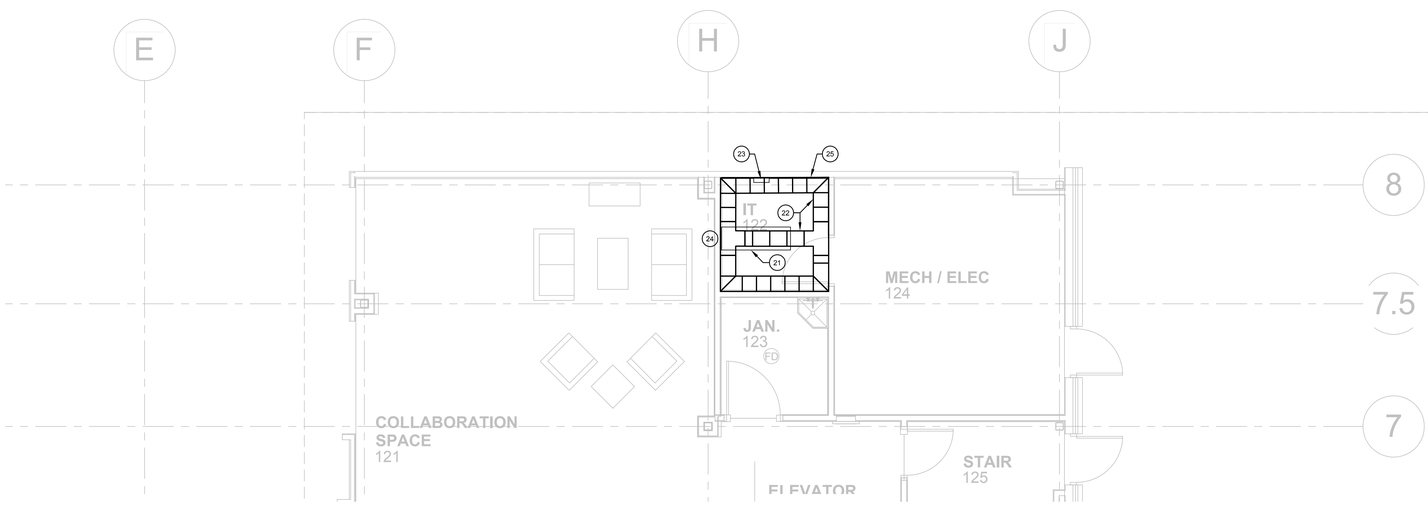


1 FIRST FLOOR PLAN - POWER/SPECIAL SYSTEMS

1/8" = 1'-0"



2 ENLARGED PLAN IT ROOM 122 - TELECOM

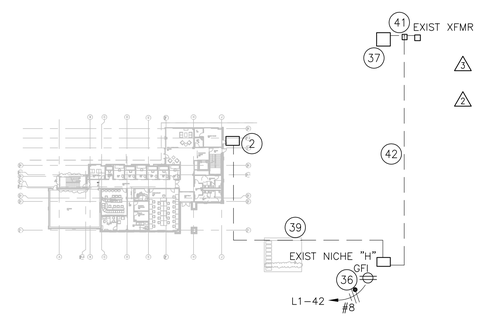
1/4" = 1'-0"

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO E-401 AND E-402 FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.
3. ALL HORIZONTAL DATA/VOICE OUTLETS SHOWN ON THIS DRAWING SHALL HOME RUN TO IT ROOM 122.
4. CABLES SHALL BE SUPPORTED BY CONDUIT, WIRE BASKET TRAY OR J-HOOKS A MAXIMUM OF 4'-0".
5. FIRESTOP ALL PENETRATIONS AS PER CODE.

KEYED NOTES:

1. KWH METER, EMON DEMON E34-480800 (OR EQUAL). COORDINATE EXACT REQUIREMENTS WITH CAMPUS. REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION.
2. PAD MOUNTED, 300 KVA, MEDIUM VOLTAGE TRANSFORMER, WITH 480/277V SECONDARY. PROVIDE PAD AS REQUIRED, COORDINATE WITH CAMPUS UTILITY. REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION.
3. UNDER GROUND SECONDARY CONDUITS, REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION. △2
4. UNDERGROUND ELECTRICAL PRIMARY TO RUN TO EXISTING ELECTRICAL NICHE PER THE PARTIAL SITE PLAN.
5. PROVIDE UNDERGROUND PRIMARY CONDUITS AS REQUIRED BY CAMPUS UTILITY.
6. 18"X4" BASKET CABLE TRAY MOUNTED ABOVE CEILING.
7. GROUND BAR MOUNTED AT 84", REFER TO DETAIL FOR ADDITIONAL INFORMATION.
8. 4-GANG J-BOX WITH (2) 1 1/4" CONDUIT TO CABLE TRAY FOR BSP PANEL AND CABLING. VERIFY LOCATION WITH OWNER.
9. 2-GANG J-BOX WITH (2) 1 1/4" CONDUIT TO CABLE TRAY FOR DATA AND SIGNAL CABLING. VERIFY LOCATION WITH OWNER.
10. WIREMOLD EFB6 SERIES MULTI-SERVICE FLOORBOX WITH (4) DUPLEX RECEPTACLES, AND (8) DATA DROPS. PROVIDE (2) 1 1/4" CONDUITS WITH PULL-STRING UNDER FLOOR FROM BOX TO CABLE TRAY FOR DATA CABLING, CONCEAL CONDUIT IN WALL.
11. WIREMOLD EFB6 SERIES MULTI-SERVICE FLOORBOX WITH (4) DUPLEX RECEPTACLES, AND (8) DATA DROPS. PROVIDE (2) 1 1/4" CONDUITS WITH PULL-STRING UNDER FLOOR FROM BOX TO CABLE TRAY FOR DATA CABLING, CONCEAL CONDUIT IN WALL.
12. PROVIDE (7) 4" CONDUIT SLEEVES THROUGH WALL ABOVE TRAY FOR TECH CABLING.
13. DUPLEX AND 2-GANG J-BOX AT +65" FOR MONITOR, PROVIDE (2) 1 1/4" CONDUIT IN WALL FROM BOX TO CABLE TRAY ABOVE CEILING. VERIFY LOCATION WITH OWNER.
14. DIVIDED 2-GANG BOX WITH ONE DUPLEX AND 1" CONDUIT IN WALL TO CABLE TRAY ABOVE CEILING FOR BROADCAST CABLES. VERIFY LOCATION WITH OWNER.
15. (2) CEILING MOUNTED L6-30R, USE #10 WIRE.
16. (8) CEILING MOUNTED L5-20R.
17. MIDDLE ATLANTIC DWR-10-17, 10 UNIT WALL RACK. PROVIDE (2) 3" CONDUITS FROM TOP OF RACK TO TRAY ABOVE FOR BROADCAST CABLE, PROVIDE QUAD RECEPTACLE IN RACK. VERIFY LOCATION WITH OWNER.
18. (2) J-BOXES MOUNTED FLUSH IN WALL FOR POWER AND VOICE/DATA CONNECTIONS TO FURNITURE. PROVIDE 2-GANG J-BOX WITH (2) 1 1/4" CONDUIT TO ABOVE ACCESSIBLE CEILING FOR VOICE/DATA CABLES, PROVIDE PULL STRING.
19. WIREMOLD RFB2 (OR EQUAL) FURNITURE FEED FEED FLOOR BOX WITH (2) 1/14" CONDUITS FROM BOX UNDER FLOOR TO INSIDE NEAREST WALL, TURN UP IN WALL TO ABOVE ACCESSIBLE CEILING, PROVIDE PULL STRING.
20. TRAY 2"X4" FOR DATA CABLES WIRE BASKET.
21. 7' TWO POST RACK SIEMON RS3-07.
22. PROVIDE 12" LADDER RUNWAY.
23. PROVIDE 4"X12" GROUNDING BAR.
24. LADDER RUNWAY SHALL BE CENTERED AND ATTACHED ABOVE RS3-07.
25. PROVIDE 3/4" PLYWOOD TYPE AC 6" AFF. PAINT FRONT AND BACK WITH TWO COATS OF FIRE RETARDENT PAINT.
26. (2) CEILING MOUNTED L5-20R
27. ELEVATOR CONNECTIONS, INTERCONNECT CONTROLS TO FIRE ALARM SYSTEM.
28. J-BOX AT +48" FOR CARD READER, PROVIDE 3/4" CONDUIT IN WALL TO ABOVE CEILING IN SECURE AREA.
29. PROVIDE TWO 4" SLEEVES WITH FIRESTOPPING.
30. J-BOX AND POWER FOR "ON-AIR" LIGHT.
31. (2) J-BOXES MOUNTED FLUSH IN WALL FOR POWER AND DATA TO FUTURE MONITOR, PROVIDE STAINLESS STEEL COVER PLATES. PROVIDE 1 1/4" CONDUIT FROM BOX TO CABLE TRAY FOR DATA/SIGNAL CABLE
32. CEILING MOUNTED POWER AND DATA FOR PROJECTOR.
33. J-BOX ABOVE CEILING WITH POWER FOR SCREEN, PROVIDE 3-POSITION SWITCH (RAISE-OFF-LOWER)
34. 4-GANG, WEATHER TIGHT, J-BOX WITH (2) 1 1/4" CONDUIT TO CABLE TRAY FOR BSP PANEL AND CABLING. VERIFY LOCATION WITH OWNER. PROVIDE WET-WHILE-IN-USE COVERS FOR QUADS DATA AND BSP PANEL. △1
35. J-BOX WITH 1" CONDUIT TO TV CONNECTIONS FOR HDMI CABLING.
36. GFI FOR SUMP PUMP IN VALVE BOX. △2
37. EXISTING SWITCH "H"
38. EXISTING ELECTRICAL NICHE "H".
39. ROUTE (2) 4" CONDUITS, CONCRETE ENCASED TO EXISTING NICHE.
40. WALL MOUNTED CONNECTION BOX BY TV EQUIPMENT INSTALLER, E.C. TO LAND CIRCUITS ON TERMINAL BLOCK.
41. PROVIDE WEATHER TIGHT TAP BOX TO SPLICE EXISTING CONDUCTORS IN UTILITY TUNNEL AT FINE ARTS BUILDING, REFER TO ONE-LINE, E-401 FOR ADDITIONAL INFORMATION.



3 PARTIAL SITE PLAN

1" = 50'-0"

CONTRACT DOCUMENTS

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
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2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

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Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

No.	Date
1	ADDENDUM 01 10/07/2015
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3	ADDENDUM 03 11/04/2015
4	ADDENDUM 04 03/07/2016

Revisions

Project No. 15.00493.80

Drawn

Architect

Checked

Approved

Engineer

STATE OF TEXAS
JAMES R. MEYER
58610
LICENSED PROFESSIONAL ENGINEER
3-7-16

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title:
FIRST FLOOR - POWER/SPECIAL SYSTEMS PLAN

Scale: AS INDICATED

Drawing No.

E-101

Issue Date
09.21.15 BID DOCUMENTS
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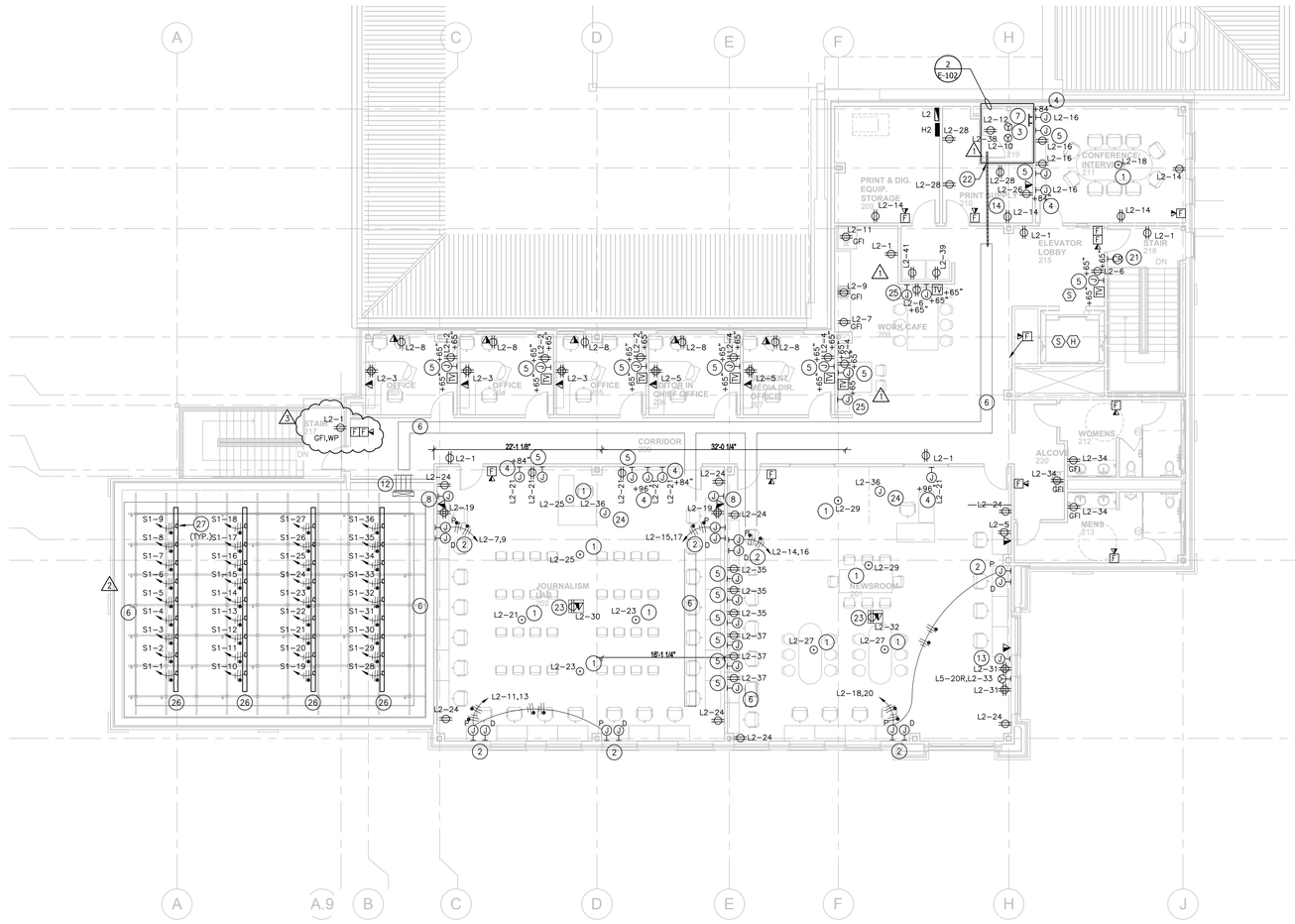
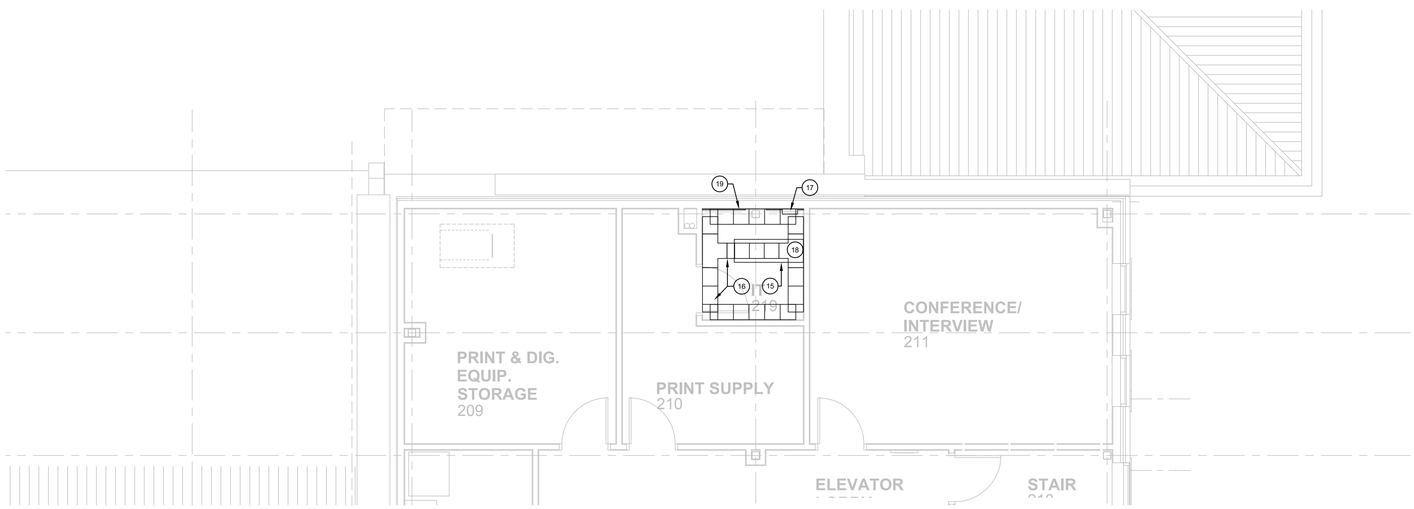


1 SECOND FLOOR PLAN - POWER/SPECIAL SYSTEMS

1/8" = 1'-0"



2 ENLARGED PLAN IT ROOM 219 - TELECOM

1/4" = 1'-0"

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO E-401 AND E-402 FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.
3. ALL HORIZONTAL DATA/VOICE OUTLETS SHOWN ON THIS DRAWING SHALL HOME RUN TO IT ROOM 122.
4. CABLES SHALL BE SUPPORTED BY CONDUIT, WIRE BASKET TRAY OR J-HOOKS A MAXIMUM OF 4'-0".
5. FIRESTOP ALL PENETRATIONS AS PER CODE.

KEYED NOTES:

1. WIREMOLD EVOLUTION 6ATCPBK WITH (2) DUPLEX RECEPTACLES AND VOICE DATA CONNECTIONS.
2. (2) J-BOXES MOUNTED FLUSH IN WALL FOR POWER AND VOICE/DATA CONNECTIONS TO FURNITURE. PROVIDE 2-GANG J-BOX WITH (2) 1 1/4" CONDUIT TO ABOVE ACCESSIBLE CEILING FOR VOICE/DATA CABLES, PROVIDE PULL STRING.
3. (2) CEILING MOUNTED L5-20R.
4. DIVIDED 2-GANG BOX WITH ONE DUPLEX AND 1" CONDUIT IN WALL TO CABLE TRAY ABOVE CEILING FOR BROADCAST CABLES.
5. DUPLEX AND 2-GANG J-BOX AT +65" FOR MONITOR, PROVIDE (2) 1 1/4" CONDUIT IN WALL FROM BOX TO CABLE TRAY ABOVE CEILING.
6. 18"X4" CABLE TRAY MOUNTED ABOVE CEILING.
7. GROUND BAR MOUNTED AT 84", REFER TO DETAIL FOR ADDITIONAL INFORMATION.
8. 4-GANG J-BOX WITH (2) 1 1/4" CONDUIT TO CABLE TRAY CEILING FOR BSP PANEL AND CABLING.
9. 2-GANG J-BOX WITH (2) 1 1/4" CONDUIT TO CABLE TRAY FOR DATA AND SIGNAL CABLING.
10. WIREMOLD EFB6 SERIES MULTI-SERVICE FLOORBOX WITH (4) DUPLEX RECEPTACLES, AND (8) DATA DROPS. PROVIDE (2) 1 1/4" CONDUITS WITH PULL-STRING UNDER FLOOR FROM BOX TO CABLE TRAY ABOVE CEILING FOR DATA CABLING, CONCEAL CONDUIT IN WALL.
11. WIREMOLD EFB6 SERIES MULTI-SERVICE FLOORBOX WITH (4) DUPLEX RECEPTACLES, AND (8) DATA DROPS. PROVIDE (2) 1 1/4" CONDUITS WITH PULL-STRING UNDER FLOOR FROM BOX TO CABLE TRAY ABOVE CEILING FOR DATA CABLING, CONCEAL CONDUIT IN WALL.
12. PROVIDE (4) 4" CONDUIT SLEEVES THROUGH WALL AND 18X4 VERTICAL TRAY RISER FOR TECH CABLING.
13. 12X12X4 J-BOX WITH (2) 2" CONDUITS TO CABLE TRAY ABOVE CEILING, PROVIDE PULL STRING.
14. TRAY 2"X4" FOR DATA CABLES WIRE BASKET.
15. 7' TWO POST RACK SIEMON RS3-07.
16. PROVIDE 12" LADDER RUNWAY.
17. PROVIDE 4"X12" GROUNDING BAR.
18. LADDER RUNWAY SHALL BE CENTERED AND ATTACHED ABOVE RS3-07.
19. PROVIDE 3/4" PLYWOOD TYPE AC 6" AFF. PAINT FRONT AND BACK WITH TWO COATS OF FIRE RETARDENT PAINT.
20. TWO 4" CONDUITS TO IT ROOM 122 BELOW.
21. J-BOX AT +48" FOR CARD READER, PROVIDE 3/4" CONDUIT IN WALL TO ABOVE CEILING IN SECURE AREA.
22. PROVIDE TWO 4" SLEEVES WITH FIRESTOPPING.
23. CEILING MOUNTED POWER AND DATA FOR PROJECTOR.
24. J-BOX ABOVE CEILING WITH POWER FOR SCREEN, PROVIDE 3-POSITION SWITCH (RAISE-OFF-LOWER) 1
25. J-BOX WITH 1" CONDUIT TO TV CONNECTIONS FOR HDMI CABLING.
26. EQUIPMENT CONNECTOR STRIP BY STUDIO EQUIPMENT INSTALLER.
27. TERMINAL BLOCKS LOCATED IN CONNECTOR STRIP, E.C. TO LAND CIRCUIT ON TERMINAL STRIP, COORDINATE WITH EQUIPMENT INSTALLER. 2

REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY 1922 WICHITA FALLS, TEXAS

No.		Date
1	ADDENDUM 01	10/07/2015
2	ADDENDUM 02	10/21/2015
3	VALUE ENGINEERING	11/04/2015

Revisions

Project No. 15.00493.80

Drawn

Architect

Checked

Approved

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 3-7-16

Engineer

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title: SECOND FLOOR - POWER/SPECIAL SYSTEMS PLAN

Scale: AS INDICATED

Drawing No.

E-102

Issue Date
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10.07.15 ADDENDUM 01
10.21.15 ADDENDUM 02
03.07.16 VALUE ENGINEERING

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214.522.7337 main

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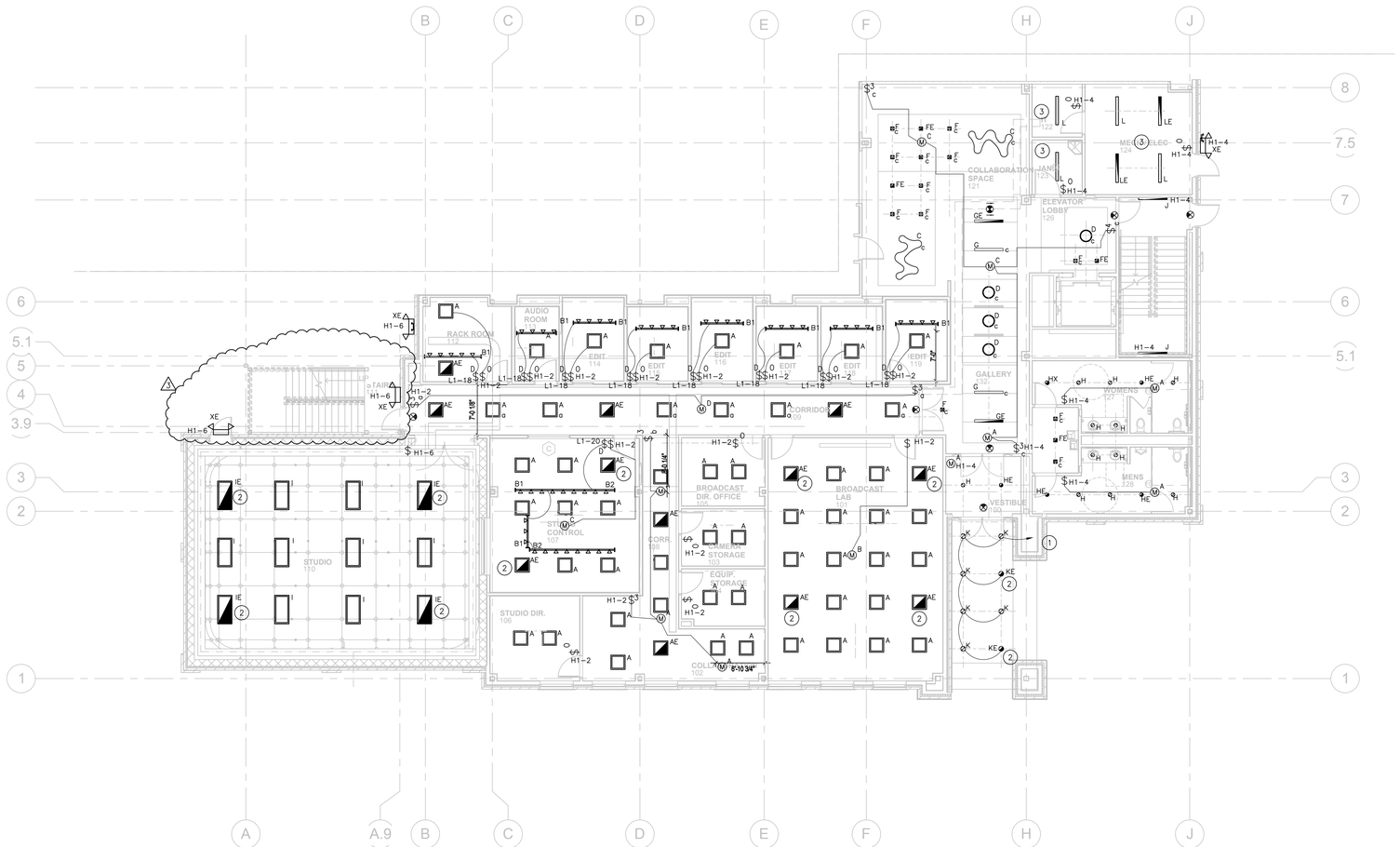

1 **FIRST FLOOR PLAN - LIGHTING**
1/8" = 1'-0"

KEYED NOTES:

1. RUN CIRCUIT THROUGH PHOTOCELL/TIMECLOCK CONTROL.
2. PROVIDE EXTRA UNSWITCHED HOT TO HOLD BATTERY PACK RELAY SO FIXTURE MAY GO ON AND OFF WITH SURROUND EXTERIOR LIGHTING AND ILLUMINATE UPON LOSS OF POWER.
3. FIXTURES IN ROOM TO BE CHAIN HUNG FROM STRUCTURE, PROVIDE ACCESSORIES AS REQUIRED.

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATIONS AND DETAILS OF CEILING MOUNTED LIGHT FIXTURES.
3. REFER TO XXX AND XXX FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.
4. SWITCH(ES) IN ROOM CONTROL FIXTURES IN ROOM UNLESS NOTED OTHERWISE.
5. LOWER CASE LETTERS ADJACENT TO A LIGHT FIXTURE INDICATES LIGHT FIXTURE OPERATED BY A SWITCH WITH THE SAME DESIGNATION.
6. ALL LIGHT SWITCHES SHALL BE LABELED WITH CIRCUIT NUMBER ON BACK OF COVER PLATE WITH A TYPED LABEL. LOCATIONS THAT REQUIRE MULTIPLE SWITCHES SHALL BE GROUPED IN ONE BOX UNDER A COMMON SWITCHPLATE. BOX SHALL BE DIVIDED AS NEC REQUIRES.
7. UPON COMPLETION OF CONSTRUCTION, CONTRACTOR SHALL PROVIDE AS-BUILT DRAWINGS ACCURATLY DEPICTING LOCATIONS, SIZING, LABELING, ETC., OF THE COMPLETED PROJECT CONDITIONS.
8. EMERGENCY EGRESS FIXTURES AND EXIT SIGNS SHALL BE CONNECTED TO CIRCUIT FEEDING SURROUNDING FIXTURES UNLESS NOTED OTHERWISE, CONNECT AHEAD OF ANY SWITCHING.
9. ALL FIXTURES TYPE "A" UNLESS OTHERWISE NOTED.

OCCUPANCY SENSOR LEGEND

M A	WATTSTOPPER W-500A ULTRASONIC SENSOR OR EQUAL
M B	WATTSTOPPER W-2000A ULTRASONIC SENSOR OR EQUAL
M C	WATTSTOPPER W-1000A ULTRASONIC SENSOR OR EQUAL
M D	WATTSTOPPER W-2000H ULTRASONIC SENSOR OR EQUAL
$O	WATTSTOPPER WS-250 PIR WALL SWITCH SENSOR

NOTE: CONTRACTOR SHALL ADJUST THE QUANTITY AND LOCATION OF MOTION SENSORS AS NEEDED TO ACHIEVE 99% COVERAGE IN THE AREA INDICATED.

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
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Mechanical, Electrical, Plumbing Engineer
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Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY WICHITA FALLS, TEXAS 1922

No.		Date
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2	ADDENDUM 02	10/21/2015
3	VALUE ENGINEERING	11/04/2015

Revisions

Project No. 15.00493.80

Drawn

Architect

Checked

Approved

Engineer

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 9-1-16

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title:
FIRST FLOOR - LIGHTING PLAN

Scale: AS INDICATED

Drawing No.
E-201

Issue Date
09.21.15 BID DOCUMENTS
10.07.15 ADDENDUM 01
10.21.15 ADDENDUM 02
03.07.16 VALUE ENGINEERING

CONTRACT DOCUMENTS

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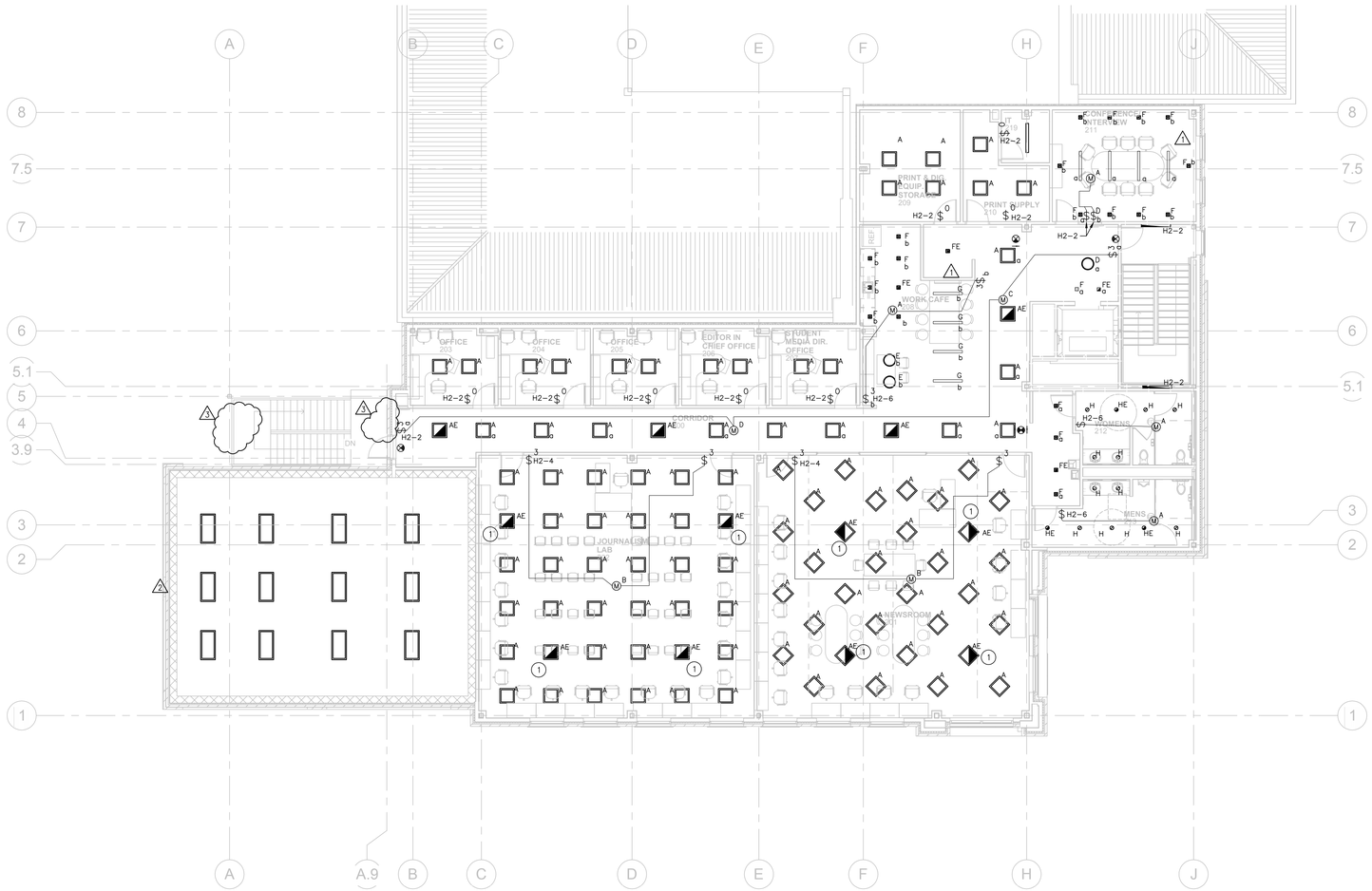

1 SECOND FLOOR PLAN - LIGHTING

1/8" = 1'-0"

KEYED NOTES:

1. PROVIDE EXTRA UNSWITCHED HOT TO HOLD BATTERY PACK RELAY SO FIXTURE MAY GO ON AND OFF WITH SURROUND EXTERIOR LIGHTING AND ILLUMINATE UPON LOSS OF POWER.
2. J-BOX MOUNTED TO STUDIO LIGHT GRID WITH POWER FOR STUDIO LIGHTING.

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATIONS AND DETAILS OF CEILING MOUNTED LIGHT FIXTURES.
3. REFER TO E-401 AND E-402 FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.
4. SWITCH(ES) IN ROOM CONTROL FIXTURES IN ROOM UNLESS NOTED OTHERWISE.
5. LOWER CASE LETTERS ADJACENT TO A LIGHT FIXTURE INDICATES LIGHT FIXTURE OPERATED BY A SWITCH WITH THE SAME DESIGNATION.
6. ALL LIGHT SWITCHES SHALL BE LABELED WITH CIRCUIT NUMBER ON BACK OF COVER PLATE WITH A TYPED LABEL. LOCATIONS THAT REQUIRE MULTIPLE SWITCHES SHALL BE GROUPED IN ONE BOX UNDER A COMMON SWITCHPLATE. BOX SHALL BE DIVIDED AS NEC REQUIRES.
7. UPON COMPLETION OF CONSTRUCTION, CONTRACTOR SHALL PROVIDE AS-BUILT DRAWINGS ACCURATLY DEPICTING LOCATIONS, SIZING, LABELING, ETC., OF THE COMPLETED PROJECT CONDITIONS.
8. EMERGENCY EGRESS FIXTURES AND EXIT SIGNS SHALL BE CONNECTED TO CIRCUIT FEEDING SURROUNDING FIXTURES UNLESS NOTED OTHERWISE, CONNECT AHEAD OF ANY SWITCHING.
9. ALL FIXTURES TYPE "A" UNLESS OTHERWISE NOTED.

OCCUPANCY SENSOR LEGEND

M A	WATTSTOPPER W-500A ULTRASONIC SENSOR OR EQUAL
M B	WATTSTOPPER W-2000A ULTRASONIC SENSOR OR EQUAL
M C	WATTSTOPPER W-1000A ULTRASONIC SENSOR OR EQUAL
M D	WATTSTOPPER W-2000H ULTRASONIC SENSOR OR EQUAL
$ O	WATTSTOPPER WS-250 PIR WALL SWITCH SENSOR

NOTE: CONTRACTOR SHALL ADJUST THE QUANTITY AND LOCATION OF MOTION SENSORS AS NEEDED TO ACHIEVE 99% COVERAGE IN THE AREA INDICATED.

CONTRACT DOCUMENTS

REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Colt Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY 1922 WICHITA FALLS, TEXAS

No.	Revisions	Date
1	ADDENDUM 01	10/07/2015
2	ADDENDUM 02	10/21/2015
3	VALUE ENGINEERING	11/04/2015

Project No. 15.00493.80

Drawn

Architect

Checked

Approved

Engineer

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 3-7-16

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title:
SECOND FLOOR - LIGHTING PLAN

Scale: AS INDICATED

Drawing No.

E-202

Issue Date
09.21.15 BID DOCUMENTS
10.07.15 ADDENDUM 01
10.21.15 ADDENDUM 02
03.07.16 VALUE ENGINEERING

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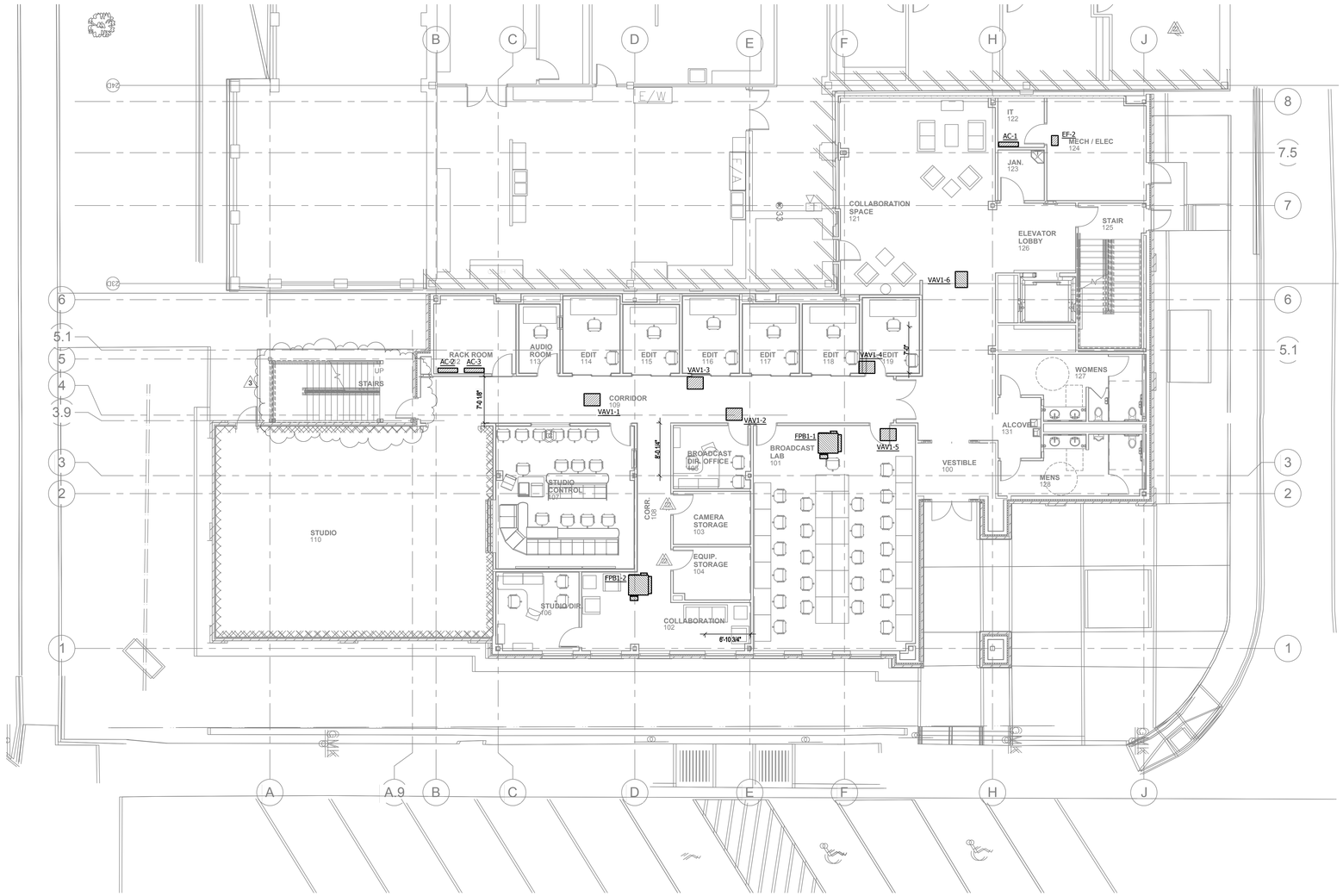

1 **FIRST FLOOR PLAN - HVAC POWER**

1/8" = 1'-0"

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO E-401 AND E-402 FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.

1ST FLOOR HVAC ELECTRICAL SCHEDULE

HVAC UNIT NUMBER	VOLTAGE	DISCONNECT SWITCH	WIRE/GND/CON	CIRCUIT
FPB1-1	277/1	60/NF/1P	2#8,#10G,3/4"C	H1-1
FPB1-2	277/1	30/NF/1P	2#10,#12G,3/4"C	H1-2
VAV1-1	277/1	30/NF/1P	2#8,#10G,3/4"C	H1-4
VAV1-2	277/1	30/NF/1P	2#10,#10G,3/4"C	H1-5
VAV1-3	277/1	20/NF/1P	2#10,#10G,3/4"C	H1-6
VAV1-4	277/1	60/NF/2P	2#6,#10G,1"C	H1-7
VAV1-5	277/1	60/NF/2P	2#6,#10G,3/4"C	H1-8
VAV1-6	277/1	30/NF/1P	2#10,#12G,3/4"C	H1-9
AC-1	120/1	20/NF/1P	2#12,#12G,3/4"C	FED FROM CU-1
CU-1	120/2	20/NF/1P/3R	2#12,#12G,3/4"C	L1-8
AC-2	208/1	30/NF/2P	2#10,#12G,3/4"C	FED FROM CU-2
CU-2	208/1	30/NF/2P	2#10,#12G,3/4"C	L1-10/12
AC-3	208/1	30/NF/2P	2#10,#12G,3/4"C	FED FROM CU-3
CU-3	208/1	30/NF/2P	2#10,#12G,3/4"C	L1-14/16
EF-2	120/1	20/NF/1P	2#12,#12G,3/4"C	LA-18

REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY
1922
WICHITA FALLS, TEXAS

No.	Date
Revisions	

Project No.
15.00493.80

Drawn

Architect

Checked

Approved

STATE OF TEXAS
JAMES R. MEYER
58610
LICENSED
PROFESSIONAL ENGINEER
9-1-16

Engineer

Key:

PLAN NORTH

NORTH

CONSTRUCTION DOCUMENTS

Title:
FIRST FLOOR - HVAC POWER PLAN

Scale: AS INDICATED

Drawing No.

E-301

Issue Date
09.21.15 BID DOCUMENTS

CONTRACT DOCUMENTS

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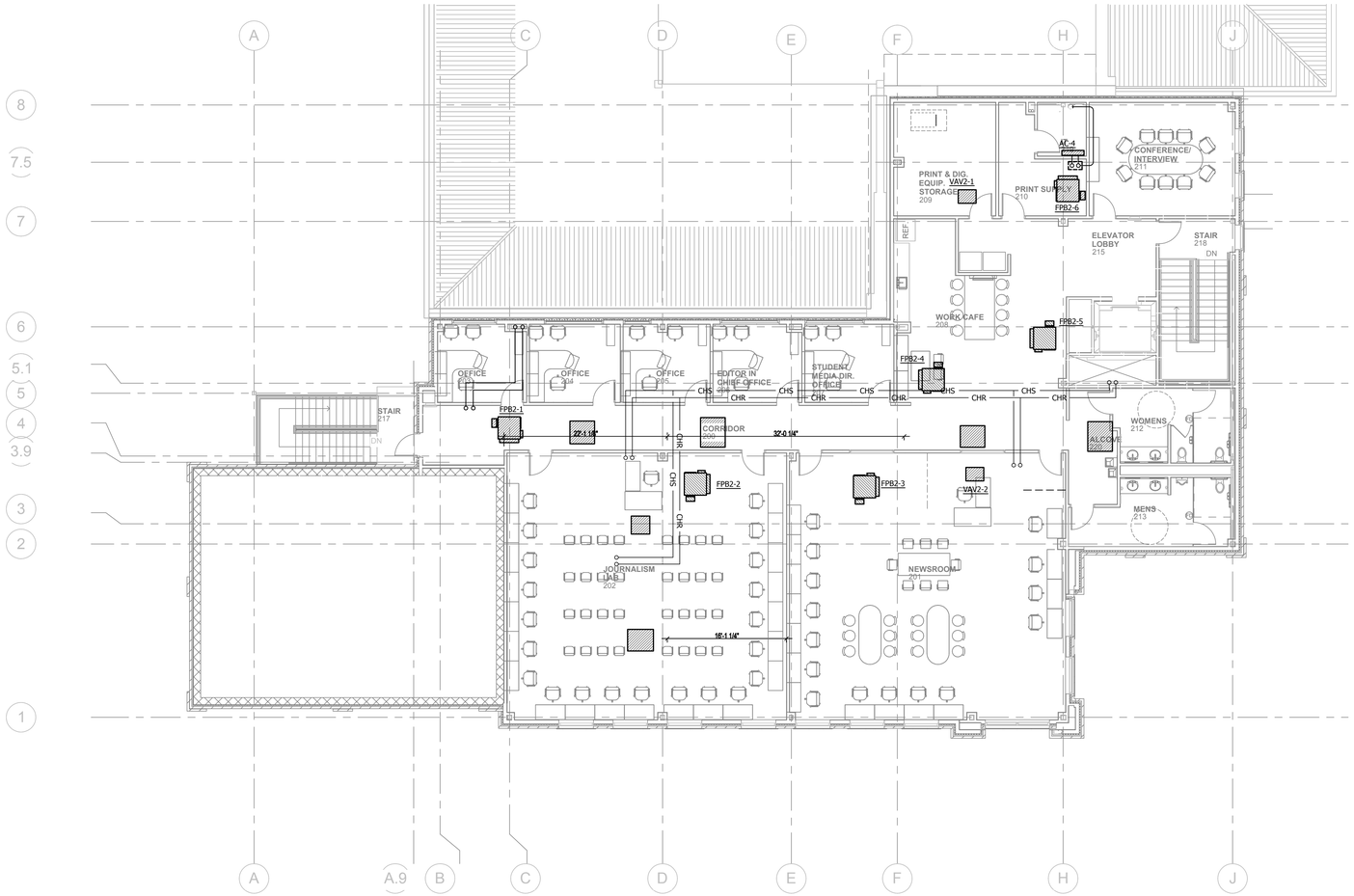

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO E-401, E-402 AND E-403 FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.

2ND FLOOR HVAC ELECTRICAL SCHEDULE

HVAC UNIT NUMBER	VOLTAGE	DISCONNECT SWITCH	WIRE/GND/CON	CIRCUIT
FPB2-1	277/1	60/NF/1P	2#6,#10G,1"C	H2-1
FPB2-2	277/1	20/NF/1P	2#12,#12G,3/4"C	H2-2
FPB2-3	277/1	20/NF/1P	2#12,#12G,3/4"C	H2-3
FPB2-4	277/1	30/NF/1P	2#10,#10G,3/4"C	H2-4
FPB2-5	277/1	30/NF/1P	2#10,#10G,3/4"C	H2-5
FPB2-6	277/1	20/NF/1P	2#12,#12G,3/4"C	H2-8
VAV2-1	277/1	20/NF/1P	2#12,#12G,3/4"C	H2-6
VAV2-2	277/1	60/NF/1P	2#6,#10G,1"C	H2-7

1 **SECOND FLOOR PLAN - MECHANICAL POWER**
1/8" = 1'-0"

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Colt Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

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1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY 1922 WICHITA FALLS, TEXAS

No.	Date
Revisions	

Project No. 15.00493.80
Drawn
Architect
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Approved
Engineer

STATE OF TEXAS
JAMES R. MEYER
58610
LICENSED
PROFESSIONAL ENGINEER
3-7-16

Key:
PLAN NORTH
NORTH

CONSTRUCTION DOCUMENTS

Title:
SECOND FLOOR - MECHANICAL POWER PLAN

Scale: AS INDICATED

Drawing No.
E-302

Issue Date
09.21.15 BID DOCUMENTS

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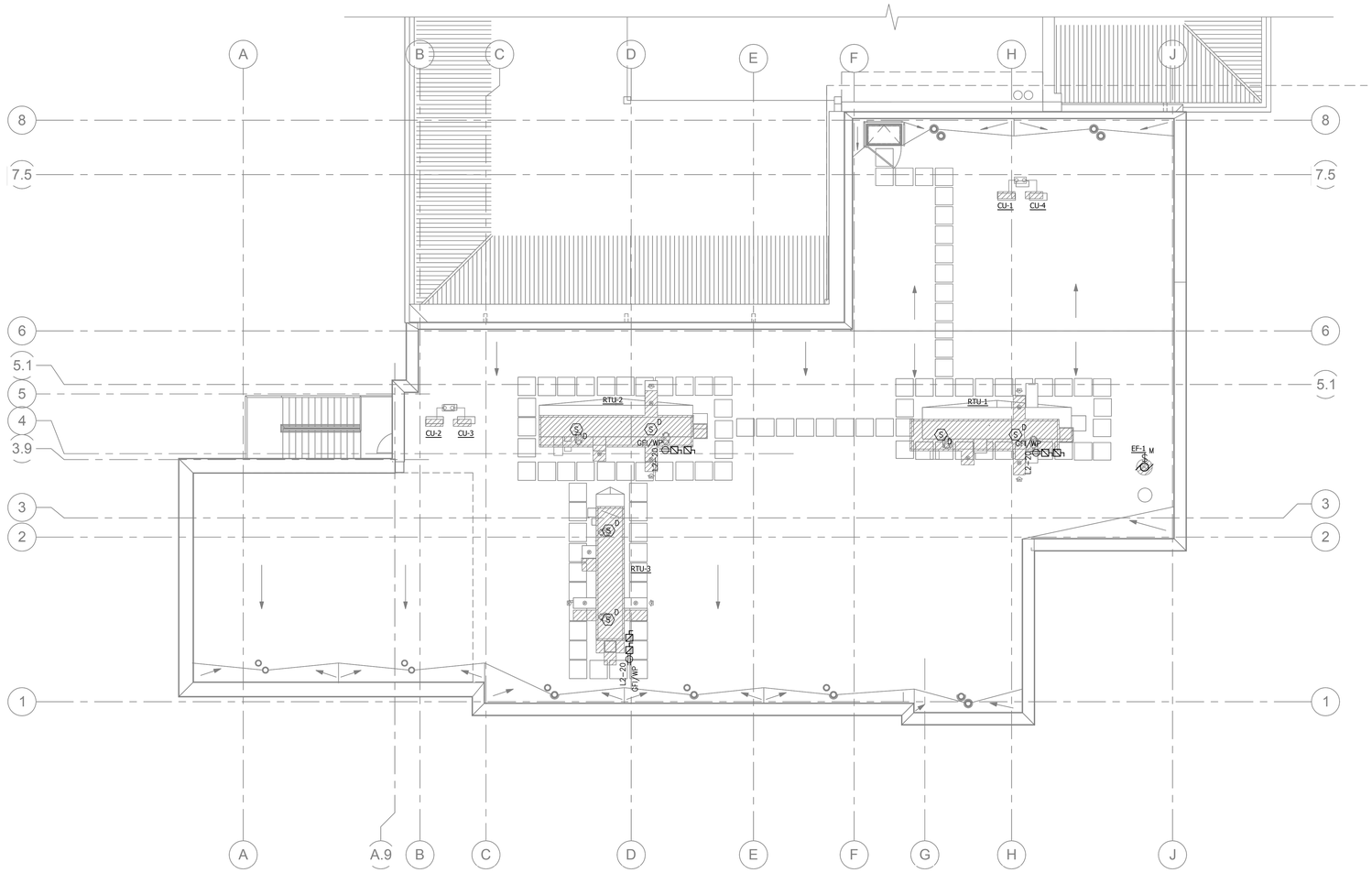

DRAWING NOTES:

1. REFER TO E-001 FOR GENERAL NOTES, SYMBOL LEGEND AND ABBREVIATIONS.
2. REFER TO E-401 AND E-402 FOR ELECTRICAL SCHEDULES, ONE LINE DIAGRAM AND ELECTRICAL DETAILS.

ROOF HVAC ELECTRICAL SCHEDULE

HVAC UNIT NUMBER	VOLTAGE	DISCONNECT SWITCH	WIRE/GND/CON	CIRCUIT
AHU-1	480/3	60/50/3P/3R	3#6,#10G,1"C	MDP-5
AHU-1	480/3	30/25/3P/3R	3#10,#10G,1"C	MDP-6
AHU-2	480/3	60/50/3P/3R	3#6,#10G,1"C	MDP-7
AHU-2	480/3	30/25/3P/3R	3#10,#10G,1"C	MDP-8
AHU-3	480/3	60/35/3P/3R	3#8,#10G,1"C	MDP-9
AHU-3	480/3	30/10/3P/3R	3#10,#10G,1"C	MDP-10

1 **ROOF PLAN - ELECTRICAL**
1/8" = 1'-0"

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
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Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
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Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY
WICHITA FALLS, TEXAS
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Project No.
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Architect

Checked

Approved

STATE OF TEXAS
JAMES R. MEYER
58610
LICENSED
PROFESSIONAL ENGINEER
5-7-16
Engineer

Key:

PLAN NORTH
NORTH

CONSTRUCTION DOCUMENTS

Title:
ROOF PLAN - ELECTRICAL

Scale: AS INDICATED

Drawing No.
E-303

Issue Date
09.21.15 BID DOCUMENTS

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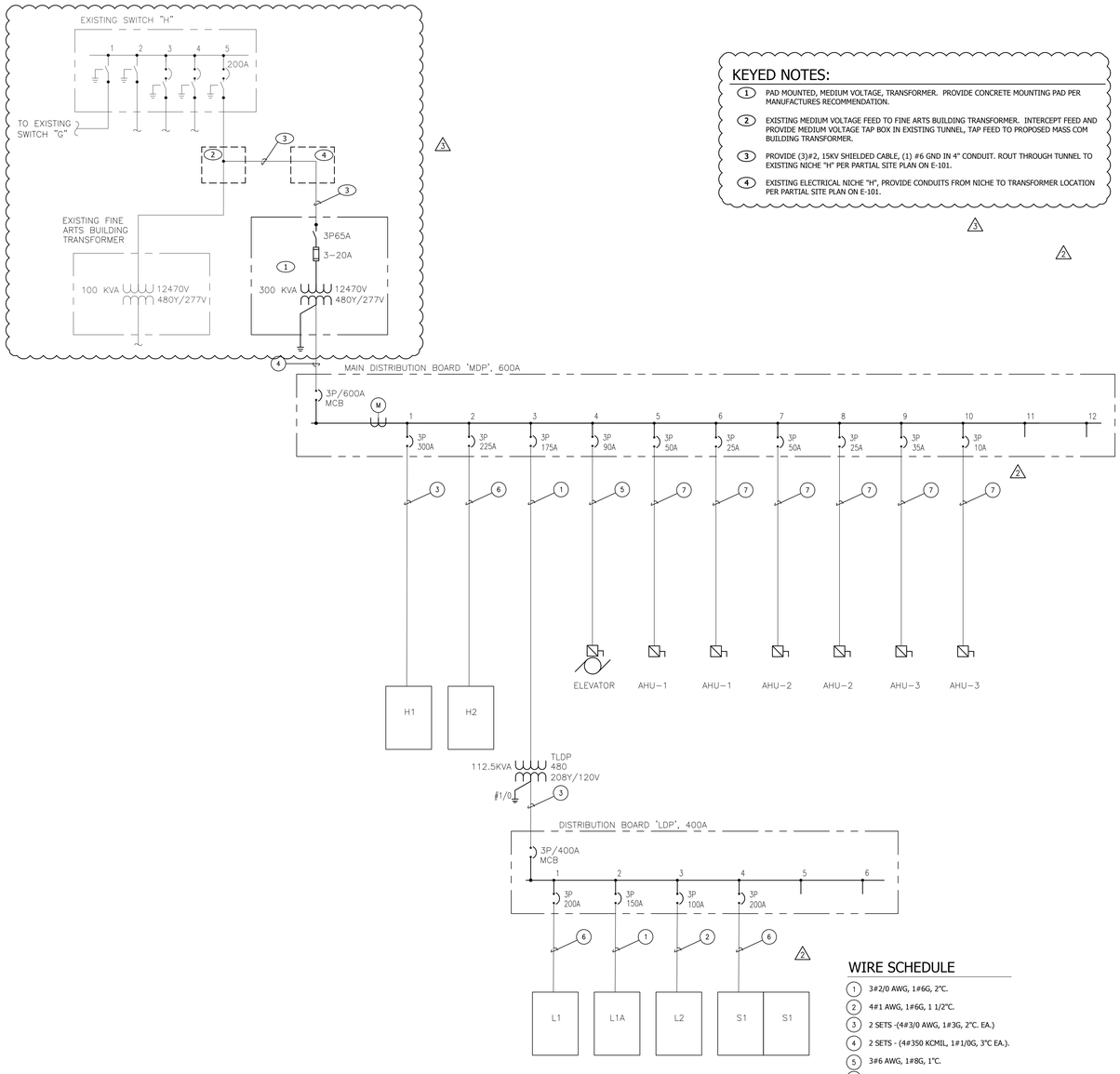

KEYED NOTES:

1. PAD MOUNTED, MEDIUM VOLTAGE, TRANSFORMER. PROVIDE CONCRETE MOUNTING PAD PER MANUFACTURES RECOMMENDATION.
2. EXISTING MEDIUM VOLTAGE FEED TO FINE ARTS BUILDING TRANSFORMER. INTERCEPT FEED AND PROVIDE MEDIUM VOLTAGE TAP BOX IN EXISTING TUNNEL, TAP FEED TO PROPOSED MASS COM BUILDING TRANSFORMER.
3. PROVIDE (3)#2, 15KV SHIELDED CABLE, (1) #6 GND IN 4" CONDUIT. ROUT THROUGH TUNNEL TO EXISTING NICHE "H" PER PARTIAL SITE PLAN ON E-101.
4. EXISTING ELECTRICAL NICHE "H", PROVIDE CONDUITS FROM NICHE TO TRANSFORMER LOCATION PER PARTIAL SITE PLAN ON E-101.

WIRE SCHEDULE

1. 3#2/0 AWG, 1#6G, 2"C.
2. 4#1 AWG, 1#6G, 1 1/2"C.
3. 2 SETS -(4#3/0 AWG, 1#3G, 2"C. EA.)
4. 2 SETS - (4#350 KCMIL, 1#1/0G, 3"C EA.).
5. 3#6 AWG, 1#8G, 1"C.
6. 4#4/0 AWG, 1#4G, 2 1/2"C.
7. REFER TO FLOOR PLANS

1 ELECTRICAL RISER DIAGRAM

NTS

PANELBOARD NO: H2

SECTION: 1 OF 1
MOUNTING: SURFACE
POLES: 42
LOCATION: ELECTRICAL RM

VOLTAGE: 120/208V
PHASE: 3
WIRE: 4
200% NEUTRAL: NO
GROUND BUS: YES

BUS: 225A
MAIN: MLO
INTERRUPTING RATING: 10 KAIC
ELECTRONIC GRADE PANEL: NO
ISOLATED GROUND BUS: YES

CKT NO.	DESCRIPTION	LOAD (VA) LTS	REC	MECH	MISC	CIRCUIT BREAKER AMPS	POLES			CIRCUIT BREAKER AMPS	POLES	LOAD (VA) LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
1	FP32-1			11693		50	1	A		20	1	2128				LIGHTING	2
3	FP32-2			2582		20	1		B	20	1	3808				LIGHTING	4
5	FP32-3			11693		50	1		C	20	1	1250				LIGHTING	6
7	FP32-4			2582		20	1	A		20	1				9000	WH-3	8
9	FP32-5			2582		20	1		B	20	1					SPARE	10
11	VAV2-1			2000		20	1		C	20	1					SPARE	12
13	VAV2-2			2000		20	1	A		20	1					SPARE	14
15	FP32-6			2582		20	1		B							SPACE	16
17	SPACE								C							SPACE	18
19	SPACE							A								SPACE	20
21	SPACE								B							SPACE	22
23	SPACE								C							SPACE	24
25	SPACE							A								SPACE	26
27	SPACE								B							SPACE	28
29	SPACE								C							SPACE	30
31	SPACE							A								SPACE	32
33	SPACE								B							SPACE	34
35	SPACE								C							SPACE	36
37	SPACE							A								SPACE	38
39	SPACE								B							SPACE	40
41	SPACE								C							SPACE	42

PANELBOARD NO: H2

	LTS	REC	MECH	MISC						LTS	REC	MECH	MISC		
SUBTOTAL CONNECTED KVA	0.0	0.0	37.7	0.0						7.2	0.0	0.0		9.0	SUBTOTAL CONNECTED KVA
										7.2	0.0	37.7		9.0	TOTAL CONNECTED KVA

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DF
PHASE A CONNECTED KVA	2.1	0.0	16.3	9.0	27.4	52.5
PHASE B CONNECTED KVA	3.8	0.0	7.7	0.0	11.6	-35.7
PHASE C CONNECTED KVA	1.3	0.0	13.7	0.0	14.9	-16.8
AVERAGE PHASE CONNECTED KVA					18.0	

LOAD SUMMARY & FEEDER CALCULATION

LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL	
7.2	0.0	37.7	9.0	53.9	10		CONNECTED KVA
1.0	#1	1.0	1.0		%		DEMAND FACTOR
7.2	0.0	37.7	9.0	53.9	5.4	59.3	DEMAND KVA
						164.6	DEMAND AMPS
1.25	1.0	1.0	1.0		1.0		CONT / NON-CONT FACTOR
						0.80	ADJ FACTOR (NOTE 8, TABLE 310-16)
						1.00	CORR FACTOR (OTHER THAN 30 DEG C)
						203.5	MIN. OVERCURRENT DEVICE AMPS
						203.5	MIN. COND. AMPS PER TERM RATING
						205.7	MIN. COND. AMPS PER INS RATING

RECEPTACLE DEMAND FACTOR:
#1 OTHER THAN HOSPITAL - 100% FIRST 10 KVA + 50% REMAINING
#2 HOSPITAL - 49% OF FIRST 50KVA + 20% OF REMAINING

PANELBOARD NO: H1

SECTION: 1 OF 1
MOUNTING: SURFACE
POLES: 42
LOCATION: ELECTRICAL RM

VOLTAGE: 120/208V
PHASE: 3
WIRE: 4
200% NEUTRAL: NO
GROUND BUS: YES

BUS: 400A
MAIN: MLO
INTERRUPTING RATING: 10 KAIC
ELECTRONIC GRADE PANEL: NO
ISOLATED GROUND BUS: YES

CKT NO.	DESCRIPTION	LOAD (VA) LTS	REC	MECH	MISC	CIRCUIT BREAKER AMPS	POLES			CIRCUIT BREAKER AMPS	POLES	LOAD (VA) LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
1	FP31-1			5693		40	1	A		20	1	2650				LIGHTING	2
3	FP31-2			5582		30	1		B	20	1	2560				LIGHTING	4
5	SPARE					20	1		C	40	1				9000	WH-1	6
7	VAV1-1			5000		20	1	A		40	1				9000	WH-2	8
9	VAV1-2			2000		20	1		B	20	1						10
11	VAV1-3			3500		20	1		C	20	1						12
13	VAV1-4			10000		20	1	A		20	1						14
15	VAV1-5			9000		20	1		B	20	1						16
17	VAV1-6			7500		20	1		C	20	1						18
19						20	1	A		20	1						20
21						20	1		B	20	1						22
23						20	1		C	20	1						24
25						20	1	A		20	1						26
27						20	1		B	20	1						28
29						20	1		C	20	1						30
31								A									32
33									B								34
35									C								36
37								A									38
39									B								40
41									C								42

PANELBOARD NO: H1

	LTS	REC	MECH	MISC						LTS	REC	MECH	MISC		
SUBTOTAL CONNECTED KVA	0.0	0.0	52.3	0.0						5.2	0.0	0.0		18.0	SUBTOTAL CONNECTED KVA
										5.2	0.0	52.3		18.0	TOTAL CONNECTED KVA

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DF
PHASE A CONNECTED KVA	2.7	0.0	24.7	9.0	36.3	44.4
PHASE B CONNECTED KVA	2.6	0.0	16.6	0.0	19.1	-23.9
PHASE C CONNECTED KVA	0.0	0.0	11.0	9.0	20.0	-20.5
AVERAGE PHASE CONNECTED KVA					25.2	

LOAD SUMMARY & FEEDER CALCULATION

LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL	
5.2	0.0	52.3	18.0	75.5	20		CONNECTED KVA
1.0	#1	1.0	1.0		%		DEMAND FACTOR
5.2	0.0	52.3	18.0	75.5	15.1	90.6	DEMAND KVA
						251.4	DEMAND AMPS
1.25	1.0	1.0	1.0		1.0		CONT / NON-CONT FACTOR
						0.80	ADJ FACTOR (NOTE 8, TABLE 310-16)
						1.00	CORR FACTOR (OTHER THAN 30 DEG C)
						314.1	MIN. OVERCURRENT DEVICE AMPS
						314.1	MIN. COND. AMPS PER TERM RATING
						313.3	MIN. COND. AMPS PER INS RATING

RECEPTACLE DEMAND FACTOR:
#1 OTHER THAN HOSPITAL - 100% FIRST 10 KVA + 50% REMAINING
#2 HOSPITAL - 49% OF FIRST 50KVA + 20% OF REMAINING

DISTRIBUTION PANELBOARD NO: MDP

SECTION: 1 OF 1
LOCATION:
VOLTAGE: 480/277
PHASE: 3
WIRE: 4
BUS: 600 A
MAIN: MCB
INTERRUPTING RATING: 42 KAIC

CKT NO.	DESCRIPTION	LOAD (VA) LTS	REC	MECH	MISC	CIRCUIT BREAKER AMPS	POLES		
1	PANEL H1	7950	0	24663	9000	300	3	A	
		2560	0	16582	0				B
		0	0	11000	9000				C
2	PANEL H2	1128	0	16275	9000	225	3	A	
		3808	0	7746	0				B
		1250	0	13663	0				C
3	TRANSFORMER TLDP	1376	49630	3120	0	175	3	A	
		0	51236	2932	0				B
		1600	48480	3916	0				C
4	ELEVATOR				11000	90	3	A	
					11000				B
					11000				C
5	AHU-1			7981		50	3	A	
				7981					B
				7981					C
6	AHU-1			6512		25	3	A	
				6512					B
				6512					C
7	AHU-2			7981		50	3	A	
				7981					B
				7981					C
8	AHU-2			6512		25	3	A	
				6512					B
				6512					C
9	AHU-3			6850		35	3	A	
				6850					B
				6850					C
10	AHU-3			2217		10	3	A	
				2217					B
				2217					C
11	SPACE							A	
									B
									C
12	SPACE							A	
									B
									C

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DF
PHASE A CONNECTED KVA	6	50	82	29	167	14.2
PHASE B CONNECTED KVA	6	51	65	11	134	-8.5
PHASE C CONNECTED KVA	3	48	67	20	138	-5.7
AVERAGE PHASE CONNECTED KVA					146	

LOAD SUMMARY

	LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL
CONNECTED KVA	15	150	214	60	439	10	
DEMAND FACTOR	1.0	0.5	1.0	1.0		%	
DEMAND KVA	15	80	214	60	369	37	406
DEMAND AMPS							489
CONTINUOUS / NON-CONTINUOUS FACTOR	1.25	1.00	1.00	1.00		1.00	

PANEL VOLTAGE 480

DISTRIBUTION PANELBOARD NO: LDP

SECTION: 1 OF 1
LOCATION:
VOLTAGE: 120/208
PHASE: 3
WIRE: 4
BUS: 400 A
MAIN: MCB
INTERRUPTING RATING: 42 KAIC

CKT NO.	DESCRIPTION	LOAD (VA) LTS	REC	MECH	MISC	CIRCUIT BREAKER AMPS	POLES		
1	PANEL L1	1376	6940	3120	0	200	3	A	
		0	9860	2932	0				B
		1600	7980	3916	0				C
2	PANEL L1A	0	5990	0	0	150	3	A	
		0	7920	0	0				B
		0	7000	0	0				C
3	PANEL L2	0	16260	0	0	100	3	A	
		0	16916	0	0				B
		0	16360	0	0				C
4	PANEL S1	0	23040	0	0	200	3	A	
		0	23040	0	0				B
		0	23040	0	0				C
5	SPACE							A	
									B
									C
6	SPACE							A	
									B
									C

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DF
PHASE A CONNECTED KVA	1	50	3	0	54	0.3
PHASE B CONNECTED KVA	0	51	3	0	54	0.0
PHASE C CONNECTED KVA	2	48	4	0	54	-0.3
AVERAGE PHASE CONNECTED KVA					54	

LOAD SUMMARY

	LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL
CONNECTED KVA	3	150	10	0	162	20	
DEMAND FACTOR	1.0	0.5	1.0	1.0		%	
DEMAND KVA	3	80	10	0	93	19	111
DEMAND AMPS							309
CONTINUOUS / NON-CONTINUOUS FACTOR	1.25	1.00	1.00	1.00		1.00	

2 ELECTRICAL PANEL SCHEDULES

NTS

CONTRACT DOCUMENTS

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Colt Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

No.	Revisions	Date
1	ADDENDUM 01	10/07/2015
2	ADDENDUM 02	10/21/2015
3	VALUE ENGINEERING	11/04/2015

Project No. 15.00493.80

Drawn

Architect

Checked

Approved

Engineer

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 3-7-16

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title:
ELECTRICAL RISER DIAGRAM AND PANEL SCHEDULES

Scale: AS INDICATED

Drawing No.

E-401

Issue Date
09.21.15 BID DOCUMENTS
10.07.15 ADDENDUM 01
10.21.15 ADDENDUM 02
03.07.16 VALUE ENGINEERING

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REES

1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

PANELBOARD NO: L1

SECTION: 1 OF 1 | MOUNTING: SURFACE | POLES: 42 | LOCATION: ELECTRICAL RM
VOLTAGE: 120/208V | PHASE: 3 | WIRE: 4 | 200% NEUTRAL: NO | GROUND BUS: YES
BUS: 225A | MAIN: MLO | INTERRUPTING RATING: 10 KAIC | ELECTRONIC GRADE PANEL: NO | ISOLATED GROUND BUS: NO

CKT NO.	DESCRIPTION	LTS	REC	MECH	MISC	AMPS	POLES				AMPS	POLES	LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
1	RECEPTACLES		1080			20	1	A			20	1		900			RECEPTACLES	2
3	RECEPTACLES		1440			20	1		B		20	1		900			RECEPTACLES	4
5	RECEPTACLES		1080			20	1			C	20	1			1680		AC-1/CU-1	6
7	RECEPTACLES		720			20	1	A			20				1560		AC-2/CU-2	8
9	RECEPTACLES		720			20	1		B			2			1560			10
11	RECEPTACLES		900			20	1			C	20				1560		AC-3/CU-3	12
13	RECEPTACLES		1080			20	1	A				2			1560			14
15	RECEPTACLES		1080			20	1		B		20	1			696		EF-2	16
17	EWC		500			20	1			C	20	1	1600				LIGHTING	18
19	PIT RECEPT/LTG	26	180			20	1	A			20	1	1250				LIGHTING	20
21	AUDIO EDIT		720			20	1		B		20	1		1440			RACK	22
23	EDIT BAY		720			20	1			C	20	1		1440			RACK	24
25	EDIT BAY		720			20	1	A			20	1	100				ON AIR	26
27	EDIT BAY		720			20	1		B		20	1		540			CHARGER	28
29	RECEPTACLES		720			20	1			C	20	1		540			CHARGER	30
31	FIRE ALARM		500			20	1	A			20	1		540			CHARGER	32
33	RECEPTACLES		720			20	1		B		20	1		540			CHARGER	34
35	RECEPTACLES		720			20	1			C	20	1		540			COURTYARD	36
37	RECEPTACLES		720			20	1	A			20	1		500			SCREENS	38
39	RECEPTACLES		540			20	1		B		20	1			676		SUMP PUMP	40
41	RECEPTACLES		720			20	1			C	20	1			676		SUMP PUMP	42

PANELBOARD NO: L1

	LTS	REC	MECH	MISC	LTS	REC	MECH	MISC	
SUBTOTAL CONNECTED KVA	0.0	16.3	0.0	0.0	3.0	7.9	10.0	0.0	SUBTOTAL CONNECTED KVA
					3.0	24.2	10.0	0.0	TOTAL CONNECTED KVA

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DIF
PHASE A CONNECTED KVA	1.4	6.9	3.1	0.0	11.4	-7.6
PHASE B CONNECTED KVA	0.0	9.4	2.9	0.0	12.3	-0.7
PHASE C CONNECTED KVA	1.6	7.9	3.9	0.0	13.4	8.3
AVERAGE PHASE CONNECTED KVA					12.4	

LOAD SUMMARY & FEEDER CALCULATION

LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL	
3.0	24.2	10.0	0.0	37.1	25		CONNECTED KVA
1.0	#1	1.0	1.0		%		DEMAND FACTOR
3.0	17.1	10.0	0.0	30.0	7.5	37.5	DEMAND KVA
						104.2	DEMAND AMPS
1.25	1.0	1.0	1.0		1.0		CONT / NON-CONT FACTOR
						0.80	ADJ FACTOR (NOTE 8, TABLE 310-16)
						1.00	CORR FACTOR (OTHER THAN 30 DEG C)
						127.5	MIN. OVERCURRENT DEVICE AMPS
						127.5	MIN. COND. AMPS PER TERM RATING
						130.3	MIN. COND. AMPS PER INS RATING

RECEPTACLE DEMAND FACTOR:
#1 OTHER THAN HOSPITAL - 100% FIRST 10 KVA + 50% REMAINI
#2 HOSPITAL - 40% OF FIRST 50KVA + 20% OF REMAINING

PANELBOARD NO: L1A

SECTION: 1 OF 1 | MOUNTING: SURFACE | POLES: 42 | LOCATION: ELECTRICAL RM
VOLTAGE: 120/208V | PHASE: 3 | WIRE: 4 | 200% NEUTRAL: NO | GROUND BUS: YES
BUS: 200A | MAIN: MLO | INTERRUPTING RATING: 10 KAIC | ELECTRONIC GRADE PANEL: NO | FEED THRU LUGS: YES

CKT NO.	DESCRIPTION	LTS	REC	MECH	MISC	AMPS	POLES				AMPS	POLES	LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
1	RECEPTACLES		720			20		A			30			1440			RACK	2
3	RECEPTACLES		720			20	1		B			2		1440				4
5	RECEPTACLES		720			20	1			C	30			1440			RACK	6
7	RECEPTACLES		720			20	1	A				2		1440				8
9	RECEPTACLES		720			20	1		B		20	1		720			RACK	10
11	RECEPTACLES		360			20	1			C	20	1		720			RACK	12
13	RECEPTACLES		1080			20	1	A			20	1		720			RACK	14
15	RECEPTACLES		720			20	1		B		20	1		720			RACK	16
17	RECEPTACLES		1080			20	1			C	20	1		720			RACK	18
19	RECEPTACLES		720			20	1	A			20	1		720			RACK	20
21	RECEPTACLES		720			20	1		B		20	1		720			RACK	22
23	RECEPTACLES		720			20	1			C	20	1		720			RACK	24
25	RECEPTACLES		720			20	1	A			20	1					SPARE	26
27	RECEPTACLES		720			20	1		B		20	1					SPARE	28
29	SPARE					20	1			C	20	1					SPARE	30
31	SPARE					20	1	A			20	1		950			PROJECTOR	32
33	SPARE					20	1		B		20	1		720			RECEPTACLES	34
35	SPARE					20	1			C	20	1		720			BSP	36
37	SPARE					20	1	A			20	1		360			MONITOR	38
39	SPARE					20	1		B		20	1					SPARE	40
41	SPARE					20	1			C	20	1					SPARE	42

PANELBOARD NO: L1A

	LTS	REC	MECH	MISC	LTS	REC	MECH	MISC	
SUBTOTAL CONNECTED KVA	0.0	10.4	0.0	0.0	0.0	14.3	0.0	0.0	SUBTOTAL CONNECTED KVA
					0.0	24.7	0.0	0.0	TOTAL CONNECTED KVA

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DIF
PHASE A CONNECTED KVA	0.0	9.6	0.0	0.0	9.6	16.4
PHASE B CONNECTED KVA	0.0	7.9	0.0	0.0	7.9	-3.8
PHASE C CONNECTED KVA	0.0	7.2	0.0	0.0	7.2	-12.6
AVERAGE PHASE CONNECTED KVA					8.2	

LOAD SUMMARY & FEEDER CALCULATION

LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL	
0.0	24.7	0.0	0.0	24.7	25		CONNECTED KVA
1.0	#1	1.0	1.0		%		DEMAND FACTOR
0.0	17.4	0.0	0.0	17.4	4.3	21.7	DEMAND KVA
						60.2	DEMAND AMPS
1.25	1.0	1.0	1.0		1.0		CONT / NON-CONT FACTOR
						0.80	ADJ FACTOR (NOTE 8, TABLE 310-16)
						1.00	CORR FACTOR (OTHER THAN 30 DEG C)
						72.3	MIN. OVERCURRENT DEVICE AMPS
						72.3	MIN. COND. AMPS PER TERM RATING
						75.3	MIN. COND. AMPS PER INS RATING

RECEPTACLE DEMAND FACTOR:
#1 OTHER THAN HOSPITAL - 100% FIRST 10 KVA + 50% REMAINI
#2 HOSPITAL - 40% OF FIRST 50KVA + 20% OF REMAINING

PANELBOARD NO: L2

SECTION: 1 OF 1 | MOUNTING: SURFACE | POLES: 42 | LOCATION: ELECTRICAL RM
VOLTAGE: 120/208V | PHASE: 3 | WIRE: 4 | 200% NEUTRAL: NO | GROUND BUS: YES
BUS: 225A | MAIN: MLO | INTERRUPTING RATING: 10 KAIC | ELECTRONIC GRADE PANEL: NO | ISOLATED GROUND BUS: NO

CKT NO.	DESCRIPTION	LTS	REC	MECH	MISC	AMPS	POLES				AMPS	POLES	LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
1	RECEPTACLES		900			20	1	A			20	1		540			RECEPTACLES	2
3	RECEPTACLES		1080			20	1		B		20	1		540			RECEPTACLES	4
5	RECEPTACLES		720			20	1			C	20	1		540			RECEPTACLES	6
7	RECEPTACLES		720			20	1	A			20	1		900			RECEPTACLES	8
9	RECEPTACLES		720			20	1		B		20	1		1440			RACK	10
11	RECEPTACLES		720			20	1			C	20	1		1440			RACK	12
13	RECEPTACLES		720			20	1	A			20	1		720			RECEPTACLES	14
15	RECEPTACLES		720			20	1		B		20	1		720			RECEPTACLES	16
17	RECEPTACLES		720			20	1			C	20	1		720			RECEPTACLES	18
19	RECEPTACLES		720			20	1	A			20	1		540			ROOF RECEPTACLES	20
21	RECEPTACLES		1080			20	1		B		20	1		696			EF-1	22
23	RECEPTACLES		720			20	1			C	20	1		1440			RECEPTACLES	24
25	RECEPTACLES		720			20	1	A			20	1		720			PRINTER	26
27	RECEPTACLES		720			20	1		B		20	1		540			RECEPTACLES	28
29	RECEPTACLES		720			20	1			C	20	1		900			PROJECTOR	30
31	RECEPTACLES		720			20	1	A			20	1		900			PROJECTOR	32
33	RECEPTACLES		1440			20	1		B		20	1		720			RECEPTACLES	34
35	RECEPTACLES		720			20	1			C	20	1		500			SCREENS	36
37	RECEPTACLES		720			20	1	A			20	1		720			I.T.	38
39	VENDING		500			20	1		B		20	1					SPARE	40
41	VENDING		500			20	1			C	20	1					SPARE	42

PANELBOARD NO: L2

	LTS	REC	MECH	MISC	LTS	REC	MECH	MISC	
SUBTOTAL CONNECTED KVA	0.0	16.3	0.0	0.0	0.0	15.2	0.0	0.0	SUBTOTAL CONNECTED KVA
					0.0	31.5	0.0	0.0	TOTAL CONNECTED KVA

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DIF
PHASE A CONNECTED KVA	0.0	10.3	0.0	0.0	10.3	-2.4
PHASE B CONNECTED KVA	0.0	10.9	0.0	0.0	10.9	3.8
PHASE C CONNECTED KVA	0.0	10.4	0.0	0.0	10.4	-1.4
AVERAGE PHASE CONNECTED KVA					10.5	

LOAD SUMMARY & FEEDER CALCULATION

LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL	
0.0	31.5	0.0	0.0	31.5	25		CONNECTED KVA
1.0	#1	1.0	1.0		%		DEMAND FACTOR
0.0	20.8	0.0	0.0	20.8	5.2	26.0	DEMAND KVA
						72.1	DEMAND AMPS
1.25	1.0	1.0	1.0		1.0		CONT / NON-CONT FACTOR
						0.80	ADJ FACTOR (NOTE 8, TABLE 310-16)
						1.00	CORR FACTOR (OTHER THAN 30 DEG C)
						86.5	MIN. OVERCURRENT DEVICE AMPS
						86.5	MIN. COND. AMPS PER TERM RATING
						90.1	MIN. COND. AMPS PER INS RATING

RECEPTACLE DEMAND FACTOR:
#1 OTHER THAN HOSPITAL - 100% FIRST 10 KVA + 50% REMAINI
#2 HOSPITAL - 40% OF FIRST 50KVA + 20% OF REMAINING

PANELBOARD NO: S1

BREAKERS TO BE SWITCH RATED

SECTION: 1 OF 1 | MOUNTING: SURFACE | POLES: 42 | LOCATION: STUDIO
VOLTAGE: 120/208V | PHASE: 3 | WIRE: 4 | 200% NEUTRAL: NO | GROUND BUS: YES
BUS: 225A | MAIN: 200A MCB | INTERRUPTING RATING: 10 KAIC | ELECTRONIC GRADE PANEL: NO | ISOLATED GROUND BUS: NO

CKT NO.	DESCRIPTION	LTS	REC	MECH	MISC	AMPS	POLES				AMPS	POLES	LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
1	GRID POWER		1440			20	1	A			20	1		1440			GRID POWER	2
3	GRID POWER		1440			20	1		B		20	1		1440			GRID POWER	4
5	GRID POWER		1440			20	1			C	20	1		1440			GRID POWER	6
7	GRID POWER		1440			20	1	A			20	1		1440			GRID POWER	8
9	GRID POWER		1440			20	1		B		20	1		1440			GRID POWER	10
11	GRID POWER		1440			20	1			C	20	1		1440			GRID POWER	12
13	GRID POWER		1440			20	1	A			20	1		1440			GRID POWER	14
15	GRID POWER		1440			20	1		B		20	1		1440			GRID POWER	16
17	GRID POWER		1440			20	1			C	20	1		1440			GRID POWER	18
19	GRID POWER		1440			20	1	A			20	1		1440			GRID POWER	20
21	GRID POWER		1440			20	1		B		20	1		1440			GRID POWER	22
23	GRID POWER		1440			20	1			C	20	1		1440			GRID POWER	24
25	GRID POWER		1440			20	1	A			20	1		1440			GRID POWER	26
27	GRID POWER		1440			20	1		B		20	1		1440			GRID POWER	28
29	GRID POWER		1440			20	1			C	20	1		1440			GRID POWER	30
31	GRID POWER		1440			20	1	A			20	1		1440			GRID POWER	32
33	GRID POWER		1440			20	1		B		20	1		1440			GRID POWER	34
35	GRID POWER		1440			20	1			C	20	1		1440			GRID POWER	36
37	WALL BOX		1440			20	1	A			20	1		1440			WALL BOX	38
39	WALL BOX		1440			20	1		B		20	1		1440			WALL BOX	40
41	WALL BOX		1440			20	1			C	20	1		1440			WALL BOX	42

PANELBOARD NO: S1

SECTION: 2 OF 2 | MOUNTING: SURFACE | POLES: 42 | LOCATION: STUDIO
VOLTAGE: 120/208V | PHASE: 3 | WIRE: 4 | 200% NEUTRAL: NO | GROUND BUS: YES
ENGINEER: | BUS: 225A | MAIN: 200A MCB | INTERRUPTING RATING: 10 KAIC | ELECTRONIC GRADE PANEL: NO | ISOLATED GROUND BUS: NO

CKT NO.	DESCRIPTION	LTS	REC	MECH	MISC	AMPS	POLES				AMPS	POLES	LTS	REC	MECH	MISC	DESCRIPTION	CKT NO
43	WALL BOX		1440			20	1	A			20	1		1440			WALL BOX	44
45	WALL BOX		1440			20	1		B		20	1		1440			WALL BOX	46
47	WALL BOX		1440			20	1			C	20	1		1440			WALL BOX	48
49	SPARE					20	1	A			20	1					SPARE	50
51	SPARE					20	1		B		20	1					SPARE	52
53	SPARE					20	1			C	20	1					SPARE	54
55	SPARE					20	1	A			20	1					SPARE	56
57	SPARE					20	1		B		20	1					SPARE	58
59	SPARE					20	1			C	20	1					SPARE	60
61	SPARE					20	1	A			20	1					SPARE	62
63	SPARE					20	1		B		20	1					SPARE	64
65	SPACE									C							SPACE	66
67	SPACE							A									SPACE	68
69	SPACE								B								SPACE	70
71	SPACE									C							SPACE	72
73	SPACE							A									SPACE	74
75	SPACE								B								SPACE	76
77	SPACE									C							SPACE	78
79	SPACE							A									SPACE	80
81	SPACE								B								SPACE	82
83	SPACE									C							SPACE	84

PANELBOARD NO: S1

	LTS	REC	MECH	MISC	LTS	REC	MECH	MISC	
SUBTOTAL CONNECTED KVA	0.0	30.2	0.0	0.0	0.0	30.2	0.0	0.0	SUBTOTAL CONNECTED KVA
					0.0	60.5	0.0	0.0	TOTAL CONNECTED KVA
SUBTOTAL CONNECTED KVA	0.0	4.3	0.0	0.0	0.0	4.3	0.0	0.0	SUBTOTAL CONNECTED KVA
					0.0	8.6	0.0	0.0	TOTAL CONNECTED KVA

PHASE BALANCE

	LTS	REC	MECH	MISC	TOTAL	% DIF
PHASE A CONNECTED KVA	0.0	23.0	0.0	0.0	23.0	0.0
PHASE B CONNECTED KVA	0.0	23.0	0.0	0.0	23.0	0.0
PHASE C CONNECTED KVA	0.0	23.0	0.0	0.0	23.0	0.0
AVERAGE PHASE CONNECTED KVA					23.0	

LOAD SUMMARY & FEEDER CALCULATION

LTS	REC	MECH	MISC	SUBTOT	SPARE	TOTAL	
0.0	69.1	0.0	0.0	69.1	25		CONNECTED KVA
1.0	#1	1.0	1.0		%		DEMAND FACTOR
0.0	39.6	0.0	0.0	39.6	9.9	49.5	DEMAND KVA
						137.3	DEMAND AMPS
1.25	1.0	1.0	1.0		1.0		CONT / NON-CONT FACTOR
						0.80	ADJ FACTOR (NOTE 8, TABLE 310-16)
						1.00	CORR FACTOR (OTHER THAN 30 DEG C)
						164.7	MIN. OVERCURRENT DEVICE AMPS
						164.7	MIN. COND. AMPS PER TERM RATING
						171.6	MIN. COND. AMPS PER INS RATING

RECEPTACLE DEMAND FACTOR:
#1 OTHER THAN HOSPITAL - 100% FIRST 10 KVA + 50% REMAINI
#2 HOSPITAL - 40% OF FIRST 50KVA + 20% OF REMAINING

2 ELECTRICAL PANEL SCHEDULES

NTS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY
WICHITA FALLS, TEXAS
1922

ADDENDUM 01 10/07/2015
ADDENDUM 02 10/21/2015

No. | Date
Revisions

Project No.
15.00493.80

Drawn

Architect

Checked

STATE OF TEXAS
JAMES R. MEYER
58610
LICENSED PROFESSIONAL ENGINEER
3-7-16

Approved

Engineer

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title:
ELECTRICAL PANEL SCHEDULES

Scale: AS INDICATED

Drawing No.
E-401A

Issue Date
09.21.15 BID DOCUMENTS
10.07.15 ADDENDUM 01
10.21.15 ADDENDUM 02

CONTRACT DOCUMENTS

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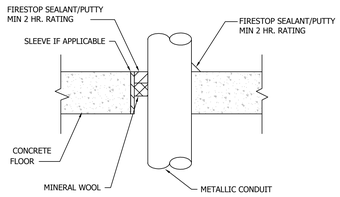
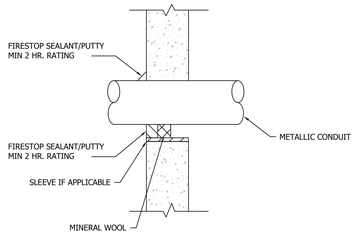
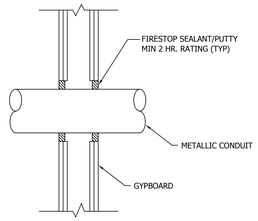


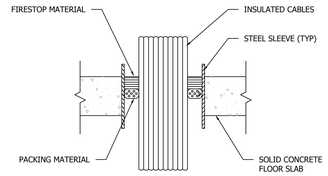
1 E-402 CONTINUOUS METALLIC CONDUIT FLOOR PENATRATION AT CONCRETE
NO SCALE



2 E-402 CONTINUOUS METALLIC CONDUIT WALL PENATRATION AT CONCRETE
NO SCALE

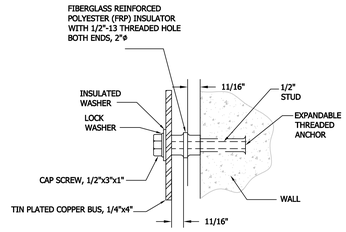


3 E-402 CONTINUOUS METALLIC CONDUIT WALL PENATRATION AT GYPBOARD FIRESTOPPING DETAIL
NO SCALE

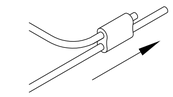


* NON-HARDENING RE-ENTERABLE PUTTY BY STI IS ACCEPTABLE.

4 E-402 FIRESTOPPING FOR CONCRETE FLOOR TELECOMMUNICATIONS DETAIL (TYP)
NO SCALE



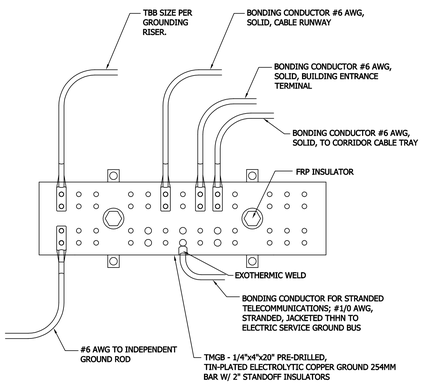
5 E-402 GROUND BUS MOUNTING DETAIL
NO SCALE



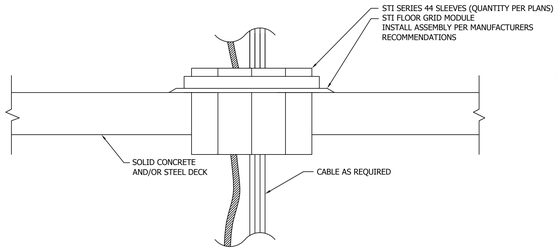
NOTES:

1. C-CLAMPS SHALL ALWAYS BE INSTALLED IN THE DIRECTION OF CURRENT FLOW.

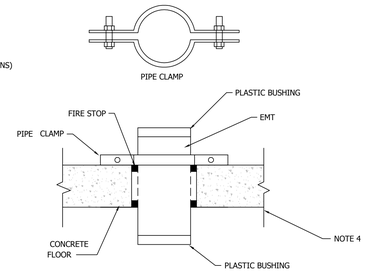
6 E-402 C-CLAMP DETAIL
NO SCALE



9 E-402 TMGB DETAIL
NO SCALE



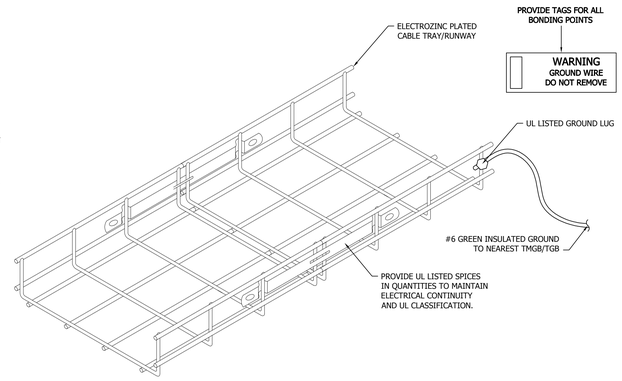
10 E-402 EZ PATH FIRESTOP DETAIL AT CONCRETE FLOOR
NO SCALE



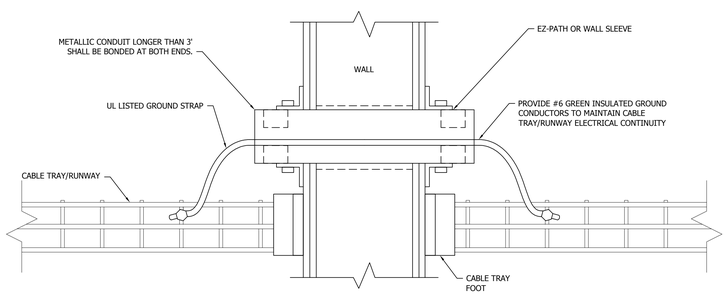
NOTES:

1. CLEAN CORE DRILL, ONE SIZE LARGER THAN SLEEVE SIZE.
2. PACK VOID BETWEEN SLEEVE AND CONCRETE FLOOR W/NON-SHRINK, WATER TIGHT, FIRE-RATED GROUT.
3. EXTEND SLEEVE 3" ABOVE AND BELOW CONCRETE FLOOR AND SUPPORT
4. CONSIDER ALL FLOORS MINIMUM 2 HOUR FIRESTOP RATING.
5. INSTALL PROPER FIRESTOP MATERIAL IN SLEEVE AND AROUND CABLES. WITH PIPE CLAMP ON THE TOP, OR OTHER APPROVED MEANS.

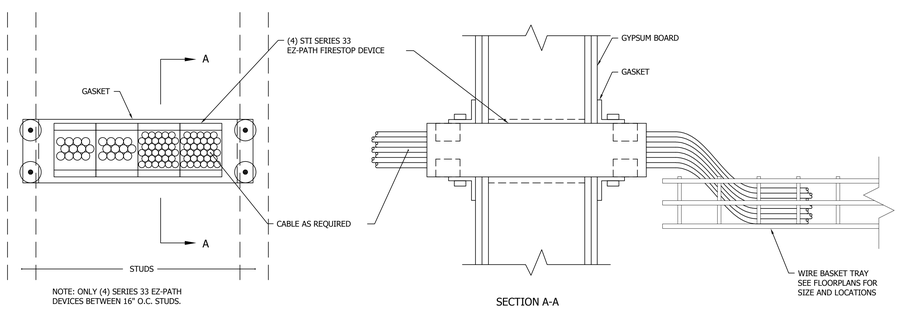
11 E-402 TYPICAL FLOOR SLEEVE PENETRATION DETAIL
NO SCALE



13 E-402 CABLE TRAY/RUNWAY SPLICING AND BONDING DETAIL
NO SCALE



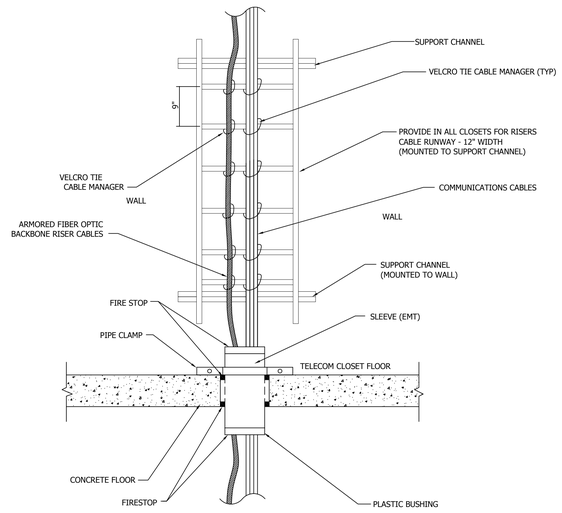
14 E-402 CABLE TRAY/RUNWAY BONDING THROUGH SLEEVE DETAIL
NO SCALE



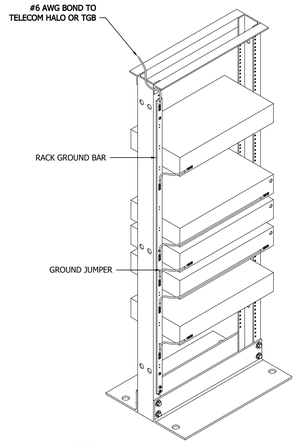
NOTES:

1. TYPE OF SLEEVE AND QUANTITY PER PLANS. EZ PATH SLEEVES ARE 3"x3"x10.5". MAX PATH SLEEVES ARE 4"x4-5/8"x14".
2. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
3. SYSTEMS SHALL BE UL1479 LISTED.

17 E-402 GANGED STI EZ-PATH FIRESTOP DETAIL AT GYPBOARD
NO SCALE



15 E-402 TYPICAL VERTICAL RISER TO TELECOMMUNICATIONS CLOSET DETAIL
NO SCALE



NOTE:
PROVIDE HORIZONTAL OR VERTICAL RACK BUS BAR PER THE ELEVATION DRAWINGS AND SPECIFCATION.

16 E-402 RACK GROUNDING DETAIL
NO SCALE

CONTRACT DOCUMENTS

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Colt Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

MIDWESTERN STATE UNIVERSITY 1922 WICHITA FALLS, TEXAS

No.	Date
Revisions	

Project No. 15.00493.80
Drawn
Architect
Checked
Approved
Engineer

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 9-1-16

Key:

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CONSTRUCTION DOCUMENTS

Title: DETAILS - TELECOM

Scale: AS INDICATED

Drawing No.
E-402

Issue Date
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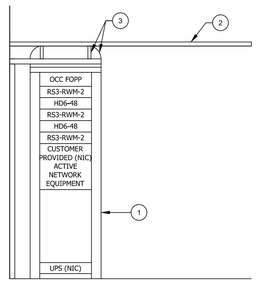
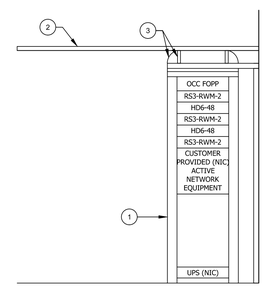


1 E-403 RACK ELEVATION IT ROOM 122
NO SCALE

KEYED NOTES:

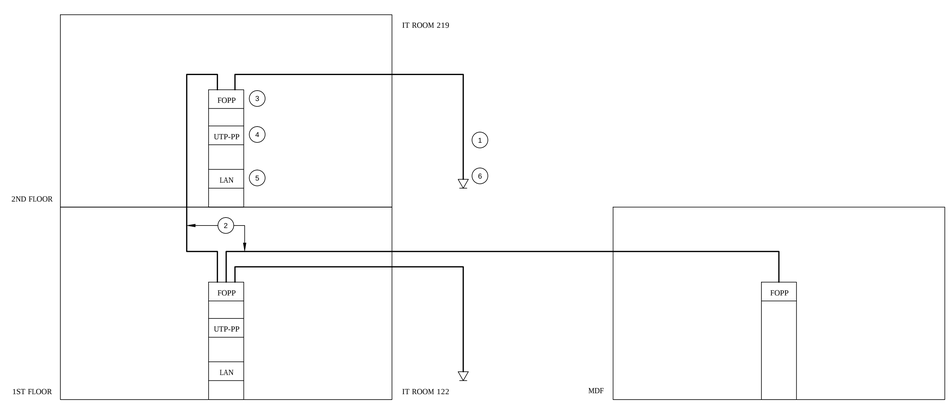
1. PROVIDE SIEMON RS 3-07.
2. PROVIDE 12" LADDER RUNWAY 7'-6" AFF.
3. PROVIDE RUNWAY SUPPORTS AND WATERFALLS.



2 E-403 RACK ELEVATION IT ROOM 219
NO SCALE

KEYED NOTES:

1. PROVIDE SIEMON RS 3-07.
2. PROVIDE 12" LADDER RUNWAY 7'-6" AFF.
3. PROVIDE RUNWAY SUPPORTS AND WATERFALLS.



3 E-403 SCHEMATIC DATA RISER DIAGRAM
NO SCALE

KEYED NOTES:

1. HORIZONTAL CAT6 UTP DROP (SIEMON 9C6P4-E4-(XX)-RBA). 2
2. PROVIDE 12 STRAND OS2 AND 12 STRAND OM3 HYBRID CABLE CMP.
3. FIBER OPTIC PATCH PANEL. (OCC).
4. CAT 6 PATCH PANEL. (SIEMON HD6-48). 2
5. LAN EQUIPMENT (NIC). 2
6. SIEMON ANGLED CAT 6 JACK (MX6-XX0, FACEPLATE (MX-FP-S-01-XX)).

CONTRACT DOCUMENTS

REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
214.522.7337 main

AN EMPLOYEE-OWNED FIRM
ARCHITECTURE PLANNING INTERIORS

Contractor
BTC
Buford Thompson Company
Jimmy Birdwell
817.262.5208
P.O. Box 151829
Fort Worth, Texas 76108

Civil Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Structural Engineer
JQ Infrastructure, LLC
John Hoening
214.152.9098
2105 Commerce Street
Dallas, Texas 75201

Mechanical, Electrical, Plumbing Engineer
Brinjac Engineering
Bob Castro
972.644.8830
Church Tower
12400 Coit Road
Dallas, Texas 75251

Broadcast Systems
The Systems Group
Scott G. Griffin
201.795.4672
317 Newark Street
Hoboken, New Jersey 07030

Construction Cost Estimates
Riddle & Goodnight, Inc.
Richard Riddle
817.461.9192
1602 Stagecoach Dr
Arlington, Texas 76013

No.	Date
1	ADDENDUM 01 10/07/2015
2	ADDENDUM 02 10/21/2015

Revisions

Project No. 15.00493.80

Drawn

Architect

Checked

Approved

Engineer

STATE OF TEXAS JAMES R. MEYER 58610 LICENSED PROFESSIONAL ENGINEER 3-7-16

Key:

PLAN NORTH NORTH

CONSTRUCTION DOCUMENTS

Title:
ELEVATIONS AND RISER DIAGRAM - TELECOM

Scale: AS INDICATED

Drawing No.
E-403

Issue Date
09.21.15 BID DOCUMENTS
10.07.15 ADDENDUM 01
10.21.15 ADDENDUM 02

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Studio Lighting Grid Mounting Hardware System

Midwestern State University in constructing a 30’X40’ broadcast production studio. The studio will include a studio lighting pipe grid hardware system that will support a series of LED light fixtures, accessories, and control panel.

This scope of work includes a system that consists of the following materials and installation: pipe grid; the structural attachments necessary to support the pipe grid; electrical distribution; curtains and track. All components shall be designed and engineered for the specific loading of the building ceiling structure.

The complete grid hardware system is comprised of all necessary equipment for mounting and support of the overhead lighting equipment for the video/film industry. The overhead lighting equipment is not include in this scope of work.

Contractor will be required to coordinate installation of lighting grid mounting system with other trades constructing the studio.

SECTION 11 61 50

TELEVISION STUDIO EQUIPMENT / LIGHTING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and noted Divisions and Specification sections, apply to work of this section.

SUMMARY

Types of Television Studio Equipment specified in this section include the following:

Walk Along Cyclorama and Background Curtains and Track Hardware.

Extent of Television Studio Equipment to be as delineated on drawing Sheet **TV.1**, and is to be coordinated with the other equipment requirement of this division and TV Studio equipment drawings.

SUBMITTALS:

Product Data, installation instructions, and general recommendations, including data which substantiates that materials comply with requirements.

Certification that Television Studio curtains comply with requirements for flame resistance.

Shop Drawings including plans, elevations, and detail sections of typical rigging elements. Show anchors, hardware, operating equipment, and other components not included in manufacturer's standard product data.

Shop Drawings shall indicate all major components and the methods of assembly. All assemblies shall include weights, dimensions, capacities and loads imposed by all components.

Samples for initial selection in form of fabric manufacturer's 12-inch square physical sample for cyclorama and background curtain fabric required.

QUALITY ASSURANCE

Fabricator/Installer Qualifications: Firm with not less than five years of successful experience in fabrication and installation of Television Studio Equipment similar to those required for this project.

Flame Resistance Requirements: Provide Television Studio curtains, which are certified to be flame resistant in accordance with requirements of Reg. No. A-358-NFPA 701 Small Scale approved after 10 Solvent Dry Cleanings and BOCA section 922.5.3, 1987 edition, Class II flame spread, 26 - 75. Permanently attach label to each curtain indicating treatment.

WARRANTY:

The Contractor shall guarantee all materials and workmanship furnished for a period of one year after the date of final acceptance. The Contractor shall repair or replace any and all material found to be defective within this time period.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Manufacturers: Subject to compliance with requirements, provide products by the following:

Integrated Lighting Systems; Tulsa, Oklahoma, (877) 325-9400,
or equal approved by the Architect.

WALK ALONG STUDIO CYCLORAMA AND BACKGROUND CURTAIN

Seamless Linoweave Cyclorama: One (1) Curtain with Height at One Foot less than the pipe grid height and 80'-0" in length, fabricated with no seams. The Cloth shall be woven from napped fabric of 91 percent cotton, 9 percent polyester. The Curtain supplied shall have the following characteristics:

Construction: The Curtain shall be fabricated with an accuracy of plus or minus 1/2" per 1'-0" height and length. The top shall be sewn with 3-1/2" jute webbing and either eyelets with "S" hooks, eyelets with rope ties, or snap swivel hooks as required for the installation. Each side shall have eyelets on approximate two-foot (2'-0") centers beginning four inches (4") from the top and bottom, and fastened through 3-1/1" jute webbing. The bottom hem of the webbing shall have a 2-1/2" hem with a separate muslin weighted pocket sewn inside this hem. Within this muslin pocket, a double no. 90 continuous lead weight shall be "tacked" sewn. Tow cords shall be furnished to transport the curtain along the track.

Color: CBS Grey

WALK ALONG STUDIO CYCLORAMA AND BACKGROUND CURTAIN (CONT'D)

Velour Background: Two (2) Curtains with Height at One Foot less than the pipe grid height and 45'-0" in length, fabricated with no pleats. The Cloth shall be woven from 16 oz velour napped fabric. Material

can be Inherently Flame Resistant (IFR) or Treated Flame Resistant 100% cotton to withstand 10 dry cleanings. The Curtain supplied shall have the following characteristics:

Construction: The Curtain shall be fabricated with an accuracy of plus or minus 1/2" per 10'-0" height and length. The top shall be sewn with 3-1/2" jute webbing and either eyelets with "S" hooks, eyelets with rope ties, or snap swivel hooks as required for the installation. The bottom hem of the webbing shall have a 2-1/2" hem with a separate muslin weighted pocket sewn inside this hem. Within this muslin pocket, a double no. 90 continuous lead weight shall be "tacked" sewn. Tow cords shall be furnished to transport the curtain along the track.

Color: Black

Cyclorama Track and Hardware: Provide dual curtain track system around the limited perimeter of the proposed TV Studio, **Room 110**, as indicated on Sheet TV.1 of the Contract Drawings. Track shall be extruded aluminum bar having a cross section of 2" O.D. in height, 5/8" O.D. in width. The extrusion shall form an "I" Beam with an additional cross section width of 5/8" beginning 5/8" from the track top for horizontal stability. All cross section wall thickness shall be 1/8".

Track is to be supplied in the longest sections possible. Track radiuses shall be supplied in quarter circles. Bent sections shall be rolled. The sections will come in radii, 4’-6”.

Carrier housing shall be of extruded aluminum with the cross section at the bottom having a 1-3/8" O.D. width, and 1" at the top giving an outward spread to properly align the wheels to the bottom track cross-section which has an angle located at the bottom cross-section to align the carrier wheels, and to keep the carriers parallel to the track. Wheels are to be constructed of nylon, and are to be assembled on ball bearings. Housing for the wheels is 1" wide with the wheels mounted within this dimension to serve as a bumper. Trim chain is to be 8" in length and is assembled through the 1/2" bottom housing extrusion, and is to be 1/8" in cross sectional thickness.

Provide brackets for attachment to pipe grid for track suspension. . See detail drawings of these brackets.

Tauting Poles: Provide One (1) Pair of tauting poles as an accessory to taut the cyclorama curtain from side to side assuring a wave-free vertical surface, in conjunction with the curtain weight, assuring a wave-free horizontal surface. Tauting poles supplied shall have the following characteristics:

Construction: Tauting poles shall be supplied at the same height as the cyclorama curtain. Poles shall be fabricated from extruded "T" Bar aluminum to a specification of 3/16" thick, by 2-1/2" across the top and 2-1/2" at the stem of the "T". Each "T" Bar is fitted with a 1-1/2" steel square tubed base and cadmium plated, one left and one right. The ends of the tubing are capped with end plugs. The "T" bar and base assemblies are factory fitted with a guy wire and turnbuckle to assure exact vertical height of the "T" bar.

Eyelet claws are used to taut the cyclorama curtain by attaching them to the tauting poles. Eyelet claw assembly consists of claw base made from 1/8" x 1" steel strap and formed in a "U" shape with notches formed to fit the pole "T" bar. Each claw is to be secured by a carriage bolt, washer and

wig nuts. The claw itself is made from 1/4" round steel with the end formed to hook through the curtain eyelets. The other end is threaded 6", therefore, by adjusting the wing nuts through the end of the claw base, the curtain can aligned perfectly vertical.

Provide two (2) saddlebag type sand bags. Bags are to be fabricated from rigid duck cloth with plastic inserts, and shall be guaranteed against the leakage of sand. Plastic liner bags shall be fabricated as to allow the liners to be removed, filled, and reinserted, in each side of the bags through the use of Velcro fasteners. Both bags shall be wrapped and sewn with heavy-duty nylon straps to support the sand bag system. Each sand bag shall be supplied with a carrying strap.

METAL PRODUCTS

Hardware: All suspension support hardware shall be 2” muffler clamps with a 1” bar welded to the bottom and have cadmium or similarly plated track clamps. All bolts shall extend a minimum of two threads beyond the nut. Self-locking nuts are approved.

All components shall be fabricated to resist rust and corrosion. Consideration of the job site environment during installation and storage will dictate measures to insure that all equipment and metal fabrications are free of rust at the time of final acceptance. Rust shall be removed from all metal components at the time of final acceptance at **no** additional cost to the Owner. All metal components shall receive a coat of rust inhibiting primer prior to component assembly. All assemblies shall receive a finish coat of paint.

PART 3 - EXECUTION

PREPARATION

Furnish layouts for inserts, clips, or other supports required to be installed for support of tracks and battens.

INSTALLATION

General: Install materials in accordance with manufacturer's printed instructions and recommendations, and to comply with governing regulations.

Tracks:

Pipe-Hung: Install track by suspending from steel pipe grid with manufacturer's special clamps at recommended spacing, not to exceed
6’-0” on center.

Curtains:

Track-Hung: Secure curtains to track carriers with track manufacturer's special heavy-duty "S" hooks or snap hooks.

.END OF SECTION

Integrated Lighting Systems
ILS
6943 E. 12th Street
Tulsa, Oklahoma 74112
Phone: (918) 523-9400
Toll Free: (877) 325-9400
Fax: (918) 523-9401

MIDWESTERN STATE UNIVERSITY
PIPEGRID HARDWARE SYSTEM

The complete grid hardware system is comprised of all necessary equipment for mounting and support of the overhead lighting equipment for the video/film industry.

The BASE BID system consists of the structural attachments necessary to support the pipe grid; electrical distribution; curtains and track. All components shall be designed and engineered for the specific loading of the building ceiling structure.

Integrity of the grid hardware system shall ultimately be the responsibility of the contractor in properly installing the system as designed.

Variations in the design during installation should be coordinated with the original design group.

Specific parameters of the components are as follows:

1. Designated structural attachments shall be installed to the building for uniform support of the grid suspension. The steel channel specified should allow for movable suspension support points as required.

2. Suspension from the structural attachments shall be made with 1/2" all-thread with all necessary hardware and length allowing leveling attachment of the grid.

3. Pipe grid is attached to the suspended all-thread with a bracket incorporating a U-bolt/muffler clamp assembly. The U-bolt shall be sized to a clamp up to a 2" O.D. pipe. The bracket is secured to the all-thread as design dictates. The U-bolt shall be secured to prevent movement of the bracket on the pipe.

4. The pipe grid utilizes steel pipe or steel tubing with a 1-1/2" I.D. Schedule 40 (2" O.D.) specification. The pipe grid is layout designed to form approximately 4' quadrants.

5. All pipe stock shall start with a smooth and unpainted surface. Pipes shall be cleaned from all rust, dirt, and oil, and then treated with a polymer black coat finish.

6. Provide necessary steel hardware fittings to lock cross pipes together, preventing any applied torque from spinning any part of the pipe system. Locking and unlocking of this hardware shall be made by a 5/8" set screw; and two set screws for the slip coupling at connecting pipes. Two pipes per each studio wall shall be attached to the wall by pipe flanges with locking set screw.

1 PIPEGRID LAYOUT
SCALE: 1/8" = 1'-0"

1 PIPEGRID LAYOUT
SCALE: 1/8" = 1'-0"

PIPE LEGEND:

1 PIPE LENGTH 13'-0"
2 PIPE LENGTH 14'-0"
3 PIPE LENGTH 16'-0"

2 CURTAIN TRACK LAYOUT
SCALE: 1/8" = 1'-0"

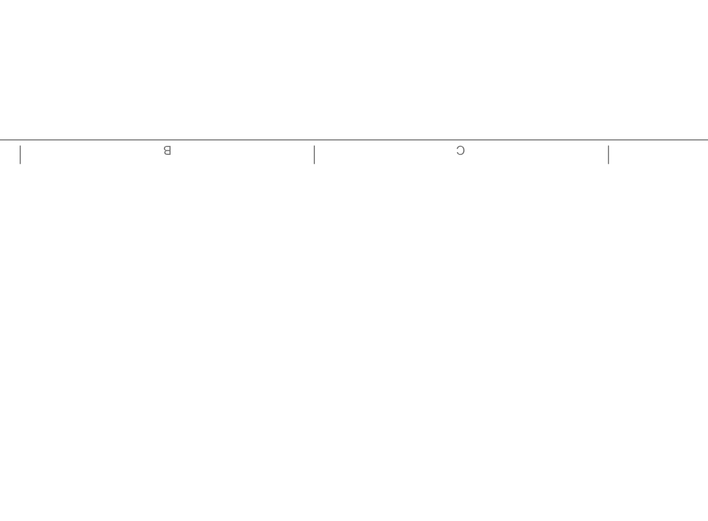
NOTES:

1. ALL TRACK WILL BE FIELD CUT AND SPLICED.

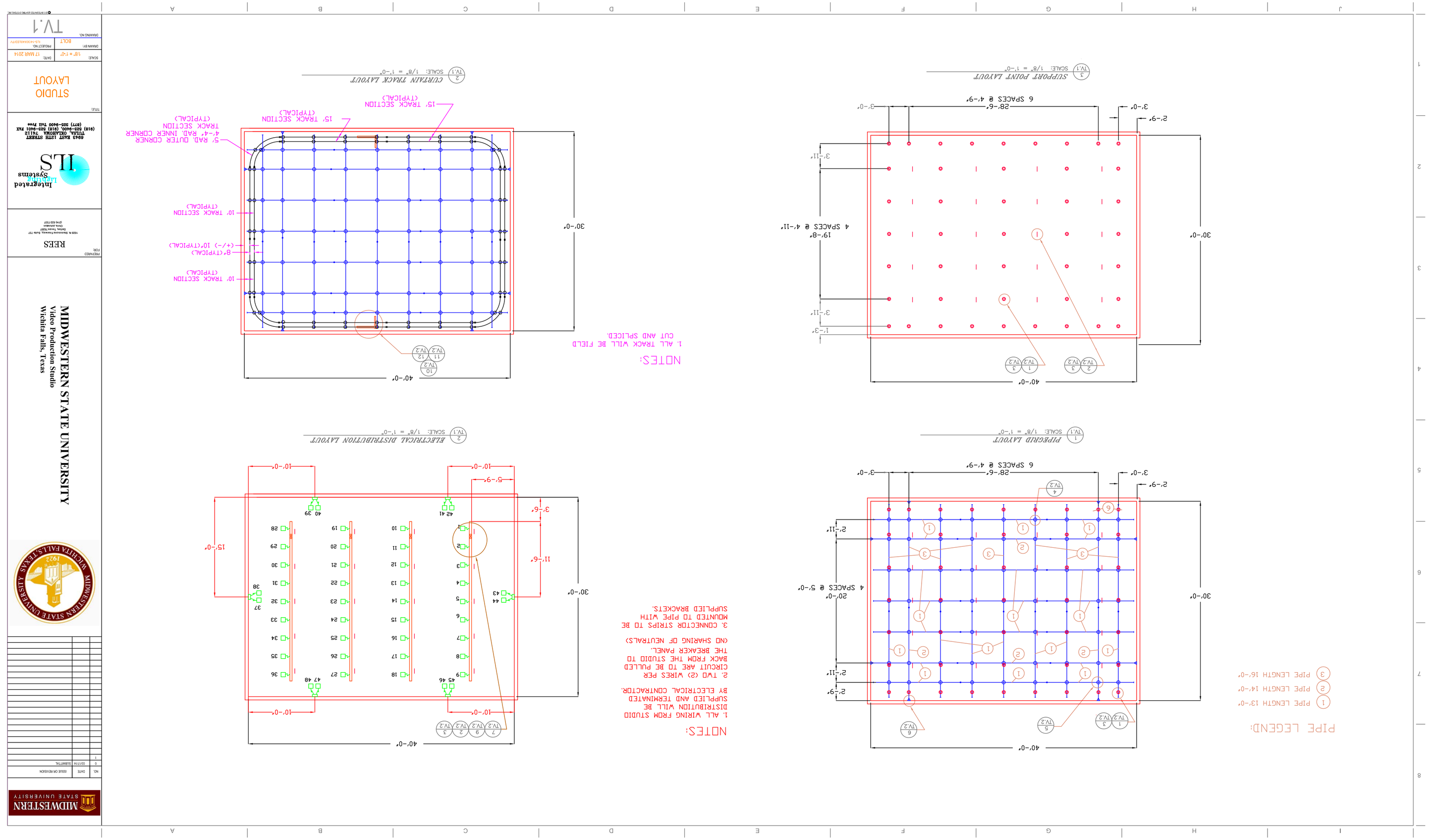
2 ELECTRICAL DISTRIBUTION LAYOUT
SCALE: 1/8" = 1'-0"

NOTES:

1. ALL WIRING FROM STUDIO DISTRIBUTION WILL BE SUPPLIED AND TERMINATED BY ELECTRICAL CONTRACTOR.
2. TWO (2) WIRES PER CIRCUIT ARE TO BE PULLED BACK FROM THE STUDIO TO THE BREAKER PANEL.
3. CONNECTOR STRIPS TO BE MOUNTED TO PIPE WITH SUPPLIED BRACKETS.
(NO SHARING OF NEUTRALS)



2 ELECTRICAL DISTRIBUTION LAYOUT
SCALE: 1/8" = 1'-0"



MIDWESTERN STATE UNIVERSITY
Video Production Studio
Wichita Falls, Texas

REES
PREPARED FOR
1020 N. Greenville Avenue, Suite 707
Dallas, Texas 75231
Chris Johnston
(214) 820-7707

Integrated Systems
ILS
6040 EAST 13TH STREET
TULSA, OKLAHOMA 74112
(918) 835-8400 (918) 835-8401 FAX
(877) 835-8400 TOLL FREE

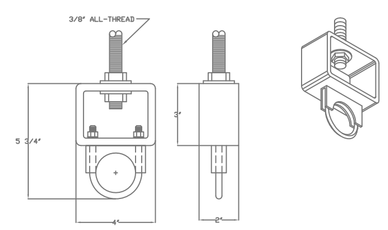
STUDIO LAYOUT

SCALE: 1/8" = 1'-0"
DATE: 17 MAR 2014
DRAWN BY: BCLT
PROJECT NO: 1000-0000-0000
DRAWING NO: TV.1

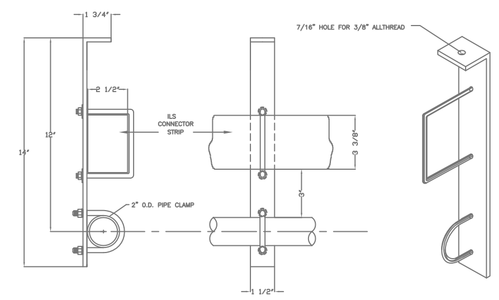
NO.	DATE	ISSUE OR REVISION
0	03/17/14	SUBMITTAL
1		

MIDWESTERN STATE UNIVERSITY

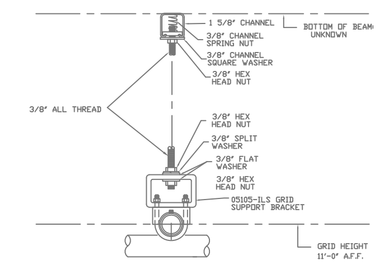
© REESTECHNOLOGIES 2014



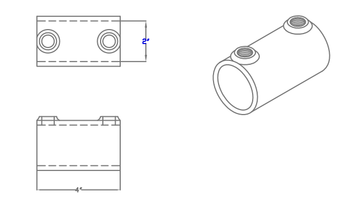
1 TV.1 GRID SUPPORT BRACKET



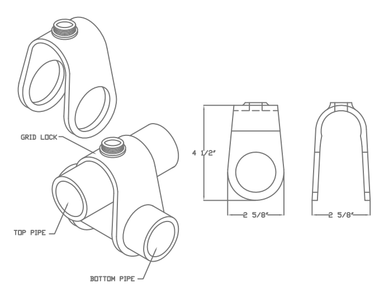
2 TV.1 CONNECTOR STRIP BRACKET



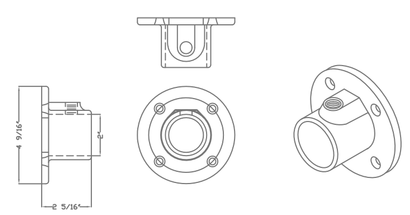
3 TV.1 GRID SUPPORT SUSPENSION DETAIL



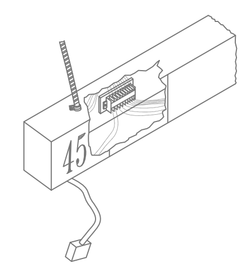
4 TV.1 PIPE SPLICE COUPLING



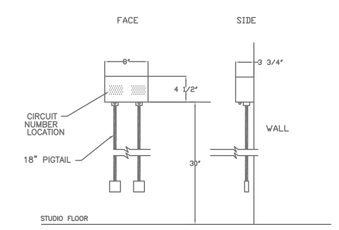
5 TV.1 CROSSOVER GRIDLOCK BRACKET



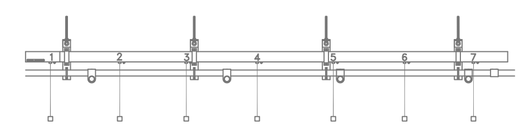
6 TV.1 WALL FLANGE BRACKET



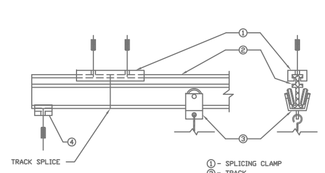
7 TV.1 TERMINAL COMPARTMENT DETAIL



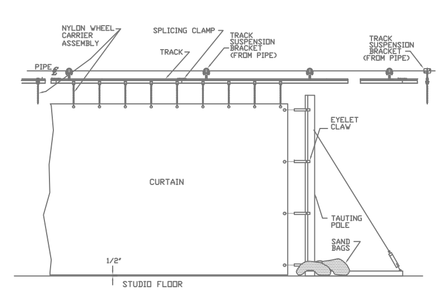
8 TV.1 WALLBOX ELEVATION



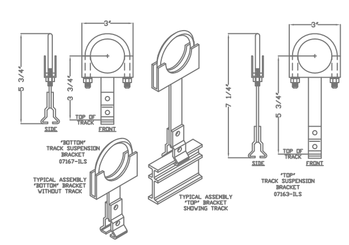
9 TV.1 CONNECTOR STRIP ELEVATION



10 TV.1 TRACK SPLICE AND CURTAIN CARRIER

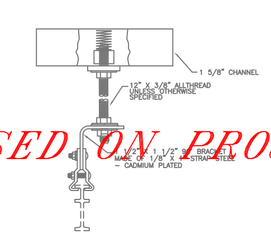


11 TV.1 CURTAIN AND TRACK ELEVATION



12 TV.1 TRACK SUSPENSION BRACKET

NOT USED ON PROJECT



13 TV.1 TRACK HANGING BRACKET

MIDWESTERN STATE UNIVERSITY

NO.	DATE	ISSUE OR REVISION
0	03/17/14	SUBMITTAL

MIDWESTERN STATE UNIVERSITY
Video Production Studio
Wichita Falls, Texas

PREPARED FOR:
REES
1628 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
Chris Johnson
(214) 522-7337

Integrated Lighting Systems
ILS
6043 EAST 12TH STREET
TULSA, OKLAHOMA 74112
(918) 523-9400, (918) 523-9401 FAX
(877) 325-9400 Toll Free

TITLE:
DETAIL DRAWINGS

SCALE: NO SCALE	DATE: 17 MAR 2014
DRAWN BY: BOLT	PROJECT NO: 13-1243WMSUSTV
DRAWING NO. TV.2	

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Studio Lighting Fixtures, Accessories, and Controls

Midwestern State University in constructing a 30’X40’ broadcast production studio. The studio will include a studio lighting pipe grid hardware system that will support a series of LED light fixtures, accessories, and control panel.

This scope of work includes the purchase and installation of the overhead lighting fixtures, accessories and control system outlined in the attached BOM and Lighting Control System Riser drawing.

BILL OF MATERIALS Date: 10/19/15

Qty	Model	Description

Studio Electrical Distribution Equipment/Grid Hardware & Accessories

STUDIO ELECTRICAL DISTRIBUTION EQUIPMENT

Connector Strips

4	CS190720D-ILS	Connector Strip Assembly (19'0") with (7) 20 Amp Circuits and 24" Pigtails. Terminal Compartment: (5) Right Hand. Plug Type: Edison Plug. Includes (5) Allthread Suspension Brackets Each.

Wall Boxes

6	05301-ILS	Wall Box with (2) 20 Amp Circuits. Taps. All with 18" Pigtails. Plug Type: Edison Plug. *Note: Studio Distribution Equipment is completely assembled with all hardware ready to suspend and to wire to the control system.*

GRID HARDWARE

140	05113-ILS	Beam Clamp, 3/8"
7	05119-ILS	All Thread Suspension Rod, 3/8" x 10'
14	05118-ILS	Load Channel, 20' Slotted Sections
43	05120-ILS	3/8" Load Channel Spring Nut
43	05121-ILS	3/8" Load Channel Square Locking Washer
189	05122-ILS	3/8" Hex Head Nut
126	05123-ILS	3/8" Flat Washer
63	05124-ILS	3/8" Lock Washer
20	05125-ILS	Connector Strip Bracket
43	05105-ILS	Grid Support Bracket
12	CLP-25-CH	Truss Clamps, Swivel
538	05107-ILS	Light Pipe: Black Polymer Finish Consisting of: (26) 13'0" x 1-1/2" I.D. Light Pipe (04) 14'0" x 1-1/2" I.D. Light Pipe (09) 16'0" x 1-1/2" I.D. Light Pipe
23	05270-ILS	Light Pipe Coupling, Threadless
8	05268-ILS	Wall Flange, Gasket
8	05271-ILS	Wall Flange, Threadless
63	05109-ILS	Gridlocks, 1-1/2" x 1-1/2"

Qty	Model	Description

Studio Electrical Distribution Equipment/Grid Hardware & Accessories - continued

CYCLORAMA AND BACKGROUND CURTAINS WITH ACCESSORIES

Cyclorama Curtain

1	CBS130800-ILS	**CBS Grey Seamless Lino Cyc** Curtain, 12'0" high x 80'0" long. This curtain has a 4" heavy-duty binding at the top with spring harness snaps on one foot centers. The 2-1/4" hem has #90 lead tape weight sewn 1" above the bottom of the hem in a separate muslin pocket. The side hems have a 2" heavy-duty binding with eyelets on two foot centers for tauting the curtain. The curtain is flameproofed and flawless (as per the standards of the mills and converters) and is fabricated to to the highest quality workmanship.

Cyclorama Curtain Accessories

1	07034-ILS	Cyc/Background Tow Cord Hardware (Pair)
4	07035-ILS	Tow Cord (Pair)
2	07013-ILS	Tauting Pole Base (One Left & One Right)
2	07019-ILS	13'0" Tauting Pole with Guy Wire and Turnbuckle
2	07029-ILS	Sand Bag, 50 lb. Size, Non-Spill Saddle Bag Type made of heavy-duty duck with inner liner and Velcro fasteners.
12	07031-ILS	Eyelet Claws to attach Tauting Pole to Cyc

Background Curtains

2	PVB130450-ILS	**Spectrocolor III, Princess Velour Black Background** Curtain 13'0" x High x 45'0" Long.
1	CKG130450-ILS	**Spectrocolor III, Chroma Key Green Background** Curtain 13'0" x High x 45'0" Long. This curtain has a 4" heavy-duty binding at the top and spring harness snaps on one foot centers. The 2-1/4" bottom hem has #90 lead tape weight sewn 1" above the bottom of the hem in a separate muslin pocket. The curtain is flawless (as per the standards of the material) and is fabricated to the highest quality workmanship. The Chroma Key curtain must be lined with a 100% black denim 11-1/2 ounces per yard and the Black curtain is fabricated from 16 ounce velour with both curtains meeting all fire codes.

Background Curtain Accessories

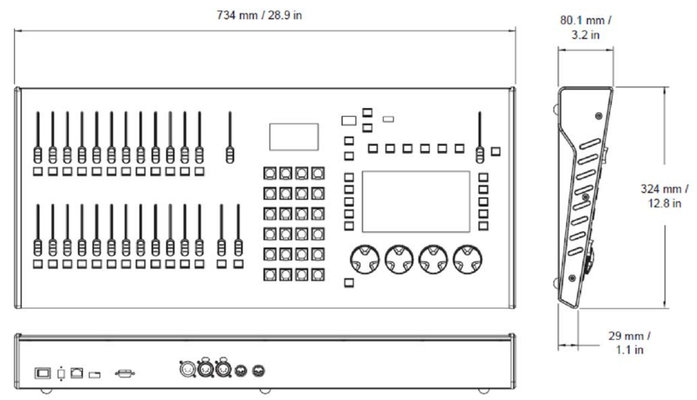
3	07034-ILS	Cyc/Background Tow Cord Hardware (Pair)
12	07035-ILS	Tow Cord (Pair)

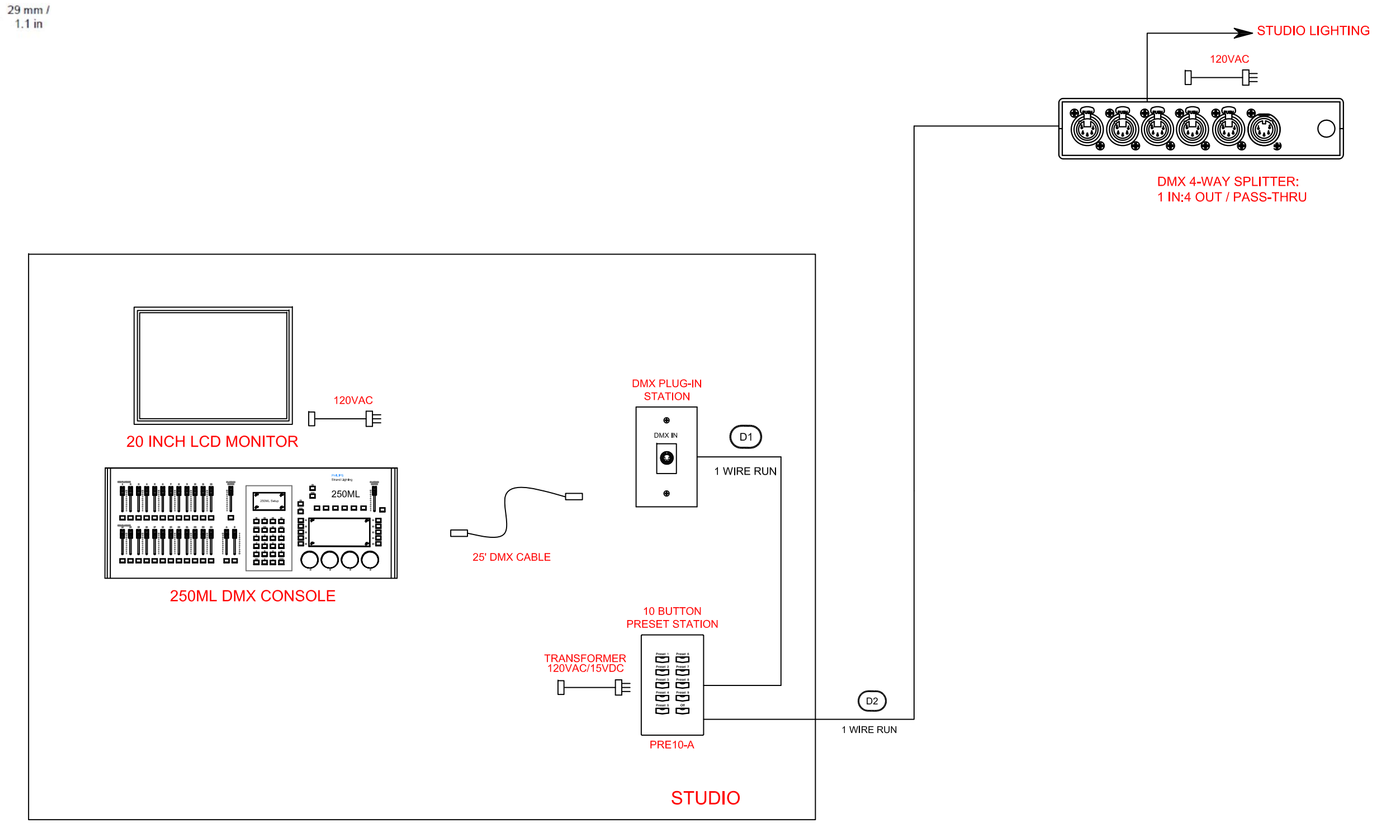
Qty	Model	Description

Studio Electrical Distribution Equipment/Grid Hardware & Accessories - continued

CYCLORAMA/BACKGROUND TRACK AND ACCESSORIES

12	07112-ILS	15' section of straight track
4	07114-ILS	9'0" radius , 1/4 circle corner track
4	07118-ILS	4'6" radius , 1/4 circle corner track
219	07128-ILS	Nylon Wheel Carrier with Bumper Assembly
20	07131-ILS	Splicing Clamp
		Track Suspension Brackets (Track to 1-1/2" I.D. Pipe)
28	07163-ILS	Top
4	07164-ILS	Top Corner Right
4	07165-ILS	Top Corner Left
20	07167-ILS	Bottom
4	07168-ILS	Bottom Corner Right
4	07169-ILS	Bottom Corner Left





WIRE LEGEND

D* - DMX - BELDEN #9729 - DAISY-CHAIN OR OPTO SPLIT ONLY

U* - UNISON - (1) BELDEN #8471 & (1) #14 AWG. - TOPOLOGY FREE

NOTES:

1. 1.) ALL CONTROL WIRING RUNS SHALL BE SUPPLIED BY OTHERS UNLESS OTHERWISE NOTED.
2. 2.) TOTAL LENGTH OF BELDEN WIRING RUNS SHALL NOT EXCEED 1500 FT.
3. 4.) DISTRIBUTION OMMITTED FOR CLAIRITY

NOTES:

1. (1) 25' DMX CABLES INCLUDED IN BASE PACKAGE
2. ALL CONDUIT, CABLE, MISC HARDWARE BY OTHERS
3. (2) WIRES PER CIRCUIT TO BE PULLED BACK TO DIMMER RACK (BY OTHERS)
4. TRAINING AND TURN ON PROVIDED FOR ADDITIONAL COST
5. LOW VOLTAGE TERMINATIONS BY OTHERS
6. SINGLE GANG BACK BOXES BY OTHERS

MIDWESTERN STATE UNIVERSITY

NO.	DATE	ISSUE OR REVISION
0	03/17/14	SUBMITTAL

MIDWESTERN STATE UNIVERSITY
Video Production Studio
Wichita Falls, Texas

PREPARED FOR:
REES
1025 N. Stemmons Freeway, Suite 737
Dallas, Texas 75207
(214) 522-7337

Integrated Lighting Systems
ILS
6043 EAST 12TH STREET
TULSA, OKLAHOMA 74112
(918) 523-9400, (918) 523-9401 FAX
(877) 325-9400 Toll Free

TITLE: LIGHTING CONTROL SYSTEM RISER

SCALE: NO SCALE	DATE: 17 MAR 2014
DRAWN BY: BOLT	PROJECT NO: 13-14-WCHARLEDITY

DRAWING NO: TV.3

© 2011 INTEGRATED LIGHTING SYSTEMS, INC.

BILL OF MATERIALS Date: 10/19/15

Qty	Model	Description

Studio Lighting Fixtures, Accessories, and Control System

LIGHTING FIXTURES AND ACCESSORIES

LED Fresnels

6	LT-V90-300.150/8BD-DI	55 Watt, 4-3/4" Magis LED 3200K Fresnel with DMX Input/Pass Thru, Power Con Connector.
	305.300-DI	Wireguard
	306.200-DI	Eight Leaf Barndoor
	307.100-DI	Color Frame
	5965VBLK-DI	PowerCon Input Cable, 10 ft, Edison Plug
	93.303-DI	C-Clamp
6	02710B-ILS	Safety Cable, Black
6	PWRCN20-AB-15-ILS	PowerCon Input/Output Power Daisy Chain, 15 ft.
6	AC5PDMX25-ILS	25' DMX Control Cable, 5-Pin XLR
8	LT-V90-310.110/8BD-DI	120 Watt, 6" LEO LED 3200K Fresnel with DMX Input/Pass Thru, Power Con Connector.
	315.300-DI	Wireguard
	316.200-DI	Eight Leaf Barndoor
	317.100-DI	Color Frame
	5965VBLK-DI	PowerCon Input Cable, 10 ft, Edison Plug
	93.210-DI	C-Clamp
8	02710B-ILS	Safety Cable, Black
8	PWRCN20-AB-15-ILS	PowerCon Input/Output Power Daisy Chain, 15 ft.
8	AC5PDMX25-ILS	25' DMX Control Cable, 5-Pin XLR
2	LT-V90-320.110/8BD-DI	150 Watt, 10" LEO LED 3200K Fresnel with DMX Input/Pass Thru, Power Con Connector.
	325.300-DI	Wireguard
	326.200-DI	Eight Leaf Barndoor
	327.100-DI	Color Frame
	5965VBLK-DI	PowerCon Input Cable, 10 ft, Edison Plug
	93.210-DI	C-Clamp
2	02710B-ILS	Safety Cable, Black
2	PWRCN20-AB-15-ILS	PowerCon Input/Output Power Daisy Chain, 15 ft.
2	AC5PDMX25-ILS	25' DMX Control Cable, 5-Pin XLR

LED Panels

24	TVL2000 II-EL	LED TV Panel Light. Cool and Warm White LED's to mix color color temperature. Includes 4 Way Barn Door and Color Frame and Edison Cable
24	400CC-ETC	C-Clamp, Black
24	02710B-ILS	Safety Cable, Black
24	AC5PDMX25PRO-ILS	25' DMX Control Cable, 5-Pin XLR
18	ECCOM-15-EL	15 ft. Extension Daisy Chain, IEC Male to Female

CYCLORAMA, SET & BACKGROUND LIGHTS

LED Cycs

8	PLCYC1-03-PC1-SL	PL Series RGBW LED C'yc Light with Safety Cable, DMX Control, Edison Plug and C-Clamp.
22	PLCYC1-03-PC1GR-SL	PL Series RGBW LED C'yc Light with Safety Cable, DMX Control, No Plug and C-Clamp.
30	PWRCN20-AB-5-ILS	PowerCon Input/Output Power Daisy Chain, 5ft.
30	AC5PDMX5-ILS	5' DMX Control Cable, 5-Pin XLR

Qty	Model	Description

Studio Lighting Fixtures, Accessories, and Control System - continued

LIGHTING FIXTURES AND ACCESSORIES (CONT'D.)

SPECIAL APPLICATION LIGHTING

LED Ellipsoidal

4	CSSPOTS-0-ETC	ColorSource Spot, LED RGB-L Light Engine Ellipsoidal with A-Size Pattern Holder, Soft Focus Diffuser, C-Clamp and Power Con to Edison Cable
4	426EDLT-ETC	26 Degree EDLT Lens Tube with Installed Lense
4	02710B-ILS	Safety Cable
4	PWRCN20-AB-15-ILS	Powercon Daisy Chain Cable, 15 ft
4	AC5PDMX25-ILS	25' DMX Control Cable, 5-Pin XLR

LOCATION/PORTABLE GAFFER'S EQUIPMENT AND SUPPLIES

Roscolux Stable Base Color Media, 20" x 24" Sheets

10	***-R	20" x 24" Roscolux Gel Sheet

Diffusion Material

2	E252R-R	Eighth White Diffusion Roll, 48" x 25'

Miscellaneous Gaffer

1	1250-R	Cinefoil Roll, 12" x 50'
12	T6666-ILS	Gaffer's Tape, Black - Roll - 2" x 60 yd
6	T103-ILS	Camera Tape, White - Roll - 1" x 60 yd
3	05220-R	Spike Tape, Yellow - Roll - 1/2" x 30 yd

Light Hangers

15	B429744-MT	3'-6' Adjustable Light Weight Hanger with Stirrup
30	429744-MT	3'-6' Adjustable Heavy-duty Telescoping Hanger
30	429612-MT	Stirrup

LOCATION/PORTABLE GAFFER'S EQUIPMENT AND SUPPLIES (CONT'D.)

Power Extension Cables

10	X10SB15-ILS	10 ft. Extension Cable, Edison Plug, 12/3 SO
6	PWRCN20-AB-5-ILS	Powercon Daisy Chain Cable, 5 ft
6	PWRCN20-AB-10-ILS	Powercon Daisy Chain Cable, 10 ft
6	PWRCN20-AB-15-ILS	Powercon Daisy Chain Cable, 15 ft

DMX Distribution

40	AC5PDMX5-ILS	5' DMX Control Cable, 5-Pin XLR
20	AC5PDMX10-ILS	10' DMX Control Cable, 5-Pin XLR
6	AC5PDMX25-ILS	25' DMX Control Cable, 5-Pin XLR
1	AC5PDMX50-ILS	50' DMX Control Cable, 5-Pin XLR
1	DMX BRANCH8-EL	DMX Opto/Iso Splitter, 1 Input-8 Output, Pass Thru, 5-Pin XLR

Qty	Model	Description

Studio Lighting Fixtures, Accessories, and Control System - continued

LIGHTING CONTROL SYSTEM

Control Console - Manual/Memory/Patch

1	64351-SL	**250 ML** Lighting Control Console, 250 Channels
1	95220-SL	20 Inch LCD Monitor
1	67528-SL	USB Flashdrive
1	AC5PDMX10-ILS	10' DMX Control Cable, 5 Pin XLR
1	DMXIN-ILS	Remote Console Wall Plug In Station, Input
1	DMXOUT-ILS	Remote Console Wall Plug In Station, Output

Remote Station

1	PRE10A-DFD	10 Pushbutton DMX Playback Station, Single Gang
1	XFMR-DFD	Transformer Power Supply, 120V Input, 10V Output.

MISCELLANEOUS GAFFER EQUIPMENT

Studio Ladder

1	09216-ILS	14'0" Grid Height Studio Ladder (Platform Height at 8'0") *Note: Meets or surpasses safety and OSHA standards* *Ladder supplied with large casters with toe locks.*

AGREEMENT BETWEEN
MIDWESTERN STATE UNIVERSITY
AND

CONTRACT NO.

This Agreement made the day of in the year 20 , by and between , hereinafter called the Contractor, and the Board of Regents of Midwestern State University, hereinafter called the Owner,

WITNESSETH, that the Contractor and the Owner for the consideration hereinafter named agree as follows:

ARTICLE 1. SCOPE OF WORK: The Contractor shall furnish all of the materials and perform all of the work shown on the drawings and described in the specifications for the project entitled . These drawings and specifications prepared for Midwestern State University by , acting as and in these Contract Documents entitled the Project Architect. The Contractor shall do everything required by this Agreement, the General and Supplemental Conditions of the Contract, the Special Conditions, the Addenda, the Specifications, the Drawings, the Historically Underutilized Business (HUB) Subcontracting Plan, and the Proposal attached as **Exhibit 1** (including any unit prices stated therein).

The Specifications and Drawings are enumerated as follows:

SPECIFICATIONS: See attached as **Exhibit 2**.

DRAWINGS: See attached as **Exhibit 2**.

ADDENDA: See attached as **Exhibit 2**.

ALTERNATES: The following Alternate Proposals, fully described in the Specifications, are included as a part of this Contract: .

ARTICLE 2. TIME OF COMPLETION: The Owner shall provide a Notice to Proceed in which a date for commencement of the work shall be stated; such commencement date shall be 10 or more days after the date of the notice. The Contractor shall achieve substantial completion of the work within ( ) calendar days after such commencement date, as such completion date may be extended by approved Change Orders. The time set forth for completion of the work is an essential element of the Contract.

ARTICLE 3. THE CONTRACT SUM: The Owner shall pay the Contractor for performance of the Contract, subject to additions and deductions provided therein, the sum of ($), and make payment on account as hereinafter provided.

SAMPLE

ARTICLE 4. HUB SUBCONTRACTING PLAN: The Owner has adopted Exhibit H, Policy on Utilization of Historically Underutilized Business ("Policy"), which is incorporated herein by reference. Contractor, as a provision of the Agreement must comply with the requirements of the Policy and adhere to the HUB Subcontracting Plan submitted with Contractor's Proposal and attached as **Exhibit 3**. No changes to the HUB Subcontracting Plan can be made by the Contractor without the prior written approval of the Owner in accordance with the Policy.

ARTICLE 5. LIQUIDATED DAMAGES: For each consecutive calendar day after the substantial completion period set forth in Article 2 above that any work, including the correction of deficiencies found during the final testing and inspection, is not completed, the amount of ($) will be deducted from the money due or becomes due the Contractor, not as a penalty but as liquidated damages representing the parties' estimate at the time of contract execution of the damages which the Owner will sustain for late completion.

ARTICLE 6. CERTIFICATION OF NO ASBESTOS CONTAINING MATERIALS OR WORK:

The Contractor shall provide a certification statement, included with each materials submittal, stating that no asbestos containing materials or work is included within the scope of the proposed submittal.

The Contractor shall insure that Texas Department of Health licensed individuals, consultants or companies are used for any required asbestos work including asbestos inspection, asbestos abatement plans/specifications, asbestos abatement, asbestos project management and third-party asbestos monitoring.

The Contractor shall provide at Substantial Completion, a notarized affidavit to the Owner and the Architect stating that no asbestos containing materials or work was provided, installed, furnished or added to the Project.

The Contractor shall take whatever measures he deems necessary to insure that all employees, suppliers, fabricators, materialmen, subcontractors, or their assigns, comply with this requirement.

All materials used on this_Project shall be certified as non Asbestos Containing Building Materials (ACBM). The Contractor shall insure compliance with the following acts from all of his subcontractors and assigns:

Asbestos Hazard Emergency Response Act (AHERA—40 CFR 763-99 (7));

National Emission Standards for Hazardous Air Pollutants (NESHAP—EPA 40 CFR 61, National Emission Standard for Asbestos;

SAMPLE

Texas Asbestos Health Protection Rules (TAHRP—Tex. Admin. Code Title 25, Part 1, Ch. 295C, Asbestos Health Protection

Every subcontractor shall provide a notarized statement that no ACBM has been used, provided, or left on this Project.

The Contractor shall provide, in hard copy and electronic form, all necessary material safety data sheets (MSDS) of all products used in the construction of the Project to the Texas Department of Health licensed inspector or Project Architect or Engineer who will compile the information from the MSDS and, finding no asbestos in any of the product, make a certification statement.

At Final Completion the Contractor shall provide a notarized certification statement per TAC Title 25 Part 1, Ch. 295.34, par. c.1 that no ACBM was used during construction of the Project.

ARTICLE 7. ACCEPTANCE OF BID OR AWARD OF CONTRACT: By signing this Agreement, the undersigned certifies as follows:

Assignment. This Agreement is a personal service contract for the services of Construction, and Contractor's interest in this Agreement, duties hereunder and/or fees due hereunder may not be assigned or delegated to a third party.

Records of expenses pertaining to Additional Services and services performed on the basis of a Worker Wage Rate or Monthly Salary Rate shall be kept on the basis of generally accepted accounting principles and in accordance with cost accounting standards promulgated by the Federal Office of Management and Budget Cost Accounting Standards Board and shall be available for audit by the Owner or the Owner's authorized representative on reasonable notice.

Family Code Child Support Certification. Pursuant to Section 231.006, Texas Family Code, Service Provider certifies that it is not ineligible to receive the award of or payments under this Agreement and acknowledges that this Agreement may be terminated and payment may be withheld if this certification is inaccurate.

Eligibility Certification. Pursuant to Section 2155.004, Texas Government Code, Service Provider certifies that the individual or business entity named in this Agreement is not ineligible to receive the award of or payments under this Agreement and acknowledges that this Agreement may be terminated and payment withheld if this certification is inaccurate.

Franchise Tax Certification. A corporate or limited liability company Contractor certifies that it is not currently delinquent in the payment of any Franchise Taxes due under Chapter 171 of the Texas Tax Code, or that the corporation or limited liability company is exempt from the payment of such taxes, or that the corporation or limited liability company is an out-of-state corporation or limited liability company that is not subject to the Texas Franchise Tax, whichever is applicable.

SAMPLE

Payment of Debt or Delinquency to the State. Pursuant to Sections 2107.008 and 2252.903, Texas Government Code, Contractor agrees that any payments owing to Contractor under this Agreement may be applied directly toward any debt or delinquency that Contractor owes the State of Texas or any agency of the State of Texas regardless of when it arises, until such debt or delinquency is paid in full.

Entire Agreement; Modifications. This Agreement supersedes all prior agreements, written or oral, between Contractor and Owner and shall constitute the entire Agreement and understanding between the parties with respect to the Project. This Agreement and each of its provisions shall be binding upon the parties and may not be waived, modified, amended or altered except by a writing signed by Contractor and Owner.

Captions. The captions of paragraphs in this Agreement are for convenience only and shall not be considered or referred to in resolving questions of interpretation or construction.

Governing Law and Venue. This Agreement and all of the rights and obligations of the parties and all of the terms and conditions shall be construed, interpreted and applied in accordance with and governed by and enforced under the laws of the State of Texas without reference to its conflicts of law provisions. The county where the Project is located shall be the sole place of venue for any legal action arising from or related to this Agreement or the Project in which the Owner is a party.

Waivers. No delay or omission by either party in exercising any right or power arising from non compliance or failure of performance by the other party with any of the provisions of this Agreement shall impair or constitute a waiver of any such right or power. A waiver by either party of any covenant or condition of this Agreement shall not be construed as a waiver of any subsequent breach of that or of any other covenant or condition of the Agreement.

Binding Effect. This Agreement shall be binding upon and inure to the benefit of the parties and their respective permitted assigns and successors.

Appointment. Owner hereby expressly reserves the right from time to time to designate by notice to Contractor a representative(s) to act partially or wholly for Owner in connection with the performance of Owner's obligations. Contractor shall act only upon instructions from the designated representative(s) unless otherwise specifically notified to the contrary.

Records. Records of Contractor's costs, reimbursable expenses pertaining to the Project and payments shall be available to Owner or its authorized representative during business hours and shall be retained for four (4) years after final Payment or abandonment of the Project, unless Owner otherwise instructs Contractor in writing.

Notices. All notices, consents, approvals, demands, requests or other communications relied on by the parties shall be in writing. Written notice shall be deemed to have been given when delivered in person to the designated representative of the Contractor or Owner for whom it is intended; or sent by U. S. Mail to the last known business address of the designated representative; or transmitted by fax machine to the last know business fax number of the designated representative.

SAMPLE

Mail notices are deemed effective upon receipt or on the third business day after the date of mailing, whichever is sooner. Fax notices are deemed effective the next business day after faxing.

Severability. Should any term or provision of this Agreement be held invalid or unenforceable in any respect, the remaining terms and provisions shall not be affected and this Agreement shall be construed as if the invalid or unenforceable term or provision had never been included.

Illegal Dumping. The Contractor shall ensure that it and all of its Subcontractors and assigns prevent illegal dumping of litter in accordance with Title 5, Texas Health and Safety Code, Chapter 365.

Ethics Matters/No Financial Interest**.** Contractor and its employees, agents, representatives and subcontractors have read and understand University's Conflicts of Interest Policy, University's Standards of Conduct Guide and applicable state ethics laws and rules. Neither Contractor nor its employees, agents, representatives or subcontractors will assist or cause University employees to violate University's Conflicts of Interest Policy, provisions described by University's Standards of Conduct Guide, or applicable state ethics laws or rules. Contractor represents and warrants that no member of the Board has a direct or indirect financial interest in the transaction that is the subject of this Agreement.

By signature hereon, Contractor certifies that no member of the Board of Regents of Midwestern State University, or Executive Officers, including component institutions, has a financial interest, directly or indirectly, in the transaction that is the subject of this contract.

SAMPLE

BY SIGNING BELOW, the Parties have executed and bound themselves to this Agreement as of the day and year first above written.

MIDWESTERN STATE UNIVERSITY

By: _____ By: _____

Signature Signature

_____ _____

Print name Print name

Date: _____ Date: _____

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