CITY OF MADISON

REQUEST FOR BIDS

RFB #: 15011-0-2026-BP

Title: State Street Garage Electric Elevator Modernization

City Agency: Parking Division

Due Date: August 19, 2026
2:00 PM CDT

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1 NOTICE TO BIDDERS

1.1 Summary

The City of Madison Parking Division ("City") is soliciting Bids from qualified vendors for State Street Garage Electric Elevator Modernization. Vendors submitting Bids ("Bidders") are required to read this Request for Bids ("RFB") in its entirety and follow the instructions contained herein.

1.2 Important Dates

Deliver Bids no later than the due time and date indicated below. The City will reject late Bids:

Issue Date:	June 25, 2026
Site Visit	July 28, 2026, 9:00am CDT
Questions Due Date:	July 31, 2026, 2:00pm CDT
Answers Posted Date:	August 5, 2026
Due Date:	August 19, 2026, 2:00 PM CDT

1.3 Format

Complete and return Forms A through E to City of Madison Purchasing Services by August 19, 2026, 2:00 PM CST.

1.4 Labeling

All email correspondence must include RFB #15011-0-2026-BP in the subject line.

1.5 Delivery of Bids

Delivery of electronic copy to: via email to bids@cityofmadison.com

Bids must be delivered as instructed. Deliveries to other City departments and/or locations may result in disqualification.

1.6 Appendix A: Standard Terms & Conditions

Bidders are responsible for reviewing Appendix A, the Standard Terms and Conditions, prior to submission of their bids. Appendix A applies to the submission of bids and in the absence of a signed contract becomes part of the contract terms. Part I of Appendix A provides legal terms relevant only to the submission of bids. Part II of Appendix A provides legal terms that would apply *only in the absence of a signed contract.*

1.7 Appendix B: Sample Contract for Purchase of Services

Bidders are responsible for reviewing Appendix B, Sample Contract, prior to submission of their bid. A contract in the form of Appendix B will serve as the basis of the contract resulting from this RFP. The resulting contract will control over any different legal terms in this RFP, Appendix A, the proposal, etc. **By submitting a proposal, Bidders affirm their willingness to enter into a contract containing the terms found in Appendix B**. While the City strives to provide the most appropriate sample contract for this RFP, the City reserves the right to modify the sample form for any resulting contract. The City does not negotiate legal terms prior to award.

1.8 Affirmative Action Notice

If Contractor employs 15 or more employees and does aggregate annual business with the City of $50,000 or more for the calendar year in which the PO and/or Contract is in effect, Contractor shall file,

within thirty (30) days from the PO/Contract effective date and BEFORE RELEASE OF PAYMENT, an Affirmative Action Plan designed to ensure that the Contractor provides equal employment opportunity to all and takes affirmative action in its utilization of applicants and employees who are women, minorities and/or persons with disabilities. A sample affirmative action plan, Request for Exemption forms, and instructions are available at: www.cityofmadison.com/civil-rights/contract-compliance/vendors-suppliers/forms or by contacting a Contract Compliance Specialist at the City of Madison Affirmative Action Division at (608) 266-4910. Vendors must register for an account to complete the required forms online, here: https://elam.cityofmadison.com/citizenaccess

Contractor shall also allow maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this PO/Contract.

Job postings: All contractors who employ 15 or more employees (regardless of the dollar amount of this contract or their annual aggregate business with the City) must notify the City of all external job openings at locations in Dane County, Wisconsin, and agree to interview candidates referred by the City or its designated organization. Job posting information is available at: http://www.cityofmadison.com/civil-rights/programs/referrals-and-interviews-for-sustainable-employment-raise-program. Instructions for contractors: http://www.cityofmadison.com/civil-rights/documents/RaISE_Job_Posting_Instructions.pdf

The complete set of Affirmative Action requirements for this purchase can be found in **paragraph 20 of Appendix A – Standard Terms and Conditions** and, in **Section 13 of Appendix B – Sample Contract for Purchase of Services**.

1.9 Multiple Bids

Multiple Bids from Bidders are permitted; however, each must fully conform to the requirements for submission. Bidders must sequentially label (e.g., Bid #1, Bid #2) and separately package each Bid. Bidders may submit alternate pricing schemes without having to submit multiple Bids.

1.10 City of Madison Contact Information

The City of Madison Parking Division is the procuring agency:	Glenn Hall City of Madison Parking Division PH: (608) 266-4744 ghall@cityofmadison.com
The City of Madison Purchasing Services administers the procurement function:	Brian Pittelli Purchasing Services City-County Bldg, Room 407 210 Martin Luther King, Jr. Blvd. Madison, WI 53703-3346 PH: (608) 267-4969 FAX: (608) 266-5948 bpittelli@cityofmadison.com
For questions regarding Affirmative Action Plans please contact:	Contract Compliance Department of Civil Rights City-County Bldg., Room 523 210 Martin Luther King, Jr. Blvd. Madison, WI 53703 PH: (608) 266-4910 dcr@cityofmadison.com

The City employs spam filtering that occasionally blocks legitimate emails, holding them in ‘quarantine” for four calendar days. The contacts listed in this RFB will acknowledge all emails received. Bidders not

receiving acknowledgement within twenty-four hours shall follow-up via phone with specific information identifying the originating email address for message recovery.

1.11 Inquiries and Clarifications

Bidders are to raise any questions they have about the RFB document without delay. Direct all questions, ***in writing,*** to the Purchasing Services administrator listed in Section 1.10.

Bidders finding any significant ambiguity, error, conflict, discrepancy, omission, or other deficiency in this RFB document shall immediately notify the Buyer and request clarification. In the event that it is necessary to provide additional clarification or revision to the RFB, the City will post addenda – see 1.12 below. Bidders are strongly encouraged to check for addenda regularly.

Bids should be as responsive as possible to the provisions stated herein. Exceptions are not permitted. The City of Madison reserves the right to disqualify any and all bids that are non-responsive or that include exceptions.

1.12 Addenda

In the event that it is necessary to provide additional clarification or revision to the RFB, the City will post addenda to its Bids distribution websites – see 1.13 below. It is the Bidders responsibility to regularly monitor the websites for any such postings. Bidders must acknowledge the receipt of any addenda on Form B. Failure to retrieve addenda and include their provisions may result in disqualification.

1.13 Bid Distribution Networks

The City of Madison posts all Request for Bids, addenda, tabulations, awards and related announcements on two distribution networks – VendorNet and DemandStar. The aforementioned documents are available **exclusively** from these websites. It is the Bidders responsibility to regularly monitor the bid distribution network for any such postings. Bidders failure to retrieve such addenda and incorporate their appropriate provisions in their response may result in disqualification. Both sites offer free registration to City Bidders.

State of Wisconsin VendorNet System:	State of Wisconsin and local agencies bid network. Registration is free. http://vendornet.state.wi.us/vendornet
DemandStar by Onvia:	National bid network – Free subscription is available to access Bids from the City of Madison and other Wisconsin agencies, participating in the Wisconsin Association of Public Purchasers (WAPP). A fee is required if subscribing to multiple agencies that are not included in WAPP.
Bid Opportunities:	www.cityofmadison.com/finance/purchasing/bidDemandStar.cfm
Home Page:	www.demandstar.com
To Register:	https://www.demandstar.com/app/registration
	Please note when registering: Pick the **Wisconsin Association of Public Procurement (WAPP)** to select all current Wisconsin government agencies.

1.14 Local Vendor Preference

The City of Madison has adopted a local preference purchasing policy granting a scoring preference to local suppliers. Only suppliers registered as of the bid's due date will receive preference. Learn more and register at the City of Madison website: www.cityofmadison.com/business/localPurchasing.

1.15 Oral Presentations/Site Visits/Meetings

Bidders may be asked to attend meetings, make oral presentations, inspect City locations or make their facilities available for a site inspection as part of this RFB process. Such presentations, meetings or site visits will be at the Bidders expense.

1.16 Acceptance/Rejection of Bids

The City reserves the right to accept or reject any or all Bids submitted, in whole or in part, and to waive any informalities or technicalities, which at the City's discretion is determined to be in the best interests of the City. Further, the City makes no representations that a contract will be awarded to any Bidder responding to this request. The City expressly reserves the right to reject any and all Bids responding to this invitation without indicating any reasons for such rejection(s).

The City reserves the right to postpone due dates and openings for its own convenience and to withdraw this solicitation at any time without prior notice.

1.17 Withdrawal or Revision of Bids

Bidders may, without prejudice, withdraw Bids submitted prior to the date and time specified for receipt of Bids by requesting such withdrawal before the due time and date of the submission of Bids. After the due date of submission of Bids, no Bids may be withdrawn for a period of 90 days or as otherwise specified or provided by law. Bidders may modify their Bids at any time prior to opening of Bids.

1.18 Non-Material and Material Variances

The City reserves the right to waive or permit cure of nonmaterial variances in the offer if, in the judgment of the City, it is in the City's best interest to do so. The determination of materiality is in the sole discretion of the City.

1.19 Public Records

Bidders are hereby notified that all information submitted in response to this RFB may be made available for public inspection according to the Public Records Law of the State of Wisconsin or other applicable public record laws. Information qualifying as a "trade secret"—defined in State of Wisconsin Statutes—may be held confidential.

Bidders shall seal separately and clearly identify all information they deem to be "trade secrets," as defined in the State of Wisconsin Statutes. Do not duplicate or co-mingle information, deemed confidential and sealed, elsewhere in your response.

> S. 19.36(5)
> (5) TRADE SECRETS. An authority may withhold access to any record or portion of a record containing information qualifying as a trade secret as defined in s. 134.90(1)(c).
>
> s. 134.90(1)(c)
> (c) "Trade secret" means information, including a formula, pattern, compilation, program, device, method, technique or process to which all of the following apply:
> 1. The information derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use.

2. The information is the subject of efforts to maintain its secrecy that are reasonable under the circumstances.

The City cannot ensure that information will not be subject to release if a request is made under applicable public records laws. The City cannot consider the following confidential: a bid in its entirety, price information, or the entire contents of any resulting contract. The City will not provide advance notice to Bidders prior to release of any requested record.

To the extent permitted by such laws, it is the intention of the City to withhold the contents of Bids from public view—until such times as competitive or bargaining reasons no longer require non-disclosure, in the City's opinion. At that time, all Bids will be available for review in accordance with such laws.

1.20 Usage Reports

Annually, the successful Bidders shall furnish to City Purchasing usage reports summarizing the ordering history for each department served during the previous contract year. The report, at a minimum, must include each and every item or service ordered during the period, its total quantities and dollars by item/service and in total. The City reserves the right to request usage reports at any time and request additional information, if required, when reviewing contract activity.

1.21 Partial Award

Unless otherwise noted, it will be assumed that Bidders will accept an order for all or part of the items/services priced.

1.22 Tax Exempt

The City of Madison as a municipality is exempt from payment of federal excise taxes (Registration Number 008-1020421147-08) and State of Wisconsin taxes per Wisconsin statute 77.54(9a). Federal Tax ID #39-6005507. A completed Wisconsin Department of Revenue Form S-211 (R.2-00) can be found on the City website. Our tax-exempt number is ES 42916.

1.23 Cooperative Purchasing

Bidders may choose to extend prices offered on bids to other municipalities. Under Wisconsin Statutes, a municipality is defined as a county; city; village; town; school district; board of school directors; sewer district; drainage district; vocational, technical and adult education district; or any other public or quasi-public corporation, officer, board or other body having the authority to award public contracts. This is known as "cooperative" or "piggyback" purchasing, a practice common amongst units of government. The City is not responsible for any contract resulting from a cooperative purchase using this RFB as a basis; they are made solely between the bidders and third party unit of government.

1.24 Bidders Responsibility

Bidders shall examine this RFB and shall exercise their judgment as to the nature and scope of the work required. No plea of ignorance concerning conditions or difficulties that exist or may hereafter arise in the execution of the work under the resulting contract, as a consequence of failure to make necessary examinations and investigations, shall be accepted as an excuse for any failure or omission on the part of the Bidders to fulfill the requirements of the resulting contract.

2 DESCRIPTION OF SERVICES/COMMODITIES

2.1 Scope of Services

Please review Appendix C with all relevant information.

2.2 Site Visit

There will be an optional site visit on July 28, 2026, at 9:00am. The plan is to meet by the elevators at the ground level.

Note that all questions asked and answers received during the site visit will be considered to be unofficial and off record. All questions requiring an official answer will need to be submitted according to the instructions in section 1.11.

If you are unable to make the date and time listed, please reach out to Stephanie Bratley at (608) 261-9252 or sbratley@cityofmadison.com.

3 REQUIRED INFORMATION AND CONTENT OF BIDS

1. Form A – Signature Affidavit
2. Form B – Receipt Forms and Submittal Checklist
3. Form C – Contractor Profile Information
4. Form D – Fee Proposal
5. Form E – References

Form A: Signature Affidavit

RFB #: 15011-0-2026-BP State Street Garage Electric Elevator Modernization

This form must be returned with your response.

In signing Proposals, we certify that we have not, either directly or indirectly, entered into any agreement or participated in any collusion or otherwise take any action in restraint of free competition; that no attempt has been made to induce any other person or firm to submit or not to submit Proposals, that Proposals have been independently arrived at, without collusion with any other Proposers, competitor or potential competitor; that Proposals have not been knowingly disclosed prior to the opening of Proposals to any other Proposers or competitor; that the above statement is accurate under penalty of perjury.

The undersigned, submitting this Proposals, hereby agrees with all the terms, conditions, and specifications required by the City in this Request for Proposals, declares that the attached Proposals and pricing are in conformity therewith, and attests to the truthfulness of all submissions in response to this solicitation.

Proposers shall provide the information requested below. Include the legal name of the Proposers and signature of the person(s) legally authorized to bind the Proposers to a contract.

_____

COMPANY NAME

_____ _____

SIGNATURE DATE

_____

PRINT NAME OF PERSON SIGNING

Form B: Receipt of Forms and Submittal Checklist

RFB #: 15011-0-2026-BP State Street Garage Electric Elevator Modernization

This form must be returned with your response.

Proposers hereby acknowledge the receipt and/or submittal of the following forms:

Forms	Initial to Acknowledge SUBMITTAL	Initial to Acknowledge RECEIPT
Description of Services/Commodities	N/A	
Form A: Signature Affidavit		
Form B: Receipt of Forms and Submittal Checklist		
Form C: Vendor Profile		
Form D: Cost Proposal		
Form E: References		
Appendix A: Standard Terms & Conditions	N/A	
Appendix B: Contract for Purchase of Services	N/A	
Appendix C: Scope of Services	N/A	
Appendix D: Specifications	N/A	
Addendum #	N/A	
Addendum #	N/A	

_____

COMPANY NAME

Form C: Vendor Profile

RFB #: 15011-0-2026-BP State Street Garage Electric Elevator Modernization

This form must be returned with your response.

COMPANY INFORMATION

COMPANY NAME (Make sure to use your complete, legal company name.)			
FEIN	(If FEIN is not applicable, SSN collected upon award)		
CONTACT NAME (Able to answer questions about proposal.)	TITLE		
TELEPHONE NUMBER	FAX NUMBER		
EMAIL			
ADDRESS	CITY	STATE	ZIP

AFFIRMATIVE ACTION CONTACT

If the selected contractor employs 15 or more employees and does aggregate annual business with the City of $50,000 or more, the contractor will be required to file an Affirmative Action Plan and comply with the City of Madison Affirmative Action Ordinance, Section 39.02(9)(e), within thirty (30) days contract signature. Vendors who believe they are exempt based on number of employees or annual aggregate business must file a request for exemption. Link to information and applicable forms: https://www.cityofmadison.com/civil-rights/contract-compliance/vendors-suppliers

CONTACT NAME	TITLE		
TELEPHONE NUMBER	FAX NUMBER		
EMAIL			
ADDRESS	CITY	STATE	ZIP

ORDERS/BILLING CONTACT

Address where City purchase orders/contracts are to be mailed and person the department contacts concerning orders and billing.

CONTACT NAME	TITLE		
TELEPHONE NUMBER	FAX NUMBER		
EMAIL			
ADDRESS	CITY	STATE	ZIP

LOCAL VENDOR STATUS

The City of Madison has adopted a local preference purchasing policy granting a scoring preference to local suppliers. Only suppliers registered as of the bid's due date will receive preference. Learn more and register at the City of Madison website.

CHECK ONLY ONE:

☐ **Yes,** we are a local vendor ***and*** have registered on the City of Madison website under the following category:_____ www.cityofmadison.com/business/localPurchasing

☐ **No,** we are not a local vendor or have not registered.

Form D: Cost Proposal

RFB #: 15011-0-2026-BP State Street Garage Electric Elevator Modernization

This form must be returned with your response.

Prepare the fee proposal as all inclusive, not-to-exceed, fixed fees:

- All Inclusive – Covers all direct and indirect necessary expenses including but not limited to; travel, telephone, copying and other out-of-pocket expenses.
- Not To Exceed – The actual fees shall not exceed the amount specified in fee proposal.
- Fixed Fee – All prices, rates, fees and conditions outlined in the proposal shall remain fixed and valid for the entire length of the contract and any/all renewals.

Any pricing increases or additions must be agreed upon in writing by both parties.

Part 1 - Pricing

List the base-bid lump sum cost to complete this project:

$_____

Per Section 1.16.C – In addition to the Base Bid, provide pricing to clean and paint the additional surfaces inside the elevator hoist ways:

$_____

Part 2

Bidder shall identify their tentative construction scheduled milestone times shown below, effective with date of contract signature.

Phase	Number of Weeks
1. Engineering: Shop Drawings/Approval	
2. Procurement: Manufacturing/Delivery	
3. Installation	
Total	

Assuming the contract is by October 1, 2026, when could the installation begin?

_____

_____

COMPANY NAME

Form E: References

RFB #: 15011-0-2026-BP State Street Garage Electric Elevator Modernization

This form must be returned with your response.

Please list three references that are **NOT** from the City of Madison. If you wish to highlight any additional work experience for the City of Madison, please list it on a separate page.

REFERENCE #1 – CLIENT INFORMATION			
COMPANY NAME	CONTACT NAME		
ADDRESS	CITY	STATE	ZIP
TELEPHONE NUMBER	FAX NUMBER		
EMAIL			
CONTRACT PERIOD	YEAR COMPLETED	TOTAL COST	
DESCRIPTION OF THE PERFORMED WORK			

REFERENCE #2 – CLIENT INFORMATION			
COMPANY NAME	CONTACT NAME		
ADDRESS	CITY	STATE	ZIP
TELEPHONE NUMBER	FAX NUMBER		
EMAIL			
CONTRACT PERIOD	YEAR COMPLETED	TOTAL COST	
DESCRIPTION OF THE PERFORMED WORK			

REFERENCE #3 – CLIENT INFORMATION			
COMPANY NAME	CONTACT NAME		
ADDRESS	CITY	STATE	ZIP
TELEPHONE NUMBER	FAX NUMBER		
EMAIL			
CONTRACT PERIOD	YEAR COMPLETED	TOTAL COST	
DESCRIPTION OF THE PERFORMED WORK			

CITY OF MADISON

1. General. Throughout this document, "City of Madison," "City" and "Purchasing" shall be synonymous and mean the City of Madison. The words "bid" and "proposal" are synonymous, as are the words "bidder," "proposer" and "contractor." The phrases "request for proposal," "invitation for bids," "request," "invitation," and "solicitation" shall also be synonymous.
   As applied to the winning or selected bidder, the words "bid," "proposal," and "contract" are synonymous.

2. Entire Agreement, Order of Precedence. These standard terms and conditions shall apply to any Purchase Order issued as a result of this Request for Bid/Proposal, except where expressly stated otherwise in the RFP or in a written instrument covering this purchase signed by an authorized representative of the City and the Contractor, in a form approved by the City Attorney (a "Separate Contract"). If such a separate contract is executed it shall constitute the entire agreement and no other terms and conditions, whether oral or written, shall be effective or binding unless expressly agreed to in writing by the City.
   If a Separate Contract is not executed, these Standard Terms and Conditions, the City's request for proposals, the version of the vendor's bid that was accepted by the City, and the City's Purchase Order (if any) shall constitute a contract and will be the entire agreement.
   Order of Precedence: If there is a conflict between this Section A and any terms in the vendor's accepted bid or proposal, this Section A shall control unless the parties expressly agree to another order of precedence, in writing. If there is a conflict between this Section A and a Separate Contract, the terms and conditions of the Separate Contract shall control.

I. TERMS FOR SUBMISSION OF BIDS: The following section applies to the bid/selection process only.

3. This invitation for bids does not commit the City to award a contract, pay any costs incurred in preparation of bids, or to procure or contract for services or equipment. The City may require the bidder to participate in negotiation and to submit such additional price or technical or other revisions to his or her bids as may result from negotiation. The bidder shall be responsible for all costs incurred as part of his or her participation in the pre-award process.
   The City reserves the right to accept or reject any or all bids submitted, in whole or in part, and to waive any informalities or technicalities which at the City's discretion are determined to be in the best interests of the City. Further, the City makes no representations that a contract will be awarded to any offeror responding to this request. The City expressly reserves the right to reject any and all bids responding to this invitation without indicating any reasons for such rejections(s).
   The City reserves the right to postpone due dates and openings for its own convenience and to withdraw this solicitation at any time without prior notice.

4. Addenda. Changes affecting the specifications will be made by addenda. Changes may include, or result in, a postponement in the bid due date. Bidders are required to complete the Bidder Response Sheet, acknowledging receipt of all parts of the bid, including all addenda.

5. Price Proposal. All bidders are required to identify the proposed manufacturer and model, and to indicate the proposed delivery time on the attached Proposal Form. Failure to do so may cause the bid to be considered not responsive. If desired, the bidder may include product literature and specifications. The price quoted will remain firm throughout each contract period. Any price increase proposed shall be submitted sixty (60) calendar days prior to subsequent contract periods and shall be limited to fully documented cost increases to the bidder which are demonstrated to be industry-wide.

6. Price Inclusion. The price quoted in any bid shall include all items of labor, materials, tools, equipment, and other costs necessary to fully complete the furnishing and delivery of equipment or services pursuant to the specifications attached thereof. Any items omitted from the specifications which are clearly necessary for the completion of the project shall be considered a portion of the specifications although not directly specified or called for in these specifications.

7. Pricing and Discount.
   a. Unit prices shown on the bid/proposal or contract shall be the price per unit of sale (e.g., gal., cs., doz., ea., etc.) as stated on the bid/proposal or contract. For any given item, the quantity multiplied by the unit price shall establish the extended price. If an apparent mistake exists in the extended price, the unit price shall govern in the bid/proposal evaluation and contract administration.
   b. In determination of award, discounts for early payment will only be considered when all other conditions are equal. Early payment is defined as payment within fifteen (15) days providing the discount terms are deemed favorable. All payment terms must allow the option of Net 30.

8. F.O.B. Destination Freight Prepaid. Bid prices must include all handling, transportation and insurance charges. Failure to bid FOB Destination Freight Prepaid may disqualify your bid.

9. Award.
   a. The City will have sole discretion as to the methodology used in making the award. Where none is specified, the award will be made to the lowest responsible bidder in compliance with the specifications and requirements of this solicitation.
   b. The right is reserved to make a separate award of each item, group of items or all items, and to make an award in whole or in part, whichever is deemed in the best interest of the City.

10. Responsiveness and Responsibility. Award will be made to the responsible and responsive bidder whose bid is most advantageous to the City with price and other factors considered. For the purposes of this project, responsiveness is defined as the bidder's conformance to the requirements of the solicitation. Being not responsive includes the failure to furnish information requested.
    Responsibility is defined as the bidder's potential ability to perform successfully under the terms of the proposed contract. Briefly, a responsible bidder has adequate financial resources or the ability to obtain said resources; can comply with required delivery taking into

account other business commitments; has a satisfactory performance record; has a satisfactory record of integrity and business ethics; and has the necessary organization, experience and technical skills.

The City reserves the right to refuse to accept any bid from any person, firm or corporation that is in arrears or is in default to the City, or has failed to perform faithfully any previous contract with the City. If requested, the bidder must present within five (5) working days evidence satisfactory to the City of performance ability and possession of necessary facilities, financial resources, adequate insurance, and any other resources required to determine the bidder's ability to comply with the terms of this solicitation document.

11. Cancellation.
    a. The City reserves the right to cancel this bid, in whole or in part, at any time for any reason. The City may, in its sole discretion and without any reason, cancel or terminate any contract or purchase order awarded as a result of this bid, in whole or in part, without penalty, by providing ten (10) days written notice thereof to the contractor.
    a. In the event the Bidder shall default in any of the covenants, agreements, commitments, or conditions and any such default shall continue unremedied for a period of ten (10) days after written notice to the Bidder, the City may, at its option and in addition to all other rights and remedies which it may have, terminate the Agreement and all rights of the Bidder under the Agreement.
    b. Failure to maintain the required certificates of insurance, permits, licenses and bonds will be cause for contract termination. If the Bidder fails to maintain and keep in force the insurance, if required, the City shall have the right to cancel and terminate the contract without notice.

II. CONDITIONS OF PURCHASE: The following section applies to purchases/contracts after the award. See Paragraphs 1 & 2 for applicability and order of precedence.

12. Specifications.
    a. All bidders must be in compliance with all specifications and any drawings provided with this solicitation. Exceptions taken to these specifications must be noted on your bid.
    b. When specific manufacturer and model numbers are used, they are to establish a design, type, construction, quality, functional capability and/or performance level desired. When alternates are bid/proposed, they must be identified by manufacturer, stock number, and the bidder/proposer is responsible for providing sufficient information to establish equivalency. The City shall be the sole judge of equivalency. Bidders are cautioned to avoid bidding alternates which do not meet specifications, which may result in rejection of their bid/proposal.

13. Regulatory Compliance.
    a. Seller represents and warrants that the goods or services furnished hereunder, including all labels, packages, and container for said goods, comply with all applicable standards, rules and regulations in effect under the requirements of all Federal, State and local laws, rules and regulations as applicable, including the Occupational Safety and Health Act (OSHA), as amended, with respect to design, manufacture or use for their intended purpose of said goods or services. Seller shall furnish Material Safety Data Sheets (MSDS) whenever applicable.
    b. If it is determined by the City that such standards are not met, the seller agrees to bear all costs required to meet the minimum standards as stated above for the equipment/products furnished under this contract.

14. Warranty. Unless otherwise specifically stated by the bidder, products shall be warranted against defects by the bidder for ninety (90) days from the date of receipt. If bidder or manufacturer offers warranty that exceeds 90 days, such warranty shall prevail.

15. Ownership of Printing Materials. All artwork, camera-ready copy, negative, dies, photos and similar materials used to produce a printing job shall become the property of the City. Any furnished materials shall remain the property of the City. Failure to meet this requirement will disqualify your bid.

16. Item Return Policy. Bidder will be required to accept return of products ordered in error for up to twenty-one (21) calendar days from date of receipt, with the City paying only the return shipping costs. Indicate in detail on the Bidder Response Sheet, your return policy.

17. Payment Terms and Invoicing. The City will pay properly submitted vendor invoices within thirty (30) days of receipt, providing good and/or services have been delivered, installed (if required), and accepted as specified.
    a. Payment shall be considered timely if the payment is mailed, delivered, or transferred within thirty (30) days after receipt of a properly completed invoice, unless the vendor is notified in writing by the agency of a dispute before payment is due.
    b. Invoices presented for payment must be submitted in accordance with instructions contained on the purchase order, including reference to purchase order and submittal to the correct address for processing. Invoice payment processing address is shown on the upper middle section of the purchase order. Send invoices to Accounts Payable address on the purchase order. Do not send invoices to Purchasing or ship to address.
    c. Bidders, proposers shall include discounts for early payment as a percent reduction of invoice. Invoice discounts shall be determined where applicable, from the date of acceptance of goods and/or the receipt of invoice, whichever is later. Discounts for early payment terms stated on the bid/proposal must be shown plainly on the invoice; discounts for early payment not shown on the invoice will be taken.
    d. Invoices submitted not in accordance with these instructions will be removed from the payment process and returned within ten (10) days.

18. F.O.B. Destination Freight Prepaid. Unless otherwise agreed in writing, the vendor shall bear all handling, transportation and insurance charges. Title of goods shall pass upon acceptance of goods at the City's dock.

19. Tax Exemption. The City of Madison is exempt from the payment of Federal Excise Tax and State Sales Tax. **The City Tax Exempt number is ES 42916.** Any other sales tax, use tax, imposts, revenues, excise, or other taxes which are now, or which may hereafter be imposed by Congress, the State of Wisconsin, or any other political subdivision thereof and applicable to the sale of material delivered as a result of the bidder's bid and which, by terms of the tax law, may be passed directly to the City, will be paid by the City.

20. Affirmative Action.

A. The following language applies to all successful bidders employing fifteen (15) or more employees (MGO 39.02(9)(c):

The Contractor agrees that, within thirty (30) days after the effective date of this Contract, Contractor will provide to the City of Madison Department of Civil Rights (the "Department"), certain workforce utilization statistics, using a form provided by the City.

If the Contract is still in effect, or if the City enters into a new Agreement with the Contractor, within one year after the date on which the form was required to be provided, the Contractor will provide updated workforce information using a second form, also to be furnished by the City. The second form will be submitted to the Department no later than one year after the date on which the first form was required to be provided.

The Contractor further agrees that, for at least twelve (12) months after the effective date of this Contract, it will notify the Department of each of its job openings at facilities in Dane County for which applicants not already employees of the Contractor are to be considered. The notice will include a job description, classification, qualifications, and application procedures and deadlines, shall be provided to the City by the opening date of advertisement and with sufficient time for the City to notify candidates and make a timely referral. The Contractor agrees to interview and consider candidates referred by the Department, or an organization designated by the Department, if the candidate meets the minimum qualification standards established by the Contractor, and if the referral is timely. A referral is timely if it is received by the Contractor on or before the date stated in the notice.

The Department will determine if a contractor is exempt from the above requirements (Sec. 20.A.) at the time the Request for Exemption in 20.B.(2) is made.

B. Articles of Agreement, Request for Exemption, and Release of Payment:

The "ARTICLES OF AGREEMENT" beginning on the following page, apply to all contractors, unless determined to be exempt under the following table and procedures:

NUMBER OF EMPLOYEES	LESS THAN $50,000 Aggregate Annual Business with the City*	$50,000 OR MORE Aggregate Annual Business with the City*
14 or less	Exempt**	Exempt**
15 or more	Exempt**	Not Exempt

*As determined by the Finance Director **As determined by the Department of Civil Rights

(1) Exempt Status: In this section, "Exempt" means the Contractor is exempt from the Articles of Agreement in section 20.B.(5) of this Contract and from filing an Affirmative Action plan as required by Section IV of the Articles of Agreement. The Department of Civil Rights ("Department") makes the final determination as to whether a contractor is exempt. If the Contractor is not exempt, sec. 20.B.(5) shall apply and Contractor shall select option A. or B. under Article IV therein and file an Affirmative Action Plan.

(2) Request for Exemption – Fewer Than 15 Employees: (MGO 39.02(9)(a)2.) Contractors who believe they are exempt based on number of employees shall submit a Request for Exemption on a form provided by the Department within thirty (30) days of the effective date of this Contract.

(3) Exemption – Annual Aggregate Business: (MGO 39.02(9)(a)c.): The Department will determine, at the time this Contract is presented for signature, if the Contractor is exempt because it will have less than $50,000 in annual aggregate business with the City for the calendar year in which the contract is in effect. CONTRACTORS WITH 15 OR MORE EMPLOYEES WILL LOSE THIS EXEMPTION AND BECOME SUBJECT TO SEC. 20.B.(5) UPON REACHING $50,000 OR MORE ANNUAL AGGREGATE BUSINESS WITH THE CITY WITHIN THE CALENDAR YEAR, BEGINNING IN 2019.

(4) Release of Payment: (MGO 39.02(9)(e)1.b.) All non-exempt contractors must have an approved Affirmative Action plan meeting the requirements of Article IV below on file with the Department within thirty (30) days of the effective date of this Contract and prior to release of payment by the City. Contractors that are exempt based on number of employees agree to file a Request for Exemption with the Department within thirty (30) days of the effective date and prior to release of payment by the City.

(5) Articles of Agreement:

ARTICLE I

The Contractor shall take affirmative action in accordance with the provisions of this Contract to ensure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin and that the employer shall provide harassment-free work environment for the realization of the potential of each employee. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training including apprenticeship insofar as it is within the control of the Contractor. The Contractor agrees to post in conspicuous places available to employees and applicants notices to be provided by the City setting out the provisions of the nondiscrimination clauses in this Contract.

ARTICLE II

The Contractor shall in all solicitations or advertisements for employees placed by or on behalf of the Contractors state that all qualified or qualifiable applicants will be employed without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin.

ARTICLE III

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining Agreement or other Contract or understanding a notice to be provided by the City advising the labor union or workers representative of the Contractor's equal employment opportunity and affirmative action commitments. Such notices shall be posted in conspicuous places available to employees and applicants for employment.

ARTICLE IV

(This Article applies to non-public works contracts.)

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison (MGO 39.02) including the Contract compliance requirements. The Contractor warrants and certifies that one of the following paragraphs is true (check one):

- ☐ A. Contractor has prepared and has on file an affirmative action plan that meets the format requirements of Federal Revised Order No, 4, 41 CFR part 60-2, as established by 43 FR 51400 November 3, 1978, including appendices required by City of Madison ordinances or it has prepared and has on file a model affirmative action plan approved by the Madison Common Council.
- ☐ B. Within thirty (30) days after the effective date of this Contract, Contractor will complete an affirmative action plan that meets the format requirements of Federal Revised Order No. 4, 41 CFR Part 60-2, as established by 43 FR 51400, November 3, 1978, including appendices required by City of Madison ordinance or within thirty (30) days after the effective date of this Contract, it will complete a model affirmative action plan approved by the Madison Common Council.
- ☐ C. Contractor believes it is exempt from filing an affirmative action plan because it has fewer than fifteen (15) employees and has filed, or will file within thirty (30) days after the effective date of this Contract, a form required by the City to confirm exempt status based on number of employees. If the City determines that Contractor is not exempt, the Articles of Agreement will apply.
- ☐ D. Contractor believes it is exempt from filing an affirmative action plan because its annual aggregate business with the City for the calendar year in which the contract is in effect is less than fifty thousand dollars ($50,000), or for another reason listed in MGO 39.02(9)(a)2. If the City determines that Contractor is not exempt, the Articles of Agreement will apply.

ARTICLE V
(This Article applies only to public works contracts.)

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison, including the Contract compliance requirements. The Contractor agrees to submit the model affirmative action plan for public works Contractors in a form approved by the Director of Affirmative Action.

ARTICLE VI

The Contractor will maintain records as required by Section 39.02(9)(f) of the Madison General Ordinances and will provide the City's Department of Affirmative Action with access to such records and to persons who have relevant and necessary information, as provided in Section 39.02(9)(f). The City agrees to keep all such records confidential, except to the extent that public inspection is required by law.

ARTICLE VII

In the event of the Contractor's or subcontractor's failure to comply with the Equal Employment Opportunity and Affirmative Action provisions of this Contract or Sections 39.03 and 39.02 of the Madison General Ordinances, it is agreed that the City at its option may do any or all of the following:

A. Cancel, terminate or suspend this Contract in whole or in part.
B. Declare the Contractor ineligible for further City contracts until the Affirmative Action requirements are met.
C. Recover on behalf of the City from the prime Contractor 0.5 percent of the Contract award price for each week that such party fails or refuses to comply, in the nature of liquidated damages, but not to exceed a total of five percent (5%) of the Contract price, or ten thousand dollars ($10,000), whichever is less. Under public works contracts, if a subcontractor is in noncompliance, the City may recover liquidated damages from the prime Contractor in the manner described above. The preceding sentence shall not be construed to prohibit a prime Contractor from recovering the amount of such damage from the noncomplying subcontractor.

ARTICLE VIII
(This Article applies to public works contracts only.)

The Contractor shall include the above provisions of this Contract in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor shall take such action with respect to any subcontractor as necessary to enforce such provisions, including sanctions provided for noncompliance.

ARTICLE IX

The Contractor shall allow the maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this Contract. (In federally funded contracts the terms "DBE, MBE, and WBE" shall be substituted for the term "small business" in this Article.)

21. Nondiscrimination. During the term of this Contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, religion, marital status, age, color, sex, handicap, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs

or student status. Contractor further agrees not to discriminate against any subcontractor or person who offers to subcontract on this Contract because of race, religion, color, age, disability, sex, sexual orientation, gender identity or national origin.

22. Prevailing Wage. Where applicable under federal law, the Contractor warrants that prevailing wages will be paid to all trades and occupations.

23. **Indemnification. The Contractor shall be liable to and hereby agrees to indemnify, defend and hold harmless the City of Madison, and its officers, officials, agents, and employees against all loss or expense (including liability costs and attorney's fees) by reason of any claim or suit, or of liability imposed by law upon the City or its officers, officials, agents or employees for damages because of bodily injury, including death at any time resulting therefrom, sustained by any person or persons or on account of damages to property, including loss of use thereof, arising from, in connection with, caused by or resulting from the acts or omissions of Contractor and any of Contractor's subcontractors in the performance of this agreement, whether caused by or contributed to by the negligence of the City or its officers, officials, agents or employees.**

24. Insurance.
The Contractor will insure, and will require each subcontractor to insure, as indicated, against the following risks to the extent stated below. The Contractor shall not commence work under this Contract, nor shall the Contractor allow any Subcontractor to commence work on its Subcontract, until the insurance required below has been obtained and corresponding certificate(s) of insurance have been approved by the City Risk Manager.
    a. Commercial General Liability - The Contractor shall procure and maintain during the life of this contract, Commercial General Liability insurance including, but not limited to, products and completed operations, bodily injury, property damage, personal injury, and products and completed operations (unless determined to be inapplicable by the Risk Manager) in an amount not less than $1,000,000 per occurrence. This policy shall also provide contractual liability in the same amount. Contractor's coverage shall be primary and list the City of Madison, its officers, officials, agents and employees as additional insureds. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain insurance meeting the above criteria, applying on a primary basis and listing the City of Madison, its officers, officials, agents and employees as additional insureds.
    b. Automobile Liability - The Contractor shall procure and maintain during the life of this contract Business Automobile Liability insurance covering owned, non-owned and hired automobiles with limits of not less than $1,000,000 combined single limit per accident. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain insurance covering each subcontractor and meeting the above criteria.
    c. Worker's Compensation - The Contractor shall procure and maintain during the life of this contract statutory Workers' Compensation insurance as required by the State of Wisconsin. The Contractor shall also carry Employers Liability limits of at least $100,000 Each Accident, $100,000 Disease – Each Employee, and $500,000 Disease – Policy Limit. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain such insurance, covering each subcontractor.
    d. Professional Liability - The Contractor shall procure and maintain professional liability insurance with coverage of not less than $1,000,000. If such policy is a "claims made" policy, all renewals thereof during the life of the contract shall include "prior acts coverage" covering at all times all claims made with respect to Contractor's work performed under the contract. This Professional Liability coverage must be kept in force for a period of six (6) years after the services have been accepted by the City.
    e. Acceptability of Insurers - The above-required insurance is to be placed with insurers who have an A.M. Best rating of no less than A- (A minus) and a Financial Category rating of no less than VII.
    f. Proof of Insurance, Approval**.** The Contractor shall provide the City with certificate(s) of insurance showing the type, amount, effective dates, and expiration dates of required policies prior to commencing work under this Contract. Contractor shall provide the certificate(s) to the City's representative upon execution of the Contract, or sooner, for approval by the City Risk Manager. If any of the policies required above expire while this Contract is in effect, Contractor shall provide renewal certificate(s) to the City for approval. Certificate Holder language should be listed as follows:

        City of Madison
        ATTN: Risk Management, Room 406
        210 Martin Luther King, Jr. Blvd.
        Madison, WI 53703

    The Contractor shall provide copies of additional insured endorsements or insurance policies, if requested by the City Risk Manager. The Contractor and/or Insurer shall give the City thirty (30) days advance written notice of cancellation, non-renewal or material changes to any of the above-required policies during the term of this Contract.

25. Work Site Damages. Any damage, including damage to finished surfaces, resulting from the performance of this contract shall be repaired to the Owner's satisfaction at the Contractor's expense.

26. Compliance.
    a. Regulations. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the work.
    b. Licensing and Permits. The Contractor selected under this bid shall be required to demonstrate valid **possession of appropriate required licenses and will** keep them in effect for the term of this contract. The Contractor shall also be required, when appropriate, to obtain the necessary building permits prior to performing work on City facilities.

27. Warranty of Materials and Workmanship.
    a. The Contractor warrants that, unless otherwise specified, all materials and equipment incorporated in the work under the Contract shall be new, first class, and in accordance with the Contract Documents. The Contractor further warrants that all workmanship shall be first class and in accordance with the Contract Documents and shall be performed by persons qualified in their respective trades.
    b. Work not conforming to these warranties shall be considered defective.

c. This warranty of materials and workmanship is separate and independent from and in addition to any other guarantees in this Contract.

28. Replacement of Defective Work or Materials. Any work or material found to be in any way defective or unsatisfactory shall be corrected or replaced by the Contractor at its own expense at the order of the City notwithstanding that it may have been previously overlooked or passed by an inspector. Inspection shall not relieve the Contractor of its obligations to furnish materials and workmanship in accordance with this contract and its specifications.

29. Reservation of the Right to Inspect Work. At any time during normal business hours and as often as the City may deem necessary, the Contractor shall permit the authorized representatives of the City to review and inspect all materials and workmanship at any time during the duration of this contract, provided, however, the City is under no duty to make such inspections, and any inspection so made shall not relieve the Contractor from any obligation to furnish materials and workmanship strictly in accordance with the instructions, contract requirements and specifications.

30. Sweatfree Procurement of Items of Apparel. If this bid results in the procurement of $15,000 or more in garments or items of clothing, any part of which is a textile, or any shoes/ footwear, then Sec. 4.25 of the Madison General Ordinances, "Procurement of Items of Apparel", is hereby incorporated by reference and made part of this contract. See Section 4.25(2) at www.municode.com for applicability specifics. The contractor shall follow labor practices consistent with international standards of human rights, meaning that, at a minimum, contractor shall adhere to the minimum employment standards found in Section 4.25 and shall require all subcontractors and third-party suppliers to do the same. For purposes of sec. 4.25, "Subcontractor" means a person, partnership, corporation or other entity that enters into a contract with the contractor for performance of some or all of the City-contracted work and includes all third-party suppliers or producers from whom the contractor or its contractors obtains or sources goods, parts or supplies for use on the city contract and is intended to include suppliers at all level of the supply chain. The standards in Sec. 4.25 shall apply in all aspects of the contractor's and subcontractor's operations, including but not limited to, manufacture, assembly, finishing, laundering or dry cleaning, (where applicable), warehouse distribution, and delivery. Contractor acknowledges that by entering into this contract, Contractor shall be subject to all of the requirements and sanctions of sec. 4.25 of the Madison General Ordinances.

    The sanctions for violating Sec. 4.25 under an existing contract are as follows:

    a. Withholding of payments under an existing contract.
    b. Liquidated damages. The contractor may be charged liquidated damages on an existing contract of two thousand dollars ($2,000) per violation, or an amount equaling twenty percent (20%) of the value of the apparel, garments or corresponding accessories, equipment, materials, or supplies that the City demonstrates were produced in violation of the contract and/or this ordinance per violation; whichever is greater.
    c. Termination, suspension or cancellation of a contract in whole or in part.
    d. Nonrenewal when a contract calls for optional renewals.
    e. Nonrenewal for lack of progress or impossible compliance. The City reserves the right to refuse to renew the contract that calls for optional renewals, when the contractor cannot comply with the minimum standard under (4)(b) and the noncompliance is taking place in a country where:
        (1) Progress toward implementation of the standards in this Ordinance is no longer being made; and
        (2) Compliance with the employment standards in the Ordinance is deemed impossible by the City and/or any independent monitoring agency acting on behalf of the City. Such determination shall be made in the sole opinion of the City and may be based upon examination of reports from governmental, human rights, labor and business organizations and after consultation with the relevant contractors and sub-contractors and any other evidence the City deems reliable.
    f. Disqualification of the contractor from bidding or submitting proposals on future City contracts, or from eligibility for future city procurements as defined in sub. (2), whether or not formal bidding or requests for proposals are used, for a period of one (1) year after the first violation is found and for a period of three (3) years after a second or subsequent violation is found. The disqualification shall apply to the contractor who committed the violation(s) whether that be under the same corporate name, or as an individual, or under the name of another corporation or business entity of which he or she is a member, partner, officer, or agent.

    The exercise by the City of any or all of the above remedies, or failure to so exercise, shall not be construed to limit other remedies available to the City under this Contract nor to any other remedies available at equity or at law.

31. Local Purchasing. The City of Madison has adopted a local preference purchasing policy granting a 5 percent request for proposal and 1 percent request for bid scoring preference to local vendors.

    To facilitate the identification of local suppliers, the City has provided an on-line website as an opportunity for suppliers to voluntarily identify themselves as local, and to assist City staff with their buying decisions. Proposers seeking to obtain local preference are required to register on the City of Madison online registration website. Only vendors registered as of the bid due date will receive preference. Additional information is available at: https://www.cityofmadison.com/finance/purchasing/local-businesses/register-business/.

32. Weapons Prohibition. Contractor shall prohibit, and shall require its subcontractors to prohibit, its employees from carrying weapons, including concealed weapons, in the course of performance of work under this Contract, other than while at the Contractor's or subcontractor's own business premises. This requirement shall apply to vehicles used at any City work site and vehicles used to perform any work under this Contract, except vehicles that are an employee's "own motor vehicle" pursuant to Wis. Stat. sec. 175.60(15m). This section does not apply to employees who are required to carry a weapon under the express terms of the Contract (such as armed security guard services, etc.).

33. Software & Technology Purchases.
    a. Software Licenses. All software license agreements shall include the City's mandatory legal terms and conditions as determined by the City Attorney. Please be advised that no City employee has the authority to bind the City by clicking on an End User License Agreement (EULA) or any other click-through terms and conditions without being specifically authorized by the City's Chief Information Officer through procedures approved by the City Attorney and Risk Manager. All legal documents associated with the purchase or download of software must be reviewed by the City Attorney and may only be signed by an individual authorized to do so.

b. Network Connection Policy. If this purchase includes software support, software maintenance, network services, and/or system development services and will require a Network Connection the City Network (as defined in the following link), the City's Network Connection Policy found at this link: www.cityofmadison.com/attorney/documents/posNetworkConnection.doc is hereby incorporated and made a part of the Contract and Contractor agrees to comply with all of its requirements.

34. Ban the Box - Arrest and Criminal Background Checks.

This provision applies to service contracts of more than $25,000 executed by the City on January 1, 2016 or later, unless exempt by Sec. 39.08 of the Madison General Ordinances (MGO).

a. Definitions. For purposes of this requirement, "Arrest and Conviction Record" includes, but is not limited to, information indicating that a person has been questioned, apprehended, taken into custody or detention, held for investigation, arrested, charged with, indicted or tried for any felony, misdemeanor or other offense pursuant to any law enforcement or military authority.

"Conviction record" includes, but is not limited to, information indicating that a person has been convicted of a felony, misdemeanor or other offense, placed on probation, fined, imprisoned or paroled pursuant to any law enforcement or military authority.

"Background Check" means the process of checking an applicant's arrest and conviction record, through any means.

b. Requirements. For the duration of any contract awarded under this RFP, the successful contractor shall:
   (1) Remove from all job application forms any questions, check boxes, or other inquiries regarding an applicant's arrest and conviction record, as defined herein.
   (2) Refrain from asking an applicant in any manner about their arrest or conviction record until after a conditional offer of employment is made to the applicant in question.
   (3) Refrain from conducting a formal or informal background check or making any other inquiry using any privately or publicly available means of obtaining the arrest or conviction record of an applicant until after a conditional offer of employment is made to the applicant in question.
   (4) Make information about this ordinance available to applicants and existing employees, and post notices in prominent locations at the workplace with information about the ordinance and complaint procedure, using language provided by the City.
   (5) Comply with all other provisions of Sec. 39.08, MGO.

c. Exemptions: This section does not apply when:
   (1) Hiring for a position where certain convictions or violations are a bar to employment in that position under applicable law, or
   (2) Hiring a position for which information about criminal or arrest record, or a background check is required by law to be performed at a time or in a manner that would otherwise be prohibited by this ordinance, including a licensed trade or profession where the licensing authority explicitly authorizes or requires the inquiry in question.

To be exempt under sec. C.1. or 2. above, contractor must demonstrate to the City that there is a law or regulation that requires the background check in question. If so, the contractor is exempt from this section for the position(s) in question.

For City Use Only:	
Contract Expiration Date: _____	Contract/Project Name: _____
Does the contract include renewals? ☐ Yes ☐ No	Are the renewals Automatic or Optional? ☐ Automatic ☐ Optional
No. of renewals: _____	Duration of each renewal: _____

City of Madison
CONTRACT FOR PURCHASE OF SERVICES

1. **PARTIES.**
This is a Contract between the City of Madison, a Wisconsin municipal corporation ("City") and _____ ("Contractor").

The Contractor is a: (to be completed by contractor) ☐ Corporation ☐ Limited Liability Company ☐ General Partnership ☐ LLP ☐ Sole Proprietor ☐ Unincorporated Association ☐ Other: _____.

2. **PURPOSE.**
The purpose of this Contract is as set forth in Section 3.

3. **SCOPE OF SERVICES AND SCHEDULE OF PAYMENTS.**
Contractor will perform the following services and be paid according to the following schedule(s) or attachment(s):

Attachment A: (name) (List all attachments here by name, and label and attach them, in order.)
Attachment B: (name)

Order of Precedence: In the event of a conflict between the terms of this Contract for Purchase of Services and the terms of any document attached or incorporated herein, the terms of this Contract for Purchase of Services shall control and supersede any such conflicting term.

4. **TERM AND EFFECTIVE DATE.**
This Contract shall become effective upon execution by the Mayor, (or the Purchasing Agent, if authorized) on behalf of the City of Madison, unless another effective date is specified in the Attachment(s) incorporated in Section 3, however in no case shall work commence before execution by the City of Madison. The term of this Contract shall be: (*Select only one check box below and leave the others blank.)*

- ☐ from _____ to _____.
- ☐ _____ year(s) from the date of final signature by the City.
- ☐ _____ months from the date of final signature by the City.
- ☐ _____ year(s) from (insert a hard start date) _____.
- ☐ _____ months from (insert a hard start date) _____.
- ☐ As set forth in (reference exhibit or attachment above and the section number of that document where the contract term is described.).

Add this language only if renewal terms have been agreed and authorized:

This contract may be renewed in writing, signed by authorized representatives of each party, for up to (number of total renewal terms) of renewal terms of (length of each renewal such as one (1) year) year(s) each.

5. CONTRACT PRICE.
It is expressly understood and agreed that in no event will the total Contract price paid by the City exceed:

- ☐ a total of $_____.
- ☐ The pricing set forth in (refer to an exhibit/attachment listed above).
- ☐ Other: (specify details here).

6. **BASIS FOR PAYMENT.**

A. GENERAL.

(1) The City will pay Contractor for completed and accepted services rendered and any goods or products under this Contract at the Contract Price set forth in Section 5. Such payment shall be full payment for services rendered and for all labor, material, supplies, equipment and incidentals necessary to complete the services. Payment in excess of the total Contract price will not be allowed unless authorized by a formal amendment signed by authorized representatives of both parties.

(2) **Payment Schedule:** The City will pay the Contractor in accordance with the schedule, if any, set forth in Section 3. Final payment of any balance due the Contractor will be made upon acceptance by the City of the services and any deliverables required by the Contract and upon receipt by the City of documents required to be returned or to be furnished by the Contractor.

(3) **Invoicing:** The Contractor shall submit invoices in a format approved by the City and as may be further specified in Section 3 of this Contract. Invoices shall include date(s) services are performed. If this Contract contains more than one product or service, invoices shall be itemized accordingly. The final invoice, if applicable, shall be submitted to the City in accordance with any agreed invoicing schedule but in no case later than thirty (30) days after completion of services and delivery of any goods.

(4) Payment shall not be construed as City acceptance of unsatisfactory or defective services or improper materials.

SAMPLE

(5) The City has the equitable right to set off against any sum due and payable to the Contractor under this Contract, any amount the City determines the Contractor owes the City, whether arising under this Contract or under any other Contract or otherwise.

(6) The City will not compensate for unsatisfactory performance by the Contractor.

B. EXTRA SERVICES OR DECREASED SERVICES.

(1) The City may request, in writing, extra services or decreased services, as defined in Section 10 of this Contract. Unless the Contractor believes the extra services entitle it to extra compensation or additional time, the Contractor shall proceed to furnish the necessary labor, materials, and professional services to complete the services within the time limits, if any, specified in this Contract.

(2) If in the Contractor's opinion the order for extra service would entitle it to extra compensation or extra time, or both, the Contractor shall not proceed to carry out the extra service, but shall notify the City, pursuant to Section 15 of this Contract. The notification shall include the justification for the claim for extra compensation or extra time, or both, and the amount of additional fee or time requested.

(3) The City shall review the Contractor's submittal and respond in writing, either authorizing the Contractor to perform the extra service, or refusing to authorize it. The Contractor shall not receive additional compensation or time unless the extra compensation is authorized by the City in writing.

7. **ASSIGNABILITY/SUBCONTRACTING.**

Contractor shall not assign or subcontract any interest or obligation under this Contract without the City's prior written approval or unless expressly stated otherwise in an attachment incorporated in Section 3. Unless the City has expressly approved subcontracting, all of the services required hereunder will be performed by Contractor and employees of Contractor.

8. **DESIGNATED REPRESENTATIVE.**

Contractor designates _____ as Contract Agent with primary responsibility for the performance of this Contract. If the Contract Agent resigns, is replaced, or is no longer acting as Contract Agent for any reason, Contractor will notify the City in writing of the change, and propose a replacement Contract Agent within seven (7) calendar days. The City may accept another person as the Contract Agent or may terminate this Contract under Section 25, at its option.

9. **PROSECUTION AND PROGRESS.**

A. Services under this Contract shall commence upon written order from the City to the Contractor, which order will constitute authorization to proceed; unless another date for commencement is specified elsewhere in this Contract including documents incorporated in Section 3.

B. The Contractor shall complete the services under this Contract within the time for completion as specified in the attachment(s) listed in Section 3. The Contractor's services are completed when the City notifies the Contractor in writing that the services are complete and are acceptable. The time for completion shall not be extended because of any delay attributable to the Contractor, but it may be extended by the City in the event of a delay attributable to the City, or in the event of unavoidable delay caused by war, insurrection, natural disaster, or other unexpected event beyond the control of the Contractor. If at any time the Contractor believes that the time for completion of the work should be extended because of unavoidable delay caused by an unexpected event, or because of a delay attributable to the City, the Contractor shall notify the City as soon as possible, but not later than seven (7) calendar days after such an event. Such notice shall include any justification for an extension of time and shall identify the amount of time claimed to be necessary to complete the work.

C. Services by the Contractor shall proceed continuously and expeditiously through completion of each phase of the work.

D. Progress reports documenting the extent of completed services shall be prepared by the Contractor and submitted to the City with each invoice, and at such other times as the City may specify, unless another procedure is specified in Section 3.

E. The Contractor shall notify the City in writing when the services under this Contract have been completed. When the City determines that the services are complete and are acceptable, the City will provide written notification to the Contractor, acknowledging formal acceptance of the completed services.

10. **EXTRA SERVICES.**

The City may require the Contractor to perform extra services or decreased services, according to the procedure set forth in Section 6. Extra services or decreased services means services which are not different in kind or nature from the services called for in Section 3, but which may increase or decrease the quantity and kind of labor or materials or expense of performing the services. Extra services may not increase the total Contract price set forth in Section 5, unless the Contract is formally amended.

11. **NO WAIVER.**

No failure to exercise, and no delay in exercising, any right, power or remedy hereunder on the part of the City or Contractor shall operate as a waiver thereof, nor shall any single or partial exercise of any right, power or remedy preclude any other or further exercise thereof or the exercise of any other right, power or remedy. No express waiver shall affect any event or default other than the event or default specified in such waiver, and any such waiver, to be effective, must be in writing and shall be operative only for the time and to the extent expressly provided by the City or Contractor therein. A waiver of any covenant, term or condition contained herein shall not be construed as a waiver of any subsequent breach of the same covenant, term or condition.

12. **NONDISCRIMINATION.**

During the term of this Contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, religion, marital status, age, color, sex, handicap, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs or student status. Contractor further agrees not to discriminate against any subcontractor or person who offers to subcontract on this Contract because of race, religion, color, age, disability, sex, sexual orientation, gender identity or national origin.

SAMPLE

13. **AFFIRMATIVE ACTION.**

A. The following language applies to all contractors employing fifteen (15) or more employees (MGO 39.02(9)(c):

The Contractor agrees that, within thirty (30) days after the effective date of this Contract, Contractor will provide to the City of Madison Department of Civil Rights (the "Department"), certain workforce utilization statistics, using a form provided by the City.

If the Contract is still in effect, or if the City enters into a new Contract with the Contractor, within one year after the date on which the form was required to be provided, the Contractor will provide updated workforce information using a second form, also to be furnished by the City. The second form will be submitted to the Department no later than one year after the date on which the first form was required to be provided.

The Contractor further agrees that, for at least twelve (12) months after the effective date of this Contract, it will notify the Department of each of its job openings at facilities in Dane County for which applicants not already employees of the Contractor are to be considered. The notice will include a job description, classification, qualifications, and application procedures and deadlines, shall be provided to the City by the opening date of advertisement and with sufficient time for the City to notify candidates and make a timely referral. The Contractor agrees to interview and consider candidates referred by the Department, or an organization designated by the Department, if the candidate meets the minimum qualification standards established by the Contractor, and if the referral is timely. A referral is timely if it is received by the Contractor on or before the date stated in the notice.

The Department will determine if a contractor is exempt from the above requirements (Sec. 13.A.) at the time the Request for Exemption in 13.B.(2) is made.

B. Articles of Agreement, Request for Exemption, and Release of Payment:
The "ARTICLES OF AGREEMENT" beginning on the following page, apply to all contractors, unless determined to be exempt under the following table and procedures:

NUMBER OF EMPLOYEES	LESS THAN $50,000 Aggregate Annual Business with the City*	$50,000 OR MORE Aggregate Annual Business with the City*
14 or fewer	Exempt**	Exempt**
15 or more	Exempt**	Not Exempt

*As determined by the Finance Director **As determined by the Department of Civil Rights

(1) Exempt Status: In this section, "Exempt" means the Contractor is exempt from the Articles of Agreement in section 13.B.(5) of this Contract and from filing an Affirmative Action plan as required by Section IV of the Articles of Agreement. The Department of Civil Rights ("Department") makes the final determination as to whether a contractor is exempt. If the Contractor is not exempt, sec. 13.B.(5) shall apply and Contractor shall select option A. or B. under Article IV therein and file an Affirmative Action Plan.

(2) Request for Exemption – Fewer Than 15 Employees: (MGO 39.02(9)(a)2.) Contractors who believe they are exempt based on number of employees shall submit a Request for Exemption on a form provided by the Department within thirty (30) days of the effective date of this Contract.

(3) Exemption – Annual Aggregate Business: (MGO 39.02(9)(a)c.): The Department will determine, at the time this Contract is presented for signature, if the Contractor is exempt because it will have less than $50,000 in annual aggregate business with the City for the calendar year in which the contract is in effect. CONTRACTORS WITH 15 OR MORE EMPLOYEES WILL LOSE THIS EXEMPTION AND BECOME SUBJECT TO SEC. 13.B.(5) UPON REACHING $50,000 OR MORE ANNUAL AGGREGATE BUSINESS WITH THE CITY WITHIN THE CALENDAR YEAR.

(4) Release of Payment: (MGO 39.02(9)(e)1.b.) All non-exempt contractors must have an approved Affirmative Action plan meeting the requirements of Article IV below on file with the Department within thirty (30) days of the effective date of this Contract and prior to release of payment by the City. Contractors that are exempt based on number of employees agree to file a Request for Exemption with the Department within thirty (30) days of the effective date and prior to release of payment by the City.

(5) Articles of Agreement:

ARTICLE I

The Contractor shall take affirmative action in accordance with the provisions of this Contract to ensure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin and that the employer shall provide harassment-free work environment for the realization of the potential of each employee. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training including apprenticeship insofar as it is within the control of the Contractor. The Contractor agrees to post in conspicuous places available to employees and applicants notices to be provided by the City setting out the provisions of the nondiscrimination clauses in this Contract.

ARTICLE II

The Contractor shall in all solicitations or advertisements for employees placed by or on behalf of the Contractors state that all qualified or qualifiable applicants will be employed without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin.

ARTICLE III

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining Agreement or other Contract or understanding a notice to be provided by the City advising the labor union or workers representative of the Contractor's equal

SAMPLE

employment opportunity and affirmative action commitments. Such notices shall be posted in conspicuous places available to employees and applicants for employment.

ARTICLE IV

(This Article applies to non-public works contracts.)

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison (MGO 39.02) including the Contract compliance requirements. The Contractor warrants and certifies that one of the following paragraphs is true **(check one):**

☐ A. Contractor has prepared and has on file an affirmative action plan that meets the format requirements of Federal Revised Order No, 4, 41 CFR part 60-2, as established by 43 FR 51400 November 3, 1978, including appendices required by City of Madison ordinances or it has prepared and has on file a model affirmative action plan approved by the Madison Common Council.

☐ B. Within thirty (30) days after the effective date of this Contract, Contractor will complete an affirmative action plan that meets the format requirements of Federal Revised Order No. 4, 41 CFR Part 60-2, as established by 43 FR 51400, November 3, 1978, including appendices required by City of Madison ordinance or within thirty (30) days after the effective date of this Contract, it will complete a model affirmative action plan approved by the Madison Common Council.

☐ C. Contractor believes it is exempt from filing an affirmative action plan because it has fewer than fifteen (15) employees and has filed, or will file within thirty (30) days after the effective date of this Contract, a form required by the City to confirm exempt status based on number of employees. If the City determines that Contractor is not exempt, the Articles of Agreement will apply.

☐ D. Contractor believes it is exempt from filing an affirmative action plan because its annual aggregate business with the City for the calendar year in which the contract is in effect is less than fifty thousand dollars ($50,000), or for another reason listed in MGO 39.02(9)(a)2. If the City determines that Contractor is not exempt, the Articles of Agreement will apply.

ARTICLE V

(This Article applies only to public works contracts.)

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison, including the Contract compliance requirements. The Contractor agrees to submit the model affirmative action plan for public works Contractors in a form approved by the Director of Affirmative Action.

ARTICLE VI

The Contractor will maintain records as required by Section **39.02**(9)(f) of the Madison General Ordinances and will provide the City's Department of Affirmative Action with access to such records and to persons who have relevant and necessary information, as provided in Section 39.02(9)(f). The City agrees to keep all such records confidential, except to the extent that public inspection is required by law.

ARTICLE VII

In the event of the Contractor's or subcontractor's failure to comply with the Equal Employment Opportunity and Affirmative Action provisions of this Contract or Sections 39.03 and **39.02** of the Madison General Ordinances, it is agreed that the City at its option may do any or all of the following:

A. Cancel, terminate or suspend this Contract in whole or in part.
B. Declare the Contractor ineligible for further City contracts until the Affirmative Action requirements are met.
C. Recover on behalf of the City from the prime Contractor 0.5 percent of the Contract award price for each week that such party fails or refuses to comply, in the nature of liquidated damages, but not to exceed a total of five percent (5%) of the Contract price, or ten thousand dollars ($10,000), whichever is less. Under public works contracts, if a subcontractor is in noncompliance, the City may recover liquidated damages from the prime Contractor in the manner described above. The preceding sentence shall not be construed to prohibit a prime Contractor from recovering the amount of such damage from the noncomplying subcontractor.

ARTICLE VIII

(This Article applies to public works contracts only.)

The Contractor shall include the above provisions of this Contract in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor shall take such action with respect to any subcontractor as necessary to enforce such provisions, including sanctions provided for noncompliance.

ARTICLE IX

The Contractor shall allow the maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this Contract. (In federally funded contracts the terms "DBE, MBE, and WBE" shall be substituted for the term "small business" in this Article.)

14. **SEVERABILITY.**
It is mutually agreed that in case any provision of this Contract is determined by any court of law to be unconstitutional, illegal or unenforceable, it is the intention of the parties that all other provisions of this Contract remain in full force and effect.

15. **NOTICES.**
All notices to be given under the terms of this Contract shall be in writing and signed by the person serving the notice and shall be sent registered or certified mail, return receipt requested, postage prepaid, hand delivered to the addresses of the parties listed

SAMPLE

below, or via email if the party has provided an email address for the purpose below. Email notices are presumed delivered on the date the email is sent by the sender.

FOR THE CITY:

(Department or Division Head)

Email address if electing to receive notice via email:

FOR THE CONTRACTOR:

Email address if electing to receive notice via email:

16. **INDEPENDENT CONTRACTOR AND TAX INFORMATION.**
It is agreed that Contractor is an independent contractor and not an employee of the City, and any persons who the Contractor utilizes or provides for services under this Contract not employees of the City of Madison.

Contractor shall provide its taxpayer identification number (or social security number) to the Finance Director, 210 Martin Luther King Jr. Blvd, Room 406, Madison, WI 53703, prior to payment. The Contractor is informed that as an independent contractor, Contractor may have a responsibility to make estimated tax returns, file tax returns, pay income taxes and make social security payments on the amounts received under this Contract. No amounts will be withheld by the City for these purposes and payment of taxes and making social security payments are solely the responsibility and obligation of the Contractor. The Contractor is further informed that they may be subject to civil and/or criminal penalties if they fail to properly report income and pay taxes and social security taxes on the amount received under this Contract.

17. **GOODWILL.**
Any and all goodwill arising out of this Contract inures solely to the benefit of the City; Contractor waives all claims to benefit of such goodwill.

18. **THIRD PARTY RIGHTS.**
This Contract is intended to be solely between the parties hereto. No part of this Contract shall be construed to add, supplement, amend, abridge or repeal existing rights, benefits or privileges of any third party or parties, including but not limited to employees of either of the parties.

19. **AUDIT AND RETAINING OF DOCUMENTS.**
The Contractor agrees to provide all reports requested by the City including, but not limited to, financial statements and reports, reports and accounting of services rendered, and any other reports or documents requested. Financial and service reports shall be provided according to a schedule (when applicable) to be included in this Contract. Any other reports or documents shall be provided within five (5) working days after the Contractor receives the City's written requests, unless the parties agree in writing on a longer period. Payroll records and any other documents relating to the performance of services under the terms of this Contract shall be retained by the Contractor for a period of three (3) years after completion of all work under this Contract, in order to be available for audit by the City or its designee.

20. **CHOICE OF LAW, VENUE, AND FORUM SELECTION.**
This Contract shall be governed by and construed, interpreted, and enforced in accordance with the laws of the State of Wisconsin, without regard to conflict of law principles. For any claim or suit or other dispute relating to this Contract that cannot be mutually resolved informally, the venue shall be Dane County, Wisconsin, and the parties agree to submit themselves to the jurisdiction of a court of competent jurisdiction in said venue, to the exclusion of any other forum that may have jurisdiction over such a dispute according to any law.

21. **COMPLIANCE WITH APPLICABLE LAWS.**
The Contractor shall become familiar with, and shall at all times comply with and observe all federal, state, and local laws, ordinances, and regulations which in any manner affect the services or conduct of the Contractor and its agents and employees.

22. **CONFLICT OF INTEREST.**
A. The Contractor warrants that it and its agents and employees have no public or private interest, and will not acquire directly or indirectly any such interest, which would conflict in any manner with the performance of the services under this Contract.
B. The Contractor shall not employ or Contract with any person currently employed by the City for any services included under the provisions of this Contract.

SAMPLE

23. **ENTIRE AGREEMENT.**
This Contract for Purchase of Services, including any and all attachments, exhibits and other documents referenced in Section 3 ("Agreement" or "Contract ") is the entire Contract of the parties and supersedes any and all oral contracts and negotiations between the parties. If any document referenced in Section 3 includes a statement that expressly or implicitly disclaims the applicability of this Contract for Purchase of Services, or a statement that such other document is the "entire agreement," such statement shall be deemed rejected and shall not apply to this Contract.

24. **AMENDMENT.**
This Contract shall be binding on the parties hereto, their respective heirs, devisees, and successors, and cannot be varied or waived by any oral representations or promise of any agent or other person of the parties hereto. Any change in any provision of this Contract may only be made by a written amendment, signed by the duly authorized agent or agents who executed this Contract.

25. **TERMINATION.**
A. In the event of a breach by the Contractor any of the covenants, agreements, commitments, or conditions of the Contract, if any such breach shall continue unremedied for a period of ten (10) days after written notice to Contractor, the City may, at its option and in addition to all other rights and remedies which it may have at law or in equity against Contractor, including expressly specific enforcement terminate this Contract and all rights of Contractor under this Contract.
B. Notwithstanding paragraph A., above, the City may in its sole discretion and without any reason terminate this Contract at any time by providing the Contractor not less than ten (10) days' written notice of termination. In the event of termination under this subsection, the City will pay for all work completed by the Contractor and accepted by the City through the effective date of the termination.

26. **INDEMNIFICATION.**
The Contractor shall be liable to and hereby agrees to indemnify, defend and hold harmless the City of Madison, and its officers, officials, agents, and employees against all loss or expense (including liability costs and attorney's fees) by reason of any claim or suit, or of liability imposed by law upon the City or its officers, officials, agents or employees for damages because of bodily injury, including death at any time resulting therefrom, sustained by any person or persons or on account of damages to property, including loss of use thereof, arising from, in connection with, caused by or resulting from the Contractor's and/or Subcontractor's acts or omissions in the performance of this Contract, whether caused by or contributed to by the negligence of the City, its officers, officials, agents, or its employees.

27. **INSURANCE.**
The Contractor will insure, and will require each subcontractor to insure, as indicated, against the following risks to the extent stated below. The Contractor shall not commence work under this Contract, nor shall the Contractor allow any Subcontractor to commence work on its Subcontract, until the insurance required below has been obtained and corresponding certificate(s) of insurance have been approved by the City Risk Manager.

Commercial General Liability
The Contractor shall procure and maintain during the life of this Contract, Commercial General Liability insurance including, but not limited to bodily injury, property damage, personal injury, and products and completed operations (unless determined to be inapplicable by the Risk Manager) in an amount not less than $1,000,000 per occurrence. This policy shall also provide contractual liability in the same amount. Contractor's coverage shall be primary and non-contributory and list the City of Madison, its officers, officials, agents and employees as additional insureds. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain insurance meeting the above criteria, applying on a primary basis and listing the City of Madison, its officers, officials, agents and employees as additional insureds.

Automobile Liability
The Contractor shall procure and maintain during the life of this Contract Business Automobile Liability insurance covering owned, non-owned and hired automobiles with limits of not less than $1,000,000 combined single limit per accident. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain insurance covering each subcontractor and meeting the above criteria.

Worker's Compensation
The Contractor shall procure and maintain during the life of this Contract statutory Workers' Compensation insurance as required by the State of Wisconsin. The Contractor shall also carry Employers Liability limits of at least $100,000 Each Accident, $100,000 Disease – Each Employee, and $500,000 Disease – Policy Limit. Contractor shall require all subcontractors under this Contract (if any) to procure and maintain such insurance, covering each subcontractor.

Umbrella Liability
The Contractor shall procure and maintain during the life of this Contract Umbrella Liability coverage at least as broad as the underlying Commercial General Liability, Business Automobile Liability and Employers Liability with minimum limits of $5,000,000 per occurrence and aggregate.

Acceptability of Insurers. The above-required insurance is to be placed with insurers who have an A.M. Best rating of no less than A- (A minus) and a Financial Category rating of no less than VII.

Proof of Insurance, Approval. The Contractor shall provide the City with certificate(s) of insurance showing the type, amount, effective dates, and expiration dates of required policies prior to commencing work under this Contract. Contractor shall provide the certificate(s) to the City's representative upon execution of the Contract, or sooner, for approval by the City Risk Manager. If any of the policies required above expire while this Contract is still in effect, Contractor shall provide renewal certificate(s) to the City for approval. Certificate Holder language should be listed as follows:

City of Madison

SAMPLE

ATTN: Risk Management, Room 406
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703

The Contractor shall provide copies of additional insured endorsements or insurance policies, if requested by the City Risk Manager. The Contractor and/or Insurer shall give the City thirty (30) days advance written notice of cancellation, non-renewal or material changes to any of the above-required policies during the term of this Contract.

28. **OWNERSHIP OF CONTRACT PRODUCT.**
All of the work product, including, but not limited to, documents, materials, files, reports, data, including magnetic tapes, disks of computer-aided designs or other electronically stored data or information (the "Documents"), which the Contractor prepares pursuant to the terms and conditions of this Contract are the sole property of the City. The Contractor will not publish any such materials or use them for any research or publication, other than as expressly required or permitted by this Contract, without the prior written permission of the City. The grant or denial of such permission shall be at the City's sole discretion.

The Contractor intends that the copyright to the Documents shall be owned by City, whether as author (as a Work Made For Hire), or by assignment from Contractor to City. The parties expressly agree that the Documents shall be considered a Work Made For Hire as defined by Title 17, United States Code, Section 101(2).

As further consideration for the City entering into this Contract, the Contractor hereby assigns to City all of the Contractor's rights, title, interest and ownership in the Documents, including the right to procure the copyright therein and the right to secure any renewals, reissues and extensions of any such copyright in any foreign country. The City shall be entitled to the sole and exclusive benefit of the Documents, including the copyright thereto, and whenever required by the City, the Contractor shall at no additional compensation, execute all documents of assignment of the full and exclusive benefit and copyright thereof to the City. Any subcontractors and other independent contractors who prepare portions of the Documents shall be required by the Contractor to execute an assignment of ownership in favor of the City before commencing work.

29. **BAN THE BOX - ARREST AND CRIMINAL BACKGROUND CHECKS.** (Sec. 39.08, MGO. Applicable to contracts exceeding $25,000.)

A. DEFINITIONS.

For purposes of this section, “Arrest and Conviction Record” includes, but is not limited to, information indicating that a person has been questioned, apprehended, taken into custody or detention, held for investigation, arrested, charged with, indicted or tried for any felony, misdemeanor or other offense pursuant to any law enforcement or military authority.

“Conviction record” includes, but is not limited to, information indicating that a person has been convicted of a felony, misdemeanor or other offense, placed on probation, fined, imprisoned or paroled pursuant to any law enforcement or military authority.

“Background Check” means the process of checking an applicant’s arrest and conviction record, through any means.

B. REQUIREMENTS. For the duration of this Contract, the Contractor shall:

(1) Remove from all job application forms any questions, check boxes, or other inquiries regarding an applicant’s arrest and conviction record, as defined herein.

(2) Refrain from asking an applicant in any manner about their arrest or conviction record until after conditional offer of employment is made to the applicant in question.

(3) Refrain from conducting a formal or informal background check or making any other inquiry using any privately or publicly available means of obtaining the arrest or conviction record of an applicant until after a conditional offer of employment is made to the applicant in question.

(4) Make information about this ordinance available to applicants and existing employees, and post notices in prominent locations at the workplace with information about the ordinance and complaint procedure using language provided by the City.

(5) Comply with all other provisions of Sec. 39.08, MGO.

C. EXEMPTIONS: This section does not apply when:

(1) Hiring for a position where certain convictions or violations are a bar to employment in that position under applicable law, or

(2) Hiring a position for which information about criminal or arrest record, or a background check is required by law to be performed at a time or in a manner that would otherwise be prohibited by this ordinance, including a licensed trade or profession where the licensing authority explicitly authorizes or requires the inquiry in question.

To be exempt under sec. C.(1) or (2) above, Contractor must demonstrate to the City that there is a law or regulation that requires the hiring practice in question. If so, the contractor is exempt from this section for the position(s) in question.

30. **WEAPONS PROHIBITION.**
Contractor shall prohibit, and shall require its subcontractors to prohibit, its employees from carrying weapons, including concealed weapons, in the course of performance of work under this Contract, other than while at the Contractor’s or subcontractor’s own business premises. This requirement shall apply to vehicles used at any City work site and vehicles used to perform any work under this Contract, except vehicles that are an employee’s “own motor vehicle” pursuant to Wis. Stat. sec. 175.60(15m).

31. **IT NETWORK CONNECTION POLICY.**
If this Contract includes software or technology services that require a Network Connection the City Network (as defined in the following link), the City’s Network Connection Policy found at this link:
www.cityofmadison.com/employeenet/documents/contracts/posNetworkConnection.docx is hereby incorporated and made a part of this Contract and Contractor agrees to comply with all of its requirements.

SAMPLE

32. **AUTHORITY.**
Contractor represents that it has the authority to enter into this Contract. If the Contractor is not an individual, the person(s) signing on behalf of the Contractor represents and warrants that they have been duly authorized to bind the Contractor and sign this Contract on the Contractor's behalf.

33. **COUNTERPARTS, ELECTRONIC SIGNATURE AND DELIVERY.**
This Contract may be signed in counterparts, each of which shall be taken together as a whole to comprise a single document. Signatures on this Contract may be exchanged between the parties by facsimile, electronic scanned copy (.pdf) or similar technology and shall be as valid as original; and this Contract may be converted into electronic format and signed or given effect with one or more electronic signature(s) if the electronic signature(s) meets all requirements of Wis. Stat. ch. 137 or other applicable Wisconsin or Federal law. Executed copies or counterparts of this Contract may be delivered by facsimile or email and upon receipt will be deemed original and binding upon the parties hereto, whether or not a hard copy is also delivered. Copies of this Contract, fully executed, shall be as valid as an original.

SAMPLE

IN WITNESS WHEREOF, the parties hereto have set their hands at Madison, Wisconsin.

CONTRACTOR:

_____
(Type or Print Name of Contracting Entity)

By: _____
(Signature)

_____
(Print Name and Title of Person Signing)

Date: _____

CITY OF MADISON, WISCONSIN
a municipal corporation:

By: _____
Satya Rhodes-Conway, Mayor

Date: _____

Approved:

_____
David P. Schmiedicke, Finance Director

Date: _____

By: _____
Lydia A. McComas, City Clerk

Date: _____

Approved as to Form:

_____
Eric T. Veum, Risk Manager

Date: _____

_____
Michael Haas, City Attorney

Date: _____

For City Use Only: SIGNATURE INSTRUCTIONS FOR CONTRACTS SIGNED BY MAYOR/CLERK:
Obtain contractor's signature first. Route this contract with all of its attachments for City signatures using Accela. Provide authorizing resolution and Certificate of Insurance as instructed in Accela.

NOTE: Certain service contracts may be executed by the designee of the Finance Director on behalf of the City of Madison:

By: _____
Mary Richards, Procurement Supervisor

Date: _____

MGO 4.26(3) and (5) authorize the Finance Director or designee to sign purchase of service contracts when all of the following apply:

(a) The funds are included in the approved City budget.
(b) An RFP or competitive process was used, or the Contract is exempt from competitive bidding by 4.26(4)(a) (contracts up to $75,000 in total or up to $75,000 per year for software and technology services are exempt).
(c) The City Attorney has approved the form of the Contract.
(d) The Contract complies with other laws, resolutions and ordinances.
(e) The Contract is for a period of 1 year or less, OR not more than 5 years AND the average cost is not more than $100,000 per year, AND was subject to competitive bidding when required by 4.26(4)(a). (If over $75,000 and exempt from bidding under 4.26(4)(a), regardless of duration, the Common Council must authorize the Contract by resolution and the Mayor and City Clerk must sign, per 4.26(5)(b).)

Emergency Service contracts may also be signed by the designee of the Finance Director if the requirements of MGO 4.26(3)(c) are met.

For City Use Only: SIGNATURE INSTRUCTIONS FOR CONTRACT TO BE SIGNED BY FINANCE (PURCHASING):
Obtain contractor's signature first. Attach the contractor-signed contract with all attachments/exhibits and the certificate of insurance to the requisition in MUNIS.

SAMPLE

STATE STREET PARKING RAMP
214 N CARROLL ST, MADISON, WI
SECTION 14 21 00
ELECTRIC ELEVATOR ALTERATIONS

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PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This Section is intended to cover the **modernization of two (2) existing Kone Elevator geared electric passenger elevators located at State Street Parking Garage, 214 North Carroll St, Madison, WI.** The scope of work includes new gearless traction machines, operation and motion controls, door operator equipment, signal fixtures, and car enclosure renovations. This Section indicates the extent of the elevator renovations.

B. Work shall include all work and material specified for a complete and first-class installation in every respect and once started is to proceed without interruption during regular working hours until complete.

C. Where a device or part of the equipment is referred to in the singular number, it is intended that such reference shall apply to all devices for all elevators, unless otherwise indicated.

D. Unless specifically identified as “Retain” or “Reuse” in Part 2, provide new equipment. Equipment that is “Retained” or “Reused” shall be reconditioned or renewed to place into satisfactory condition for reuse. Any components not specifically replaced (retained components) shall be cleaned, adjusted, lubricated, refurbished, recalibrated, painted, fasteners tightened, tested, and warrantied.

E. Where “Bidder” or “Contractor” is identified, it shall refer to the Contractor and/or their subcontractors. Where Contractor is directed to “Provide” devices or equipment, such devices or equipment shall be furnished and installed as work under this project.

F. Contractor shall provide all labor, elevator equipment, material, transportation, tools and equipment, temporary protection, lubricants and cleaning supplies, employee safety equipment, supervision, coordination, and other work or items required to perform work under this Section, whether or not expressly stated.

G. Contractor shall be solely responsible for complete compliance with contract documents, omissions, environmental regulations other than asbestos or lead paint, for verifying all dimensions, existing conditions, calculations, and voltages found in this Specification or on the drawings, which are provided for the convenience of bidders, for fabrication, and for coordination of work of other trades. It is stipulated that the drawings are representations of the existing equipment. See Part 2 for changes.

H. Failure to visit site or failure to examine any and all documents will in no way relieve successful Bidder from the necessity of furnishing any materials or equipment or performing any work that may be required. Neglect of above requirements will not be grounds for delay in work or additional compensation.

I. All applicable permit and inspection fees and licenses are to be included by Contractor in their bid price.

1.2 RELATED WORK PROVIDED BY OTHER THAN THE ELEVATOR CONTRACTOR

The existing elevator hoistways and machine room will be reused in their present locations. The following work is not included in the scope of work performed by the Elevator Contractor. The Contractor shall coordinate this work.

A. MACHINE ROOM:

1. Minimum 7’0” headroom shall be maintained to the extent possible below new conduits, ventilation equipment, lights, etc.

2. Existing machine room door is self-closing and self-locking. No changes required for the machine room door.

3. Elevator machine room heating and an independent ventilation or air conditioning system to protect against the overheating of the electrical equipment. Maintain the room at an ambient temperature of 50°F degrees to 90°F degrees and non-condensing humidity up to 95%; or otherwise within the control manufacturer's specifications.

   Existing HVAC unit and heater provided in machine room shall be retained.

4. Maintain annual certification on the existing Class ABC fire extinguisher in machine room.

B. ELECTRICAL SERVICE, CONDUCTORS AND DEVICES:

1. Disconnect the existing electrical service from each elevator disconnect switch to the existing controllers. Also disconnect existing 110V supply and telephone service.
2. Plywood behind existing mainline disconnects shall be removed and disconnects securely installed using metal supports.
3. Connect new or existing service with separate equipment grounding conductor to terminals of each new elevator controller.
4. Each elevator shall have a circuit breaker or fused disconnect switch with sufficiently sized time delay fuses that is lockable in the "open" position.
5. All disconnect switches in the machine room shall be labeled as to their function and provided with signage to identify location of the supply side overcurrent protection.
6. Selective Coordination Study - Where main electrical disconnects are replaced and more than one driving machine disconnecting means is supplied by a single feeder, overcurrent protection in machine room must be selectively coordinated with the upstream overcurrent protection. Documentation must be provided with the elevator alteration submittal showing that the overcurrent protection is selectively coordinated or a statement provided by the electrician indicating the elevators are served by separate individual feeders.
7. Lighting in the machine room to provide illumination of not less than 19 fc throughout the room. All new LED lighting shall be activated by a single switch located adjacent to the machine room door. Guards or safety sleeves are recommended over all lamps.
8. Separate branch circuits located in the elevator machine room containing lockable circuits for 1) elevator car lighting (15 amps) for each elevator, and 2) additional branch circuits for other utilization equipment identified in NEC 620 such as machine room HVAC equipment, etc. The overcurrent devices (circuit breaker or fused switch) for the utilization of equipment circuits must be located in the machine room.
9. Single-phase power to terminals on each elevator controller for car lighting and exhaust fan on emergency power.
10. The machine room and each pit each require a GFCI protected duplex receptacle. The receptacles in the machine room may be GFCI protected or GFCI type. The receptacles in the elevator pits must be of the GFCI type.
11. Replacement of the existing pit lighting with a minimum of two light fixtures in each elevator pit and illumination of not less than 10fc anywhere on the pit floor. Lighting to be operated by new switches located adjacent to the pit ladders. Provide (2) fixtures per elevator pit.
12. Sufficient lighting of at least 10fc in each elevator lobby whenever the elevators are available for service, measured in front of each elevator at the landing sills.
13. Only electrical wiring used directly in connection with the elevator is permitted to be in the machine room.

C. FIRE ALARM SYSTEM REQUIREMENTS:

1. Any upgrades to the existing fire alarm initiating devices located in the elevator lobbies and machine room and the building fire alarm system per NFPA 72-2022.
2. A listed relay or other listed appliance connected to the fire alarm system used to initiate control of protected premises fire safety functions shall be located within 3 ft of the controlled circuit or appliance.
3. New fire alarm panel to be installed inside the Parking Garage office at the ground level.
4. A minimum of three separate elevator control circuits is to be terminated to each of the new elevator controllers; the Designated Level, Alternate Level, and a separate signal (flashing hat) must be derived from the elevator machine room smoke detector.
5. Actuation from elevator machine room smoke detectors shall cause separate and distinct visible annunciation at the control unit and required annunciators to alert firefighters and other emergency personnel that the elevators are no longer safe to use.
6. The machine room is not presently equipped with fire sprinklers. If sprinklers are installed in the machine room or hoistway at a future date, a heat detector located within 24” of each sprinkler shall activate a shunt trip circuit breaker to automatically disconnect power to the elevators prior to or upon the application of water from sprinklers per NFPA 72-2022. *No sprinklers or shunt trip devices to be installed at this time.*

D. OTHER:

1. Card reader to be installed in Elevator #2 on the car operating panel. Provide all necessary wiring and hardware to complete installation and operation.
2. Provide and installed drip pan in machine room where drain piping passes over elevator and/or electrical equipment adjacent to Elevator #1.
3. Existing phone lines shall be retained and reused.

1.3 RELATED WORK INCLUDED BY ELEVATOR CONTRACTOR

The following work must be undertaken by the Elevator Contractor as work under this Section.

A. Protection of floors, walls, and elevator entrances. Barricade any open hoistway entrances during work activity per OSHA Regulations and good industry practices.

B. Clean any work dust and gear oil from machine room floor, equipment, and adjacent route to the exit stairway to minimize tracking of dirt, dust, and debris into hallway and onto the top landing lobby.

C. Suitable screening or separation between elevator hoistways for prior to the start of the modernization in the associated hoistways, in accordance with section 8.3 of the Elevator Industry Field Employees’ Safety Handbook. *(N/A for this project).*

D. Coordination and testing of all smoke detectors and Firefighter’s Service prior to and at time of acceptance inspection is included as work under this section.

E. Cutting and/or patching of machine room floor or hoistway walls. Contractor shall provide any needed cutouts and shall patch and close up any existing openings no longer required, including signal fixtures.

F. Disposal of all existing elevator equipment removed by the Contractor, however the Owner has the express right to retain any superseded equipment. The hoist motor,

transformer and controls from the first elevator shall remain on site until the modernization of the second elevator has commenced.

G. Verify the adequacy of the supports for new Emergency Brake or traction machine by a licensed professional engineer, if required for City of Madison approval.

H. The cost of repairs for damage or cleaning of the stairway, lobby flooring, rooftop or walls during modernization will be the responsibility of the Contractor. Contractor and Owner or Consultant to inspect at commencement of field work.

I. Provide all necessary labor to coordinate installation of card reader inside Elevator #2.

J. Provide labeling on machine room door stating, ‘Elevator Machine Room’ in minimum 1” lettering.

1.4 REGULATORY REQUIREMENTS

A. Elevator system design and installation shall comply with all applicable safety codes, including but not limited to the following, or subsequent code editions in effect as of date of contract signature.

1. ASME A17.1-2016 Safety Code for Elevators and Escalators.
2. ICC/ANSI A117.1-2017, Accessible and Usable Buildings and Facilities
3. ADAAG Americans with Disabilities Act Accessibility Guidelines
4. NFPA 70-2017, National Electrical Code
5. NFPA 72-2022, National Fire Alarm and Signaling Code
6. Wisconsin Administrative Code Chapter SPS 318, effective 5/1/21
7. Madison Chapter 40 Conveyance Code

B. The Contractor shall apply for any permits necessary for work under this Section, pay all City, State, and Local permit, inspection, licensing, cutting or burning permit fees required for their work.

C. Contractor shall also provide all additional material or modifications to equipment required to meet enforceable codes, standards, and laws.

D. Provide copies of permit application “Conditionally Approved” by the City of Madison to Owner per SPS 318.1008(4). The elevator approval letter shall be posted prior to construction at or near the equipment room, and a copy of the approved elevator plans shall be available at the site.

E. Provide all installer and contractor licenses, permits, and perform required acceptance tests, including all applicable fees. The Contractor shall pay reinspection fees for deficiencies or violations that are the responsibility of the Contractor or subcontractors per terms of this Section.

1.5 QUALITY ASSURANCE

A. Bidders shall have a minimum five-year record of successful experience in the business of installing, modernizing, and servicing elevators covered by this specification.

B. Contractor shall use skilled installers, trained and experienced in installing the equipment. All work shall be performed in a workmanlike manner and is to include all materials, accessories, and labor necessary for a complete and proper operating system, whether or not expressly specified.

1.6 SAFETY AND HAZARDOUS MATERIALS

A. Owner or their designee may approve all chemicals and lubricants prior to Contractor bringing them on site. Contractor shall furnish a Safety Data Sheet and proper labeling for each hazardous chemical to be brought into the premises in compliance with OSHA Hazard Communication Standards, and track usage for EPA reporting purposes.

B. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety programs or initiatives and shall comply with applicable safety laws, good industry standards, and take all reasonable precautions for the safety of property, residents and Owners, visitors, and the Contractor's employees.

1. The Contractor is solely responsible for providing all safety training to their employees in compliance with State, Federal, or local requirements including, but not limited to, Lockout/Tagout, Electrical Safety, Mechanical Stored Energy, Hazardous Communication, Bloodborne Pathogens, working near asbestos or lead paint, and safely accessing elevator pits, car tops, and Confined Spaces.

2. The Owner reserves the right to request and review records documenting evidence of training received, and to require at no cost, that Contractor's personnel successfully complete training programs conducted by Owner or its affiliates.

C. Asbestos or Lead Paint: There is no anticipated lead paint or asbestos work associated with this Specification. Any other materials which the Contractor encounters and suspects may contain asbestos or lead paint shall be left undisturbed until such time that they can be tested by the Owner and verified to be free of asbestos or lead paint.

1.7 SITE INSPECTIONS

An optional pre-bid conference will be held for prospective Bidders on July 28, 2026, at 9:00am. Meet at the ground floor elevator entrance. Each bidder has an obligation to attend and is responsible for verifying all conditions and the accuracy of the information contained in the specification and drawings.

A. If you are unable to attend the pre-bid conference on the date and time listed, or you need to request additional site inspections after the Pre-Bid Conference, please contact Stephanie Bratley at (608) 261-9252 or sbratley@cityofmadison.com.

B. All questions asked and answers received during the site visit will be considered to be unofficial and off record. All questions requiring an official answer will need to be submitted according to the instructions to Brian Pittelli, bpittelli@cityofmadison.com by July 31, 2026 at 2:00pm.

C. No modifications or adjustments to bids shall be allowed because of any error, neglect, or failure on the part of the bidder to verify site conditions or should the information in the specification or on the drawings be in error. Any items omitted from the specification or drawings which are necessary for the completion of the elevator modernization shall be considered to be a part of the specification, although not directly referenced.

D. Neglect of above requirements will in no way relieve the successful bidder from furnishing all materials or equipment and performing any work that may be required and will not be grounds for delay in work or additional compensation.

E. By submitting a bid, Contractor acknowledges that it has surveyed, inspected, and is familiar with the equipment.

1.8 SCHEDULE

Bidders shall identify their tentative construction schedule as shown below and on Form D, effective with date of contract signature.

Shop Drawings/Approval _____ wks

Manufacturing/Delivery _____ wks

Installation _____ wks

A. After award, successful bidder shall provide a project schedule in MS Project or equivalent and submit as a PDF document. Contractor Bidder shall periodically update the schedule and incorporate Owner work items upon request.

B. Once installation has started, all work shall be pursued continuously without interruption during regular working hours until complete, with a 2-person installation crew working five eight hour days per week.

C. At least one elevator shall remain in service at all times. Should work tasks by the Contractor require more than one elevator be out of service at the same time for special material movement, adjusting, testing, or for other reasons, such work shall be scheduled in advance outside of regular working hours at the Contractor's expense unless approved by Owner to be performed during normal work hours.

1.9 SUBSTITUTION OF MATERIALS

A. All requests for substitution shall be submitted in writing prior to bidding and shall include sufficient product information and time allowance to permit Consultant to evaluate the request prior to the bid due date.

B. The Owner specifically reserves the right to reject or approve any and all substitute materials or equipment in order to ensure compliance with the minimum standards of quality established for the project herein specified.

C. When an item is approved as an equal, either by the specification or by approved substitution request, this item shall provide the same end results and maintain the style and appearances established for this project to the Consultant's and Owner's satisfaction. Any modification, additional fitting or change to the approved items to accomplish these results shall be at the expense of the Contractor.

1.10 SUBMITTAL DATA

Submittals will be reviewed for general compliance with design concept and contract documents only. Compliance with contract documents, Code requirements, dimensions, fit, finishes, and integration with the existing elevator equipment remains the Contractor's responsibility. Within 30 days after award of contract, provide submittals required by Sections A-B-C. Allow 7 days for response to submittals. Contractor shall respond to submittal review comments in writing within 7 days of submittal return, promptly incorporating changes so that delivery and installation schedules are not delayed.

A. SCHEDULE OF VALUES: Contractor shall complete a schedule of values using AIA documents provided by the Contractor that identify the material and labor details for the elevator modernization.

B. PRODUCT DATA: Submit electronic PDF files of manufacturer's color product brochures for each principal component within 30 days after award of contract by electronic mail. Mark product data to indicate job specific equipment to be furnished. Provide a single PDF file by principal component, including:

1. Elevator controls – brochure and product data
2. Gearless traction machine, deflector sheave
3. Emergency brake, governor and tension sheave
4. Signal fixtures, including lobby status panel
5. Door operator equipment

6. Supplier order confirmation for the traction machine and controller, when available.

C. SHOP DRAWINGS: Within 30 days after award of contract and before beginning equipment fabrication, submit electronic PDF files containing shop drawings for review by electronic mail.

1. Submit complete machine room plan in compliance with SPS 318.1007. Indicate new equipment, location and the required clearances. A detailed machine room plan with locations of the new and retained equipment by Contractor is required for use in laying out and coordinating the Work by Others.

2. All signal fixtures

3. The Contractor shall provide copies of “Conditionally Approved” permit applications each to Owner and Consultant prior to commencing with installation.

D. HOISTING AND STORAGE PLAN: A copy of the Contractor’s schedule for equipment delivery and storage shall be provided to Owner and Consultant for review and approval prior to commencing installation. Owner to approve of storage location for elevator equipment.

E. SAMPLES: 4” square samples of car enclosure finishes upon request.

F. SDS: Owner may approve all chemicals and lubricants prior to Contractor bringing them on site. The Contractor shall furnish a Safety Data Sheet and proper labeling for each hazardous chemical to be brought into the premises in compliance with OSHA Hazard Communication Standards, and track usage for EPA reporting purposes.

G. MAINTENANCE MANUALS: Submit electronically as a single electronic PDF file with index and two (2) hard (printed) copies. Operating and maintenance instructions shall include:

1. Bound 8-1/2-inch x 11-inch binders with durable plastic covers.

2. Binder cover with title and name of project, table of contents, and reinforced dividers to organize sections.

3. Complete replacement parts listing with part numbers and sourcing information for each component.

4. Firefighters’ Emergency Operation instructions, including quarterly test procedure.

5. Operation, maintenance, adjustment and repair procedures for components including emergency brake, door operator, brake release, etc.

6. Lubrication instructions including recommended products and frequency

7. Full installation, adjustment, maintenance, and troubleshooting instructions for elevator controls, including regenerative static AC Drive.

8. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

9. Maintenance check charts, indicating recommend tasks and intervals.

10. Certificates of inspection by regulatory agencies.

11. Provide a Maintenance Control Program (MCP) accessible to the elevator personnel and documenting compliance with ASME A17.1 Requirements 8.6. Where unique or product-specific procedures or methods are required to inspect or test equipment, such procedures or methods shall be included in the Maintenance Control Program. The MCP shall be considered the Owner’s property and shall not be removed from the premises.

12. All Code required written procedures (e.g., check out, inspection, testing, and maintenance). Procedures for tests, periodic inspections, maintenance, replacements, adjustments, and repairs for all SIL rated E/E/PES electrical protective devices and circuits shall be incorporated into and made part of the Maintenance Control Program.
13. Where unique or product-specific procedures or methods are required to inspect or test equipment, such procedures or methods shall be included in the Maintenance Control Program.

H. AS BUILT DRAWINGS: “As-Built” shop drawings shall be submitted within 14 days following substantial completion of the last elevator modernized.

I. WIRING DIAGRAMS: The Elevator Contractor shall provide complete As-Built schematic wiring diagrams of the new control systems, including field revisions. Provide one full sized hard copy and one electronic PDF file to the Owner, and **a full-sized laminated set stored in the elevator machine room.**

J. TEST REPORTS: Obtain Inspection and Acceptance reports from City of Madison Elevator Inspector and Elevator Contractor’s own Adjuster’s Test Report.

K. CLOSEOUT DOCUMENTS: Final or record submittal of drawings or submittals shall also be provided in electronic media format. Drawings shall be in AutoCAD and texts in Microsoft Word for Windows. PDF files are also an acceptable form of electronic media. Submit electronic copies on USB flash (thumb or jump) drive. **Closeout submittals are required within 30 days of City of Madison inspection of the final elevator.**

1.11 WARRANTY

A. The equipment installed shall be warranted by Contractor against defects in materials and workmanship throughout the project duration and for a period of 12 months starting on the date of final acceptance of the last elevator by Owner. Warranty shall include correction of defective material or workmanship to the satisfaction of the Owner and Consultant.

B. Owner shall have the right to reject defective or inferior material or workmanship, which shall comply in every respect with the Contract Documents. Contractor shall make modifications, adjustments, and improvements of new equipment to meet performance or other requirements of this specification at no additional cost to Owner or Owner’s Contractors.

C. “Defective” is defined to include, but not limited to, operating or control system failures, failure of new components, performance below required minimum standards, excessive wear, unusual deterioration or aging of materials or finishes, finishes not complying with specifications, the need for excessive maintenance, unsafe conditions, abnormal noise or vibration, and other unusual, unexpected, or unsatisfactory conditions.

D. Neither the final payment nor any provision of the contract documents relieves the Contractor of the responsibility for negligence or faulty materials or workmanship within the extent and period provided by law.

1.12 MAINTENANCE

For the duration of the elevator modernization work, the current Elevator Contractor shall suspend the existing preventative maintenance program and upon completion of the 12-month warranty period the elevators shall resume maintenance coverage under the existing City of Madison elevator maintenance contract. During the course of the modernization all elevator equipment, whether new or retained and reconditioned, shall be fully covered under complete maintenance, and any proration of costs to Owner is prohibited.

A. Interim maintenance shall include 24-hour callback service and commence upon the start of work on the first elevator and continue until both elevators have passed the AHJ acceptance inspections and been turned over for public use.

B. 12 months after completion of the final elevator the Elevator Contractor shall verify that the counterweight runby meets the applicable requirements of A17.1 2016 and that the suspension means tension meets the requirements of A17.1 2016 8.6.4.1.3. Findings and suspension means tension measurements shall be included in the maintenance records.

C. Prior to completion of the 12-month warranty period, the Elevator Contractor shall complete the Category 1 testing on both elevators. Required test reports shall be filled out and kept in the machine room service records.

D. Prior to completion of the 12-month warranty period, the Elevator Contractor shall verify the counterweight runby is a minimum of 6" and make any adjustments as necessary. In addition, the tensioning of the suspension means shall be measured and adjusted to be code compliant; within 10%.

E. Maintenance service shall be performed by skilled and trained employees of the Elevator Contractor and shall not be subcontracted. Elevator Contractor shall provide all material and labor, and original equipment manufacturer (OEM) parts shall be used.

F. **The preventive maintenance program following the completion of both elevators shall consist of 8-hour callback service** and an examination, cleaning, lubrication, adjustment, parts replacement, painting, testing, and repair service performed.

G. Beginning with final acceptance of the first elevator, provide not less than twelve (12) monthly maintenance examinations at approximately 31-day intervals on all equipment detailed above, commencing on the date of final acceptance for the final elevator and continuing throughout the 12-month warranty and maintenance period.

H. Each scheduled monthly preventive maintenance inspection shall be a minimum of 90 min.

I. All new and existing elevator equipment shall be fully covered under complete maintenance whether new or retained.

J. Maintenance service shall include providing 24 hour/7 day a week phone monitoring service for the emergency elevator telephone. Monitoring service shall provide notification to Owner per Owner's instructions upon receipt of any calls initiated from elevator emergency phones.

K. In the event the minimum service inspections are not provided at the prescribed time interval and duration, the Elevator Contractor shall extend its warranty and complete maintenance coverage, including all callbacks, repairs, parts, testing, labor and any other items necessary to keep the elevator in like new condition until a minimum of 12 maintenance examinations at approximately 31 day intervals have been completed.

L. Maintenance shall include callbacks during regular working hours at no additional cost subject to the following exclusion: Repair or replacement due to low voltage, misuse, abuse, or neglect caused by persons other than Elevator Contractor's personnel is excluded from coverage unless it is a result of work provided under this specification. Overtime or excluded callbacks may be invoiced using hourly labor rates included on the Bid Form at the difference between the applicable overtime and regular time rates.

M. Maintain the elevator machine room, hoistway, car top, pit, and equipment in these areas in clean condition throughout and at the end of the one-year warranty/maintenance period.

N. Elevator Contractor is responsible for providing a written record of work performed at the time of each visit, which must be kept in the elevator equipment room. Elevator Contractor shall be solely responsible for all General Maintenance Requirements of

ASME A17.1-2016 Req. 8.6.1.2 and Maintenance Records per Req. 8.6.1.4, including a Maintenance Control Program, and Firefighter's Service check documented on a quarterly basis at a minimum. Maintenance record format is subject to approval by the Owner and records shall be kept in the machine room and available to the Owner at all times.

O. Elevator Contractor shall respond on site within two hours of any request for service during regular working hours or overtime callbacks.

1.13 EXTENDED MAINTENANCE

None included.

1.14 INSURANCE REQUIREMENTS

Contractor is required to carry and maintain the insurance coverages listed in the City of Madison Terms and Conditions included in the bid documents.

1.15 CONTRACT ADMINISTRATION

A. Bidder shall be prepared to enter into a construction contract provided by General Contractor.

B. Bidder agrees to abide by all work requirements listed in the City of Madison Construction Documents.

1.16 BIDS AND FORMAT OF BID

A. Bids may not be withdrawn after submittal, nor modified, withdrawn, or cancelled by Bidder for 90 days after receipt of bids.

B. BASE BID: Submit Lump Sum Price for modernization of two (2) Kone Elevator electric passenger elevators, Regulated Object ID 511199-511200 in complete compliance with the specification and drawings.

C. ADDITIONAL WORK BID: Provide Lump Sum pricing to clean and paint black all hoistway divider beams, guide rail brackets and vertical surfaces of the car and counterweight guide rails. Exposed metal surface of guide rails for roller travel shall not be painted.

PART 2 – PRODUCTS

2.1 SUMMARY: TWO (2) EXISTING KONE ELECTRIC PASSENGER ELEVATORS

FEATURE/COMPONENT	ELEVATOR #1-2	DISPOSITION
CAPACITY	2,500 LBS	RETAIN
RATED SPEED	350 FPM	RETAIN
REG OBJECT ID	ELEV 1 – 511119 ELEV 2 – 511200	RETAIN
INSTALLATION DATE	1996	
NET TRAVEL	ELEV 1 – APPROX 62’ 4” ELEV 2 – APPROX 72’ 8”	RETAIN (VERIFY)
POWER SUPPLY	480 VAC – 3 PH – 60 CY	RETAIN (VERIFY)
LANDINGS (IN LINE)	ELEV 1 – 7 FRONT/1 REAR ELEV 2 – 8 FRONT	RETAIN
CLEAR INSIDE	ELEV 1 – 6’ 8” W x 4’ 3” D ELEV 2 – 6’ 8” W x 4’ 3” D	RETAIN
EMPTY CAR WEIGHT (CROSSHEAD PLATE)	4,900 LBS	RETAIN
MACHINE LOCATION	OVERHEAD MACHINE ROOM	RETAIN
DRIVING MACHINE	MONT/KONE 208E	NEW ACPM GEARLESS MACHINE
EMERGENCY BRAKE	NONE	NEW PER MANUFACTURER
SUSPENSION ROPES	ELEV 1 – (6) 5/8” ELEV 2 – (6) 1/2"	NEW PER MACHINE MANUFACTURER
DEFLECTOR SHEAVES	IN MACHINE ROOM	NEW AS SPECIFIED
CONTROLLER	KONE MIPROM	NEW NON-PROPRIETARY MICROPROCESSOR
MOTION CONTROL	VVVF AC	NEW ACPM DIGITAL CLOSED LOOP REGENERATIVE DRIVE
OPERATION CONTROL	DUPLEX OPERATION	RETAIN
CONTROL FEATURES, PROVIDE NEW	A17.1-2016 FIREFIGHTERS’ OPERATION PHASES I & II BYPASS AND ANTI-NUISANCE LOADWEIGHING DEVICE INDEPENDENT SERVICE, HOISTWAY ACCESS, ASCENDING CAR AND UNINTENDED MOTION PROTECTION	
HOISTWAY ENTRANCE	3’ 6” x 7’ 0” SSCO	RETAIN SIZE
DOOR PROTECTION	INFRARED CURTAIN	NEW FORMULA SYST FCU47 PLUG & PLAY
DOOR OPERATOR	MAC HARMONIC	NEW GAL MOVFR-II
CAR DOOR EQUIPMENT	SINGLE SPEED SIDE OPENING	RETAIN CAR DOOR PANELS, NEW SHEAVES, CLUTCH
HATCH DOOR EQUIPMENT	SINGLE SPEED SIDE OPENING	RETAIN HANGERS, NEW SHEAVES AND INTERLOCKS

FEATURE/COMPONENT	ELEVATOR #1-2	DISPOSITION
HOISTWAY DOOR PANELS	SINGLE SPEED SIDE OPENING	RETAIN EXISTING
HOISTWAY DOOR SILLS	EXTRUDED ALUMINUM	RETAIN, CLEAN EXIST
CAR DOOR SILL	EXTRUDED ALUMINUM	RETAIN, CLEAN EXIST
SAFETY	MONT/KONE TYPE B	RETAIN, REFURBISH EXISTING
SPEED GOVERNOR	KONE	REPLACE WITH NEW HW
GOVERNOR ROPE AND TENSION ASSEMBLY	3/8” 8X19 WIRE ROPE	REPLACE WITH NEW
CAR BUFFERS	(1) OIL	RETAIN, TEST AND PAINT
CWT BUFFERS	(1) OIL	RETAIN, TEST AND PAINT
CAR ROLLER GUIDES	MONTGOMERY 7”	REPLACE PER SPEC
CWT ROLLER GUIDES	MONTGOMERY 4”	REPLACE PER SPEC
GUIDE RAILS, RAIL BRACKETS, FASTENERS	15# CAR / 8# CWT	RETAIN, CLEAN AND ALIGN, TIGHTEN GUIDE RAIL, BRACKET FASTENINGS
COUNTERWEIGHT	RETAIN AND RECONDITION EXISTING, REBALANCE	
TERMINAL STOPPING DEVICES	ROLLER LIMIT SWITCHES	NEW COMPATIBLE WITH NEW CONTROLS
CAR ENCLOSURES	REFURBISH PER SPECIFICATION	
SIGNAL FIXTURES	NEW INNOVATION INDUSTRIES WITH CHOICE OF BUTTON, LED ILLUMINATION	
CAR STATION (NEW)	ALL DEVICES TO BE PROVIDED IN NEW COP: NEW PUSHBUTTONS, KEY SWITCHES, FLUSH BRAILLE, 2” HIGH DIGITAL POSITION INDICATOR, SERVICE CABINET IN COP	
DIRECTION INDICATORS	IN CAR ENTRANCE	NEW AS SPECIFIED
FIRE SERVICE DEVICES	INCORPORATE IN NEW STATION AT *1 LANDING	
JAMB BRAILLE	AT EACH LANDING	NEW TO BE PROVIDED
TOP OF CAR INSPECTION	NEW WITH ENABLE BUTTON, GFCI RECEPTACLE, & LIGHT	
MISCELLANEOUS NEW	NEW PIT STOP SWITCHES, ALARM BELL, CAR & HOISTWAY WIRING INCL TRAVELING CABLES, STATUS PANEL	

2.2 MATERIALS

The following suppliers and products may be considered approved providing they comply with other specification requirements. Other suppliers and products must be approved by Consultant and the Owner in writing prior to Bid Date.

A. MICROPROCESSOR-BASED GROUP CONTROLS: The following control systems are approved subject to full compliance with requirements of req. 2.4 A.

1. GAL Manufacturing – GALaxy IV Elevator Control
2. Smartrise – C4
3. or approved equal

B. GEARLESS ACPM MACHINE:

1. Hollister Whitney GL171
2. Imperial 525
3. or approved equal

C. CLOSED LOOP DOOR OPERATOR:

1. GAL Manufacturing – MOVFR-II
2. or approved equal

D. SIGNAL FIXTURES:

1. Innovation Industries
2. or approved equal

E. CAR CEILING:

1. Snap Cab
2. Globe
3. Retro Elevator
4. or approved equal

2.3 DUPLEX OPERATION

Duplex Operation: Using a microprocessor-based controller, the operation shall be automatic by means of the car and landing buttons. Stops registered by the momentary actuation of the car or landing buttons shall be made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. All stops shall be subject to the respective car or landing button being actuated sufficiently in advance of the arrival of the car at that landing to enable the stop to be made. The direction of travel for an idle car shall be established by the first car or landing button actuated.

“UP” landing calls shall be answered while a car is traveling in the up direction and “DOWN” landing calls shall be answered while a car is traveling down. The car shall reverse after the uppermost or lowermost car or landing call has been answered and then proceed to answer car calls and landing calls registered in the opposite direction of travel.

If the car without registered car calls arrives at a floor on which both up and down hall calls are registered, it shall initially respond to the hall call in the direction that the car is traveling. If no car call or hall call is registered for further travel in that direction, the car shall close its doors and immediately reopen them in response to the hall call in the opposite direction. Hall lantern shall indicate the change in direction.

2.4 MACHINE ROOM EQUIPMENT

A. MICROPROCESSOR BASED CONTROLS:

The elevator controllers shall be designed specifically for elevator applications and shall comply with all applicable elevator and electrical safety codes. Elevator logic shall be implemented with a real-time, multi-tasking operating system to allow the processor to simultaneously execute elevator control logic, drive control logic, operator interface logic, and communication support. The controller shall be approved to the latest edition of ASME-A17.5, and a complete procedure for testing and demonstrating compliance to the ASME A17.1-2016 edition shall be provided at a minimum.

1. MOTION CONTROL: Microprocessor based AC, synchronous motor control with digitally encoded closed-loop position velocity feedback suitable for operation specified and capable of providing smooth, comfortable car acceleration, retardation, and dynamic braking. The closed loop feedback power control shall continuously

monitor the actual elevator speed for optimal, safe operation.

2. POWER CONVERSION AND REGULATION: The AC drive shall be fully regenerative to allow the overhauling loads to feed clean power back to the building's electrical system. Isolation transformer, suppression and/or filters for electromagnetic interference (EMI) and radio frequency interference (RFI) shall be provided where recommended by the controls manufacturer or required by jobsite conditions.

    a. **Where KEB drives are provided, the Elevator Contractor shall include the Bluetooth Adapter, Part # 0058K60-L060, which shall remain on site as property of the Owner.**

3. ON-BOARD DIAGNOSTICS: The controller shall have extensive on-board diagnostic capability. All available programming options or parameters shall have field programmable parameters (door times, etc.) without requiring external tools or troubleshooting devices. Programmable options and parameters shall be stored in nonvolatile memory. Time-based requirements to upgrade software or access shall be prohibited.

    The control system shall be equipped with plainly labeled diagnostic LEDs, indicators for displaying car position, direction, car/hall calls, relay indicators, etc., and buttons to allow user interface to all controller adjustment and setup parameters.

4. TESTING COMPATIBLE: Onboard software shall enable any service provider to perform all applicable Category 1 and Category 5 tests without additional interface or access codes.

5. INDEPENDENT SERVICE: Independent Service Operation shall be provided so that actuation of a switch in the car operating panel will cancel any existing car calls, and hold the doors open at the landing. The car will then respond only to car calls. Car and hoistway doors will only close with constant pressure on a car call pushbutton or door close button.

6. HOISTWAY ACCESS OPERATION: When enabled by the in-car inspection key switch, access to the car top and pit shall be available through means of key switches at both terminal landings. The operation of the continuous pressure key switch at either access landing will initiate and maintain movement of the car with the hoistway doors at this landing open, subject to code requirements.

7. MACHINE ROOM INSPECTION OPERATION: An inspection switch and an up/down switch shall be provided in the controller to enable inspection operation. When activated the elevator should be removed from group operation.

8. UNINTENDED MOTION AND ASCENDING CAR OVERSPEED PROTECTION: Per ASME A17.1 2016 requirements provide Hollister Whitney rope gripper emergency brake for each elevator, if required by driving machine manufacturer.

9. LEVELING: The elevators shall be equipped with automatic two-way leveling to control initial floor stops of the car to within .25" (6.35 mm) or better above or below the landing sill, with any load up to full load.

10. LOAD WEIGHING: Provide means for weighing car passenger load. Provide hall call by-pass when the car is filled to preset percentage of rated capacity and traveling in down direction. If car loading relative to weight in car is not commensurate with number of registered car calls, then cancel car calls.

11. DISPATCHING: The control system shall incorporate multiple microprocessor systems, one installed inside each car control cabinet. In the event that the primary dispatching means fails, car controllers shall communicate and share dispatching functions of supervision and call assignment data with backup group dispatching from other controllers.

12. FIREFIGHTERS' EMERGENCY OPERATION: FEO and operating features shall be incorporated per ANSI A17.1-2016 code requirements.

13. AUTO CAR LIGHTING SHUTOFF: For automatic operation of car lighting in compliance with ASME A17.1-2016 req. 2.14.7.2.2.
14. REMOTE MONITORING: Equipment shall be capable of remote monitoring.
15. USER INTERFACE: Where provided by control manufacturer, provide one laptop computer or tablet with monitor and keyboard for diagnostics, fault reporting, and adjustment of parameters, timers, call security settings, and ride quality. All diagnostic and programming equipment including hardware, software, and instructional manuals shall be considered the property of the Owner.
16. TECHNICAL SUPPORT: In-house technical support from the control manufacturer for the life of the product, available to both the initial installer and any future maintenance company.
17. PARTS AVAILABILITY: Minimum of 10 years available supply for key spare and replacement parts.
18. ELECTRICAL TRANSFORMERS: To retain the electrical design of the existing elevator equipment the Elevator Contractor shall provide and install electrical transformers for each elevator controller to transform the 208v building voltage to 480v for the new elevator equipment.

B. GEARLESS ACPM MACHINES:

New heavy duty gearless AC machines should be designed for the existing capacity and rated speed. Components shall be mounted on a fabricated steel base.

1. MACHINE MOUNTING: Each machine shall be installed directly over the hoistway and fastened to the existing machine beams or structural slab per site conditions. Existing machine beams may be reused or removed and replaced with new - in coordination with elevator driving machine manufacturer. **If new machine beams are provided Elevator Contractor is responsible for verifying adequate structural support and installation.** Verify machine beam reactions and provide structural mounting to the existing or new machine beams consistent with the new machine manufacturer’s recommendations. Incorporate the manufacturer’s recommended isolation assembly to minimize the transmission of noise and/or vibration to the elevator car, building structure, or occupied areas of the building.
2. AC MOTOR: The new machines shall have a 60-minute duty AC synchronous permanent magnet design motor especially designed for elevator service and shall be sized or configured as required for the duty specified. A digital velocity encoder shall be provided to give feedback to the controller on motor speed and position.
3. BRAKE: A solenoid activated machine brake shall be spring applied and electrically released and designed and adjusted to hold the car at the floor with load up to 25% in excess of the rated load, after it has come to rest. The brake shall automatically apply in the event of interruption of power supply from any cause and be equipped with a brake switch. Control of the brake shall be digital. The setting and lifting of the brake shall be software based and all electronic. A redundant emergency braking means shall also be provided. Brake release tool shall be provided in the machine room and is the property of the Owner.
4. DRIVE SHEAVE: The machine shall have an integral traction sheave accurately turned and grooved for the quantity and size of hoist cables (min 1/2") required for the duty specified. The sheave shall be equipped with suitable sheave and cable guards.
5. DEFLECTOR SHEAVE: Provide new steel deflector sheave with guarding inside the elevator machine room.
6. GUARDING: Provide manufacturer’s complete guarding option for machine, drive sheave, bedplate, and machine/deflector stand. All pinch points shall be guarded, and guarding must be easily removable for maintenance.

C. EMERGENCY BRAKE: Provide an emergency brake for protection against ascending car overspeed and unintended car movement in conformance with ASME A17.1-2016 requirement 2.19. The device shall stop the elevator in the event of a mechanical or electrical failure in both the upward or downward direction. Contractor shall provide structural mounting directly to the machine beams, or integral factory design mounting on brake side of machine bedplate. Wear in linings, and test consistent with manufacturer's recommended procedures.

D. STRUCTURAL MOUNTING:

1. Furnish and install structural steel where required and provide or modify supports for the new traction machine, emergency brake, and machine room mounted cable deflector sheave. Provide bearing plates, anchors, shelf angles, beams, and blocking as required to support new equipment fastened directly to the existing machine beams. Include all mounting hardware and related components.

2. Provide any engineering or design services for the installation of new equipment requested by the City of Madison for compliance with A17.1 2016. Contractor shall verify the adequacy of new or existing structural beams, structural slabs, supports, foundations, or building structure to support the loads by a licensed professional engineer as required by ASME A17.1-2016 req. 2.9 and the City of Madison. **The new driving machines and supports shall be reviewed by a WI licensed Professional Engineer to ensure they are compliant with ASME A17.1 2016.** All costs shall be borne by the Contractor.

3. All welding shall comply with ASME A17.1-2016 req. 8.8. Where adjacent beams have greater than 5 degree sloping flanges of structural shapes, beveled steel washers shall be used. All structural supports, guarding, etc. shall be painted by Contractor.

E. SPEED GOVERNOR:

The existing overspeed governors shall be removed and replaced with new overspeed governors, including wire rope and tail sheave assemblies. Governors shall be manufactured by Hollister Whitney.

Existing governors are mounted to the machine beams. New governors may be mounted to existing or new machine beams or mounted at floor level if machine beams are replaced with shorter beams.

F. TEMPERATURE/HUMIDITY SIGNAGE: The temperature and humidity range specified by the elevator controls manufacturer shall be permanently posted in the machine room.

G. CODE DATA PLATE: Provide metal plate on controller indicating A17.1, IND 4 and SPS 318 codes under which the elevators were installed and modernized.

2.5 HOISTWAY EQUIPMENT

A. GUIDE RAILS: Reuse planed steel car and counterweight guide rails and rail brackets. Tighten rail bracket, rail clip, fishplate and connection bolts, shim, realign, clean, remove rust, and file rails and joints as required to provide smooth car ride. Provide supplemental rail brackets, supports, and/or backing where needed to enhance car ride quality or minimize deflection.

B. HOISTWAY ACCESS: Hoistway access operation shall be provided from new keyed switches at the terminal landings in full compliance with A17.1-2016 Requirement 2.12.7.

C. TERMINAL-SLOWDOWN AND STOPPING DEVICES: New terminal stopping devices compatible with the new traction controls shall be provided in compliance with A17.1-2016 Requirement 2.25.

D. SUSPENSION ROPES:

1. New traction steel wire suspension ropes shall be provided of the proper size, grade,

construction, and ultimate breaking strength, as determined by the traction machine manufacturer and ASME A17.1-2016 requirements.

2. Wire rope specification shall also match original design requirements indicated on the crosshead data plate and be a minimum of 1/2” diameter.

3. New wire ropes shall be complete with new wedge clamp shackles at both rope terminations, rope data tag, and mounting hardware, including two rope clips per shackle.

4. Make necessary modifications to cable hitch plates for the quantity and size of suspension ropes required for the new traction machine.

E. COUNTERWEIGHT:

1. Contractor shall ensure that no defects exist or shall repair or replace, including frame, filler weights, and wire rope terminations.

2. Elevator cars shall be suitably counterbalanced by adjusting the quantity of existing and/or new counterweight fillers to a 40-45% ratio per industry standards. Take measures to reduce free play in filler weights and the associated noise.

3. The existing counterweight roller guides shall be replaced with new spring tensioned Elsco Model D assemblies or Hollister Whitney Model 379.

4. Contractor shall document the weight or materials removed and added to the car. If the modernization results in an increase or decrease in the deadweight of the car that increases or decreases the sum of the deadweight and rated load, as originally installed, by more than 5%, the installation shall be made to conform to all applicable code requirements.

5. A minimum of 6” counterweight runby shall be provided at all times.

6. Provide counterweight runby data plate in elevator pit per A17.1-2016 requirement 2.4.5. Data plate shall clearly state the maximum and the minimum counterweight runby.

F. PIT EQUIPMENT:

1. PIT LADDER: Existing steel pit ladders may be reused and retained. Provide non-slip surfacing on ladder rungs, by thoroughly cleaning and then applying sand textured paint. Horizontal distance from pit ladder to hoistway door unlocking means shall not exceed 39”. Relocate other equipment such as installed electrical devices, hoistway duct or conduit wireways, junction boxes, traveling cable(s), or other components as required, which shall not block or inhibit access to the ladder and shall not be located behind the ladder.

2. EMERGENCY STOP SWITCH: Furnish and install new push to stop emergency stop switch in elevator pits located 18” above the bottom landing. Stop switch shall be adjacent to the new ladder and accessible from the hoistway entrance. Elevator #1 shall be provided with additional stop switch located not more than 47” from the pit floor.

3. CAR AND COUNTERWEIGHT BUFFERS: The existing pit mounted oil buffers may be retained and reconditioned. Inspect, clean, recondition, remove corrosion, and paint existing buffer equipment, including buffer stands, and support channels. Replace buffer fluid and demonstrate successful buffer test. Perform necessary repairs or adjustments to meet code or performance requirements or replace equipment found not to be in acceptable condition for reuse. Provide and install new electrical safety switches on buffers and replace corroded conduit on pit floor with new.

4. PAINTING: Clean and paint new and existing pit equipment, including lower guide rails and counterweight rails and rail brackets, governor tension weight assembly, guards, buffers, stands and supports. Pit floor shall be thoroughly cleaned and broom

swept.

5. FASCIA: Fascia below elevator landing sill at bottom landing shall be verified to protect full width of car door opening and shall extend to where the car rests of the fully compressed buffer. If fascia needs to be extended to provide full protection elevator contractor shall extend fascia or replace with new. Fascia shall be returned to wall or continue to elevator pit floor. **Fascia for full length of hoistway shall be scraped and painted black.**

G. DOOR OPERATOR EQUIPMENT: All new and existing door operator equipment shall be adjusted to comply with current Elevator code and Part 3 Performance standards, including the maintenance standards contained in the NEII-1 Building Transportation Standards and Guidelines by the National Elevator Industry, Inc.

1. DOOR OPERATOR: A new closed loop, microprocessor based heavy duty harmonic door operator shall be provided, MOVFR-II or approved equal. The processor will monitor the door's actual position and velocity compared to its desired position and velocity. If variations are detected in the profile the command will be automatically corrected. **One hand-held programmer used to adjust the operators shall be provided and is to be considered property of the Owner.**
2. CAR DOOR CLUTCH: Furnish and install new GAL car door clutch assembly. The door equipment shall be adjusted so that the car or hoistway doors shall not be opened more than 4 inches from inside the car when outside the new 7" unlocking zone; and the doors shall be unlocked when the car is within 3 inches (76 mm) above or below the landing. Provide GAL door zone lock with new clutch assembly.
3. DOOR REOPENING DEVICE: Provide and install new car door reopening device. The car and hoistway doors should open automatically without contact should the doors become obstructed or detect an advancing passenger or freight object. The new door reopening devices and reduced speed door closing on Phase I and Phase II shall comply with Code requirements on Firefighters' Operation.
4. CAR DOOR HANGERS: The existing car door hangers and tracks should be cleaned and lubricated. Provide all new polyurethane hanger sheaves, upthrust rollers, eccentrics, hardware, etc.
5. CAR DOOR PANELS: Retain existing car door panels. Provide new gibs and polish stainless steel panels. Replace damaged astragals on center opening doors.
6. HOISTWAY DOOR ROLLERS: Clean, polish, and lightly lubricate existing hanger tracks. Provide all new polyurethane hangar sheaves, upthrust rollers, eccentrics, hardware, etc. Existing top safety retainers may be retained and reused. Make necessary repairs or replacements where required.
7. HOISTWAY DOOR INTERLOCKS: Provide all new GAL interlocks and release assemblies. Interlock pickup assemblies shall be pinned in place after final adjustment.
8. DOOR CLOSERS: Provide all new heavy duty reel closers.
9. HOISTWAY ENTRANCE DOOR PANELS, FRAMES AND FASCIA: Retain existing hoistway entrance frames and door panels. Clean hoistway side of door panels as necessary. Provide new aluminum escutcheon tubes where existing tubes are missing. Remove any rust or corrosion on the inside of the hoistway door panels. Replace any damaged or missing dust covers or fascia plates. Provide all new gibs on each hoistway door. Bottom retainers shall be replaced where missing.
10. HOISTWAY DOOR SILLS: All existing landing sills may be reused in place. Clean and polish existing landing sills, including unexposed ends inside hoistway.
11. RUNNING CLEARANCE: The horizontal clearance between the car and landing sills shall not exceed 1-1/4" at any landing, and shall not be less than 3/4", and the platform shall be level with the landings. Provide extended car sill where required to

achieve the required clearances.

12. MISCELLANEOUS: Replace all missing bumpers on strike side of elevator car and landing entrances. Repair or replace damaged astragals at each elevator entrance.

H. ELEVATOR IDENTIFICATION

1. JAMB BRAILLE: Remove existing Braille plates. Install new Braille plates on both entrance jambs at each landing, subject to Owner approval. New Braille plates shall not be smaller than existing.
2. IN HOISTWAY: Where existing hoistway floor numbers are missing or incorrect provide new hoistway floor number decals, not less than 4 inches in height, on the hoistway side of the enclosure and hoistway doors.
3. ON EQUIPMENT: Each elevator shall be identified with decals containing the corresponding Elevator number per A17.1-2016 2.29 requirements, on the driving machine, controllers, governor, disconnect switch, car lighting disconnect, crosshead, car operating panel, and buffers.
4. ELEVATOR ID: Provide metal elevator identification signage on both entrance jambs at the Designated and Alternate landings, not less than 2 inches in height and located immediately below the jamb Braille. Sign selection shall be subject to Owner's approval.

I. CAR ACCESSORIES

1. WORK LIGHT AND RECEPTACLE ON CAR TOP: Provide 120V 15 ampere utility outlet on the car top with ground-fault circuit-interrupter receptacle (GFCI). A minimum of two lights on each elevator car top, activated by a single switch, shall provide an illumination level of not less than 10 fc. One light shall be portable with a permanently connected flexible cord and magnetic base. All light bulbs shall be externally guarded against breakage. Lighting shall not be connected to the load side of the GFCI.
2. EXHAUST FAN: Provide new car top ventilation fan.
3. **BATTERY BACKUP: Provide battery standby power for the ventilation fans on each elevator per requirements of A17.1 2.14.2.3.3.**
4. CAR TOP INSPECTION STATION: Furnish and install a new NEMA 1 rated top-of-car inspection station with light fixture, transfer switch, push to stop emergency stop switch, and constant pressure (up - down - enable) buttons. Elevator 1 shall be provided with an additional car top stop switch easily accessible from the rear landing entrance.
5. TOP OF CAR RAILING: Provide car top handrailing compliant with A17.1 2016 requirements with top rail, mid rail and 4" toe board.
6. STABILIZERS: Provide new stabilizer system providing stability and isolation between the car enclosure and stiles.
7. EXIT CONTACT: The car top emergency exit cover shall be fastened in the closed position from the car top and provided with an electrical contact that must be manually reset from the top of the car after the exit cover is within 2 inches of the fully closed position.

J. SELECTOR POSITIONING SYSTEM: A position/speed feedback system shall be provided, using dual independent means reading a fixed guide rail sensor, a fixed tape system, a motor or governor encoder, all with multiple independent processors. System shall be an absolute position type, in which the car doesn't need to move to reestablish position in the hoistway after a power outage.

K. LOADWEIGHING DEVICE: Provide a load weighing device compatible with the manufacturer controls. When an elevator is filled to an adjustable percentage of the

capacity load, the elevator shall bypass hall calls but not car calls. The passed landing calls shall remain registered for the next elevator. The microprocessor control system shall compare the load on the elevator to the number of car calls registered. If the number of car calls exceeds the load by a field programmable value, the car calls shall be canceled after the first call has been answered. The loadweigher shall automatically recalibrate itself periodically.

L. TRAVELING CABLES: All new hoistway traveling cables shall be provided.

1. Elevator traveling cable shall be Type E, EO, ETP, or ETT with flame and moisture resistant outer covering.
2. Provide one (1) Cat 5e cable for security camera inside each elevator cab for future use.
3. Provide four (4) #20 AWG twisted shielded pair conductors for card reader wired back to the elevator controller. Elevator #2 shall be provided with card reader at time of installation. Wiring for Elevator #1 shall be for future use.
4. A minimum of 10% spare wires for future use shall be provided in both the traveling cables(s) and hoistway wiring. Include at least three (3) #20 AWG twisted shielded pairs and tag conductors as ‘spares’.
5. Divider beams or other equipment in the hoistway that make contact with the flexible portion of the traveling cable shall be guarded to protect against damage.

2.6 CAR FRAME AND PLATFORM EQUIPMENT

A. CAR FRAME AND PLATFORM: Check, tighten, or renew all car frame fasteners as required. Renew any compressed isolation pads on the platform assembly. Repair any voids in the sheet steel fire resistant barrier below the platform subflooring. Paint the accessible parts of the car frame and platform structure including underside of platform in black enamel or other approved color.

B. SAFETY DEVICE: The existing Type B safety device shall be inspected, cleaned, reconditioned, tested with capacity load, and demonstrated that it is in conformance with code requirements. Make any necessary repairs required, including at the time of acceptance testing. Inspect, recondition, adjust, calibrate, replace safety switch, and test complete governor, release carrier, and car safety system. Making necessary repairs to fully comply with elevator code requirements, otherwise provide new Hollister-Whitney Type “B,” Model 480 flexible guide clamp safety.

C. PLATFORM GUARD (APRON): A new smooth metal guard plate shall be provided on the entrance sides of the platform, minimum 14 gauge steel, reinforced and braced, extending below the surface of the platform a minimum of 48” , per 2.15.9. Provide galvanized or painted finish. Contractor shall take all measures required, including modification or replacement of the existing buffer assemblies and strike plates.

D. CAR ROLLER GUIDES: The existing car roller guides shall be replaced with new ELSCO Model B car roller guides equipped with six 6” spring dampened, sound-deadening rollers per shoe assembly. Adjust to maintain roller contact with the guide rails regardless of load or position in the hoistway.

E. CLEANING: Car tops and car top equipment shall be thoroughly cleaned of dust and debris.

2.7 CAR ENCLOSURES

A. Existing wall finishes shall be retained. Polish brushed stainless steel vertical surfaces, including car door panels using Ace Metal Refinishers or other approved vendor. Existing 5WL wall panels shall be thoroughly cleaned and wiped down.

B. Glass wall panels inside each elevator cab shall be replaced with new glass panels. Glass panels and their installation shall meet the requirements of A17.1 2016 2.14.1.8 and the required labeling shall be visible from the inside of the elevator.

C. CEILING AND LIGHTING: Basis of Design – Snapcab Island Ceiling

1. Provide new stainless steel suspended ceiling with recessed LED lighting. **Suspended ceiling shall be designed with a close fit to the car enclosure so that trash and debris cannot be placed through the sides of the ceiling and into the panels.** Any tools necessary to replace the in-car lamps shall be provided to the Owner at the time of installation.

2. Provide automatic operation of car lighting to control lights in an unoccupied cab in compliance with ASME A17.1-2016 req. 2.14.7.2.2 after an adjustable time interval.

3. At least two lamps adjacent to the car operating panel shall function as emergency lighting.

D. HANDRAILS AND BUMPER RAILS:

1. Existing handrails shall be reused, tightened and polished to remove any scratches.

E. CAR SILL:

1. Existing car sills shall be retained, cleaned and polished.

F. PROTECTION PADS: None to be provided.

2.8 SIGNAL FIXTURES – GENERAL

A. SIGNAL FIXTURE COVERPLATES: Remove existing fixtures and hall call stations at each landing. Coordinate any necessary cutouts for new fixtures and wiring with Owner. New coverplates shall cover the entirety of the cutout from the existing fixture.

B. PUSHBUTTONS: New car station pushbuttons shall be minimum 1” diameter round raised call register pushbuttons. The visible indication shall extinguish when the car arrives at the designated floor. Owner shall select button and Braille design from Innovation Industries’ available products. Bruiser PB-72 is preferred.

C. ILLUMINATION: All new and existing signal fixtures, including car and landing pushbuttons, position indicator, and car direction indicators shall be provided with long-life LED illumination. Buttons shall have LED illumination in Owner’s choice of standard colors.

D. KEYS: Two (2) keys shall be provided to the Owner for each key switch.

E. EMERGENCY OPERATION KEY SWITCHES: Firefighters’ Operation key switches shall be keyed FEO-K1 as per ASME A17.1-2016 requirements.

2.9 CAR SIGNAL EQUIPMENT

A. NEW CAR OPERATING PANEL: Contractor shall provide one new car control panel per elevator. Each panel shall be stainless steel, containing all specified devices in a single coverplate. Unless stated otherwise, devices listed below shall be provided in both panels.

1. Elevator number and rated load in replaceable laser etched data plate near top of coverplate.

2. Digital car position indicator with 2” high visible indicator.

3. Fire Cabinet: Fire Operation grouped together near the upper section of the car operating panel behind a locked cover labeled ‘Firefighters’ Operation’ in red letters and operable by a FEO-K1 switch. Devices behind the locked cover shall include: car call pushbuttons, Fire Operation Phase II key switch, call cancel button, visual fire hat signal, Firefighters’ stop switch, additional door open and door close buttons, and operating procedures signage.
4. An additional illuminated fire hat visual signal shall be located in the car operating panel coverplate above the Fire Cabinet.
5. Devices shall be provided in a locked service cabinet: toggle fan, light, and independent service switches, GFCI duplex receptacle and keyed hoistway access enable. Hoistway access in the car and in the hall shall be keyed the same. Cabinet shall be engraved ‘Service Cabinet’.
6. Floor call buttons shall be arranged with numbers in ascending order up to 48” high and shall read from left to right.
7. Exposed non-illuminated door open and door close buttons.
8. Exposed alarm button shall be provided. Button shall illuminate and ring signal bell on elevator when activated. Alarm bell inside elevator shall operate on battery standby power.
9. Exposed keyed in-car stop switch.
10. Braille: Metal tactile characters and Braille, mechanically fastened and field replaceable integral cast designations substantially flush with the front of the coverplate. Adhesive type plates are not acceptable.
11. Provide a self-dialing ADA compliant emergency phone button on the car operating panel. Coordinate the programming and testing of the telephone, which shall enable emergency personnel within the building to establish two-way voice communications to each car individually. Two-way voice communication shall be established without any intentional delay and shall not require intervention by a person within the car. The means shall override communications to outside of the building, be compatible with customer’s telephone system and ASME A117.1-2017 and ASME A17.1-2016 compliant. Program to dial Parking Garage’s security monitoring company as primary with Elevator Contractor’s phone monitoring service as secondary number. Existing cellular phone lines shall be reused.
12. Support – Car station panel shall be provided with heavy duty hinges and shall swing open to the side.
13. Company name or logo: None visible is permitted.

B. ELEVATOR VOICE ANNOUNCER: Audible voice announcer shall play message as the elevator passes or stop at a floor and contain additional standard messages as selected by Owner. Device shall have volume adjustment and the ability to deactivate non-elevator code required messages.

2.10 CORRIDOR SIGNAL FIXTURES

A. CALL STATIONS: Provide one riser of corridor call stations on each side of the elevator lobby, installed in the same location as the existing fixtures. Hall call stations and Hoistway Access fixtures shall be recessed and sized to match existing.

1. A single call register button at each terminal landing and up and down call register buttons at intermediate landings.
2. The call buttons shall be centered at 42” AFF.
3. Provide separate ‘In case of fire’ pictograph signs. Signs shall be mounted in a robust and secure manner to walls at each landing.
4. The hall stations installed adjacent to Elevator #1 at the front landings shall be

provided with an additional pushbutton to place a call for Elevator in the direction of travel to the rear Skywalk entrance. The face of the hall stations shall be engraved ‘Skywalk’ under the additional button. Hall stations shall be provided with braille tags in the fixture to match the existing fixtures.

B. HOISTWAY ACCESS: Provide new constant pressure keyed access switch with labeled key core located at both terminal landings, located either in the hoistway door sight guard. Key switch shall be located within 12” of the elevator entrance.

C. FIXTURES AT *1:

1. FIREFIGHTERS OPERATION: A17.1-2016 compliant Phase I emergency recall key switch, illuminated signal, and Phase I operating procedures signage shall be incorporated into new hall call station adjacent to Elevator #1 at landing *1.

2. Existing fixture at landing *1 for the Lobby Car Controls shall be removed and replaced with the new Communication Failure fixture. Fixture shall be designed to fit into existing cutout.

D. CUTTING AND PATCHING: The Contractor shall provide any cutting and patching required for installation of new corridor signal fixtures.

E. STATUS PANEL: Elevator Status Panel: Provide one elevator status panel in the Parking Garage office for Elevators #1-2. Include all raceways and wiring from elevator status panel to hoistway and controllers. Panel shall contain the following:

2” digital position indicator for each elevator

Direction indication for each elevator

Phase I illuminated signals

Out of service illuminated signal for each elevator

Car to Lobby key switch for each elevator

PART 3 – EXECUTION

3.1 SITE CONDITIONS AND INSPECTION

Bidder is responsible for inspecting the Elevator equipment and verifying all critical dimensions, voltages, and equipment prior to fabrication. Should Contractor discover material discrepancies, additional project requirements, or other conditions detrimental to performance of work under this Section, Consultant and Owner shall be notified immediately.

3.2 INSTALLATION

A. A copy of this specification and all approved layout drawings shall be kept on site by the Contractor for the duration of this project and shall be available for review by elevator personnel at all times.

B. Install all Elevator components.

C. Protection of floors, walls, and Elevator entrances. Keep hoistway doors in the closed position or provide sufficient barricades to protect employees and the public from open hoistways during work activity per good industry standards and OSHA Regulations.

D. All welding shall comply with ASME A17.1-2016 req. 8.8.

E. Contractor shall coordinate with Owner for the temporary deactivation of affected smoke detectors. Welding, cutting, grinding, and other work tasks that create dust or may affect air quality shall require advance notice to Owner prior to proceeding.

F. Cutting and/or patching of hoistway walls and equipment room floor. Contractor shall provide any needed cutouts and shall patch and close up any existing openings no longer required. Penetrations in hoistway from elevator fixtures shall be fire caulked by Contractor.

G. A clear path shall be provided to all new components or equipment that require maintenance, of not less than 18 inches clearance in the direction(s) required for maintenance access.

H. Sufficient hoistway clearances shall be provided and maintained per code requirements.

I. All field wiring required to perform work under this Section shall be provided, and in compliance with NFPA 70.

J. All car and hoistway wiring shall be replaced, all insulation on new wiring shall have flame retardant and moisture-proof insulation and shall be run in conduit, tubing, or electrical raceways. Contractor may reuse existing raceways with the consent of Consultant.

K. All new flexible hoistway traveling cables shall be provided, suitably suspended to relieve strain on individual conductors. Tag conductors as ‘spares’.

L. AC motor encoder shall be electrically isolated from the motor.

M. The Contractor shall be responsible for all rigging and hoisting required for installation of their equipment including crane rental, permits, and fees, and the removal and disposal of the old equipment. Hoisting of equipment shall be scheduled and approved ahead of time with City of Madison Parking.

N. The traction machines shall be properly installed, commissioned, and the machine brake and emergency brake adjusted per the manufacturer’s recommended procedures.

O. The machine, drive sheave, and cable deflector sheave shall be equipped with guarding by Elevator Contractor. Guarding shall be galvanized or painted.

P. Protect equipment and exposed finishes from damage during installation.

3.3 FIELD QUALITY CONTROL

Owner or their designee may periodically check the jobsite during the course of installation to view execution of work. Full cooperation and communication with the Owner, Consultant, or their designees, who do NOT supervise or direct work, is mandatory.

3.4 PRODUCT DELIVERY, SITE ORGANIZATION AND CLEANUP

A. Contractor shall take precautions to secure the elevator hoistway and construction tools and equipment from residents, other contractors, and the Public. Coordinate work to minimize conflict with building operations.

B. Deliver materials in original, unopened protective packaging. Protect equipment and finishes from damage during transportation, storage, and construction. Provide protective coverings, barriers, etc. to protect equipment and finishes.

C. Temporary storage of materials, job boxes, etc. must be arranged with Owner as space permits. Due to the nature of this modernization project, it is stipulated that Contractor shall provide off-site storage at their expense until components are needed on site. Coordinate the scope of equipment delivery in advance with Consultant and Owner.

D. All waste items including, but not limited to, cleaning compounds or fluids, waste cloths or wipers, lubricants, old parts, containers, oil absorbent or oil absorbent pads, and waste oil must be removed from the premises and disposed of offsite by Contractor of in full compliance with OSHA and EPA guidelines.

E. All safety signage shall be provided by the Contractor.

F. The car top, hoistway, machine room, pit, and equipment located in these areas shall be thoroughly cleaned at completion of the modernization work, throughout and at the end of the one-year warranty/maintenance period, to both the Owner and Consultant’s satisfaction.

G. Hoistway cleaning shall include guide rails and rail brackets, divider and other structural beams in the hoistway, counterweights and shackles, platform apron and fascia, hoistway doors, hangars, headers, and hoistway sills.

H. All new structural steel, such as required for support of the machine, deflector sheave, buffer stands and support channels, adaptor plates, new platform guards, pit ladders, new or existing hoistway fascia, dust covers, or toe guards, and any other guards shall be painted or galvanized.

I. Touch up damaged factory-painted finish on with original paint and color as required. Machine room floor shall be thoroughly cleaned and painted gray at the end of the project.

3.5 ACCEPTANCE TESTS

A. Advise Consultant and Owner of dates and time acceptance tests are scheduled.

B. Perform a full load test of new or existing car safety and new speed governor. Governor adjustments shall be calibrated and sealed. Elevator Contractor shall provide test weights, including 125% load for brake test.

C. Perform testing of Emergency Power Operation, Phase I and Phase II Firefighters’ Emergency Operation, including assisting the Fire Alarm vendor with testing of all elevator smoke detectors prior to and at the acceptance inspection of the alterations.

D. The contractor shall make all acceptance or other tests required by the governing codes and submit copies of all City of Madison inspection and test reports and certificates to Consultant.

E. Load weighing shall initially be manually calibrated using test weights. Verify the zero calibration after the first 30 days of operation and recalibrate as required per manufacturer's instructions.

F. Emergency brake and normal brake shall be independently tested per manufacturer's instructions and per ASME A17.1-2016 requirements.

G. Contractor shall pay reinspection fees for deficiencies or violations of the initial inspection and re-inspections that are the responsibility of the Contractor.

H. Work shall not be considered complete until accepted in writing by Owner or their designee, and then only after successful completion of all violations cited by the City of Madison Elevator Inspector and completion of Consultant's punch list.

3.6 PERFORMANCE AND DEMONSTRATION

A. The Owner shall have the final determination of all performance standards, at its sole discretion.

B. Demonstration shall include:

1. Installation compliance with specifications.
2. Conduct a running speed test with full load, check starting, acceleration, deceleration, and stopping g-forces and ride quality, stopping accuracy, and floor-to-floor performance times.
3. Stopping accuracy, smooth acceleration, deceleration, and car ride in compliance with industry standards.
4. Operation and testing of emergency brake per manufacturer's suggested procedures.
5. Load weighing system testing and adjustment.
6. Door operation, closing force, opening and closing times as specified.
7. Firefighters' Emergency Operation.
8. Promptly remove all work rejected by Consultant or Owner for failure to meet specifications and replace to comply with requirements, at no additional cost to the Owner. All expenses of repairing work of other trades damaged by this replacement shall be borne by Contractor.
9. Rejected work, which is not made good within a reasonable time, determined by the Owner, may be corrected by the Owner at Contractor's expense.
10. Operating Instructions: Provide instruction to the Owner's personnel, including safety procedures, proper operation of the equipment, and firefighters' emergency operation.

C. Elevator Performance: The Contractor agrees to provide elevator performance, meeting the standards listed below, at a minimum. The elevators shall be reconditioned and adjusted to meet maintenance standards as published in the NEII-1 Building Transportation Standards and Guidelines by the National Elevator Industry, Inc. Compliance with these performance requirements shall be in addition to the AHJ acceptance inspection and certification process. Elevators shall comply with the minimum performance standards at final acceptance and throughout the warranty period.

Elevator Designation	Floor to Floor Performance Time	Door Open Time	Door Close Time	Stopping Accuracy
Elevators #1-2	12.0	3.1	4.0	1/4
Unit of measurement	Seconds (12' flr hts)	Seconds	Seconds	Inch

1. Speed – rated speed shall not vary more than + 3% for static control equipment, regardless of load.
2. Brake Test - Safely lower, stop, and hold 125% of rated load.
3. Stopping Accuracy - ±1/8" under any loading condition or direction of travel.
4. Elevator Performance (Floor to Floor) Time – measured from the start of doors closing until the Elevator is stopped level at the next successive floor, under any loading condition and in either direction of travel, with the car doors approximately ¾ open. Times shall be increased by 0.2 seconds per foot for floor heights exceeding 12 feet.
5. Door Opening Time – measured from the start of doors opening until the doors are fully open, or nominally, until the door is approximately 2" from fully open.
6. Door Closing Time – measured from the start of doors closing until doors are fully closed. The door closing time shall not be less than the minimum permitted by the Elevator code. Longer door closing time may be requested by the Owner.
7. Door Nudging Time – Enable nudging after a minimum of 20 seconds or at a longer interval upon the request of Owner.
8. Door Closing Force – measured with the door at rest and between 1/3 and 2/3 closed. See inspector's manual for procedure. **Door closing force shall not exceed 20 ftlb.**
9. Leveling – The accessibility code requires that the car sill initially stop within ½" of the landing sill vertically. New equipment shall stop within ¼". Leveling accuracy should be measured under various loading conditions.
10. Ride Quality and Acceleration – Contractor shall maintain a comfortable Elevator ride with smooth acceleration, deceleration, and final stop as measured with a Maxton SafeTach.
11. Noise – There should be no perceptible hoistway noises audible inside the car enclosure as the Elevators move through the hoistway, within reason.
12. Door operators and associated equipment shall be adjusted to NEII Performance Standards.

3.7 ACCEPTANCE AND INSTRUCTIONS

A. Upon notice from Contractor that all work is substantially complete and copies of all punch lists with date of corrections are provided to Consultant, Consultant and Owner will arrange to make a final inspection and acceptance audit.

B. Contractor shall instruct Owner's personnel in the proper use and operation of all new devices. Review and demonstrate emergency procedures with Owner's personnel, including operational failures and Firefighters' Service Operation. Train Owner's representative in normal procedures to be followed. Such training shall include a

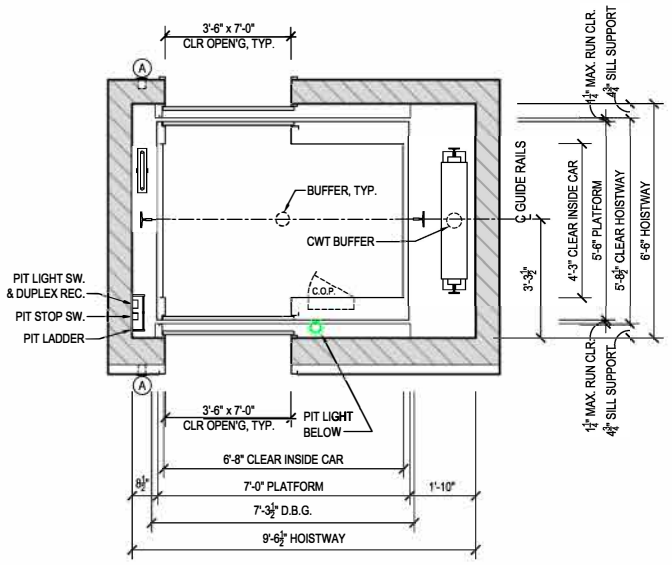
familiarization with the Elevator equipment, conducted for Owner's designated representative on one occasion.

C. Switch keys shall be released to the Owner as coordinated by Consultant. Each key number shall be on a separate ring, properly tagged and identified for function, and a separate listing of key number and function provided. Provide (2) keys per key switch.

D. One hand-held door operator parameter unit used to set door parameters shall be provided and is to be considered property of Owner.

E. All Operation and Maintenance manuals, As Built Drawings, Wiring Diagrams, and Waivers of Lien shall be provided by Contractor prior to issue of final invoice.

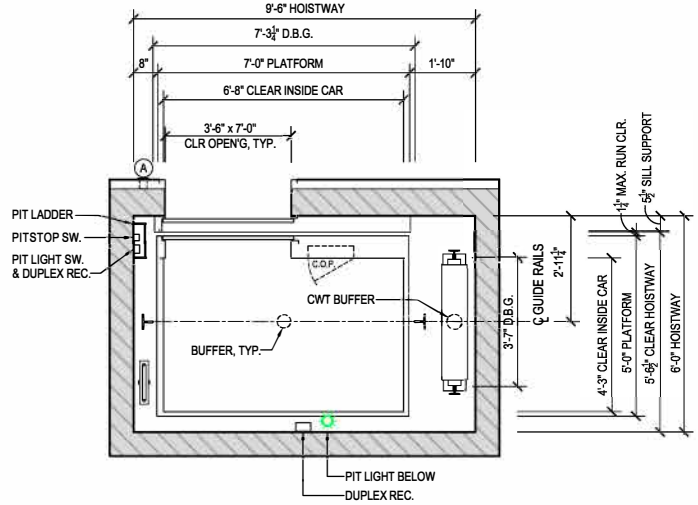
END OF SECTION



01 PLAN OF ELEVATOR #1 HOISTWAY

(EXISTING CONDITIONS SHOWN)

$\frac{3}{16}$"=1'-0"



02 PLAN OF ELEVATOR #2 HOISTWAY

(EXISTING CONDITIONS SHOWN)

$\frac{3}{16}$"=1'-0"

KEY LEGEND

- (A) = HALL P/B STATION TYP., ALL FLOORS
- (B) = CAR DIRECTION INDICATOR AT ENTRANCES
- C.O.P. = CAR OPERATING PANEL
- $ = LIGHT SWITCH
- = STANDARD BASE LAMP
- = FLUORESCENT LIGHT FIXTURE
- (S) = SMOKE DETECTOR
- = FIRE EXTINGUISHER

REVISION HISTORY

DATE	SYM.	REVISIONS (DESCRIPTION)	BY

EXISTING ELEVATOR DATA

ELEV ID	# 1	# 2
STATE REG. NO.	---	---
REG. OBJECT ID	511199	511200
RATED LOAD	2,500 LBS.	2,500 LBS.
RATED SPEED	350 FPM	350 FPM
STOPS	7 FRONT / 1 REAR	8 FRONT
LANDINGS	L-☆1-2-3-3R-4-5-6	S-L-☆1 to 6
NET TRAVEL	62'-4"	72'-8"
CAR RAILS:	15#	15#
CWT RAILS	8#	8#
MACHINE	MONTGOMERY 208E	MONTGOMERY 208E
MACHINE MOTOR	25HP	25HP
MACHINE ROPING	1:1(6) 5/8"	1:1(6) 1/2"
POWER SUPPLY	480 VOLTS	480 VOLTS
CONTROLS	KONE MIPROM	KONE MIPROM
ORIGINAL INSTALLATION:	1996	1996

ELEVATOR CONSULTANT

Performance Elevator Consulting LLC.

DRAWING:	HOISTWAY PLAN
ELEVATOR TYPE:	ELECTRIC PASSENGER
ENTITY:	STATE STREET PARKING RAMP
ELEVATOR # :	ELEVATORS #1, #2
ADDRESS:	214 N CARROLL ST
CITY, STATE, ZIP:	MADISON, WI 53703

DRAWING DATE	REVISION	SHEET NUMBER	DRAWING NUMBER
4/29/2026	-	1 of 2	EL 101

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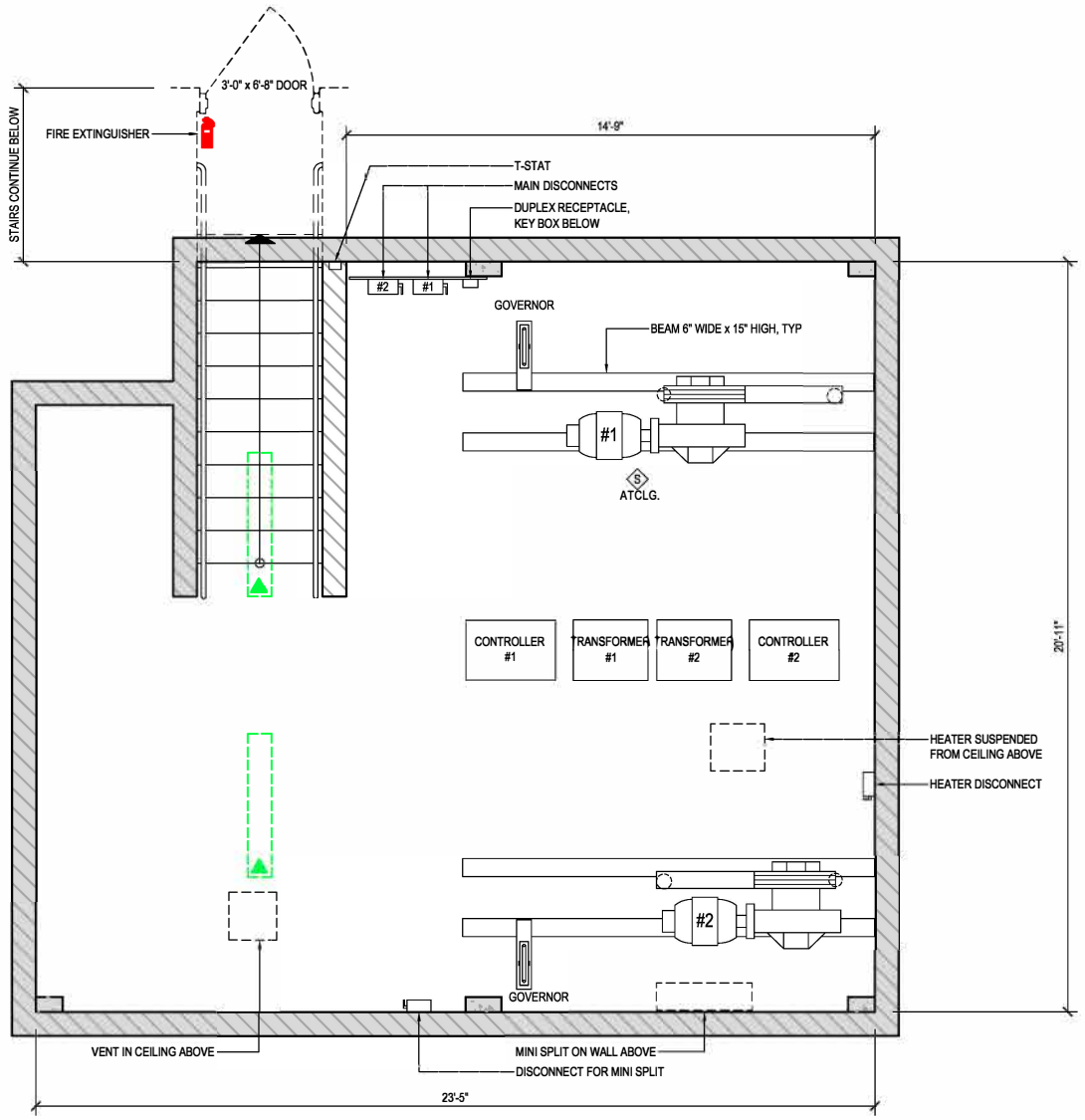

01 PLAN OF ELEVATOR MACHINE ROOM

(EXISTING CONDITIONS SHOWN)

$\frac{3}{16}$"=1'-0"

N

KEY LEGEND

A	=	HALL P/B STATION TYP., ALL FLOORS
B	=	CAR DIRECTION INDICATOR AT ENTRANCES
C.O.P.	=	CAR OPERATING PANEL
$	=	LIGHT SWITCH
	=	STANDARD BASE LAMP
	=	FLUORESCENT LIGHT FIXTURE
S	=	SMOKE DETECTOR
	=	FIRE EXTINGUISHER

REVISION HISTORY

DATE	SYM.	REVISIONS (DESCRIPTION)	BY

EXISTING ELEVATOR DATA

ELEV ID	# 1	# 2
STATE REG. NO.	---	---
REG. OBJECT ID	511199	511200
RATED LOAD	2,500 LBS.	2,500 LBS.
RATED SPEED	350 FPM	350 FPM
STOPS	7 FRONT / 1 REAR	8 FRONT
LANDINGS	L-☆1-2-3-3R-4-5-6	S-L-☆1 to 6
NET TRAVEL	62'-4"	72'-8"
CAR RAILS:	15#	15#
CWT RAILS	8#	8#
MACHINE	MONTGOMERY 208E	MONTGOMERY 208E
MACHINE MOTOR	25HP	25HP
MACHINE ROPING	1:1(6) 5/8"	1:1(6) 1/2"
POWER SUPPLY	480 VOLTS	480 VOLTS
CONTROLS	KONE MIPROM	KONE MIPROM
ORIGINAL INSTALLATION:	1996	1996

ELEVATOR CONSULTANT

Performance Elevator Consulting LLC.

DRAWING:	MACHINE ROOM PLAN
ELEVATOR TYPE:	ELECTRIC PASSENGER
ENTITY:	STATE STREET PARKING RAMP
ELEVATOR # :	ELEVATORS #1, #2
ADDRESS:	214 N CARROLL ST
CITY, STATE, ZIP:	MADISON, WI 53703

DRAWING DATE	REVISION	SHEET NUMBER	DRAWING NUMBER
4/29/2026	-	2 of 2	EL 102

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LIGHTING FIXTURES

- SURFACE OR PENDANT MOUNTED
- RECESS MOUNTED
- WALL SURFACE MOUNTED
- WALL RECESS MOUNTED
- STRIP OR UNDER CABINET LIGHT
- LIGHTING TRACK
  - LENGTH AS INDICATED ON DRAWINGS
  - NUMBER AND DIRECTION OF FIXTURES AS INDICATED ON DRAWINGS AND / OR SCHEDULE
- SURFACE MOUNTED ACCENT
  - ARROW INDICATES DIRECTION OF ILLUMINATION
- RECESS MOUNTED ACCENT
  - ARROW INDICATES DIRECTION OF ILLUMINATION
- POLE MOUNTED WITH ARM
- POST TOP POLE
- BOLLARD
- FLOOD LIGHT
- EMERGENCY BATTERY UNIT
  - WALL MOUNT AT 8'-0" AFF UOI
- EMERGENCY BATTERY UNIT CEILING
- EMERGENCY BATTERY SINGLE REMOTE HEAD
  - WALL MOUNT AT 8'-0" AFF UOI
- EMERGENCY BATTERY DUAL REMOTE HEAD
  - WALL MOUNT AT 8'-0" AFF UOI
- WALL MOUNTED EXIT LIGHT FIXTURE WITH EMERGENCY HEADS
  - MOUNT AT 8'-0" AFF UOI
  - SHADING INDICATES FACE(S)
  - ARROW(S) AND FACE(S) AS INDICATED ON DRAWINGS
- CEILING MOUNTED EXIT LIGHT FIXTURE WITH EMERGENCY HEADS
  - SHADING INDICATES FACE(S)
  - ARROW(S) AND FACE(S) AS INDICATED ON DRAWINGS
- CEILING MOUNTED EXIT LIGHT FIXTURE
  - SHADING INDICATES FACE(S)
  - ARROW(S) AND FACE(S) AS INDICATED ON DRAWINGS
- WALL MOUNTED EXIT LIGHT FIXTURE
  - MOUNT AT 8'-0" AFF UOI
  - SHADING INDICATES FACE(S)
  - ARROW(S) AND FACE(S) AS INDICATED ON DRAWINGS

LIGHTING FIXTURE DESIGNATIONS

- SHADING INDICATES FIXTURE WIRED TO EMERGENCY
- AA-1b — LIGHT FIXTURE DESIGNATION
  - (AA) INDICATES FIXTURE TYPE
  - (1) INDICATES CIRCUIT NUMBER (PANEL BOUNDS AS INDICATED ON DRAWINGS)
  - (b) INDICATES CONTROL DESIGNATION (IF NOT INDICATED, CONTROLLED VIA SWITCH AT ROOM ENTRY)
  - (NL) INDICATES UNSWITCHED NIGHT LIGHTING

TYPICAL AT EACH FIXTURE LOCATION

- ca — CONTACTOR DESIGNATION
  - CONTROLLED VIA CONTACTOR
- dal — DIMMER CHANNEL
  - CABINET DESIGNATION
  - CONTROLLED VIA ELECTRONIC DIMMING SYSTEM
- oa — SPECIFIC DEVICE DESIGNATION
  - CONTROLLING CIRCUIT OR PORTION OF CIRCUIT
  - OCCUPANCY SENSOR CONTROLLED
- ra — RELAY DESIGNATION
  - CONTROLLING CIRCUIT OR PORTION OF CIRCUIT
  - LOW VOLTAGE RELAY
  - CONTROLLED VIA RELAY CABINET
- ta — TIME CLOCK DESIGNATION
  - TIME CLOCK CONTROLLED

GENERAL SYMBOLS

- NORTH INDICATOR
- ELEVATION VIEW INDICATOR (A1 / E-201)
- SECTION VIEW INDICATOR (A6 / E-501)
- VIEW CALLOUT (A6 / E-501)
- 1 / E-XXX — VIEW INDICATOR
- PICTURE LOCATION REFERENCE (X / E-XXX)
- 01 — KEYNOTE INDICATOR
- REVISION CLOUD
- 1 — REVISION INDICATOR

VIEW LOCATION LEGEND

C1	C2	C3	C4	C5
B1	B2	B3	B4	B5
A1	A2	A3	A4	A5

ELECTRICAL SHEET INDEX

E-001	ELECTRICAL SYMBOLS, ABBREVIATIONS & SHEET INDEX
E-002	ELECTRICAL SYMBOLS CONTINUED
E-100	OVERALL LEVEL 1 FLOOR PLAN
E-101	LEVEL U TO 3 FLOOR PLANS - DEMOLITION
E-102	LEVEL 4 TO PENTHOUSE FLOOR PLANS - DEMOLITION
E-111	LEVEL U TO 3 FLOOR PLANS - LIGHTING
E-112	LEVEL 4 TO PENTHOUSE FLOOR PLANS - LIGHTING
E-121	LEVEL U TO 3 FLOOR PLANS - POWER & SYSTEMS
E-122	LEVEL 4 TO PENTHOUSE FLOOR PLANS - POWER & SYSTEMS
E-501	ELECTRICAL DETAILS
E-601	ELECTRICAL SCHEDULES
E-602	ELECTRICAL SCHEDULES
E-603	ELECTRICAL SCHEDULES
E-610	PANEL SCHEDULES

SECURITY AND ACCESS CONTROL

- SECURITY OR ACCESS CONTROL PANEL
  - SURFACE MOUNTED
  - (X) INDICATES DESIGNATION
    - (DACP) DOOR ACCESS CONTROL PANEL
    - (SAP) SECURITY ANNUNCIATOR PANEL
    - (SACP) SECURITY ACCESS CONTROL PANEL
- AA — AUDIBLE ALARM
- X — CCTV CAMERA
  - CEILING OR WALL MOUNTED
  - PROVIDE (1) CATEGORY 6 CABLE
  - (X) INDICATES TYPE:
    - (WP) WEATHER PROOF
    - (VP) VANDAL PROOF
- X — CCTV CAMERA
  - CEILING OR WALL MOUNTED
  - (X) INDICATES TYPE:
    - (WP) WEATHER PROOF
    - (VP) VANDAL PROOF
- X CR — CARD READER
  - WALL MOUNTED 3'-8" AFF UOI
  - (X) INDICATES TYPE:
    - (M) MULLION MOUNT
    - (WP) WEATHER PROOF
    - (VP) VANDAL PROOF
- DE — DELAYED EGRESS
- DC — DOOR CONTACT
- X DHG — DOOR HARDWARE GROUP (DHG)
  - (X) INDICATES: DHG DESIGNATION
- DPS — DOOR POSITION SWITCH
- DR — DOOR RELEASE PUSH BUTTON
  - WALL MOUNTED 3'-8" AFF UOI
- DRS — DOOR RELEASE SWITCH
- DB — DURESS BUTTON
- EFED — ELECTRIC FIRE EXIT DEVICE
- EL — ELECTRIC LOCKING DEVICE
- EPD — ELECTRIC PANIC DEVICE
- EPT — ELECTRIC POWER TRANSFER
- ES — ELECTRIC STRIKE
- ETW — ELECTRIC THROUGH WIRE HINGE
- GB — GLASS BREAK DETECTOR
- IR — INFRARED MOTION SENSOR
- KP — KEY PAD
- KS — KEY SWITCH
- ML — MAGNETIC LOCK
- M — MONITOR
- MD — MOTION DETECTOR
- PB — PANIC BUTTON
- PS — POWER SUPPLY
- PTH — POWER TRANSFER HINGE
- RSD — REMOTE STATUS DISPLAY
- REX — REQUEST TO EXIT SENSOR
- SD — SOUND DETECTOR

LIGHTING CONTROL

SWITCH / SENSOR TYPE ABBREVIATIONS:
- (2) TWO POLE
- (3) THREE WAY
- (4) FOUR WAY
- (A) ADDED TO ANY CEILING SENSOR IS FOR AUXILIARY RELAY FOR HVAC CONNECTION
- (50) OCCUPANCY SENSOR (AUTO OFF / 50% ON)
- (D) DAYLIGHT SENSOR
- (D50) DAYLIGHT / OCCUPANCY SENSOR (AUTO OFF / 50% ON)
- (DLS) DUAL LEVEL SWITCH
- (DO) DAYLIGHT / OCCUPANCY SENSOR
- (DV) DAYLIGHT / VACANCY SENSOR
- (K) KEY OPERATED
- (O) OCCUPANCY SENSOR (AUTO OFF / AUTO FULL ON)
- (P) WITH PILOT LIGHT
- (T) TIMER
- (V) VACANCY SENSOR (AUTO OFF / MANUAL ON)

X, a — MANUAL WALL SWITCH
- MOUNTED 3'-8" AFF UOI
- SINGLE POLE UOI
- ON / OFF
- (a) INDICATES SWITCH DESIGNATION
- (X) INDICATES SWITCH TYPE

X, a — MANUAL WALL DIMMER
- MOUNT AT 3'-8" AFF UOI
- (a) INDICATES SWITCH DESIGNATION
- (X) INDICATES SWITCH TYPE

Y — MOMENTARY CONTACT SWITCH
- MOUNTED 3'-8" AFF UOI
- (Y) INDICATES MOMENTARY CONTACT SWITCH DESIGNATION (SEE FACEPLATE DETAIL AND SCHEDULE)

Y — TOUCH SCREEN CONTROL STATION
- MOUNTED 3'-8" AFF UOI
- ASSOCIATED WITH A NETWORKED LIGHTING CONTROLS SYSTEM
- DIGITAL TOUCH SCREEN CONTROL - ACUITY FRESCO OR NLIGHT UNITOUCH
- (Y) INDICATES CONTROL STATION DESIGNATION (SEE FACEPLATE DETAIL AND SCHEDULE)

Y D — DIGITAL LIGHTING CONTROL STATION
- MOUNTED 3'-8" AFF UOI
- ASSOCIATED WITH A NETWORKED LIGHTING CONTROLS SYSTEM
- SWITCHES AND DIMMER SWITCHES WITH OR WITHOUT SENSORS AND PUSH BUTTON SCENE CONTROLLERS WITH OUR WITHOUT DIMMING
- (Y) INDICATES DIGITAL LIGHTING CONTROL STATION DESIGNATION (SEE FACEPLATE DETAIL AND SCHEDULE)

X S — CEILING SENSOR
- (X) INDICATES SENSOR TYPE

PC — PHOTOCELL

Y C — CONTACTOR
- (Y) INDICATES CONTACTOR DESIGNATION (SEE SCHEDULE)

Y T — TIME CLOCK
- (Y) INDICATES TIME CLOCK DESIGNATION (SEE SCHEDULE)

CABINET
- TOP (X) INDICATES TYPE
  - BB - BACKBONE
  - LCP - LIGHTING CONTROL PANEL
  - RP - RELAY PANEL
- BOTTOM (Y) INDICATES DESIGNATION (SEE SCHEDULE)

FIRE ALARM

- FIRE ALARM PANEL
  - SEMI-FLUSH MOUNTED
  - (X) INDICATES DESIGNATION
    - (FAAP) ANNUNCIATOR PANEL
    - (FACU) CONTROL UNIT
    - (NAC) NAC PANEL
    - (FSS) FIRE SUPPRESSION CONTROL PANEL
- FIRE ALARM PANEL
  - SURFACE MOUNTED
  - (X) INDICATES DESIGNATION
    - (FAAP) ANNUNCIATOR PANEL
    - (FACU) CONTROL UNIT
    - (NAC) NAC PANEL
    - (FSS) FIRE SUPPRESSION CONTROL PANEL
- FIRE FIGHTER'S TELEPHONE JACK
  - MOUNTED 3'-8" AFF UOI
- FIRE FIGHTER'S HAND SET
  - MOUNTED 3'-8" AFF UOI
- PULL STATION
  - MOUNTED 3'-8" AFF UOI
- H — HEAT DETECTOR
- B XX — BEAM SMOKE DETECTOR
  - CEILING MOUNTED
  - (X) INDICATES TYPE:
    - (PR) PRISM REFLECTOR
    - (RE) RECEIVER
    - (TR) TRANSMITTER
    - (TR/RE) TRANSMITTER / RECEIVER IN ONE
- XX B — BEAM SMOKE DETECTOR
  - WALL MOUNTED
  - (X) INDICATES TYPE:
    - (CTL) CONTROLLER
    - (PR) PRISM REFLECTOR
    - (RE) RECEIVER
    - (TR) TRANSMITTER
    - (TR/RE) TRANSMITTER / RECEIVER IN ONE
- S XX — PHOTO - ELECTRIC SMOKE DETECTOR
  - CEILING MOUNTED
  - (X) INDICATES TYPE:
    - (NONE) STANDARD
    - (CO) CARBON MONOXIDE
    - (ER) ELEVATOR RECALL
    - (MS) MULTIPLE STATION
    - (SB) SOUNDER BASE
    - (SS) SINGLE STATION
- S XX — PHOTO - ELECTRIC SMOKE DETECTOR
  - WALL MOUNTED 1'-0" BFC UOI
  - (X) INDICATES TYPE:
    - (NONE) STANDARD
    - (CO) CARBON MONOXIDE
    - (ER) ELEVATOR RECALL
    - (MS) MULTIPLE STATION
    - (SB) SOUNDER BASE
    - (SS) SINGLE STATION
- CO XX — CARBON MONOXIDE DETECTOR
  - CEILING MOUNTED
  - (X) INDICATES TYPE:
    - (NONE) STANDARD
    - (MS) MULTIPLE STATION
    - (SB) SOUNDER BASE
    - (SS) SINGLE STATION
- XX CO — CARBON MONOXIDE DETECTOR
  - WALL MOUNTED 1'-0" BFC UOI
  - (X) INDICATES TYPE:
    - (NONE) STANDARD
    - (MS) MULTIPLE STATION
    - (SB) SOUNDER BASE
    - (SS) SINGLE STATION
- DS — DUCT SMOKE DETECTOR
- RTS/I — REMOTE TEST SWITCH AND / OR INDICATOR
- R — FAN SHUTDOWN RELAY
- SD — SMOKE DAMPER
- DH — MAGNETIC DOOR HOLDER
- CM — CONTROL MODULE
- MM — MONITOR MODULE
- FS — FLOW SWITCH
- TS — TAMPER SWITCH
- PE — PRESSURE SWITCH
- EOL — END OF LINE RESISTOR
- X — FIRE ALARM STROBE NOTIFICATION APPLIANCE
  - WALL MOUNTED 6'-8" AFF OR 6" BFC, WHICHEVER IS LOWER
  - (X) INDICATES STROBE CANDELA RATING
- X — FIRE ALARM STROBE NOTIFICATION APPLIANCE
  - CEILING MOUNTED
  - (X) INDICATES STROBE CANDELA RATING
- X S — FIRE ALARM SPEAKER / STROBE NOTIFICATION APPLIANCE
  - WALL MOUNTED 6'-8" AFF OR 6" BFC, WHICHEVER IS LOWER
  - (X) INDICATES STROBE CANDELA RATING
- X — FIRE ALARM SPEAKER / STROBE NOTIFICATION APPLIANCE
  - CEILING
  - (X) INDICATES STROBE CANDELA RATING
- S — FIRE ALARM SPEAKER NOTIFICATION APPLIANCE
  - WALL MOUNTED 6'-8" AFF OR 6" BFC, WHICHEVER IS LOWER
- S — FIRE ALARM SPEAKER NOTIFICATION APPLIANCE
  - CEILING
- S — FIRE ALARM SUPERVISED HORN LOUDSPEAKER NOTIFICATION APPLIANCE
  - WALL MOUNTED 6'-8" AFF OR 6" BFC, WHICHEVER IS LOWER
- F — FIRE ALARM BELL
  - WALL MOUNTED 6'-8" AFG UOI

ELECTRICAL ABBREVIATIONS

1P	-	ONE POLE
2P	-	TWO POLE
3P	-	THREE POLE
4P	-	FOUR POLE
1P, 1W	-	ONE POLE, ONE WIRE
1P, 2W	-	ONE POLE, TWO WIRE
2P, 2W	-	TWO POLE, TWO WIRE
2P, 3W	-	TWO POLE, THREE WIRE
3P, 2W	-	THREE POLE, TWO WIRE
3P, 3W	-	THREE POLE, THREE WIRE
3P, 4W	-	THREE POLE, FOUR WIRE
4P, 4W	-	FOUR POLE, FOUR WIRE
A	-	AMPERE
AC	-	ALTERNATING CURRENT
AF	-	AMPERE FRAME
AFF	-	ABOVE FINISHED FLOOR
AFG	-	ABOVE FINISHED GRADE
AIC	-	AMPERE INTERRUPTING CAPACITY
ANSI	-	AMERICAN NATIONAL STANDARDS INSTITUTE
AL	-	ALUMINUM
AS	-	AMPERE SWITCH
AT	-	AMPERE TRIP
ARCH	-	ARCHITECT
ATS	-	AUTOMATIC TRANSFER SWITCH
A / V	-	AUDIO VISUAL
AWG	-	AMERICAN WIRE GRADE
B	-	PEDESTAL MOUNTED ON BENCH TOP
BF	-	BELOW FLOOR
BFC	-	BELOW FINISHED CEILING
BFF	-	BELOW FINISHED FLOOR
BFG	-	BELOW FINISHED GRADE
BLDG	-	BUILDING
C	-	CONDUIT
CAM	-	CAMERA
CAT	-	CATALOG
CATV	-	CABLE TELEVISION
CB	-	CIRCUIT BREAKER
CKT	-	CIRCUIT
CLG	-	CEILING MOUNTED
CO	-	COPIER
CT	-	CURRENT TRANSFORMER
CU	-	COPPER
CL	-	CENTERLINE
DC	-	DIRECT CURRENT
DR	-	DRYER
Δ	-	DELTA
DISC	-	DISCONNECT
DW	-	DISHWASHER
DWG	-	DRAWING
E	-	EMERGENCY
EC	-	ELECTRICAL CONTRACTOR
EMT	-	ELECTRIC METALLIC TUBING
ETR	-	EXISTING TO REMAIN
ER	-	EXISTING TO BE REMOVED
ERL	-	EXISTING TO BE RELOCATED
ERLD	-	RELOCATED EQUIPMENT'S NEW LOCATION
EWC	-	ELECTRIC WATER COOLER
EX	-	EXISTING
FA	-	FIRE ALARM
FLA	-	FULL LOAD AMPS
FO	-	FIBER OPTIC
FPC	-	FIRE PROTECTION CONTRACTOR
GC	-	GENERAL CONTRACTOR
GDS	-	GENERATOR DOCKING STATION
GFCI	-	GROUND FAULT CIRCUIT INTERRUPTER
GFPE	-	GROUND FAULT PROTECTION EQUIPMENT
GND	-	GROUND
GRC	-	GALVANIZED RIGID CONDUIT
HH	-	HANDHOLE
HP	-	HORSEPOWER
HVAC	-	HEATING, VENTILATING, AND AIR CONDITIONING
HZ	-	HERTZ (CYCLE) PER SECOND
IECC	-	INTERNATIONAL ENERGY CONSERVATION CODE
ISP	-	INSIDE PLANT
IT	-	INFORMATION TECHNOLOGY
JB	-	JUNCTION BOX
KVA	-	KILOVOLT AMPERE
KVAR	-	KILOVOLT AMPERE REACTIVE
KW	-	KILOWATT
LP	-	LIGHTING PANEL
LS	-	LIMIT SWITCH
LTG	-	LIGHTING
LV	-	LOW VOLTAGE
MC	-	MECHANICAL CONTRACTOR
MCA	-	MINIMUM CIRCUIT AMPS
MCC	-	MOTOR CONTROL CENTER
MDP	-	MAIN DISTRIBUTION PANEL
MISC	-	MISCELLANEOUS
MH	-	MANHOLE
MLO	-	MAIN LUGS ONLY
MTD	-	MOUNTED
MTG	-	MOUNTING
MTS	-	MANUAL TRANSFER SWITCH
MW	-	MICROWAVE
MV	-	MEDIUM VOLTAGE
N / A	-	NOT APPLICABLE
NC	-	NORMALLY CLOSED
NEC	-	NATIONAL ELECTRIC CODE
NIC	-	NOT IN CONTRACT
NO	-	NORMALLY OPEN
#	-	NUMBER
NTS	-	NOT TO SCALE
OSP	-	OUTSIDE PLANT
P	-	POLE
PB	-	PULL BOX
PC	-	PLUMBING SYSTEM CONTRACTOR
PH	-	PHASE
PNL	-	PANEL OR PANELBOARD
PP	-	POWER PANEL
PR	-	PAIR
PRI	-	PRIMARY
PROJ	-	PROJECTOR
PVC	-	POLYVINYL CHLORIDE
REC	-	RECESSED
RE / CKT	-	REUSE EXISTING CIRCUIT
REF	-	REFRIGERATOR
RSC	-	RIGID STEEL CONDUIT
SC	-	SECURITY CONTRACTOR
SEC	-	SECONDARY
SN	-	SOLID NEUTRAL
SP	-	SPARE
SS	-	STAINLESS STEEL
ST	-	SHUNT TRIP
STP	-	SHIELDED TWISTED PAIR
SUSP	-	SUSPENDED
SW	-	SWITCH
SWBD	-	SWITCHBOARD
TBB	-	TELECOMMUNICATIONS BONDING BACKBONE
TC	-	TELEPHONE CABINET
TCI	-	TELECOMMUNICATIONS CABLING INSTALLER
TELE / DATA	-	TELEPHONE / DATA
TEL	-	TELEPHONE
TELECOM	-	TELECOMMUNICATIONS
TGB	-	TELECOMMUNICATIONS GROUNDING BUSBAR
TMGB	-	TELECOMMUNICATIONS MAIN GROUNDING BUSBAR
TP	-	TWISTED PAIR
TR	-	TAMPER RESISTANT SAFETY RECEPTACLE
TYP	-	TYPICAL
UG	-	UNDERGROUND
UTP	-	UNSHIELDED TWISTED PAIR
UOI	-	UNLESS OTHERWISE INDICATED
V	-	VOLT
W	-	WATT
WA	-	WASHER
WAP	-	WIRELESS ACCESS POINT
WP	-	WEATHERPROOF
XFMR	-	TRANSFORMER
XR	-	XRAY
XV	-	XRAY VIEWER
Y	-	WYE
ZAM	-	ZONE ADAPTER MODULE

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APPROVED BY:	DJK
SCALE:	AS NOTED

SHEET TITLE:

ELECTRICAL SYMBOLS, ABBREVIATIONS & SHEET INDEX

SHEET NUMBER:

E-001

6/19/2026 10:37:46 AM

MOTOR STARTERS AND DISCONNECTS

- M — MANUAL MOTOR STARTER
- MAGNETIC MOTOR STARTER
- MAGNETIC MOTOR STARTER AND DISCONNECT COMBINATION
- X — DISCONNECT SWITCH
  SIZE AS INDICATED ON DRAWINGS
  - (X) INDICATES TYPE:
    (CB) CIRCUIT BREAKER
    (F) FUSED
    (NF) NON-FUSED
- VFD — VARIABLE FREQUENCY DRIVE MOTOR CONTROLLER

RACEWAYS AND BOXES

- BUSWAY
  - RATING AND TYPE AS INDICATED ON DRAWINGS
- MULTI-OUTLET RACEWAY ASSEMBLY
  - WALL MOUNTED 1'-6" AFF, UOI
- MANHOLE
- HH — HANDHOLE
- PB — PULL BOX
- JUNCTION BOX
- CTB — CABLE TAP BOX
- F — FLOOR BOX
  - FLUSH
  - OUTLET TYPES REQUIRED AT EACH BOX AS INDICATED ON DRAWINGS
- P — POKE THRU
  - FLOOR MOUNTED
  - OUTLET TYPES REQUIRED AT EACH BOX AS INDICATED ON DRAWINGS
- PP — POWER POLE
  - OUTLET TYPES REQUIRED AT EACH BOX AS INDICATED ON DRAWINGS

EQUIPMENT AND PANELBOARDS

- TRANSFORMER
  - (X) INDICATES DESIGNATION
- CT — CURRENT TRANSFORMER CABINET
- M — METER
- MGB — MAIN GROUND BAR
- DISTRIBUTION CIRCUIT PANELBOARD
  - SURFACE MOUNTED
  - (X) INDICATES DESIGNATION
- BRANCH CIRCUIT PANELBOARD
  - RECESSED MOUNTED
  - (X) INDICATES DESIGNATION
- BRANCH CIRCUIT PANELBOARD
  - SURFACE MOUNTED
  - (X) INDICATES DESIGNATION

WIRING DEVICES

TYPE ABBREVIATIONS:
(AF) ARC-FAULT CIRCUIT INTERRUPTER
(GF) GROUND FAULT CIRCUIT INTERRUPTING
(TR) TAMPER RESISTANT
(USB) RECEPTACLE WITH ONE TYPE A AND ONE TYPE C USB CHARGING PORTS. 2 AMP CHARGING MINIMUM.
(WP-D) DAMP LOCATION WITH WEATHERPROOF COVER
(WP-W) WET LOCATION WITH WEATHERPROOF IN-USE COVER
(WR) WEATHER RESISTANT

- Y / X — DUPLEX RECEPTACLE
  - MOUNTED 1'-6" AFF UOI
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
  - (H) INDICATES HORIZONTAL MOUNT
- Y / X — QUADPLEX RECEPTACLE
  - MOUNTED 1'-6" AFF UOI
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- Y / X — DUPLEX RECEPTACLE MOUNTED 6" ABOVE COUNTER BACKSPLASH, UOI
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- Y / X — QUADPLEX RECEPTACLE MOUNTED 6" ABOVE COUNTER BACKSPLASH, UOI
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- Y / X — DUPLEX RECEPTACLE
  - TOP HALF SWITCHED
  - MOUNTED 1'-6" AFF UOI
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- Y / X — DUPLEX RECEPTACLE
  - MOUNTED FLUSH IN COUNTERTOP
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- C / Y / X — DUPLEX RECEPTACLE
  - MOUNTED FLUSH IN CEILING
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- C / Y / X — QUADPLEX RECEPTACLE
  - MOUNTED FLUSH IN CEILING
  - (X) INDICATES CIRCUIT NUMBER (PANEL BOUNDARY AS INDICATED ON DRAWINGS)
  - (Y) INDICATES TYPE
- Y / X — SIMPLEX OUTLET
  - MOUNT 1'-6" AFF UOI
  - (Y) INDICATES TYPE
- X — SPECIAL PURPOSE OUTLET (SPO)
  - (X) INDICATES SPO DESIGNATION
- X — MOTOR CONNECTION
  - (X) INDICATES MOTOR DESIGNATION
- TV / POWER OUTLET BOX 6'-8" AFF UOI.
- PUSHBUTTON
  - MOUNTED 3'-8" AFF UOI
- DUPLEX RECEPTACLE; BOTH CONTROLLED
- DUPLEX RECEPTACLE; ONE CONTROLLED, ONE STANDARD
- QUADPLEX RECEPTACLE; FOUR CONTROLLED
- QUADPLEX RECEPTACLE; TWO CONTROLLED, TWO STANDARD

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SHEET TITLE:
ELECTRICAL SYMBOLS CONTINUED

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E-002

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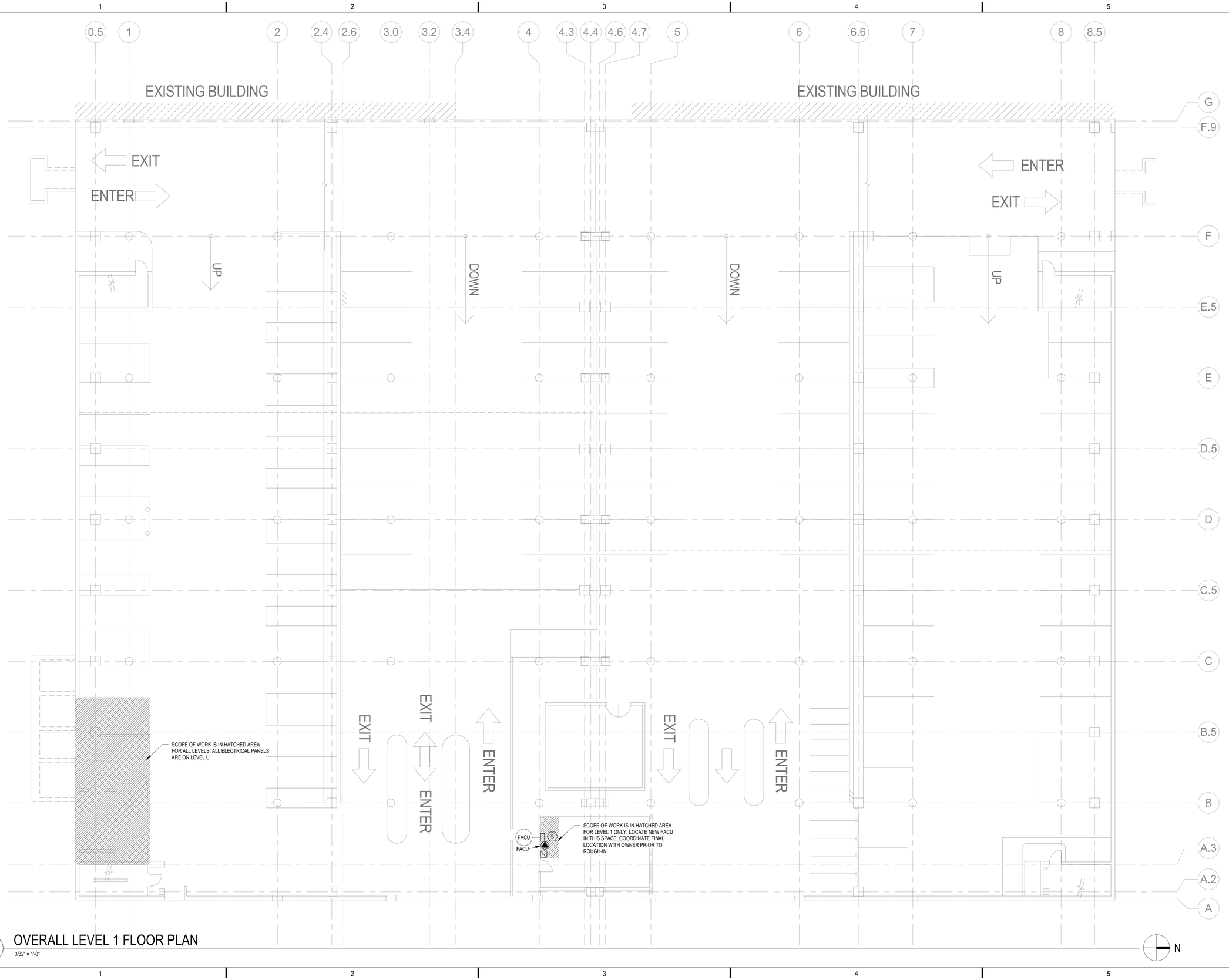

A1 OVERALL LEVEL 1 FLOOR PLAN

3/32" = 1'-0"

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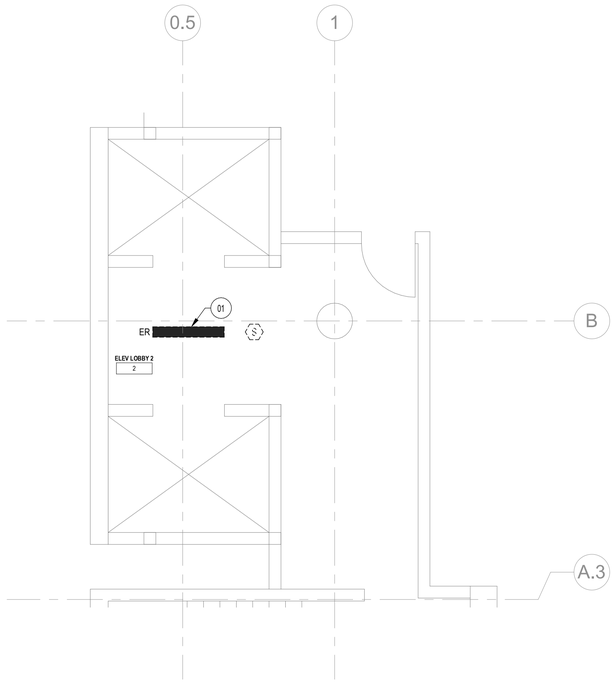
SHEET TITLE:

OVERALL LEVEL 1 FLOOR PLAN

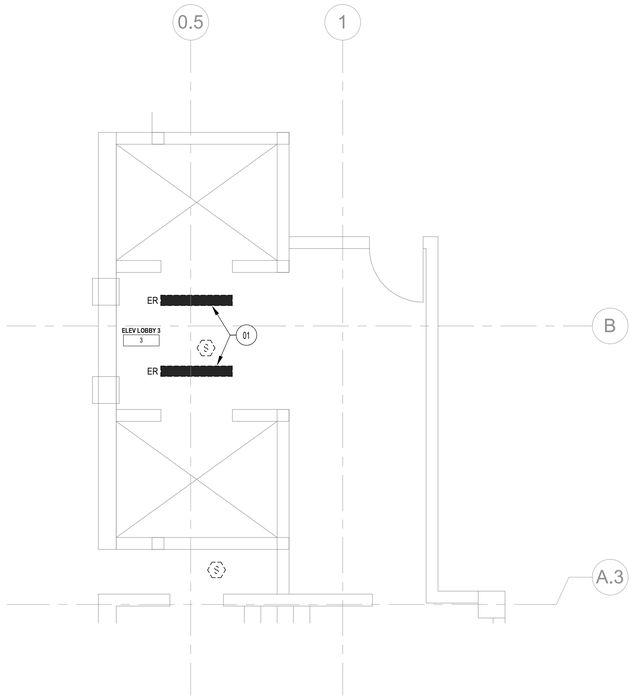
SHEET NUMBER:

E-100



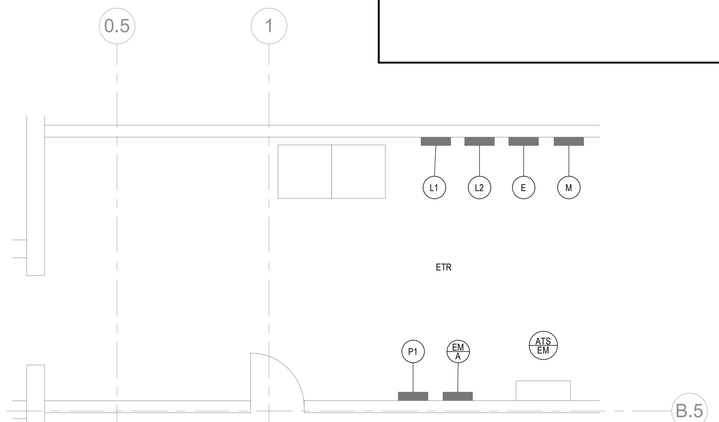
B1 LEVEL 2 FLOOR PLAN - DEMOLITION

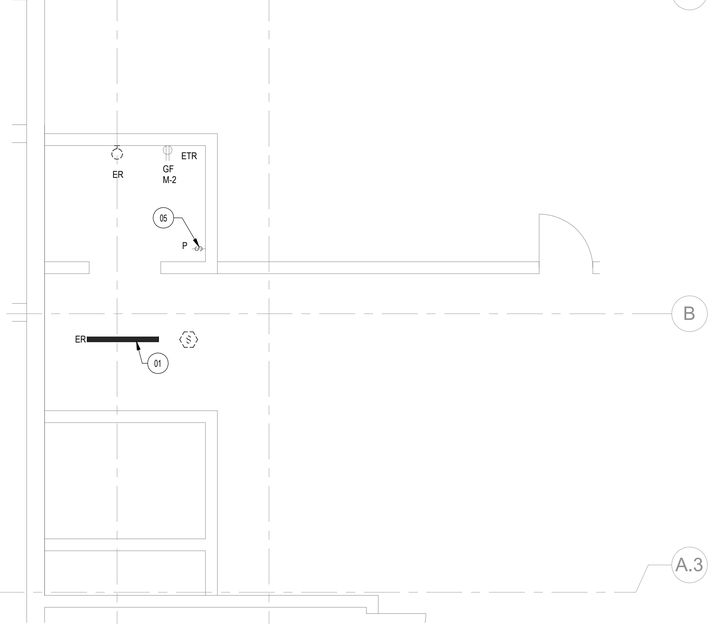
1/4" = 1'-0"

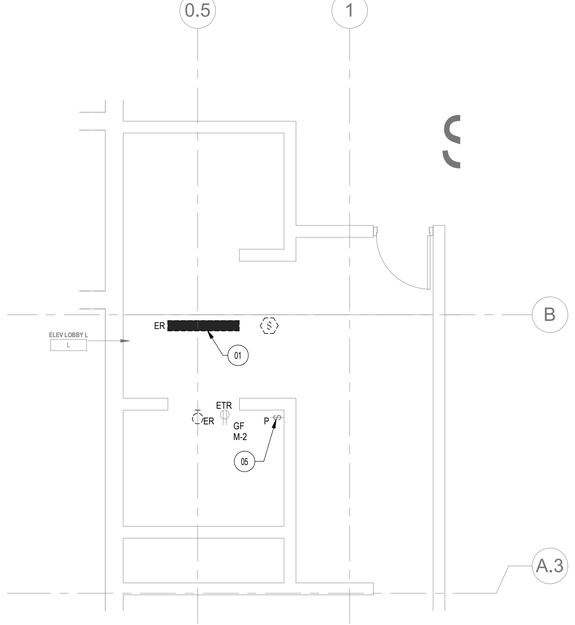


B2 LEVEL 3 FLOOR PLAN - DEMOLITION

1/4" = 1'-0"

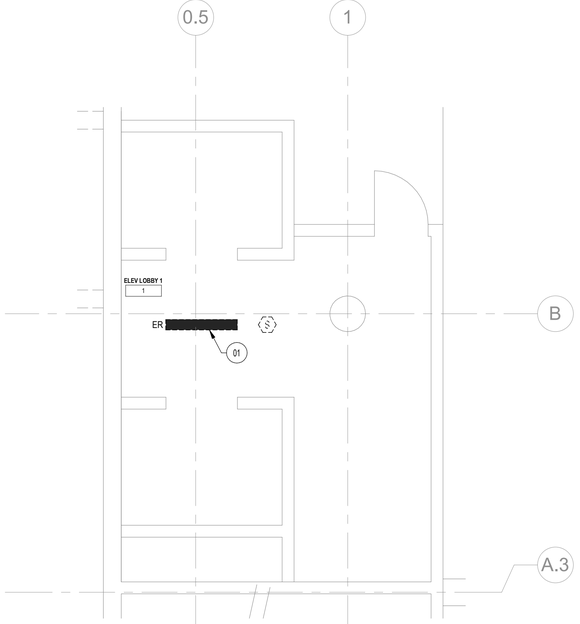






A1 LEVEL L FLOOR PLAN - DEMOLITION

1/4" = 1'-0"



A2 LEVEL 1 FLOOR PLAN - DEMOLITION

1/4" = 1'-0"

A4 LEVEL U FLOOR PLAN - DEMOLITION

1/4" = 1'-0"

N

GENERAL SHEET NOTES

A. ALL ELECTRICAL EQUIPMENT SHOWN ON THIS DEMOLITION PLAN IS "EXISTING TO BE REMOVED" UNLESS NOTED OTHERWISE. IN ADDITION TO REMOVING DEVICES, REMOVE ALL ABANDONED ELECTRICAL CIRCUITS BACK TO THEIR SOURCE. REFER TO THE SPECIFICATIONS FOR ADDITIONAL ELECTRICAL DEMOLITION REQUIREMENTS.

B. IN GENERAL, DASHED WALLS ON THIS PLAN INDICATE EXISTING WALLS BEING DEMOLISHED. DO NOT RELY SOLELY ON ELECTRICAL DRAWINGS TO DETERMINE EXTENT OF GENERAL CONSTRUCTION DEMOLITION. REFER TO ARCHITECTURAL DEMOLITION PLANS FOR THE EXACT EXTENT OF GENERAL CONSTRUCTION DEMOLITION REQUIRED BY THIS CONTRACT.

C. REFER TO DEMOLITION DRAWINGS OF OTHER TRADES. WHERE MOTORS, CONTROL PANELS, AND OTHER LOADS THAT HAVE AN ELECTRICAL CONNECTION ARE BEING REMOVED, INCLUDE THE DISCONNECTION AND REMOVAL OF ASSOCIATED ELECTRICAL FEEDS, CIRCUITS, AND LOOSE CONTROL EQUIPMENT IN THIS CONTRACT.

D. ROOMS IDENTIFIED WITH "ETR", (EXISTING TO REMAIN) ARE ESSENTIALLY TO REMAIN UNCHANGED. ALTHOUGH THIS DESIGNATION IN A GIVEN ROOM REFERS TO THE STATUS OF BASIC ELECTRICAL DEVICES, THERE MAY BE SOME DEMOLITION WORK REQUIRED INVOLVING BACK-FEEDING EXISTING CIRCUITS, REMOVING CIRCUITS THAT ARE DE-ENERGIZED DUE TO DEMOLITION IN OTHER ROOMS, OR OTHER NECESSARY MODIFICATIONS, SEE ALL DOCUMENTS THAT MAKE UP THIS CONTRACT FOR THE TOTAL EXTENT OF WORK REQUIRED IN ALL SPACES.

DEMO SHEET KEYNOTES

01 TURN OVER EXISTING LIGHT FIXTURE TO OWNER.

05 REMOVE LIGHT SWITCH. BRANCH CIRCUIT WIRING TO REMAIN FOR FUTURE USE.

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LEVEL U TO 3 FLOOR PLANS - DEMOLITION

SHEET NUMBER:

E-101

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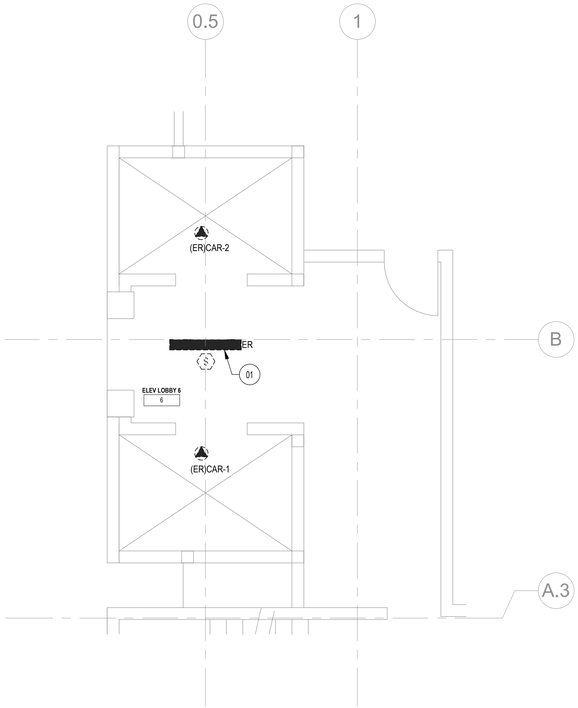
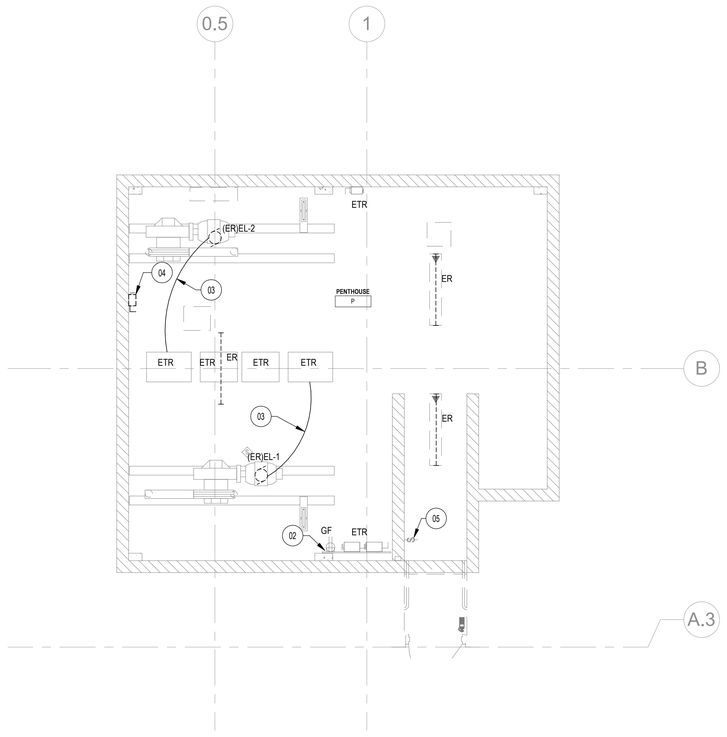


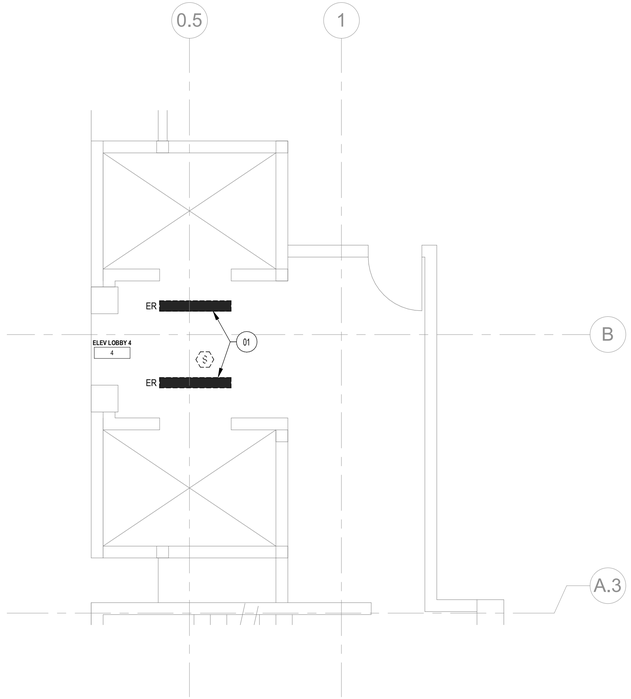
B1 LEVEL 6 FLOOR PLAN - DEMOLITION

1/4" = 1'-0"



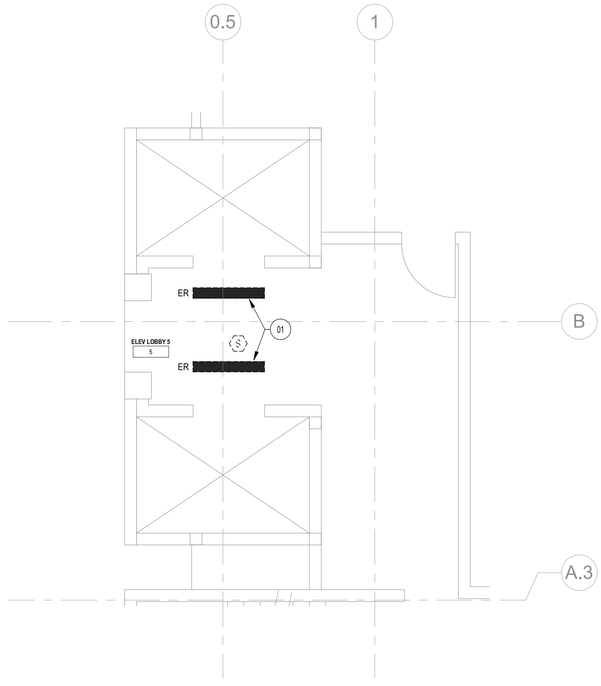
B2 LEVEL PENTHOUSE FLOOR PLAN - DEMOLITION

1/4" = 1'-0"



A1 LEVEL 4 FLOOR PLAN - DEMOLITION

1/4" = 1'-0"



A2 LEVEL 5 FLOOR PLAN - DEMOLITION

1/4" = 1'-0"

GENERAL SHEET NOTES

A. ALL ELECTRICAL EQUIPMENT SHOWN ON THIS DEMOLITION PLAN IS "EXISTING TO BE REMOVED" UNLESS NOTED OTHERWISE. IN ADDITION TO REMOVING DEVICES, REMOVE ALL ABANDONED ELECTRICAL CIRCUITS BACK TO THEIR SOURCE. REFER TO THE SPECIFICATIONS FOR ADDITIONAL ELECTRICAL DEMOLITION REQUIREMENTS.

B. IN GENERAL, DASHED WALLS ON THIS PLAN INDICATE EXISTING WALLS BEING DEMOLISHED. DO NOT RELY SOLELY ON ELECTRICAL DRAWINGS TO DETERMINE EXTENT OF GENERAL CONSTRUCTION DEMOLITION. REFER TO ARCHITECTURAL DEMOLITION PLANS FOR THE EXACT EXTENT OF GENERAL CONSTRUCTION DEMOLITION REQUIRED BY THIS CONTRACT.

C. REFER TO DEMOLITION DRAWINGS OF OTHER TRADES. WHERE MOTORS, CONTROL PANELS, AND OTHER LOADS THAT HAVE AN ELECTRICAL CONNECTION ARE BEING REMOVED, INCLUDE THE DISCONNECTION AND REMOVAL OF ASSOCIATED ELECTRICAL FEEDS, CIRCUITS, AND LOOSE CONTROL EQUIPMENT IN THIS CONTRACT.

D. ROOMS IDENTIFIED WITH "ETR", (EXISTING TO REMAIN) ARE ESSENTIALLY TO REMAIN UNCHANGED. ALTHOUGH THIS DESIGNATION IN A GIVEN ROOM REFERS TO THE STATUS OF BASIC ELECTRICAL DEVICES, THERE MAY BE SOME DEMOLITION WORK REQUIRED INVOLVING BACK-FEEDING EXISTING CIRCUITS, REMOVING CIRCUITS THAT ARE DE-ENERGIZED DUE TO DEMOLITION IN OTHER ROOMS, OR OTHER NECESSARY MODIFICATIONS, SEE ALL DOCUMENTS THAT MAKE UP THIS CONTRACT FOR THE TOTAL EXTENT OF WORK REQUIRED IN ALL SPACES.

DEMO SHEET KEYNOTES

01	TURN OVER EXISTING LIGHT FIXTURE TO OWNER.
02	DEMOLISH EXISTING PLYWOOD. TEMPORARILY SUPPORT EQUIPMENT. PROVIDE NEW UNI STRUT SUPPORT FOR ALL ELECTRICAL EQUIPMENT.
03	DEMOLISH EXISTING FEEDER FROM CONTROLLER TO ELEVATOR MOTOR.
04	DEMOLISH EXISTING SPACE HEATER DISCONNECT. REPLACE WITH FUSED DISCONNECT.BRANCH CIRCUIT WIRING TO REMAIN FOR FUTURE USE.
05	REMOVE LIGHT SWITCH. BRANCH CIRCUIT WIRING TO REMAIN FOR FUTURE USE.

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LEVEL 4 TO PENTHOUSE FLOOR PLANS - DEMOLITION

SHEET NUMBER:

E-102

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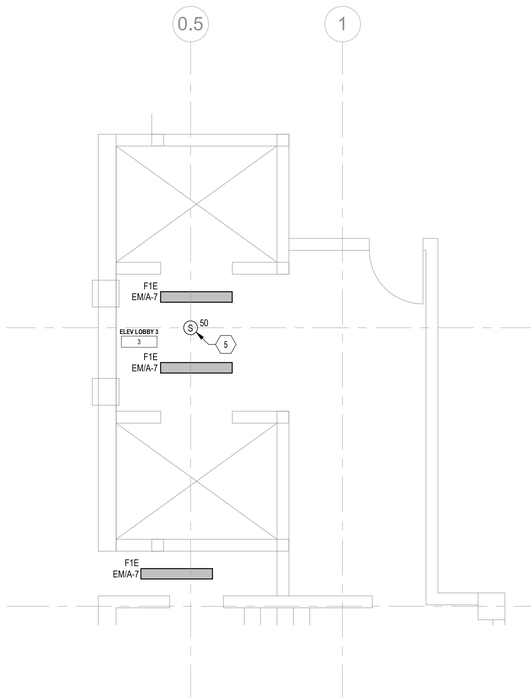
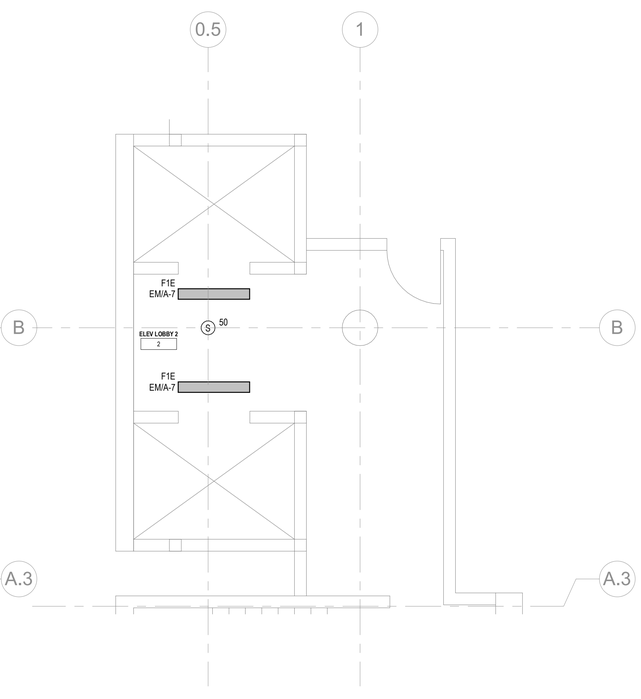
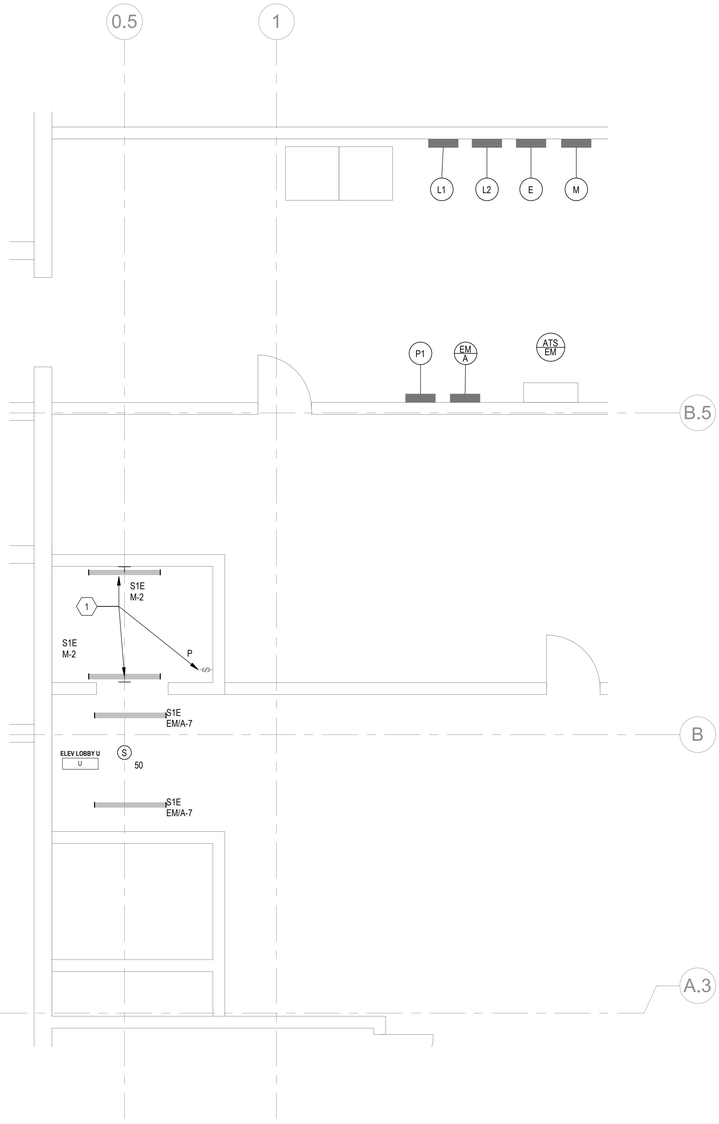


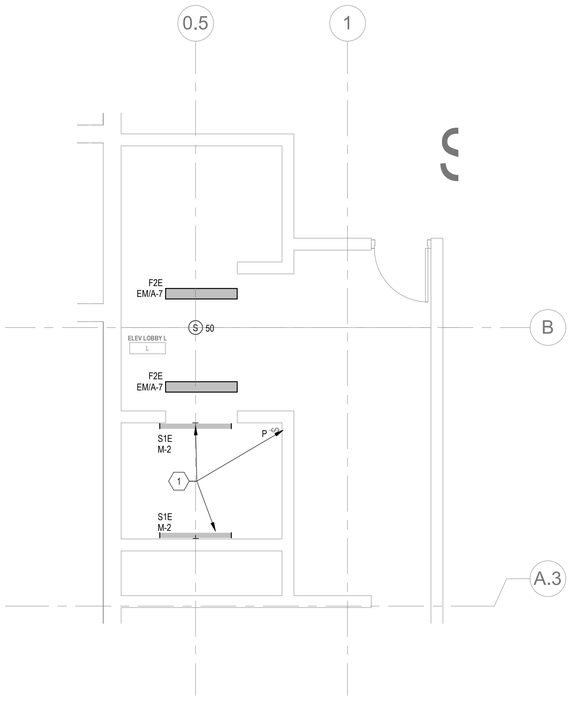
B1 LEVEL 3 FLOOR PLAN - LIGHTING
1/4" = 1'-0"



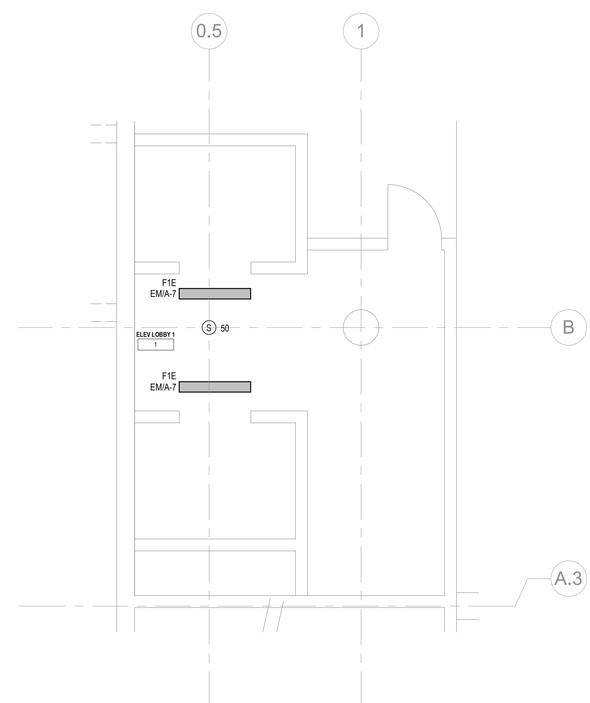
B2 LEVEL 2 FLOOR PLAN - LIGHTING
1/4" = 1'-0"



A4 LEVEL U FLOOR PLAN - LIGHTING
1/4" = 1'-0"



A1 LEVEL L FLOOR PLAN - LIGHTING
1/4" = 1'-0"



A2 LEVEL 1 FLOOR PLAN - LIGHTING
1/4" = 1'-0"

GENERAL SHEET NOTES

A. SEE DETAIL SHEET E-501 FOR WIRING INFORMATION.
B. SEE ELECTRICAL SCHEDULES SHEETS E-602 AND E-603 FOR SOO.
C. REUSE EXISTING LIGHTING RACEWAY OR PATH FOR ALL ELEVATOR LOBBY LIGHTING.

SHEET KEYNOTES

1 CONNECT LIGHIT FIXTURES THIS ROOM TO EXISTING LIGHT SWITCH. NEW LIGHT SWITCH AT EXISITNG LOCATION.
5 PLACE MOTION SENSOR ON BOTTOM OF STRUCTURAL BEAM.

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PROJECT TITLE:
ELEVATOR MODERNIZATION

214 N CARROLL ST
MADISON, WI 53703

ISSUE:
06/11/2026 BID SET

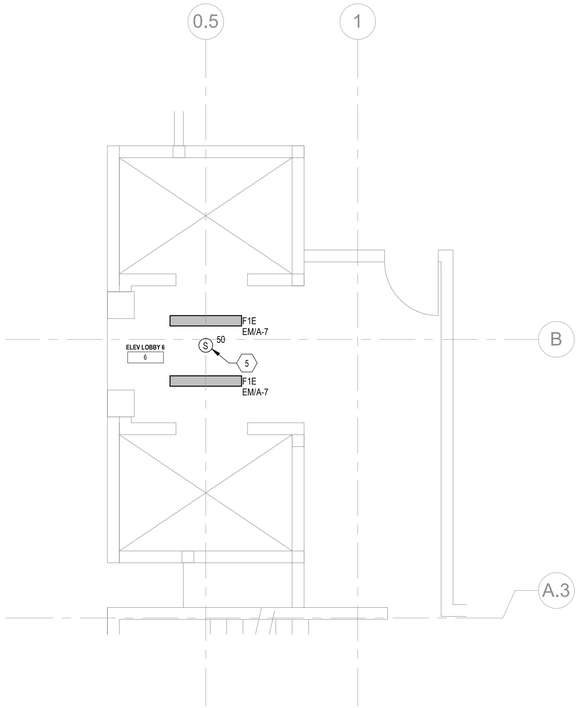
PROJECT INFORMATION:

PROJECT NUMBER:	2025-5004.06
DATE:	06/11/2026
DRAWN BY:	GB
CHECKED BY:	DJK
APPROVED BY:	DJK
SCALE:	AS NOTED

SHEET TITLE:
LEVEL U TO 3 FLOOR PLANS - LIGHTING

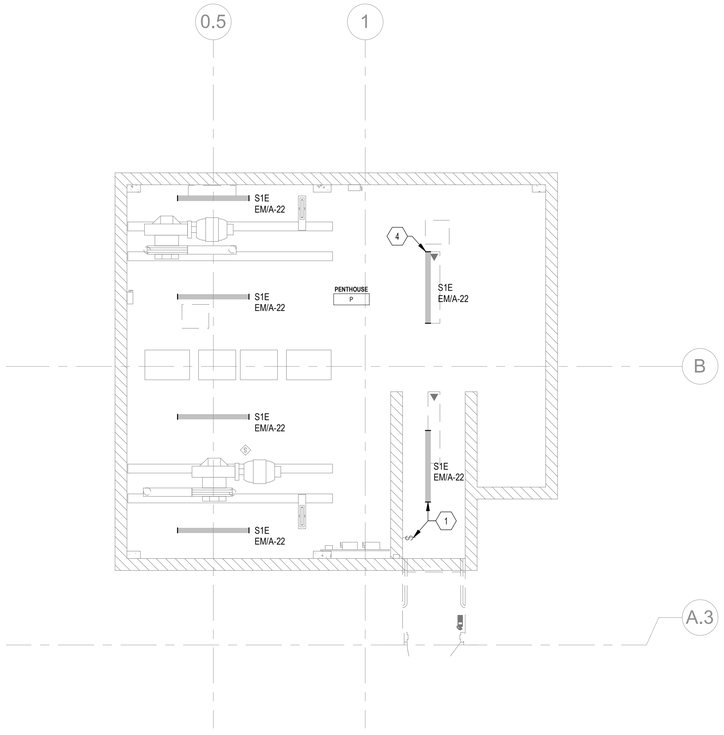
SHEET NUMBER:
E-111

6/19/2026 10:37:47 AM



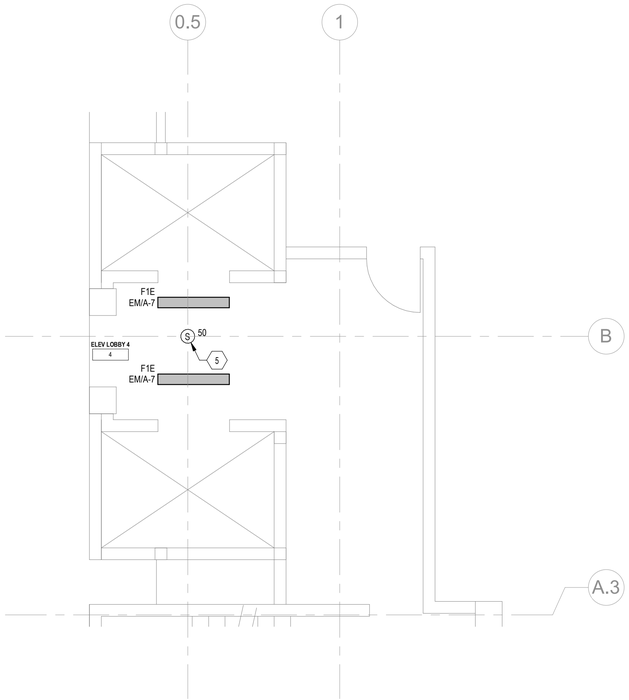
B1 LEVEL 6 FLOOR PLAN - LIGHTING

1/4" = 1'-0"



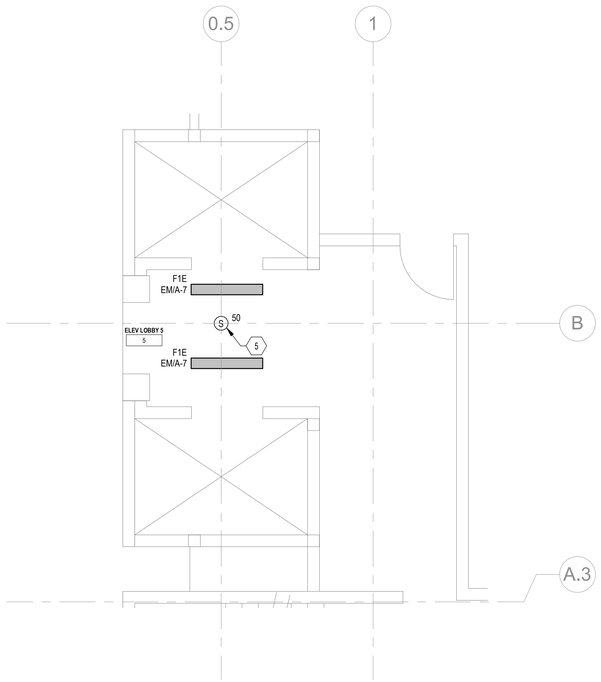
B2 LEVEL PENTHOUSE FLOOR PLAN - LIGHTING

1/4" = 1'-0"



A1 LEVEL 4 FLOOR PLAN - LIGHTING

1/4" = 1'-0"



A2 LEVEL 5 FLOOR PLAN - LIGHTING

1/4" = 1'-0"

N

GENERAL SHEET NOTES

A. SEE DETAIL SHEET E-501 FOR WIRING INFORMATION.
B. SEE ELECTRICAL SCHEDULES SHEETS E-602 AND E-603 FOR SOO.
C. REUSE EXISTING LIGHTING RACEWAY OR PATH FOR ALL ELEVATOR LOBBY LIGHTING.

SHEET KEYNOTES

1 CONNECT LIGHIT FIXTURES THIS ROOM TO EXISTING LIGHT SWITCH. NEW LIGHT SWITCH AT EXISITNG LOCATION.
4 REUSE EXISTING LIGHTING RACEWAY OR PATH.
5 PLACE MOTION SENSOR ON BOTTOM OF STRUCTURAL BEAM.

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APPROVED BY:	DJK
SCALE:	AS NOTED

SHEET TITLE:

LEVEL 4 TO PENTHOUSE FLOOR PLANS - LIGHTING

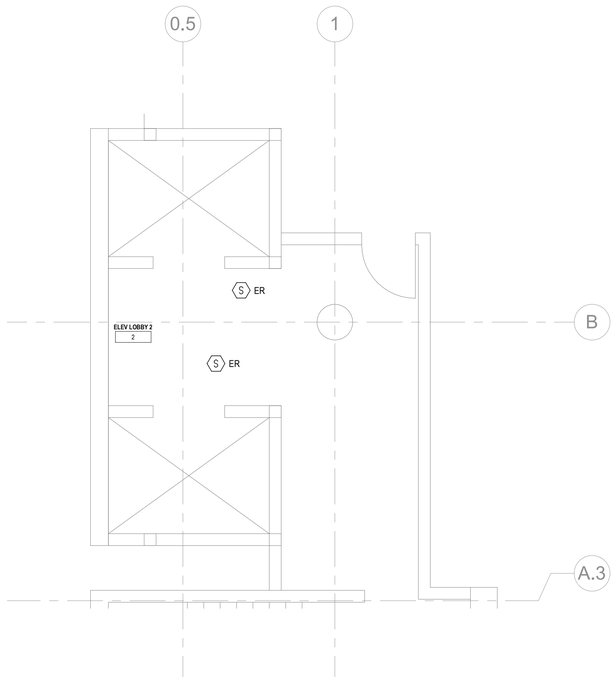
SHEET NUMBER:

E-112

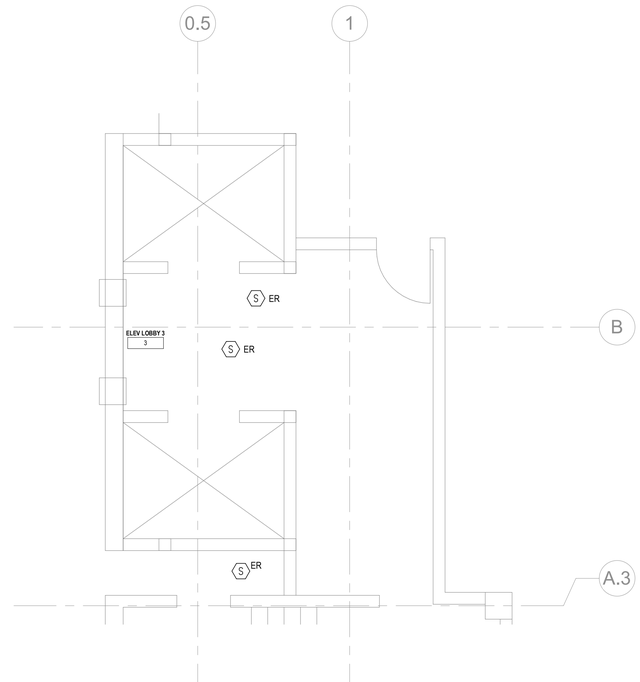
6/19/2026 10:37:48 AM

GENERAL SHEET NOTES

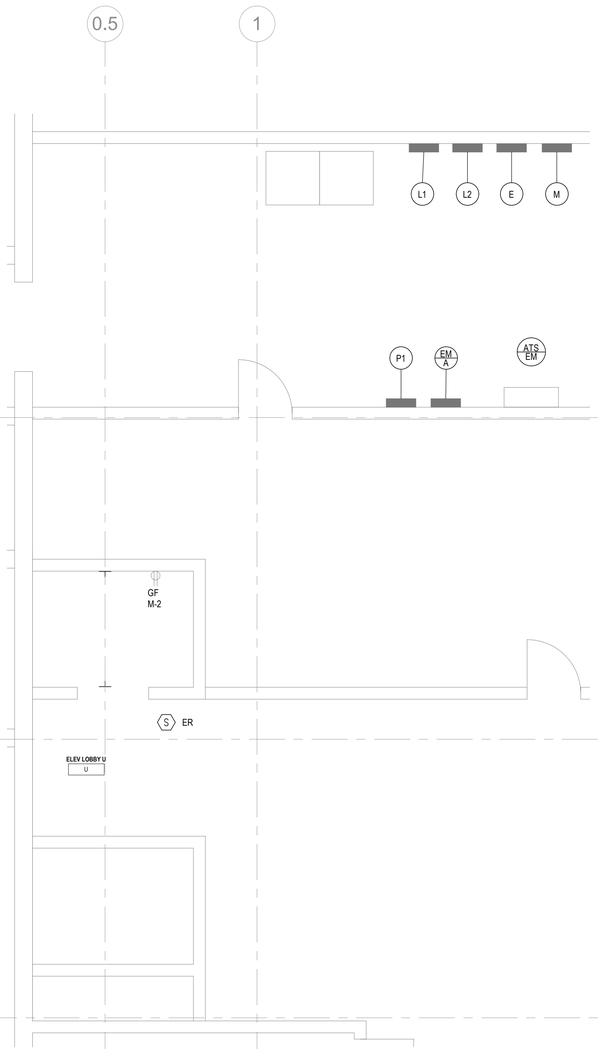
A. SEE DETAIL SHEET E-501 FOR WIRING INFORMATION.



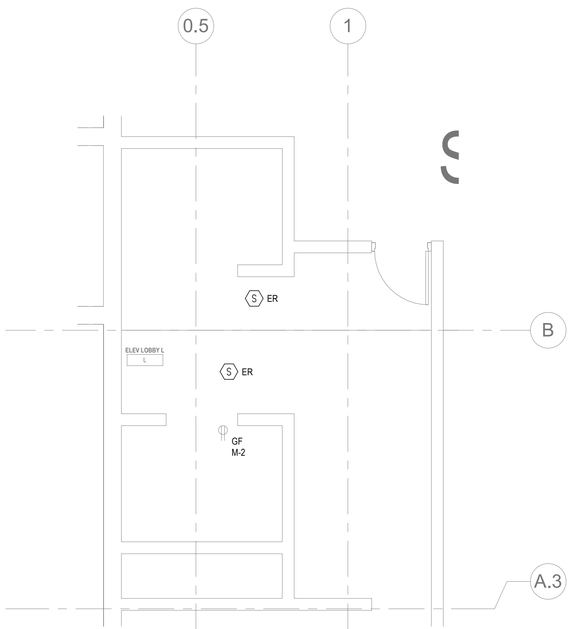
B1 LEVEL 2 FLOOR PLAN - POWER & SYSTEMS
1/4" = 1'-0"



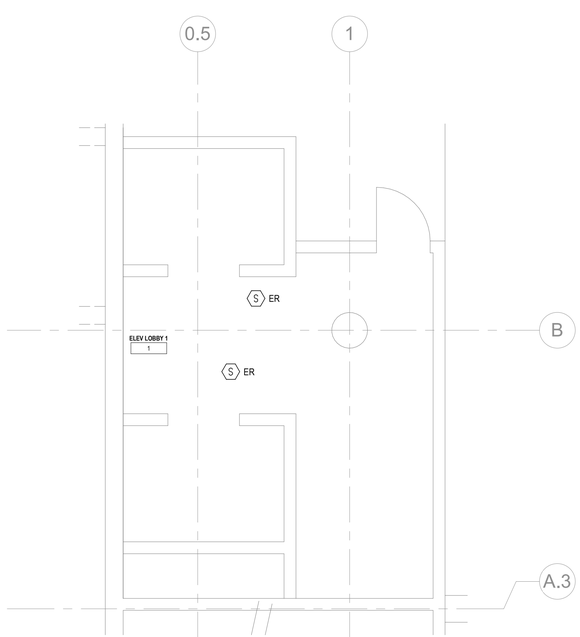
B2 LEVEL 3 FLOOR PLAN - POWER & SYSTEMS
1/4" = 1'-0"



1 LEVEL U FLOOR PLAN - POWER & SYSTEMS
1/4" = 1'-0"



A1 LEVEL L FLOOR PLAN - POWER & SYSTEMS
1/4" = 1'-0"



A2 LEVEL 1 FLOOR PLAN - POWER & SYSTEMS
1/4" = 1'-0"

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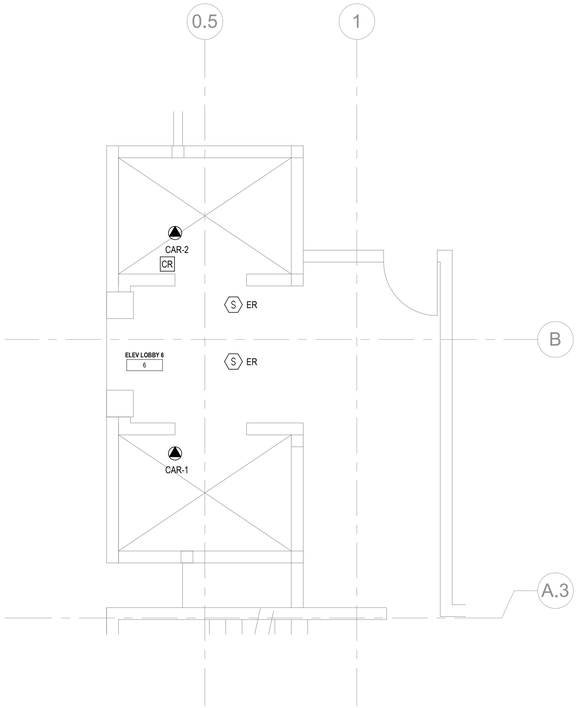
SHEET TITLE:

LEVEL U TO 3 FLOOR PLANS - POWER & SYSTEMS

SHEET NUMBER:

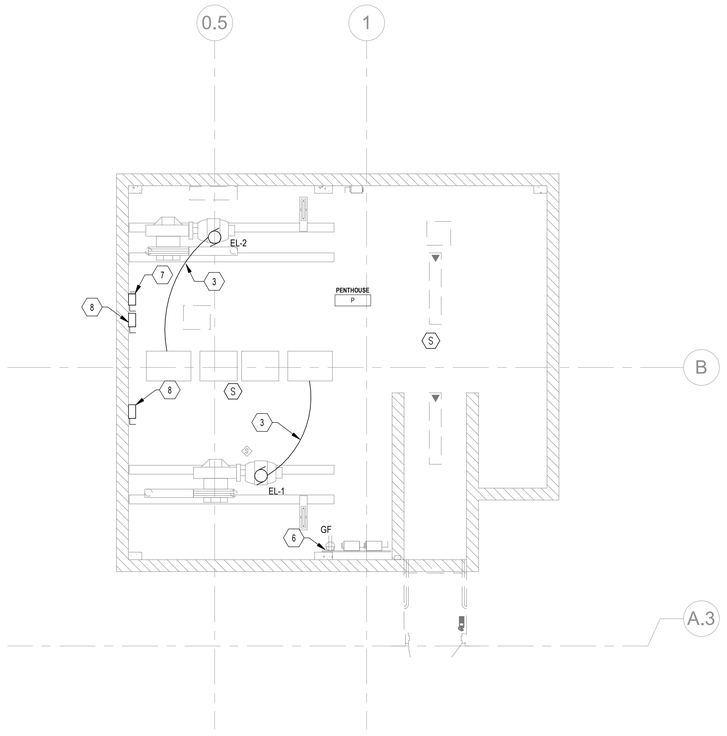
E-121

6/19/2026 10:37:48 AM



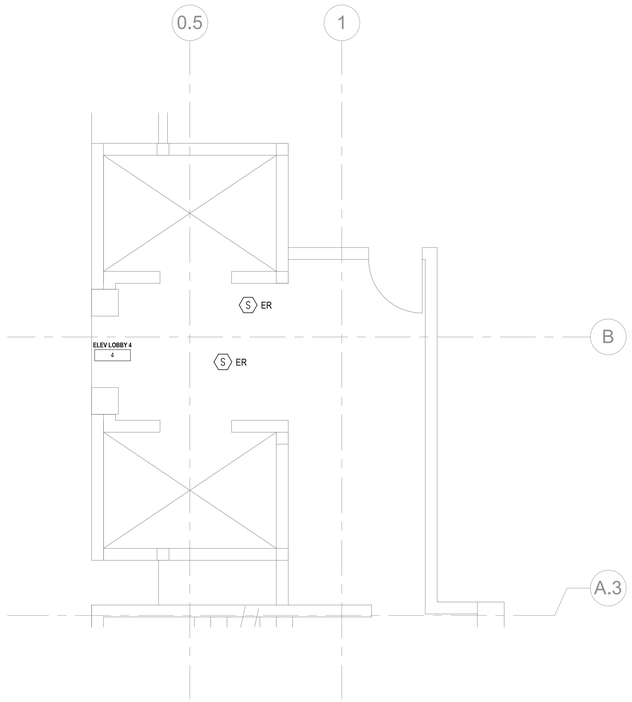
B1 LEVEL 6 FLOOR PLAN - POWER & SYSTEMS

1/4" = 1'-0"



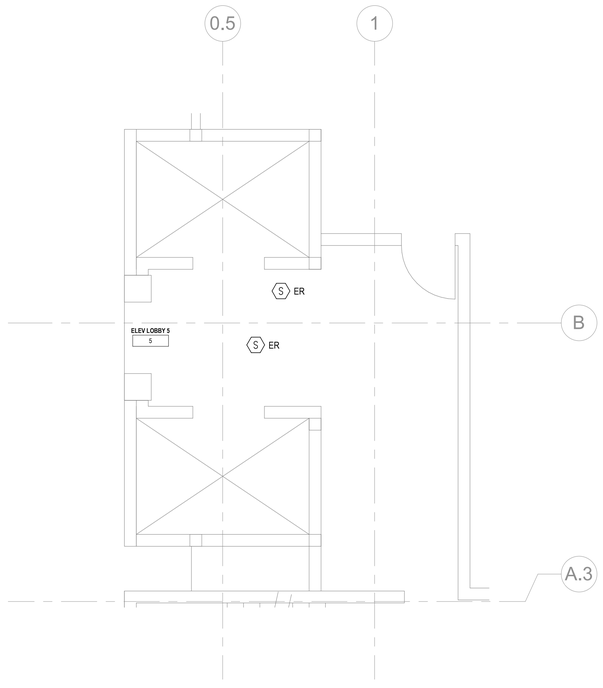
B2 LEVEL PENTHOUSE FLOOR PLAN - POWER & SYSTEMS

1/4" = 1'-0"



A1 LEVEL 4 FLOOR PLAN - POWER & SYSTEMS

1/4" = 1'-0"



A2 LEVEL 5 FLOOR PLAN - POWER & SYSTEMS

1/4" = 1'-0"

N

GENERAL SHEET NOTES

A. SEE DETAIL SHEET E-501 FOR WIRING INFORMATION.

SHEET KEYNOTES

3 PROVIDE NEW FEED TO ELEVATOR FROM EXISTING CONTROLLER. SEE MOTOR SCHEDULE FOR FEEDER SIZE.

6 PROVIDE NEW UNI STRUT SUPPORT FOR ALL ELECTRICAL EQUIPMENT.

7 PROVIDE NEW 20AMP FUSED DISCONNECT FOR SPACE HEATER.

8 REUSE EXISTING RACEWAY OR PATH FOR ELEVATOR CAR CONNECTION. PROVIDE LOCKABLE ENCLOSED 20AMP CIRCUIT BREAKER (QO2L30S).

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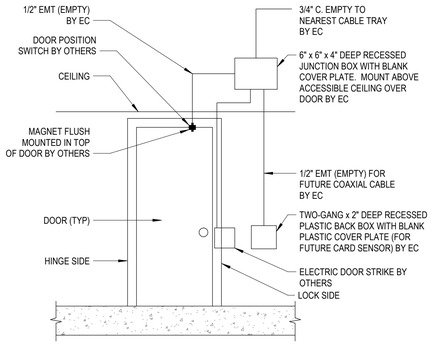
SHEET TITLE:

LEVEL 4 TO PENTHOUSE FLOOR PLANS - POWER & SYSTEMS

SHEET NUMBER:

E-122

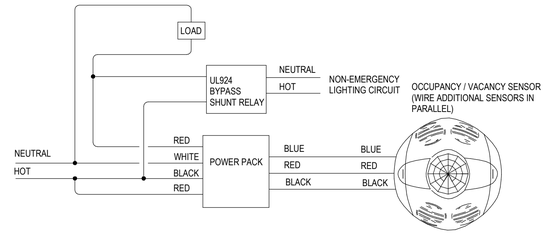
6/19/2026 10:37:48 AM



NOTES:
1. ELECTRICAL CONTRACTOR TO PROVIDE CONDUITS AND BOXES.
2. EMPTY CONDUITS TO CONTAIN NYLON PULL STRING ENTIRE LENGTH.
3. HARDWARE CONTRACTOR TO PROVIDE DOOR POSITION SWITCH, MAGNET, AND ELECTRIC DOOR STRIKE.
4. SEE ARCHITECTURAL DOOR SCHEDULE FOR DOORS REQUIRING SECURITY DEVICES.

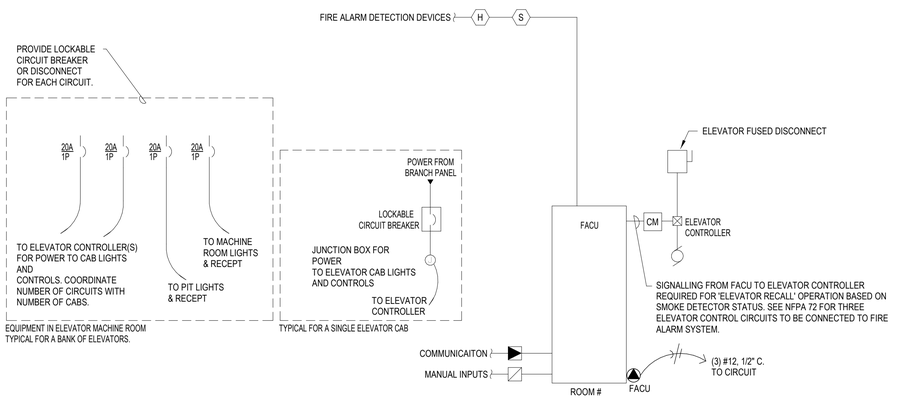
B1 SECURITY SYSTEM ROUGH IN DETAIL

NTS



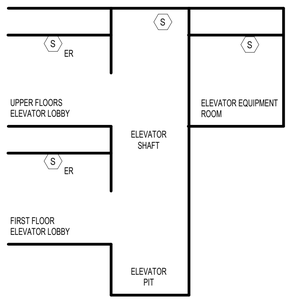
B2 OCCUPANCY SENSOR WITH EMERGENCY BYPASS

NTS



A1 FIRE ALARM SYSTEM SCHEMATIC - ELEV

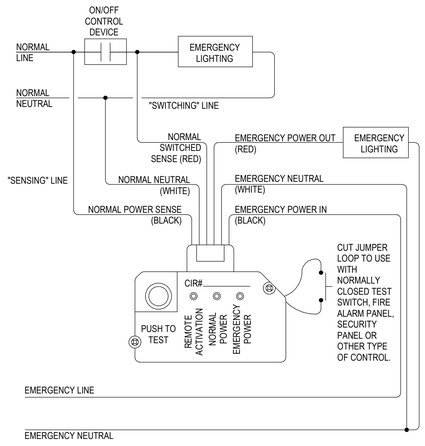
NOT TO SCALE



NOTES:

1. EACH ELEVATOR WITHIN THE BUILDING SHALL HAVE ADDRESSIBLE FIRE ALARM CONTROL MODULES SEPARATE FROM OTHER ELEVATORS, EACH PROGRAMMED TO OPERATE AS DETAILED BELOW FOR THAT PARTICULAR ELEVATOR.

2. SEQUENCE OF OPERATION FOR ELEVATOR RECALL SHALL FOLLOW NFPA 72.



A5 UL924 DEVICE DETAIL

NTS

GENERAL SHEET NOTES

A. BASIS OF DESIGN FOR DIGITAL LIGHTING CONTROLS IS NLIGHT BY ACUITY.
B. LIGHT SWITCHING AND CONTROLS PACKAGES SHALL COMPLY WITH IECC 2021.
C. ACCEPTABLE LIGHTING CONTROLS PACKAGES INCLUDE:
   - PRIOR APPROVED EQUAL PRODUCT.
D. CONTROLS PACKAGE MUST INCLUDE THE FOLLOWING:
   - NETWORK SYSTEM.
   - PROVIDE BRIDGES AS REQUIRED AND INCLUDE (1) ADDITIONAL BRIDGE USED AS A HUB.
E. PROVIDE POWER TO THE FOLLOWING ITEMS FROM THE NEAREST AVAILABLE *NORMAL / EMERGENCY 120V CIRCUIT.
   - HEAD END EQUIPMENT
   - BRIDGES
   - TOUCH SCREEN (IF APPLICABLE)
F. LINE VOLTAGE WIRING SHALL BE #12 AWG MINIMUM, INSTALLED IN CONDUIT.
G. CONTROL CABLING SHALL BE CAT 5e AS REQUIRED BY CONTROL DEVICE MANUFACTURER. INSTALL IN CONDUIT OR ROUTE IN FREE AIR AS ALLOWED BY THE SPECIFICATIONS. PROVIDED BY ELECTRICAL CONTRACTOR.
H. DIGITAL LIGHTING CONTROL DEVICE DETAILS ARE DIAGRAMMATIC. SEE FLOOR PLANS FOR QUANTITIES AND TYPES OF DEVICES REQUIRED IN EACH ROOM OR SPACE.
I. LIGHTING CONTROL RELAY / POWER PACKS ARE NOT SHOWN ON FLOOR PLANS. PROVIDE IN QUANTITIES AS REQUIRED TO ACCOMMODATE LIGHTING CONTROL SCHEME INDICATED ON FLOOR PLANS. LOCATE RELAY / POWER PACKS ABOVE ACCESSIBLE ROOM CEILINGS, IN AN ACCESSIBLE LOCATION NEAR ROOM SERVED OR USE A WIREWAY SYSTEM NEAR THE NLIGHT ECLYPSE OR POWER PANEL. INDICATE EXACT LOCATIONS OF RELAY / POWER PACKS ON AS-BUILT RECORD DRAWINGS.
J. IF ANOTHER DIGITAL LIGHTING CONTROLS PACKAGE IS APPROVED FOR THIS PROJECT, FOLLOW MANUFACTURER'S WIRING DIAGRAMS AND INSTALLATION INSTRUCTIONS. FOR PROJECTS WITH LUTRON LIGHTING CONTROLS, PROVIDE LUTRON DRIVERS AS REQUIRED.
K. PROVIDE COMMISSIONING OF THE ENTIRE SYSTEM.

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ELECTRICAL DETAILS

SHEET NUMBER:

E-501

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LIGHT FIXTURE SCHEDULE

GENERAL NOTES:

A. SEE SPECIFICATION SECTION FOR ADDITIONAL INFORMATION REGARDING FIXTURE AND INSTALLATION REQUIREMENTS.

B. MANUFACTURERS LISTED AS ACCEPTABLE SHALL MEET ALL REQUIREMENTS AND FEATURES INDICATED. ACCEPTABLE MANUFACTURERS MUST MEET THE PHOTOMETRIC PERFORMANCE OF THE LISTED UNIT. ELECTRICAL CONTRACTOR SHALL ENSURE THE FIXTURE DEPTH / HEIGHT WILL COMPLY WITH ADA REQUIREMENTS AND WILL NOT INTERFERE WITH OTHER TRADES WITHIN THE CEILING CAVITY.

C. ELECTRICAL CONTRACTOR SHALL COORDINATE T-GRID, WOOD AND SPECIALTY CEILING SYSTEMS WITH ARCHITECT PRIOR TO ORDERING.

D. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL REQUIRED PARTS AND PIECES FOR A COMPLETE INSTALLATION.

E. ALL REMOTE DRIVERS SHALL BE LOCATED IN AN ACCESSIBLE LOCATION THAT MEETS THE AMBIENT TEMPERATURE REQUIREMENTS OF THE DRIVER. ELECTRICAL CONTRACTOR SHALL VERIFY WITH SUBMITTED SHOP DRAWING WIRING DIAGRAMS THAT ALL DRIVER LOCATIONS ARE WITHIN MANUFACTURER'S RECOMMENDED DISTANCE REQUIREMENTS.

NOTES:

1. PROVIDE GTD FOR ALL LIGHT FIXTURES. SEE DETAILS B2 AND A5 FOR WIRING INFORMATION.

TAG	PERFORMANCE & ELECTRICAL DATA				LIGHT FIXTURE PROPERTIES				OPTIONS & ACCESSORIES				NO EQUALS	MOUNTING		SEE NOTE
	LUMENS	KELVIN TEMP	LOAD	FIXTURE VOLTAGE	DESCRIPTION	MANUFACTURER	CATALOG SERIES	DEPTH OR HEIGHT	DIMMING TYPE	DRIVER LOCATION	REQUIRED LISTINGS	SENSOR TYPE		MATERIAL	TYPE	
F1E	5400	4000K	54 VA	120	VANDEL RESISTANT LINEAR STAIRWAY SURFACE MOUNT WITH PHOTO CELL	LUMINAIRE LED	CLF7 4FT AL MIN10 2DRV 50W 40K 120 OP WHT PC	0' - 3"	0-10-10	I	DL VR	P		CONCRETE	SURFACE	1
F2E	5400	4000K	54 VA	120	VANDEL RESISTANT LINEAR STAIRWAY SURFACE MOUNT	LUMINAIRE LED	CLF7 4FT AL MIN10 2DRV 50W 40K 120 OP WHT	0' - 3"	0-10-10	I	DL VR	P		CONCRETE	SURFACE	1
S1E	7000	4000K	54 VA	120	4' LED STRIP WITH DIFFUSE LENSE	LITHONIA	CLX L48 7000LM HEF RDL MVOLT GZ10 40K 80CRI	0' - 3 1/2"	0-10-10	I	DL	N		CONCRETE	SURFACE	1

MOTOR WIRING SCHEDULE

GENERAL NOTES:

A. OBTAIN SUPPLIERS SHOP DRAWINGS/WIRING DIAGRAMS TO VERIFY LOCATION AND REQUIREMENTS PRIOR TO ROUGH-IN.

B. IF THE WORD "VARIES" APPEARS IN THE PANEL AND/OR CIRCUIT COLUMNS, SEE FLOOR PLANS FOR CIRCUITING INFORMATION.

NOTE:

1. PROVIDE NEW FEED TO NEW ELEVATOR MOTOR FROM EXISITNG CONTROLLER. VERIFY FINAL MOTOR SIZE AND FEEDER SIZE ONCE MANUFACTURER HAS BEEN SELECTED.

TAG	DRIVING	POWER				WIRING				SEE NOTE
		SPECIFIED SIZE	VOLTAGE	PHASE	ELECTRICAL LOAD	PHASE & NEUTRAL QTY	PHASE & NEUTRAL SIZE	GROUND SIZE	COND.	
EL-1	ELEVATOR	15 HP	480 V	3	17459 VA	3	8	10	3/4"	1
EL-2	ELEVATOR	15 HP	480 V	3	17459 VA	3	8	10	3/4"	1

SPECIAL PURPOSE OUTLET SCHEDULE

GENERAL NOTE:

A. LOADS SHOWN ON THE SPECIAL PURPOSE OUTLET SCHEDULE MAY REQUIRE EITHER A RECEPTACLE (A PLUG-IN CONTACT DEVICE AS DEFINED BY THE NEC) OR MAY REQUIRE A DIRECT CONNECTION (HARDWIRED) TO THE LOADS BRANCH CIRCUIT. FOR EACH LOAD THE ELECTRICAL CONTRACTOR SHALL CONFIRM THE TYPE OF TERMINATION REQUIRED AS INDICATED ON THE EQUIPMENT MANUFACTURER'S SHOP DRAWINGS. ALL RECEPTACLES, DISCONNECT SWITCHES, OR OTHER DEVICES REQUIRED FOR TERMINATION OF THESE CIRCUITS SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID. LOADS ON THIS SCHEDULE MAY ALSO REQUIRE...

B. ALL MOUNTING HEIGHTS ARE MEASURED FROM ABOVE FINISHED FLOOR OR GRADE TO THE CENTER OF BOX, UNLESS OTHERWISE INDICATED.

C. IF THE NEMA TYPE IS LEFT BLANK IT IS A DIRECT CONNECTION.

D. IF THE WORD "VARIES" APPEARS IN THE PANEL AND/OR CIRCUIT COLUMNS, SEE FLOOR PLANS FOR CIRCUITING INFORMATION.

NOTE:

1. REUSE EXISTING RACEWAY OR PATH. PROVIDE LOCKABLE ENCLOSED 20AMP CIRCUIT BREAKER (QO2L30S) LOCATED IN PENTHOUSE.

TAG	DRIVING	POWER				FEED FROM		WIRING				SEE NOTE
		SPECIFIED SIZE	VOLTAGE	PHASE	ELECTRICAL LOAD	PANEL	CIRCUIT	PHASE & NEUTRAL QTY	PHASE & NEUTRAL SIZE	GROUND SIZE	COND.	
CAR-1	ELEVATOR CAR #1 (EAST)	-	120 V	1	500 VA	EM/A	19	2	12	12	3/4"	1
CAR-2	ELEVATOR CAR #2 (WEST)	-	120 V	1	500 VA	EM/A	21	2	12	12	3/4"	1
FACU	FIRE ALARM CONTROL UNIT	-	120 V	1	100 VA	EM/A	17	2	12	12	3/4"	

LIGHT FIXTURE SCHEDULE ABBREVIATIONS

DIMMING TYPE

0-10-0.1 = 0-10 V 0.1%
0-10-1 = 0-10 V 1%
0-10-5 = 0-10 V 5%
0-10-10 = 0-10 V 10%
BL = BILEVEL / STEP
E = ELDOLED
FF = FORWARD PHASE
D = DALI
DX = DMX
L = LUTRON
N = NONE
O = OSRAM
P = PHASE
RF = REVERSE PHASE

DRIVER LOCATION

I = INTEGRAL
N = NONE
R = REMOTE

REQUIRED LISTINGS

= IP ## RATED
AT = AIR TIGHT
C#D# = CLASS # DIVISION #
DL = DAMP LOCATION
F = FIRE RATED
IC = IC RATED
IR = IMPACT RESISTANT
LR = LIGATURE RESISTANT
SL = SHOWER LIGHT
TR = TAMPER RESISTANT
VR = VANDAL RESISTANT
WL = WET LOCATION

MOUNTING MATERIAL

B = BRICK
C = CONCRETE
CB = CONCRETE BASE
DW = DRYWALL
ES = EXPOSED STRUCTURE
G = GROUND
LG = LAY-IN GRID
M = METAL
PL = PLASTER
S = STONE
T = TILE
V = VARIES
W = WOOD

MOUNTING TYPE

C = COVE
CH = CHAIN - PROVIDE ACCESSORY KIT
CA = CATENARY
MP = MONOPOINT
MPC = MULTIPORT CANOPY
PC = PENDANT - CABLE
PCH = PENDANT - CHAIN
PRS = PENDANT - RIGID STEM
PS = PENDANT - SWAG
PO = POLE
R = RECESSED
S = SURFACE
TC = TRACK - CABLE
TMC = TRACK - MONORAIL - CURVED
TMF = TRACK - MONORAIL - FLEXIBLE
TMS = TRACK - MONORAIL - STRAIGHT
W = WALL

SENSOR TYPE

D = DAYLIGHT SENSOR
MO = MULTI-LEVEL OCCUPANCY SENSOR
N = NONE
O = OCCUPANCY SENSOR
P = PHOTOCELL

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PROJECT TITLE:

ELEVATOR MODERNIZATION

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MADISON, WI 53703

ISSUE:

06/11/2026 BID SET

PROJECT INFORMATION:

PROJECT NUMBER:	2025-5004.06
DATE:	06/11/2026
DRAWN BY:	GB
CHECKED BY:	DJK
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SCALE:	AS NOTED

SHEET TITLE:

ELECTRICAL SCHEDULES

SHEET NUMBER:

E-601

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SEQUENCE OF OPERATIONS NOTES

A. MANUAL ON/OFF SWITCHING CONTROL:
   a. WALL SWITCH SWITCHLEG "x" SHALL PROVIDE MANUAL ON/OFF CONTROL OF SWITCHLEG "x" LUMINAIRES, UNIFORMLY OPERATING ALL LIGHTING.
   b. WALL SWITCHES SHALL BE CAPABLE OF TURNING LIGHTING ON AND OFF AT ANY TIME REGARDLESS OF AUTOMATIC CONTROL BY TIME-SWITCH SCHEDULING OR OCCUPANCY SENSORS. WALL SWITCHES SHALL NOT INCREASE THE LIGHTING LEVEL ABOVE THE AUTOMATIC DAYLIGHT-HARVESTING CONTROL LIGHTING LEVEL.

B. MANUAL DIMMING CONTROL:
   a. WALL DIMMER SWITCHLEG "x" SHALL PROVIDE MANUAL ON/OFF AND DIMMING CONTROL OF SWITCHLEG "x" LUMINAIRES, UNIFORMLY OPERATING THE LIGHTING. LOW-END-TRIM SHALL BE BASED ON FIXTURE DRIVER, AND HIGH-END TRIM SHALL BE 100%.
   b. WALL SWITCHES SHALL BE CAPABLE OF TURNING LIGHTING ON AND OFF AT ANY TIME REGARDLESS OF AUTOMATIC CONTROL BY TIME-SWITCH SCHEDULING OR OCCUPANCY SENSORS. WALL DIMMERS SHALL NOT INCREASE THE LIGHTING LEVEL ABOVE THE AUTOMATIC DAYLIGHT-HARVESTING CONTROL LIGHTING LEVEL.

C. HIGH-END TRIM:
   a. THE MAXIMUM OPERATING LEVEL SHALL BE SET TO <X%> OF MAXIMUM FOR ALL GENERAL LIGHTING.

D. LOW-END TRIM:
   a. THE MINIMUM OPERATING LOW-END TRIM LEVEL SHALL BE SET FOR ALL LIGHTING IN ALL COMMON AND CIRCULATION AREAS TO THE MINIMUM LEVEL SPECIFIED ON THE LUMINAIRE SCHEDULE FOR EACH LUMINAIRE TYPE BASED ON THE LIGHT FIXTURE DRIVER.

E. TIME SCHEDULING OFF CONTROL:
   a. ALL SPACE LIGHTING, EXCEPT REQUIRED EGRESS LIGHTING, SHALL BE SCHEDULED BY CENTRALIZED TIME SWITCH TO BE TURNED OFF 1 HOUR AFTER THE END OF BUSINESS OPERATING HOURS AND REMAIN OFF UNTIL 1 HOUR PRIOR TO THE BEGINNING BUSINESS OPERATING HOURS THE NEXT BUSINESS DAY.
   b. WALL CONTROL SWITCHES OR DIMMERS SHALL BE CONFIGURED TO PROVIDE OVERRIDE-ON CONTROL OF LIGHTING AFTER BUSINESS HOURS. ACTUATION OF A WALL CONTROL AFTER BUSINESS HOURS SHALL TURN THE LIGHTING ON FOR 120 MINUTES.
   c. LIGHTING IN THE SPACE SHALL MOMENTARILY TURN OFF AND BACK ON WITHIN 5 SECONDS, TO WARN OCCUPANTS 5 MINUTES BEFORE SHUT-OFF. MANUAL ACTUATION OF THE WALL CONTROL AFTER THIS WARNING SIGNAL SHALL CANCEL THE PENDING SHUTOFF.

F. OCCUPANCY SENSOR - 100% ON:
   a. UPON DETECTION OF OCCUPANTS, GENERAL LIGHTING SHALL AUTOMATICALLY TURN ON TO 100% FULL POWER.
   b. A WALL SWITCH AT THE ENTRANCE SHALL PROVIDE THE USER CONTROL TO TURN ON, INCREASE, DECREASE, OR TURN OFF THE GENERAL LIGHTING.
   c. OCCUPANCY SENSOR MOUNTING LOCATION AND SENSITIVITY SHALL BE SET FOR MAJOR-MOTION FULL-ROOM COVERAGE AND MINOR-MOTION COVERAGE IN THE WORKSTATION AREA.
   d. ALL ROOM LIGHTING SHALL BE AUTOMATICALLY TURNED OFF 10 MINUTES AFTER OCCUPANCY WAS LAST DETECTED.
   e. THE OCCUPANCY SENSOR WALK-THROUGH MODE SHALL BE ENABLED, AUTOMATICALLY TURNING LIGHTING OFF 2 MINUTES AFTER INITIAL DETECTION, WHEN OCCUPANCY IS DETECTED FOR A DURATION OF LESS THAN 30 SECONDS.

G. OCCUPANCY SENSOR - 50% ON:
   a. UPON DETECTION OF OCCUPANTS, GENERAL LIGHTING SHALL AUTOMATICALLY TURN ON TO 50% FULL POWER.
   b. A WALL SWITCH AT THE ENTRANCE SHALL PROVIDE THE USER CONTROL TO TURN ON, INCREASE, DECREASE, OR TURN OFF THE GENERAL LIGHTING.
   c. OCCUPANCY SENSOR MOUNTING LOCATION AND SENSITIVITY SHALL BE SET FOR MAJOR-MOTION FULL-ROOM COVERAGE AND MINOR-MOTION COVERAGE IN THE WORKSTATION AREA.
   d. ALL ROOM LIGHTING SHALL BE AUTOMATICALLY TURNED OFF 10 MINUTES AFTER OCCUPANCY WAS LAST DETECTED.
   e. THE OCCUPANCY SENSOR WALK-THROUGH MODE SHALL BE ENABLED, AUTOMATICALLY TURNING LIGHTING OFF 2 MINUTES AFTER INITIAL DETECTION, WHEN OCCUPANCY IS DETECTED FOR A DURATION OF LESS THAN 30 SECONDS.

H. VACANCY SENSOR - MANUAL ON:
   a. A VACANCY SENSOR SWITCH SHALL BE INSTALLED AT THE ENTRANCE TO THE SPACE, PROVIDING USER'S MANUAL CONTROL TO TURN ON, INCREASE, DECREASE, OR TURN OFF THE GENERAL LIGHTING.
   b. VACANCY SENSOR MOUNTING LOCATION AND SENSITIVITY SHALL BE SET FOR MAJOR-MOTION FULL-ROOM COVERAGE AND MINOR-MOTION COVERAGE IN THE WORKSTATION AREA.
   c. ALL LIGHTING SHALL BE AUTOMATICALLY TURNED OFF 10 MINUTES AFTER OCCUPANCY WAS LAST DETECTED. LIGHTING SHALL AUTOMATICALLY TURN BACK ON IF OCCUPANCY IS DETECTED WITHIN 30 SECONDS OF AUTOMATICALLY TURNING OFF. AFTER 30 SECONDS AFTER AN AUTOMATIC SHUTOFF, THE LIGHTING SHALL ONLY BE TURNED ON FROM THE VACANCY SENSOR SWITCH.
   d. THE VACANCY SENSOR'S WALK-THROUGH MODE SHALL BE ENABLED, AUTOMATICALLY TURNING LIGHTING OFF 2 MINUTES AFTER INITIAL DETECTION, WHEN OCCUPANCY IS DETECTED FOR A DURATION OF LESS THAN 30 SECONDS.

I. OCCUPANCY SENSORS - AUTO DIM:
   a. GENERAL INTERIOR LIGHTING:
      - ALL ROOM LIGHTING SHALL BE AUTOMATICALLY DIMMED TO 50% LIGHT OUTPUT 10 MINUTES AFTER OCCUPANCY WAS LAST DETECTED.
   b. STAIRWELL:
      - ALL LIGHTING SHALL BE AUTOMATICALLY DIMMED TO 20% LIGHT OUTPUT 10 MINUTES AFTER OCCUPANCY WAS LAST DETECTED.
   c. PARKING GARAGE:
      - ALL LIGHTING SHALL BE AUTOMATICALLY DIMMED TO 70% LIGHT OUTPUT 20 MINUTES AFTER OCCUPANCY WAS LAST DETECTED.

J. DAYLIGHT HARVESTING:
   a. THE DAYLIGHTING CONTROL PHOTOSENSOR SHALL BE SET TO CONTINUOUSLY INCREASE OR DECREASE THE ELECTRIC LIGHTING LUMINOUS INTENSITY TO MAINTAIN THE TARGET ILLUMINANCE OF THE DAYLIGHT AREA.
   b. WHEN COMBINED ELECTRIC AND DAYLIGHT ILLUMINANCE EXCEEDS <A%> OF TARGET LEVELS FOR <B> SECONDS, ELECTRIC LIGHT SHALL BE REDUCED BY <C%> PER SECOND.
   c. WHEN COMBINED ELECTRIC AND DAYLIGHT ILLUMINANCE FALLS BELOW <D%> OF TARGET LEVELS FOR <E> SECONDS, ELECTRIC LIGHT OUTPUT SHALL BE INCREASED BY <F%> PER SECOND.
   d. WHEN THE COMBINED ELECTRIC AND DAYLIGHT ILLUMINANCE EXCEEDS <G%> OF TARGET LEVELS FOR <H> SECONDS, THE ELECTRIC LIGHTING SHALL BE AUTOMATICALLY TURNED OFF.
   e. THE INTERFACE SHALL NOT ALLOW THE USER TO OVERRIDE THE ELECTRIC LIGHTING CONTROLS IN A WAY THAT WILL PROVIDE GREATER ILLUMINANCE THAN ALLOWED BY THE DAYLIGHT CONTROL PHOTOSENSOR.
   f. THE DAYLIGHT CONTROL PHOTOSENSOR SHALL NOT REQUIRE PHYSICAL ADJUSTMENT AT THE SENSOR. ALL SETTINGS SHALL BE ACCESSIBLE BY AUTHORIZED PERSONNEL WHEN STANDING ON THE FLOOR OF THE SPACE FOR WHICH THE SENSOR HAS CONTROL.
   g. PARKING GARAGE:
      - LIGHTING AT THE ENTRY AND EXIT SHALL ONLY HAVE AUTOMATIC SENSING FROM SUNSET TO SUNRISE FOR 50% REDUCTION.
      - 20' WITHIN EXTERIOR WALL REDUCES LIGHT LEVEL BY 50% UNLESS ACCESS TO DAYLIGHT IS BLOCKED.

K. NIGHT LIGHT DUTY:
   a. FIXTURES ARE CONTROLLABLE VIA LOCAL SWITCH DURING THE DAY.
   b. FIXTURES WITHIN THE DAYLIGHT ZONE ARE CONTROLLABLE VIA DAYLIGHT HARVESTING DURING THE DAY.
   c. FROM <EVENING START TIME, HH:MM P.M.> UNTIL <MORNING END TIME, HH:MM A.M.> NIGHT LIGHT DUTY FIXTURES REMAIN ON AT <100%> LIGHT OUTPUT. NO OTHER CONTROL SHALL BE CAPABLE OF OPERATING OR OVERRIDING THE LIGHT OUTPUT STATE.

L. EMERGENCY LIGHTING - LIGHT FIXTURE DRIVER BATTERY BACKUP:
   a. UPON LOSS OF NORMAL POWER, EMERGENCY LIGHTING DESIGNATED LUMINAIRES SHALL BE AUTOMATICALLY TURNED ON TO MAXIMUM LIGHT OUTPUT OPERATING ON BATTERY BACKUP POWER. NO OTHER CONTROL SHALL BE CAPABLE OF OPERATING OR OVERRIDING THE MAXIMUM LIGHT OUTPUT STATE DURING LOSS OF NORMAL POWER.
   b. UPON RESTORATION OF NORMAL POWER, EMERGENCY LIGHTING DESIGNATED LUMINAIRES SHALL REVERT BACK TO NORMAL OPERATION AND PROVIDE THE LAST COMMANDED ILLUMINANCE.

M. EMERGENCY LIGHTING - INVERTER BACKUP:
   a. UPON LOSS OF NORMAL POWER, EMERGENCY LIGHTING DESIGNATED LUMINAIRES SHALL BE AUTOMATICALLY TURNED ON TO FULL LIGHT OUTPUT OPERATING ON INVERTER BACKUP POWER. NO OTHER CONTROL SHALL BE CAPABLE OF OPERATING OR OVERRIDING THE FULL LIGHT OUTPUT STATE DURING LOSS OF NORMAL POWER.
   b. UPON RESTORATION OF NORMAL POWER, EMERGENCY LIGHTING DESIGNATED LUMINAIRES SHALL REVERT BACK TO NORMAL OPERATION AND PROVIDE THE LAST COMMANDED ILLUMINANCE.

N. EMERGENCY LIGHTING - GENERATOR BACKUP:
   a. UPON LOSS OF NORMAL POWER, EMERGENCY LIGHTING DESIGNATED LUMINAIRES SHALL BE AUTOMATICALLY TURNED ON TO FULL LIGHT OUTPUT OPERATING ON GENERATOR BACKUP POWER. NO OTHER CONTROL SHALL BE CAPABLE OF OPERATING OR OVERRIDING THE FULL LIGHT OUTPUT STATE DURING LOSS OF NORMAL POWER.
   b. UPON RESTORATION OF NORMAL POWER, EMERGENCY LIGHTING DESIGNATED LUMINAIRES SHALL REVERT BACK TO NORMAL OPERATION AND PROVIDE THE LAST COMMANDED ILLUMINANCE.

O. EXTERIOR LIGHTING (PHOTOCELL & ASTRONOMICAL TIME CLOCK):
   a. BUILDING ENTRY, BUILDING EXIT, PATHWAY, PLAZA, PARKING, AND WALKWAY LIGHTING SHALL BE TURNED ON TO 100% LIGHTING POWER BY PHOTOCELL CONTROL WHEN ILLUMINANCE FROM DAYLIGHT DECREASES TO LESS THAN <A> <LUX OR FC>. THE LIGHT OUTPUT FROM EACH LUMINAIRE SHALL BE UNIFORMLY REDUCED BY <B%> TO THE CODE-SPECIFIED LIGHTING POWER AT <HH:MM> P.M. THE LIGHTING SHALL BE TURNED ON TO 100% LIGHTING POWER AT <HH:MM> A.M., REMAINING FULLY ON UNTIL BEING TURNED OFF WHEN ILLUMINANCE FROM DAYLIGHT BECOMES GREATER THAN <C> <LUX OR FC>.
      - ALL FIXTURES SHALL BE EQUIPPED WITH INTEGRAL OR EXTERNAL OCCUPANCY SENSORS.
        1. THE LIGHT OUTPUT FROM EACH LUMINAIRE SHALL BE UNIFORMLY REDUCED BY 80% WHEN NO ACTIVITY HAS BEEN DETECTED FOR 15 MINUTES.
   b. BUILDING FAÇADE AND LANDSCAPE LIGHTING SHALL BE TURNED ON TO 100% LIGHTING POWER BY PHOTOCELL CONTROL WHEN ILLUMINANCE FROM DAYLIGHT DECREASES TO LESS THAN <D> <LUX OR FC>. THIS LIGHTING SHALL BE TURNED OFF AT <HH:MM> P.M. THE LIGHTING SHALL BE TURNED ON TO 100% LIGHTING POWER AT <HH:MM> A.M., REMAINING FULLY ON UNTIL BEING TURNED OFF WHEN ILLUMINANCE FROM DAYLIGHT BECOMES GREATER THAN <E> <LUX OR FC>.

P. EXTERIOR LIGHTING (ASTRONOMICAL TIME CLOCK ONLY):
   a. BUILDING ENTRY, BUILDING EXIT, PATHWAY, PLAZA, PARKING, AND WALKWAY LIGHTING SHALL BE TURNED ON TO 100% LIGHTING POWER BY ASTRONOMICAL TIME CLOCK FOR DUSK UNTIL DAWN OPERATION.
      - ALL FIXTURES SHALL BE EQUIPPED WITH INTEGRAL OR EXTERNAL OCCUPANCY SENSORS.
        1. THE LIGHT OUTPUT FROM EACH LUMINAIRE SHALL BE UNIFORMLY REDUCED BY 80% WHEN NO ACTIVITY HAS BEEN DETECTED FOR 15 MINUTES.
   b. BUILDING FAÇADE AND LANDSCAPE LIGHTING SHALL BE TURNED ON TO 100% LIGHTING POWER AT <HH:MM> P.M. THE LIGHTING SHALL BE TURNED OFF AT <HH:MM> A.M., REMAINING FULLY ON UNTIL BEING TURNED OFF AT DAWN.

Q. ROOM PARTITIONING:
   a. WHEN PARTITIONS BETWEEN ROOMS ARE CLOSED, ONLY THE LIGHTING CONTROL DEVICES WITHIN EACH INDIVIDUAL ROOM SHALL OPERATE THE LIGHTING WITHIN THAT ROOM.
   b. WHEN PARTITIONS BETWEEN ROOMS ARE OPENED A SENSOR SIGNAL SHALL COMBINE OPERATION OF ALL LIGHTING CONTROL DEVICES WITHIN THE COMBINED ROOM TO OPERATE ALL LIGHTING WITHIN THE COMBINED ROOM TOGETHER.

R. DEMAND RESPONSE:
   a. DEMAND RESPONSE REQUIRES A NETWORKED CONTROL SYSTEM BECAUSE THE COMMAND ORIGINATES FROM A CENTRAL SERVER.
   b. WHEN A DEMAND RESPONSE REQUEST SIGNAL IS RECEIVED THE GENERAL LIGHTING IN SPACES DESIGNATED FOR DEMAND RESPONSE SHALL AUTOMATICALLY REDUCE LIGHTING POWER BY AT LEAST 25% OVER 10 SECONDS.
   c. WHEN A DEMAND RESPONSE SIGNAL REQUEST CONCLUDES, GENERAL LIGHTING IN SPACES DESIGNATED FOR DEMAND RESPONSE SHALL AUTOMATICALLY BE RESTORED TO THE LAST COMMANDED ILLUMINANCE OR, IF THE LIGHTING LEVEL WAS CHANGED DURING THE EVENT, SHALL REMAIN AT THE CHANGED LIGHTING LEVEL.
   d. SPACES NOT DESIGNATED FOR DEMAND RESPONSE CONTROL SHALL NOT CHANGE THE LIGHTING LEVEL DURING A DEMAND RESPONSE EVENT.

S. BUILDING MANAGEMENT SYSTEM (BMS) INTEGRATION:
   a. THE LIGHTING CONTROL SYSTEM SHALL BE CONNECTED TO THE BMS VIA BACNET. OCCUPANCY STATUS CHANGES DETECTED BY THE LIGHTING CONTROL SYSTEM IN THE SPACES WITH SPECIFIED OCCUPANCY SENSOR POINTS SHALL BE SENT TO THE BMS VIA THE BACNET CONNECTION.
   b. UPON DETECTION OF OCCUPANCY, THE SENSOR SHALL SEND A BACNET COMMAND TO THE HVAC SYSTEM. UPON DETECTION OF VACANCY, THE SENSOR SHALL SEND A BACNET COMMAND.
   c. NO INFORMATION IS REQUIRED TO BE EXCHANGED FROM THE BMS TO THE LIGHTING CONTROL SYSTEM.

T. SECURITY INTEGRATION:
   a. THE LIGHTING CONTROL SYSTEM SHALL RECEIVE 3 DRY-CONTACT CLOSURES FROM THE <NAME OF SECURITY SYSTEM OR MANUFACTURER> SECURITY SYSTEM. THIS INTERFACE DEVICE IS LOCATED IN <DEVICE LOCATION>, AND THIS CONTACT SHALL BE CONNECTED TO <LIGHTING CONTROL SYSTEM DEVICE> IN <ROOM LOCATION>
      - SECURITY CONTACT CLOSURE 1, "ARMED," SHALL TRIGGER THE "NIGHT" PRESET.
      - SECURITY CONTACT CLOSURE 2, "UNARMED," SHALL TRIGGER THE "DAY" PRESET.
      - SECURITY CONTACT CLOSURE 3, "SECURITY SWEEP," SHALL TRIGGER THE "CLEANUP" PRESET. WHEN THIS CONTACT CLOSURE IS ACTUATED, THE LIGHTING SYSTEM SHALL BEGIN A 2-HOUR COUNTDOWN, AFTER WHICH THE LIGHTING SYSTEM SHALL REVERT TO ITS PREVIOUS PRESET.

U. FIRE ALARM INTEGRATION:
   a. A CHANGE IN THE CONTACT-CLOSURE STATUS SHALL SIGNIFY AN ALARM CONDITION. WHEN THIS OCCURS, THE LIGHTING CONTROL SYSTEM SHALL COMMAND THE EMERGENCY LIGHTING PRESET AS A SYSTEM-WIDE OVERRIDE. THE EMERGENCY LIGHTING PRESET WILL BE RECORDED ONSITE BY THE LIGHTING DESIGNER AND WILL, AT A MINIMUM, INCLUDE ALL EMERGENCY-DESIGNATED (EM) LUMINAIRES AT FULL LIGHT OUTPUT. NO LUMINAIRES SHALL BE COMMANDED TO TURN OFF IN THIS ALARM CONDITION.
   b. UPON RESUMPTION OF THE NORMAL CONTACT CONDITION, LUMINAIRES SHALL RETURN TO THEIR NORMAL OPERATIVE CONDITION.

V. AUDIO/VIDEO (AV) INTEGRATION:
   a. THE LIGHTING CONTROL PRESETS IN THE ROOM SHALL BE:
      - <PRESET A NAME>
      - <PRESET B NAME>
      - <PRESET C NAME>
      - <PRESET D NAME>
      - <PRESET E NAME>
   b. THESE PRESETS SHALL BE RECALLABLE FROM THE AV SYSTEM VIA UDP COMMANDS. THE AV SYSTEM SHALL BE ABLE TO QUERY WHETHER THE LIGHTING PRESET IS ACTIVE IN THE ROOM VIA UDP POLLING, AND SEND AN ASSOCIATED UDP RESPONSE.

W. WINDOW SHADE INTEGRATION:
   a. THE LIGHTING CONTROL SYSTEM SHALL COMMAND THE WINDOW SHADE SYSTEMS IN ROOMS <NAMES OR DESIGNATIONS>. THE LIGHTING CONTROL SYSTEM SHALL PROVIDE TWO CONTACT CLOSURES FOR EACH WINDOW SHADE OR SHADE GROUP IN EACH ROOM. ONE CONTACT CLOSES TO FULLY RAISE THE WINDOW SHADES, AND ONE CONTACT CLOSES TO FULLY LOWER THE SHADES.
   b. AUTOMATIC SHADE ADJUSTMENTS SHALL BE MADE:
      - AT <MORNING GLARE START TIME, HH:MM A.M.>, THE SHADES ARE LOWERED.
      - AT <MORNING GLARE END TIME, HH:MM A.M.>, THE SHADES ARE RAISED.
      - AT <AFTERNOON GLARE START TIME, HH:MM P.M.>, THE SHADES ARE LOWERED.
      - AT <AFTERNOON GLARE END TIME, HH:MM P.M.>, THE SHADES ARE RAISED.
   c. AT ANY TIME, AN OCCUPANT OF THE ROOM MAY MANUALLY COMMAND THE SHADES TO RAISE OR LOWER VIA THE <LIGHTING CONTROL INTERFACE DEVICE IN THE ROOM (SPECIFY BUTTONS, WHAT THEY ARE CALLED, AND IF THEY ARE THE TOGGLE TYPE OR TWO SEPARATE BUTTONS)>.
   d. THE LIGHTING CONTROL SYSTEM SHALL COMMAND THE WINDOW SHADES TO BE ONLY FULLY RAISED OR FULLY LOWERED, DEPENDING ON THEIR CURRENT STATE AT THE TIME OF THE COMMAND.
   e. THE LIGHTING CONTROL SYSTEM IS NOT RESPONSIBLE FOR ANY ENDPOINT ADJUSTMENT, CONFIGURATION, OR PROGRAMMING OF THE WINDOW SHADE SYSTEM.

X. ARCHITECTURAL SHADING INTEGRATION:
   a. THE LIGHTING CONTROL SYSTEM SHALL BE INTEGRATED WITH THE ARCHITECTURAL SHADING SYSTEM SO THAT BOTH THE ELECTRIC LIGHTING AND DAYLIGHT CONTRIBUTIONS ARE CONTROLLED VIA A CLOSED-LOOP PHOTOSENSOR IN THE LIGHTING CONTROL SYSTEM. THIS INTEGRATION SHALL OCCUR VIA A <PROTOCOL NAME> CONNECTION BETWEEN THE LIGHTING CONTROL SYSTEM AND THE ARCHITECTURAL SHADING SYSTEM, AND SHALL BE CONTINUOUSLY UPDATED TO ACHIEVE THE SEQUENCE OF OPERATION SPECIFIED HEREIN.
      - A CLOSED-LOOP DAYLIGHTING CONTROL PHOTOSENSOR SHALL BE SET TO THE ILLUMINANCE TARGET AND SHALL CONTINUOUSLY MONITOR THE DAYLIGHT CONTRIBUTION TOWARD THE TARGET AND INCREASE OR DECREASE THE ELECTRIC LIGHTING AS NEEDED WITHIN THE SPACE.
      - WHEN THE DAYLIGHT LEVEL EXCEEDS <A%> OF THE ILLUMINANCE TARGET FOR <B> MINUTES, THE ELECTRIC LIGHTING SHALL BE COMPLETELY TURNED OFF, AND THE ARCHITECTURAL SHADING SYSTEM SHALL BE ARTICULATED TO CONTROL ILLUMINATION BY DECREASING THE DAYLIGHT ENTERING THE SPACE.
      - WHEN THE ILLUMINANCE IS BELOW <C%> OF THE TARGET AND THE ARCHITECTURAL SHADING SYSTEM HAS BEEN FULLY OPEN FOR <D> MINUTES, THE LIGHTING CONTROL SYSTEM SHALL COMMAND ELECTRIC LIGHTS TO BE ENERGIZED SO AS TO MAINTAIN THE TARGET ILLUMINANCE.
      - THE ARCHITECTURAL SHADING TRANSITION SPEED SHALL RANGE FROM THE MINIMUM ARTICULATION SPEED OF THE SHADING SYSTEM TO <F%> PER SECOND. THE ACCELERATION RATE OF THE SHADE OPENING OR CLOSING SHALL BE <G%> PER SECOND.
      - WHEN THE DAYLIGHT LEVEL DECREASES BELOW <H%> OF THE TARGET ILLUMINANCE FOR <I> MINUTES, THE ARCHITECTURAL SHADING SYSTEM SHALL BE ARTICULATED TO ITS FULLY OPEN POSITION, AND THE ELECTRIC LIGHTING SHALL BE COMMANDED TO A LEVEL THAT WILL PROVIDE THE TARGET ILLUMINANCE.
      - THE INTERFACE SHALL NOT ALLOW THE OCCUPANT TO OVERRIDE THE ELECTRIC LIGHTING CONTROLS IN A WAY THAT WILL PROVIDE GREATER ILLUMINANCE THAN ALLOWED BY THE DAYLIGHT CONTROL PHOTOSENSOR.
      - ALL CONFIGURATION, PROGRAMMING, AND PARAMETER ADJUSTMENTS AND SETTINGS SHALL BE ACCESSIBLE ONLY BY AUTHORIZED PERSONNEL. AUTHORIZED PERSONNEL SHALL BE ABLE TO ACCESS THE PROGRAMMING MODE WHEN STANDING ON THE FLOOR IN THE SPACE BEING CONTROLLED.

Y. AUTOMATED TUNABLE WHITE (OPTION 1 - CIRCADIAN):
   a. THE CCT OF LIGHTING ZONES <ZONE NAMES OR DESIGNATIONS> SHALL BE TUNABLE WHITE. THE LUMINAIRES IN THESE ZONES SHALL BE PROGRAMMED TO TRACK THE CCT OF DAYLIGHT AS PRESENTED TO THE CCT SENSOR INSTALLED ON A NORTH FACING WALL ON THE ROOF. THIS CCT SENSOR SHALL BE CALIBRATED ONSITE AT NO FEWER THAN FIVE SETTINGS RANGING FROM 2300K TO 5000K, AND SHALL INTERPOLATE ALL CCTS IN BETWEEN. FOR ALL CCTS MEASURED BELOW 2300K, THE SYSTEM SHALL COMMAND THE USE OF 2300K FOR THE RELEVANT INTERIOR ZONES. FOR ALL CCTS READ ABOVE 5000K, THE SYSTEM SHALL COMMAND THE USE OF 5000K FOR THE ZONES.
   b. WHEN NO LIGHT IS SENSED, THE SYSTEM SHALL COMMAND THE USE OF 2300K IN THE ZONES.
   c. ALL LUMINAIRES SHALL BE CALIBRATED ONSITE AT NO FEWER THAN FIVE SETTINGS RANGING FROM THE LUMINAIRES' MAXIMUM CCT TO THEIR MINIMUM CCT, SUCH THAT THEIR CCTS MATCH THOSE COMMANDED BY THE SYSTEM. GIVEN VARIATIONS IN LED CHIPS, MINOR ADJUSTMENTS TO THIS CALIBRATION MAY BE REQUIRED WITH THE LIGHTING DESIGNER ONSITE.
   d. CCT CHANGES SHALL BE APPLIED AT A RATE OF <X%> PER SECOND, AND THERE SHALL BE A CCT DEADBAND OF <Y>K.
   e. IF THE CCT SENSOR INPUT IS LOST, THE SYSTEM SHALL PROVIDE NOTIFICATION VIA THE TOUCHSCREEN AND REVERT TO A SCHEDULE OF:
      - 2300K: FROM 1 HOUR BEFORE SUNSET TO 1 HOUR BEFORE SUNRISE.
      - 3500K: FROM 1 HOUR BEFORE SUNRISE TO SUNRISE
      - 4500K: FROM SUNRISE TO 1 HOUR AFTER SUNRISE
      - 5000K: FROM 1 HOUR AFTER SUNRISE TO 3 HOURS BEFORE SUNSET
      - 4500K: FROM 3 HOURS BEFORE SUNSET TO 2 HOURS BEFORE SUNSET
      - 3500K: FROM 2 HOURS BEFORE SUNSET TO 1 HOUR BEFORE SUNSET
   f. THIS BACKUP CCT SCHEDULE SHALL BE APPLIED AT A RATE OF <X%> PER SECOND.

Z. AUTOMATED TUNABLE WHITE (OPTION 2 - SECURITY SYSTEM TIE IN):
   a. ON OCCUPANCY DETECTION BETWEEN <HH:MM> A.M. AND <HH:MM> P.M., TUNABLE LUMINAIRES LOCATED IN SPACES <SPACE NAMES OR DESIGNATIONS> SHALL GO TO A TUNED CCT OF 4000K, WITH LIGHT OUTPUT REDUCED TO 50% OF MAXIMUM.
   b. ON OCCUPANCY DETECTION BETWEEN <HH:MM> P.M. AND <HH:MM> A.M., TUNABLE LUMINAIRES SHALL GO TO A TUNED CCT OF 2700K, WITH LIGHT OUTPUT REDUCED TO 35% OF MAXIMUM.
   c. ON OCCUPANT ADJUSTMENT OF THE TUNED LIGHT COLOR, LUMINAIRES SHALL HOLD THE SELECTED COLOR UNTIL OCCUPANCY DETECTOR TIMEOUT.
   d. WHEN THE ALARM SYSTEM IS ARMED, LIGHTS SHALL FADE OUT COMPLETELY AND REMAIN OFF UNLESS THE ALARM IS ACTIVATED.
   e. WHEN THE ALARM SYSTEM GOES INTO ALARM CONDITION, THE TUNABLE LIGHTS SHALL GO TO FULL OUTPUT WITH A CCT OF 4000K AND REMAIN AT THAT OUTPUT UNTIL THE ALARM CONDITION IS CLEARED, REGARDLESS OF OCCUPANT INPUT ON THE CONTROL.

AA. WARM DIM:
   a. AS LIGHT FIXTURES ARE DIMMED THE LUMINAIRE / LAMP SHALL AUTOMATICALLY SHIFT TO A WARMER COLOR TEMPERATURE.
      - THE USER IS NOT ABLE TO ADJUST THE COLOR TEMPERATURE SEPARATELY FROM THE DIMMING.

BB. COLOR TUNING:
   a. THE COLOR OF LIGHTING ZONES <NAMES OR DESIGNATIONS OF ZONES> SHALL BE CONTROLLED VIA FULL-SPECTRUM COLOR TUNING. THE LIGHTING IN THE ZONES SHALL BE PREPROGRAMMED PER A SCHEDULE, AND OVER-RIDABLE BY AN END USER.
   b. PROVIDE THE FOLLOWING LIST OF COLOR PRESETS.
      - NEW YEAR'S DAY
      - MARTIN LUTHER KING JR. DAY
      - VALENTINE'S DAY
      - PRESIDENT'S DAY
      - RAMADAN
      - ST PATRICK'S DAY
      - EASTER
      - PASSOVER
      - ARBOR DAY
      - CINCO DE MAYO
      - MEMORIAL DAY
      - PRIDE MONTH
      - JUNETEENTH
      - INDEPENDENCE DAY
      - LABOR DAY
      - COLUMBUS DAY / INDIGENOUS PEOPLE'S DAY
      - HALLOWEEN
      - VETERANS DAY
      - THANKSGIVING DAY
      - CHRISTMAS EVE
      - CHRISTMAS DAY
      - CHANUKAH / HANUKKAH
      - KWANZAA
      - NEW YEAR'S EVE
      - [...]
      - SPARE 1
      - SPARE 2
      - SPARE 3
   c. THESE SHALL BE PROGRAMMED INTO THE PROCESSOR AND SCHEDULED AS SHOWN BELOW. ALL DATES BEGIN AND END AT 4 A.M., AND IF THE LUMINAIRES ARE OFF AT 4 A.M., THIS COLOR SHALL TAKE EFFECT THE NEXT TIME THE LIGHTS ARE TURNED ON. THIS COLOR SCHEDULE SHALL BE ASSERTED EVERY MORNING AT 4 A.M. DURING THE PROGRAMMED TIME.
      - FEB. 7 THRU FEB. 14: VALENTINE'S DAY
      - MAR. 10 THRU MAR. 19: ST PATRICK'S DAY
      - [...]
   d. THESE PRESETS AND SCHEDULES SHALL BE STORED IN THE SYSTEM BY THE PROGRAMMER, AS DIRECTED ONSITE BY THE LIGHTING DESIGNER. THE OWNER SHALL BE ABLE TO ADJUST BOTH THE CONTENT AND THE SCHEDULED DAYS VIA A USER INTERFACE DISPLAYED ON THE OWNER'S WIRELESS INTERFACE DEVICE. THE SPARE COLOR PRESETS ARE INTENDED TO REPRESENT SPORTS TEAMS, LOCAL ACADEMIC INSTITUTIONS, OR LOCAL HOLIDAYS OF IMPORTANCE TO THE OWNER/TENANT. THESE WILL BE DEFINED AND PROGRAMMED ON THE USER INTERFACE DISPLAY BY OWNERSHIP. PREPARE TO ADJUST LABELS ACCORDINGLY.
   e. WHEN NO PROGRAMMED COLOR IS SET FOR A GIVEN DAY, THE LIGHTS SHALL <DEFINE ACTION>.
   f. ADDITIONALLY, USERS SHALL BE ABLE TO OVERRIDE COLOR MANUALLY VIA A COLOR PICKER PRESENTED AT THE <LOBBY> TOUCHSCREEN AS WELL AS ON THE OWNER'S WIRELESS INTERFACE DEVICE. THESE CHANGES SHALL TAKE EFFECT IMMEDIATELY AND SHALL REMAIN IN EFFECT UNTIL 4 A.M. THE FOLLOWING MORNING, WHEN THE ABOVE SPECIFIED SCHEDULE SHALL BE REASSERTED.
   g. A BUTTON SHALL BE LOCATED ON THE TOUCHSCREEN NEXT TO THE COLOR PICKER TO REASSERT THE SCHEDULE, OVERRIDING THE MANUAL ENTRY AND RETURNING THE LIGHTING TO THE PRESCHEDULED COLOR(S).

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CLIENT:

Owner

Madison Municipal Building
215 Martin Luther King Blvd
Suite 109
Madison, Wisconsin 53703

PROJECT TITLE:

ELEVATOR MODERNIZATION

214 N CARROLL ST
MADISON, WI 53703

ISSUE:

06/11/2026 BID SET

PROJECT INFORMATION:

PROJECT NUMBER:	2025-5004.06
DATE:	06/11/2026
DRAWN BY:	GB
CHECKED BY:	DJK
APPROVED BY:	DJK
SCALE:	AS NOTED

SHEET TITLE:

ELECTRICAL SCHEDULES

SHEET NUMBER:

E-602

SEQUENCE OF OPERATIONS (SOO)

GENERAL NOTES:

A. SEQUENCE OF OPERATIONS SHALL COMPLY WITH ALL ENERGY CODE REQUIREMENTS.

B. INFORMATION LISTED BELOW SHALL BE USED FOR INITIAL LIGHTING CONTROLS PROGRAMMING.

C. FOR PROJECTS WITH DIGITAL LIGHTING CONTROLS SYSTEMS, ALL SETTINGS SHALL BE FIELD ADJUSTABLE VIA DIGITAL LIGHITNG CONTROLS PROGRAM.

D. DIGITAL LIGHTING CONTROLS SYSTEM SHALL BE WIRELESS.

E. ALL OCCUPANCY SENSORS WITHIN A ROOM SHALL BE CONTROLLED TOGETHER UNLESS OTHERWISE INDICATED ON THE FLOOR PLANS.

F. DAYLIGHT HARVESTING SENSORS SHALL ONLY CONTROL FIXTURES WITHIN THE DAYLIGHT ZONE AS INDICATED ON THE FLOOR PLANS.

G. LOCAL CONTROLS SHALL BE PROVIDED AS INDICATED ON PLANS AND CONTROL FIXTURES INDICATED.

H. NIGHT LIGHT DUTY FIXTURES AS INDICATED ON PLANS.

NOTE:

1. NOT USED.

| | | LOCAL CONTROL AND MULTI-LEVEL | | | | | | | | | ON CONTROL | | | | | DIM / OFF CONTROL | | | | TIME CLOCK FUNCTION | | | | | | | | |

PANEL: EM/A

Existing

VOLTAGE:	208Y/120V	BUS RATING:	225 A	FEED-THRU LUGS:	-
PHASE / WIRE:	3P / 4W	MAIN TYPE:	MCB	MOUNTING:	SURFACE
SVC. ENTRANCE LABEL:	NO	MAIN RATING:	225 A	ENCLOSURE:	TYPE 1
MINIMUM AIC:	-	UPSTREAM BREAKER RATING:	225 A	200% NEUTRAL:	-
IS SERIES RATED ALLOWED:	NO	SPD:		PANELBOARD TYPE:	NQ

CKT	DESCRIPTION	TRIP	POLE	CB TYPE	LOAD TYPE	LOAD	A		B		C		LOAD	LOAD TYPE	CB TYPE	POLE	TRIP	DESCRIPTION	CKT
1	LEVEL L LIGHTING	20 A	1		--	--	907 VA	1292 VA					--	--		1	20 A	LEVEL 3 LIGHTING	2
3	LEVEL 1 LIGHTING	20 A	1		--	--			1292 VA	984 VA			--	--		1	20 A	LEVEL 4 LIGHTING	4
5	LEVEL 2 LIGHTING	20 A	1		--	--					1600 VA	1292 VA	--	--		1	20 A	LEVEL 5 LIGHTING	6
7	ELEVATOR LOBBY LIGHTING	20 A	1		L	918 VA	918 VA	702 VA					--	--		1	20 A	NW STAIR LIGHTING	8
9	SE STAIR LIGHTING	20 A	1		--	--			702 VA	702 VA			--	--		1	20 A	NE STAIR LIGHTING	10
11	SW STAIR LIGHTING	20 A	1		--	--					546 VA	840 VA	--	--		1	20 A	TOP DECK LIGHTING	12
13	CO MONITORING	20 A	1		--	--	10 VA	1200 VA					--	--		1	20 A	POWER DOOR OP L, 1	14
15	STORAGE BASEMENT LIGHTING	20 A	1		--	--			108 VA	1200 VA			--	--		1	20 A	POWER DOOR OP 2, 3	16
17	**FACU**	**20 A**	**1**	**L**	**EQ**	**100 VA**					100 VA	1200 VA	--	--		1	20 A	POWER DOOR OP 4, 5	18
19	**CAR-1**	**20 A**	**1**	**L**	**EQ**	**500 VA**	500 VA	600 VA					--	--		1	20 A	POWER DOOR OP 6	20
21	**CAR-2A**	**20 A**	**1**		**EQ**	**500 VA**			500 VA	324 VA			**324 VA**	**L**		**1**	**20 A**	**LTG PENTHOUSE**	**22**
23	SPARE	20 A	1		--	--					0 VA	0 VA	--	--		1	20 A	SPARE	24
25	SPARE	20 A	1		--	--	0 VA	0 VA					--	--		1	20 A	SPARE	26
27	SPARE	20 A	1		--	--			0 VA	0 VA			--	--		1	20 A	SPARE	28
29	POWER LINK	20 A	1		--	--					10 VA	0 VA	--	--		1	20 A	SPARE	30
31	SPACE	--	1		--	--	--	--					--	--		1	--	SPACE	32
33	SPACE	--	1		--	--			--	--			--	--		1	--	SPACE	34
35	SPACE	--	1		--	--					--	--	--	--		1	--	SPACE	36
37	SPARE	20 A	1		--	--	0 VA	3842 VA					--	--		3	60 A	PANEL EM/B	38
39	SPARE	20 A	1		--	--			0 VA	3842 VA			--	--	--	--	--	--	40
41	SPARE	20 A	1		--	--					0 VA	3842 VA	--	--	--	--	--	--	42
							9971 VA		9654 VA		9430 VA								

PANEL TOTALS	
TOTAL CONN. LOAD:	29055 VA
TOTAL ADJUSTED LOAD:	29366 VA
TOTAL CONN. AMPS:	81 A
TOTAL ADJUSTED AMPS:	82 A

NOTES:
1. BOLD FONT INDICATES EXISTING CIRCUIT BREAKER TO BE USED.
2. ALL OTHER CIRCUIT BREAKERS ARE EXISTING TO REMAIN.

LOAD TYPE	CONNECTED LOAD	ADJUSTMENT FACTOR	ADJUSTED LOAD
EQ	1100 VA	100.00%	1100 VA
L	1242 VA	125.00%	1553 VA
Spare	26713 VA	100.00%	26713 VA

CIRCUIT BREAKER TYPE ABBREVIATIONS:	LOAD TYPE ABBREVIATIONS:		
GFCI = GROUND FAULT CIRCUIT INTERRUPTER	C = COOLING SEASON ONLY	F = FARM	SA = SMALL APPLIANCE
HB = HAND-BLOCKING DEVICE	ECD = ELECTRIC CLOTHES DRYER	GL1 = GENERAL LIGHTING - 2 W / SQ FT	T = TRANSFORMER
L = LOCKABLE	EL = ELEVATOR	GL2 = GENERAL LIGHTING - 3 W / SQ FT	V = VENTILATING
ST = SHUNT TRIP	EQ = EQUIPMENT	H = HEATING SEASON ONLY	W = WELDING
	ER1 = ELECTRIC RANGE LESS THAN 3.5 KW	K = KITCHEN EQUIPMENT - NON-DWELLING UNIT	X = XRAY
	ER2 = ELECTRIC RANGE 3.5 - 8.75 KW	L = LIGHTING	YR = YEAR ROUND
	EWH - ELECTRIC WATER HEATER	P = PANEL	
	EX = EXISTING	R = RECEPTACLE	

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APPROVED BY:	DJK
SCALE:	AS NOTED

SHEET TITLE:
PANEL SCHEDULES

SHEET NUMBER:
E-610

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SECTION 26 05 05

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

1.3 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

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C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

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J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. See Division 01 - General Requirements for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 05

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Service entrance cable.

C. Metal-clad cable.

D. Variable-frequency drive cable.

E. Wiring connectors.

F. Electrical tape.

G. Heat shrink tubing.

H. Oxide inhibiting compound.

I. Wire pulling lubricant.

J. Cable ties.

K. Firestop sleeves.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.

G. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.

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1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

I. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); 2008a (Validated 2019).

J. IEEE 1210 - IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable; 2004 (Corrigendum 2014).

K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

L. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

M. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

N. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

O. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

R. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

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S. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

T. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

U. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

V. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

W. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

X. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

Y. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

C. Shop Drawings.
1. Product data. Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configuration, and stranding.
2. Manufactured wiring system shop drawings. Provide plan views indicating proposed system layout with components identified. Indicate branch circuit connections.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing.

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G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
   1. Exceptions:
      a. Use metal-clad cable for installation in cable tray.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Armored cable is not permitted.

F. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:

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a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
1) Maximum Length: 6 feet.

2. In addition to other applicable restrictions, may not be used:
a. Unless approved by Owner.
b. Where not approved for use by the authority having jurisdiction.
c. Where exposed to view, except in dedicated electrical, communications, and mechanical rooms where not subject to damage.
d. Where exposed to damage.
e. For damp, wet, or corrosive locations.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

I. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

J. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

K. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

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L. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

M. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.
      d. Travelers for 3-Way and 4-Way Switching: Pink.
      e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
      f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation: www.generalcable.com/#sle.
      d. Service Wire Co: www.servicewire.com/#sle.
      e. Southwire Company: www.southwire.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

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a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.
c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 METAL-CLAD CABLE

A. Manufacturers:
1. AFC Cable Systems Inc: www.afcweb.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Service Wire Co: www.servicewire.com/#sle.
4. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide dedicated neutral conductor for each phase conductor.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

I. Provide PVC jacket applied over cable armor.

2.5 VARIABLE-FREQUENCY DRIVE CABLE

A. Manufacturers:
1. Service Wire Co; ServiceDrive: www.servicewire.com/#sle.

B. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 1000 V.

E. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.

F. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.

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G. Provide metallic shielding.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.6 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use mechanical connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. NSI Industries LLC: www.nsiindustries.com/#sle.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. nVent ILSCO: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

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d. Substitutions: See 01 60 00 - Product Requirements or Division 01 – General Requirements

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. nVent ILSCO: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.7 ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Burndy LLC: www.burndy.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant:
1. Manufacturers:
a. 3M: www.3m.com/#sle.

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b. American Polywater Corporation: www.polywater.com/#sle.
c. Ideal Industries, Inc: www.idealindustries.com/#sle.
2. Listed and labeled as complying with UL 267.
3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
4. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
1. Products:
a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
1. Products:
a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.

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2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Include circuit lengths required to install connected devices within 10 ft of location indicated.
4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
8. Provide oversized neutral/grounded conductors where indicated and as specified below.
   a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
   b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

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H. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
   2. Damp Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

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R. Identify conductors and cables in accordance with Section 26 05 53.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 05 19

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

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1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. General. See Division 01 - General Requirements or See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
   2. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
   3. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

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PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG

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embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Ground Rod Electrode(s):
    a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
    b. Space electrodes not less than 10 feet from each other and any other ground electrode.
    c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
    d. Provide ground enhancement material around electrode where indicated.
    e. Provide ground access well for each electrode.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
    b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

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6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
8. Provide bonding for metal building frame.

I. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
    c. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
    d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    a. Exceptions:
        1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use compression connectors or exothermic welded connections for accessible connections.
    a. Exceptions:
        1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
    a. allG Fabrication: www.allgfab.com/#sle.
    b. Burndy LLC: www.burndy.com/#sle.

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c. Harger Lightning & Grounding: www.harger.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.

5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC: www.burndy.com/#sle.
   b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
   a. allG Fabrication: www.allgfab.com/#sle.
   b. Harger Lightning & Grounding: www.harger.com/#sle.
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
5. Manufacturers:
   a. allG Fabrication: www.allgfab.com/#sle.
   b. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
   c. Harger Lightning & Grounding: www.harger.com/#sle.

F. Oxide Inhibiting Compound: Comply with Section 26 05 19.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury

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horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 05 26

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SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

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A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Product data. Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

D. Installer's qualification statement.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

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A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Applicable building code.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: See Section 05 50 00.

C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
   1. Manufacturers:
      a. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

E. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.
   3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
   4. Channel Material:
      a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
   6. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

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1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2-inch diameter.
    b. Busway Supports: 1/2-inch diameter.
    c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
    d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
    e. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
    f. Outlet Boxes: 1/4-inch diameter.
    g. Luminaires: 1/4-inch diameter.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
    a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.
    d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

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B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.

I. Field Welding, Where Approved by Architect: See Section 05 50 00.

J. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Section 03 30 00.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

K. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

L. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

M. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Secure fasteners in accordance with manufacturer's recommended torque settings.

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P. Remove temporary supports.

Q. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 05 29

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SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Galvanized steel intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Galvanized steel electrical metallic tubing (EMT).

G. Rigid polyvinyl chloride (PVC) conduit.

H. Electrical nonmetallic tubing (ENT).

I. Liquidtight flexible nonmetallic conduit (LFNC).

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.

C. Section 07 84 00 - Firestopping.

D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.

E. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

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

G. Section 26 05 33.16 - Boxes for Electrical Systems.

H. Section 26 05 33.23 - Surface Raceways for Electrical Systems.

I. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

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J. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

K. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

L. Section 33 71 19 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

M. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

P. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

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R. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

T. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

U. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

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PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   3. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
   4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection.
   6. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
   2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit or rigid PVC conduit.
   3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit or rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from concrete.
   5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

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F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use PVC-coated galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
      b. As identified by the Authority Having Jurisdiction.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit (RMC) or reinforced thermosetting resin conduit (RTRC).
   1. Corrosive locations include, but are not limited to:
      a. Parking garage..

N. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC).

O. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet.

P. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

2.2 CONDUIT - GENERAL REQUIREMENTS

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A. Comply with NFPA 70.

B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
   1. Where permitted, existing conduits to be reused may be used as sole equipment grounding conductor only when continuity of conduit pathway, including associated boxes and fittings, is verified; see Section 26 05 26.

C. Electrical Service Conduits: See Section 26 21 00 for additional requirements.

D. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

E. Provide conduit, fittings, supports, and accessories required for complete raceway system.

F. Provide products listed, classified, and labeled as suitable for purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4-inch trade size.
   3. Control Circuits: 1/2-inch trade size.
   4. Flexible Connections to Luminaires: 3/8-inch trade size.
   5. Underground, Interior: 3/4-inch trade size.
   6. Underground, Exterior: 1-inch trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      c. Substitutions: See 01 60 00 - Product Requirements or Division 01 – General Requirements
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel.
      a. Do not use die cast zinc fittings.

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5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel.
      a. Do not use die cast zinc fittings.
   5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Calbond
   2. Robroy Industries: www.robroy.com/#sle.
   3. Substitutions: See .01 60 00 - Product Requirements or Division 01 – General Requirements

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

D. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.

E. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel or malleable iron.
   5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

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6. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.

2.8 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular/#sle.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
b. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel.
a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use compression/gland or set-screw type.
a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. ABB; Carlon: www.carlon.com/#sle.
2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
3. Cantex Inc: www.cantexinc.com/#sle.
4. JM Eagle: www.jmeagle.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. IPEX, a division of Aliaxis: www.ipexna.com/#sle.

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.11 ACCESSORIES

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A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

F. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
      b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

H. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
   1. Products:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

I. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

J. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.

K. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

F. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

G. Liquidtight Flexible Nonmetallic Conduit (LFNC): Install in accordance with NECA 111.

H. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than equivalent of three 90-degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.

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11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in same area on common rack.

I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.
12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

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K. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
   6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
   8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
   9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

L. Underground Installation:
   1. Provide trenching and backfilling;
   2. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 36" inches.
      b. Under Slab on Grade: 12 inches to bottom of slab.
   3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.

M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
   1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
   2. Install conduits within middle one third of slab thickness.
   3. Secure conduits to prevent floating or movement during pouring of concrete.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.

O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings or approved flexible connections to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

P. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
      a. Where conduits enter building from outside.
      b. Where service conduits enter building from underground distribution system.
      c. Where conduits enter building from underground.
      d. Where conduits may transport moisture to contact live parts.

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2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
    a. Where conduits pass from outdoors into conditioned interior spaces.
    b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

Q. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

R. Provide grounding and bonding; see Section 26 05 26.

S. Identify conduits; see Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 05 33.13

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SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

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

C. Section 26 05 33.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 27 26 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

F. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

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E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, floor boxes, and underground boxes/enclosures.
1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

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C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
   4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
   5. Use suitable concrete type boxes where flush-mounted in concrete.
   6. Use suitable masonry type boxes where flush-mounted in masonry walls.

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7. Use raised covers suitable for the type of wall construction and device configuration where required.
8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
15. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: Comply with Section 27 10 00.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
16. Wall Plates: Comply with Section 26 27 26.
17. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    e. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

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D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
   1. Manufacturers:
      a. Hubbell Incorporated: www.hubbell.com/#sle.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.

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b. Communications Systems Outlets: Comply with Section 27 10 00.

4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 26 05 48.
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

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L. Install boxes as required to preserve insulation integrity.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 26 05 26.

R. Identify boxes in accordance with Section 26 05 53.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

C. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.

D. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

E. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

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E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittals procedures.

B. Shop Drawings:
   1. Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
   2. Provide manufacturer's standard catalog pages and data sheets for each product.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.

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3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
6) For power panelboards without a door, use typewritten circuit directory to identify load(s) served for each branch device. Identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

2. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification nameplate on inside of door at each fused switch to identify required NEMA fuse class and size.
8. Use identification nameplate on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
9. Use identification nameplate to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
10. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
11. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.
b. Elevator control panels.
12. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
13. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with

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the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

14. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
15. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
   3. Use identification nameplate to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
   4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
      a. At each source and load connection.
      b. Within boxes when more than one circuit is present.
      c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
      d. In cable tray, at maximum intervals of 20 feet.
   5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
   6. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:
   1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
   2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
      a. Maximum Intervals: 20 feet.
      b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
         1) Field-Painting: Comply with Section 09 91 23 and 09 91 13.
         2) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
      c. Color Code:
         1) Emergency Power System: Orange .
         2) Fire Alarm System: Red.
   3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor

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penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 13 per the same color code used for raceways.
      1) Emergency Power System: Orange .
      2) Fire Alarm System: Red.
   b. For exposed boxes in public areas, color code inside of cover.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 10 00.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
3. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
   a. Brimar Industries, Inc: www.brimar.com/#sle.

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b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
c. Seton Identification Products: www.seton.com/#sle.

2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
   a. Brady Corporation: www.bradyid.com/#sle.
   b. Brother International Corporation: www.brother-usa.com/#sle.
   c. Panduit Corp: www.panduit.com/#sle.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.

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2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
    a. Exceptions:
        1) Provide white text on red background for general information or operational instructions for emergency systems.
        2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
    a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.

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B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
   1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".
      b. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.

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B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Insite Solutions, LLC: www.stop-painting.com/#sle.
   4. Seton Identification Products: www.seton.com/#sle.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc: www.brimar.com/#sle.
   2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
   3. Insite Solutions, LLC: www.stop-painting.com/#sle.
   4. Seton Identification Products: www.seton.com/#sle.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
      a. Do not use labels designed to be completed using handwritten text.

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b. Provide polyester overlaminate to protect handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

E. Floor Signs:
1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlaminate; removable.
2. Minimum Size: 17-inch diameter unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

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3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

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SECTION 26 05 73

POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

C. Section 26 24 16 - Panelboards.

D. Section 26 28 13 - Fuses.

E. Section 26 28 16.13 - Enclosed Circuit Breakers.

F. Section 26 28 16.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

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F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
   3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

D. Scheduling:
   1. Arrange access to existing facility for data collection with Owner.
   2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Include characteristic time-current trip curves for protective devices.
   2. Include impedance data for busway.

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3. Include impedance data for engine generators.
4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
5. Include documentation of listed series ratings upon request.
6. Identify modifications made in accordance with studies that:
    a. Can be made at no additional cost to Owner.
    b. As submitted will involve a change to the contract sum.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. Project Record Documents: Revise studies as required to reflect as-built conditions.
1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

K. **Electrical equipment covered by this study shall not be released for fabrication until the Power System Study required by this section has been submitted by the electrical contractor and approved by the Electrical Engineer. If the electrical contractor releases any equipment for fabrication prior to the approval of the study, any costs associated with revisions to electrical equipment to address recommendations made in the study shall be borne by the contractor.**

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:
1. Perform analysis of new electrical distribution system as indicated on drawings.
2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    a. Known Operating Modes:
        1) Utility as source.
        2) Generator as source.
        3) Maintenance settings.

B. General Study Requirements:
1. Comply with NFPA 70.
2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

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1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
        2) Utility Company: To be determined by Contractor.
    b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
    d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    e. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
        2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
    1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
    2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
        a. Maximum utility fault currents.
        b. Maximum motor contribution.
        c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
    3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
    1. Comply with applicable portions of IEEE 242 and IEEE 399.
    2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
    3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:
    1. Comply with NFPA 70E.
    2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

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a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.

3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
   a. Maximum and minimum utility fault currents.
   b. Maximum and minimum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
   a. Identify date of study and study preparer.
   b. Identify study methodology and software product(s) used.
   c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
   d. Identify base used for per unit values.
   e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
   f. Include conclusions and recommendations.
2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      2) Fault point X/R ratio.
      3) Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
   a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
   b. For each graph include (where applicable):
      1) Partial single-line diagram identifying the portion of the system illustrated.
      2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
      3) Conductors: Damage curves.
      4) Transformers: Inrush points and damage curves.
      5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
      6) Motors: Full load current, starting curves, and damage curves.
      7) Capacitors: Full load current and damage curves.
   c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.

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1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.
4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For the worst case for each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.
   b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
   c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.7 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
   1. Study preparer may be employed by manufacturer of electrical distribution equipment.
   2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
   1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Products:
      a. EasyPower LLC: www.easypower.com/#sle.
      b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
      c. Power Analytics Corporation: www.poweranalytics.com/#sle.
      d. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 26 05 53.

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2. Minimum Size: 4 by 6 inches.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    a. Include orange header that reads "WARNING" unless otherwise indicated.
    b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
    c. Include the following information:
        1) Arc flash boundary.
        2) Available incident energy and corresponding working distance.
        3) Site-specific PPE (personnel protective equipment) requirements.
        4) Nominal system voltage.
        5) Limited approach boundary.
        6) Restricted approach boundary.
        7) Equipment identification.
        8) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements See Se for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

A. See Division 01 - General Requirements for closeout submittals.

B. See Division 01 - General Requirements for additional requirements.

C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
    1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
    2. Provide minimum of eight hours of training.

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3. Instructor: Representative of entity performing study.
4. Location: At project site.

END OF SECTION 26 05 73

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SECTION 26 05 83

WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 33.16 - Boxes for Electrical Systems.

E. Section 26 27 26 - Wiring Devices.

F. Section 26 28 16.16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

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C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 28 16.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 27 26.

D. Flexible Conduit: As specified in Section 26 05 33.13.

E. Wire and Cable: As specified in Section 26 05 19.

F. Boxes: As specified in Section 26 05 33.16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

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G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 26 05 83

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SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor motion sensors.

C. In-wall time switches.

D. Outdoor photo controls.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

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

E. Section 26 05 33.16 - Boxes for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
   1. Includes finish requirements for wall controls specified in this section.
   2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

H. Section 26 51 00 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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D. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

G. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
2. Coordinate placement of wall switch occupancy sensors with installed door swings.
3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
4. Coordinate placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement.
5. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 51 00 and lighting fixture schedule.
6. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Digital Load Controllers: Provide dimensioned plan views indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing factory and field connections. Include manufacturer product characteristics and application instructions for wired and wireless applications, including start-up and commissioning.
3. Include detailed coverage range diagrams for motion detectors.
4. Include manufacturer's standard cut sheets for each item being provided. Cut sheets shall include ratings, configurations, standard wiring diagrams, dimensions, colors, service requirements, and installed features.
5. Include Bill of Materials listing all equipment being provided.

C. Field quality control reports.

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D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements for additional provisions.

G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Maintain at project site one copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

D. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Division 01 - General Requirements for additional warranty requirements.

B. Provide five year manufacturer warranty for occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide five year manufacturer warranty for digital load controllers.

PART 2 PRODUCTS

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2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Hubbell Incorporated: www.hubbell.com/#sle.
   3. Legrand North America, Inc: www.legrand.us/#sle.
   4. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   5. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

B. General Requirements:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
   7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   8. Sensitivity: Field adjustable.
   9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   10. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   11. Load Rating for Line Voltage Occupancy Sensors: As required to control load indicated on drawings.
   12. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

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13. Where wired sensors are indicated, wireless sensors are acceptable provided that components and wiring modifications necessary for proper operation are included.
14. Wireless Sensors:
    a. RF Range: 30 feet through typical construction materials.
    b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    c. Power: Battery-operated with minimum ten-year battery life.

C. Ceiling Mounted Occupancy Sensors:
1. General Requirements:
    a. Description: Low profile occupancy sensors designed for ceiling installation.
    b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
    c. Provide field selectable setting for disabling LED motion detector visual indicator.
    d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
    e. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
    a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
    b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 15 feet, with a field of view of 360 degrees.

D. Power Packs for Low-Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low-voltage class 2 transformer and relay compatible with specified low-voltage occupancy sensors for switching of line-voltage loads.
2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control load indicated on drawings.

2.3 ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA IA 10039.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

B. Pilot Devices:
1. Comply with NEMA IA 10039; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
4. Indicating Lights: Push-to-test type unless otherwise indicated.
5. Provide LED lamp source for indicating lights and illuminated devices.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Install lighting control relays; see Section 25 36 26

C. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 26 05 33.16.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 44 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Maintain separation of remote-control, signaling, and power-limited circuits.
   1. See manufacturer instructions and Section 26 05 19 for control wiring conductors, wiring methods, and identification requirements.

E. Install lighting control devices in accordance with manufacturer's instructions.

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F. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Install lighting control devices plumb and level, and held securely in place.

H. Where required and not furnished with lighting control device, provide wall plate; see Section 26 27 26.

I. Provide required supports; see Section 26 05 29.

J. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

K. Identify lighting control devices; see Section 26 05 53.

L. Occupancy Sensor Locations:
   1. Location Adjustments: Within design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

M. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by photo control itself.

N. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into photo control.

O. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Within design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure light level controlled at designated task location, while minimizing measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into space, while minimizing measured amount of lighting from artificial sources.

P. Combination Enclosed Lighting Contactors:
   1. Except where indicated to be mounted adjacent to equipment they supply, mount lighting contactors such that highest position of operating handle does not exceed 79 inches above floor or working platform.

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Q. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

R. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.

S. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

T. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

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E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Division 01 - General Requirements for closeout submittals.

B. See Division 01 - General Requirements for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of installed lighting control devices.
   4. Location: At project site.

END OF SECTION 26 09 23

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SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

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

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

G. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.

H. Section 26 43 00 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

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F. NEMA PB 1 - Panelboards; 2011.

G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

L. UL 67 - Panelboards; Current Edition, Including All Revisions.

M. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Shop Drawings.
   1. Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   2. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
   3. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.

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4. Include wiring diagrams showing all factory and field connections.

C. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 - General Requirements for additional provisions.
2. Panelboard Keys: Two of each different key.

I. **Panelboards shall not be released for fabrication until Power System Study required by Section 26 05 73 has been submitted by the electrical contractor and approved by the Electrical Engineer. If the electrical contractor releases the panelboards for fabrication prior to the approval of the Power System Study, any costs associated with revisions to panelboard bussing or breakers to address recommendations in the Power System Study shall be borne by the contractor.**

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

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C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
      b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Listed series ratings are not acceptable.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

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1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
1. Distribution and branch panelboards that are downstream of an emergency transfer switch (NEC Article 700) shall be provided with surge protective devices in accordance with NEC Article 700.8.

K. Load centers are not acceptable.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

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D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Fusible Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA BS 31047, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

B. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
2) 14,000 rms symmetrical amperes at 480 VAC.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
6. Do not use tandem circuit breakers.
7. Do not use handle ties in lieu of multi-pole circuit breakers.
8. Provide the following features and accessories where indicated or where required to complete installation:
a. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.5 SOURCE QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

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B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 26 05 26.

K. Install all field-installed branch devices, components, and accessories.

L. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.

M. Provide filler plates to cover unused spaces in panelboards.

N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Fire detection and alarm circuits.

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O. Identify panelboards in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 800 amperes. Tests listed as optional are not required.

E. Test GFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates and covers.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 33.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.

G. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

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F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. General: See Division 01 - General Requirements or See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings:
   1. Product Data. Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Project Record Documents: Record actual installed locations of wiring devices.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements or See Section 01 60 00 - Product Requirements for additional provisions.
   2. Wall Dimmers: Include information on operation and setting of presets.
   3. GFCI Receptacles: Include information on status indicators.

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4. Surge Protection Receptacles: Include information on status indicators.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Wiring Device Applications:
1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
2. Provide GFCI protection for:
a. Receptacles installed within 6 feet of sinks.
b. Receptacles installed in kitchens.
c. Receptacles serving electric drinking fountains.
3. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.

C. Wiring Device Finishes:
1. Provide wiring device finishes as described below, unless otherwise indicated.
2. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.
3. Wiring Devices Installed in Finished Spaces: White with stainless steel wall plate.
4. Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.
5. Wiring Devices Installed in Wet or Damp Locations: White with weatherproof cover.
6. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved with text "Emergency".

2.2 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

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B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw. Plug-in wiring connections not permitted.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.3 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

E. Provide locator light, illuminated with load off.

2.4 RECEPTACLES

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498

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Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.5 WALL PLATES AND COVERS

A. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

D. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.

E. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

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F. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows: Mounting heights are the centerline of the device.
      a. Wall Switches: 44 inches above finished floor.
      b. Wall Dimmers: 44 inches above finished floor.
      c. Receptacles:18 inches above finished floor. Where receptacles are indicated on the plans to be above counter mounted, they shall be 6 inches above countertop where there is no countertop backsplash, or 6 inches above countertop backsplash where counters are provided with a backsplash.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated on the floor plans or on equipment manufacturer approved shop drawings.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

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4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Identify wiring devices in accordance with Section 26 05 53.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

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B. Inspect each wiring device for damage and defects.

C. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect/Owner.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

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SECTION 26 28 13

FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

D. Section 26 24 16 - Panelboards: Fusible switches.

E. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

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H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
      a. Fusible Switches for Panelboards: See Section 26 24 16.
      b. Fusible Enclosed Switches: See Section 26 28 16.16.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Shop Drawing Submittal.
   1. Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   2. Spare fuse cabinet including cabinet dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fuses: One set(s) of three for each type and size installed.
   2. Fuse Pullers: One set(s) compatible with each type and size installed.
   3. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

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2.2 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

H. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.
   2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.3 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

END OF SECTION 26 28 13

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SECTION 26 28 16.13

ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

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

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

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1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of circuit breaker upon request.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

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B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed circuit breakers and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
   2. Label equipment utilizing series ratings as required by NFPA 70.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide electronic trip circuit breakers for circuit breaker frame sizes 800 amperes and above.

H. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

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I. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

J. Provide externally operable handle with means for locking in the OFF position.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      b. 14,000 rms symmetrical amperes at 480 VAC.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Provide mechanical lugs unless otherwise indicated.
   2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1. Provide the following field-adjustable trip response settings:
      a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      b. Long time delay.
      c. Short time pickup and delay.
      d. Instantaneous pickup.
      e. Ground fault pickup and delay where ground fault protection is indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.1 EXAMINATION

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A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

I. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

J. Identify enclosed circuit breakers in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 600 amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

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3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.13

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SECTION 26 28 16.16

ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

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

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

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1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Shop Drawings.
1. Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
2. Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
3. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
4. Include wiring diagrams showing all factory and field connections.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of enclosed switches.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 - General Requirements See Section 01 60 00 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

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A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
   2. Minimum Ratings:

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a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
1. Comply with NEMA BS 31047.
2. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Copper, suitable for terminating copper conductors only.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

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B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.16

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

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

C. Section 26 05 33.16 - Boxes for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 09 23 - Lighting Control Devices.

F. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

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G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

L. UL 1598 - Luminaires; Current Edition, Including All Revisions.

M. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Shop Drawings:
   1. Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   2. For LED luminaires.
      a. Include estimated useful life, calculated based on IES LM-80 test data.

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3. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
4. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Division 01 - General Requirements or See Section 01 60 00 - Product Requirements for additional provisions.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Division 01 - General Requirements for additional warranty requirements.

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B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

D. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

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2.3 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
   3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 26 27 26.
      b. Daylighting Controls: See Section 26 09 23.

2.4 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Fire-Rated Luminaire Enclosures:
   1. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

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3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install accessories furnished with each luminaire.

L. Bond products and metal accessories to branch circuit equipment grounding conductor.

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M. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements or See Section 01 40 00 - Quality Requirements for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Division 01 - General Requirements for closeout submittals.

B. See Division 01 - General Requirements for additional requirements.

C. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 51 00

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SECTION 27 00 05

COMMUNICATIONS CABLING

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

B. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

C. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

1.2 SCOPE OF WORK

A. This section specifies the City of Madison requirements for product design, performance, quality assurance, and contractor responsibilities for the execution of work to install a complete Category 6 (CAT6) structured cabling system.

B. Execution of work includes but is not limited to the delivery and storage of materials, preparation, installation, field testing, and project completion tasks.

C. System certification and warranty requirements for completed work and future moves, adds, and changes (MACs) are also specified in the section.

1.3 RELATED SPECIFICATIONS

A. Section 01 33 23 – Submittals

B. Section 27 21 33 - Wireless Access Points (WAP)

1.4 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have experience in the installation and testing of similar systems a specified in the plans and specifications for this contract.
   1. The Contractor shall have completed at least 2 projects of similar size and scope within the last 24 months.
   2. The contractor shall provide references upon request. Information to provide shall include , address, date of installation, client name, title, telephone number, and project description.

B. The Contractor shall be certified by the connectivity manufacturer to install, service and warranty the specified product from the time of bidding through the duration of the contract installation and warranty period.

C. The Contractor must maintain a State Contractors License as required by the State of Wisconsin.

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D. All members of the Contractors installation team must be certified by the manufacturer as having completed the necessary training to complete their part of the installation. All personnel shall be adequately trained in the use of tools and equipment required for the complete installation.

E. The Contractor shall own and maintain tools, installation equipment, and testing equipment necessary for the successful installation and testing of Optical and Category 5E, 6, and 6A premise distribution systems.

F. The Owners reserves the right to require the Contractor to remove from the project any such employee the Owner deems to be incompetent, careless, or insubordinate.

1.5 DRAWINGS AND INSPECTION OF THE SITE

A. The Communication (Technical) floor plan drawings are in PDF format, are not typically dimensioned, and should not be scaled. The contractor should refer to the Architectural sheets and construction details for dimensions.

B. The Contractor shall review all site conditions prior to submitting a bid for this project. Any obvious discrepancies between site conditions and the bidding documents shall be brought to the attention of the Architect/Engineer immediately so clarification can be made to the bidding documents by addendum.

C. Any existing wires, utilities, or equipment shown on the drawings as existing are for general information and to the best knowledge of the Architect/Engineer. The contractor shall field verify all existing conditions.

D. The contractor shall field verify distances and equipment placements, and coordinate all installation locations with other trades, construction managers and the general contractor prior to installation.

E. Change order requests for additional material or labor costs due to the contractor's lack of knowledge of existing field conditions will not be allowed.

1.6 SUBMITTALS

A. The Contractor shall review Section 01 33 23 Submittals for additional information.

B. The Contractor shall provide a complete submittal package prior to ordering equipment and materials. Partial submittals will not be considered. A complete submittal shall include but not be limited to the following:
   1. Manufacturers data (specifications, "Cut Sheets")
   2. Wiring diagrams for all installed cabling
   3. Equipment rack and cabinet layouts
   4. List of cabling distances (typical and maximum) for all structured cabling

C. The Contractor shall provide all license and certification documents for the project manager and all project technicians as part of the product submittal. All documents shall be valid through the completion of the installation and warranty period. Documents shall include but not be limited to the following:
   1. State of Wisconsin Contractors license

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2. Structured cabling and termination equipment installation certifications for:
    a. Copper
    b. Optical Fiber Connectivity
    c. Cabling

D. Product submittals are required for sole source products.

E. Product submittals are not required for Owner provided equipment and materials. However miscellaneous materials required for a complete installation of Owner provided equipment may be necessary.

F. Work shall not proceed until all submittal items have been approved.

1.7 PRODUCT SUBSTITUTIONS

A. The Contractor shall thoroughly review all specifications associated with the Division 27 installations for product specific information.

B. Substitutions for sole sourced products will not be permitted.

C. Substitutions for items to be considered as equals shall be submitted for review at the time of bidding in accordance with the bidding instructions. Approved substitutions will be identified by a written addendum to the bidding documents prior to the end of bidding. Only items in the approved addendum will be allowed as substitutions.

1.8 TESTING

A. See Part 3.

PART 2 PRODUCTS

2.1 GENERAL

A. This section indicates pre-approved product manufacturers, specific products, or minimum product performances. Substitutions/alternates to this information shall only be allowed as described in paragraph 1.07 above.

B. The manufacturer of the connectivity products specified in this document as required for construction of the cabling infrastructure shall be:
    1. Hubbell Premise Wiring

C. The manufacturer of the cabling products specified in this document as required for construction of the copper cable infrastructure shall be:
    1. Mohawk Cable

D. The manufacturer of the fiber optic cabling products specified in this document as required for construction of the fiber optic cable shall be:
    1. Mohawk Cable
    2. Pre-approved equal

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2.2 WORK AREA CONNECTORS

A. Category 6 Jacks
   1. Jacks shall be standard 8-position, RJ-45 style, un-keyed, FCC compliant
   2. Jacks shall be designed for 4-pair, 100 Ohm balanced un-shielded twisted pair (UTP) cable.
   3. Jacks shall terminate 26-22 AWG solid or stranded conductors.
   4. Jacks shall include a dust cap for wire retention.
   5. Jacks shall accept FCC compliant 6-position plugs.
   6. Jacks shall have attached wiring instruction labels to permit T568B wiring configurations.
   7. CAT6 jacks shall be backward compatible with existing category 3, 5, and 5E cabling systems for fit, form and function.
   8. Jacks shall be manufactured in the USA.
   9. CAT6 jacks shall meet or exceed CAT6 transmission requirements for connecting hardware as specified in ANSI/TIA/EIA-568-C-2 transmission performance specifications for 4-pair 100 ohm cable.
   10. Jacks shall be UL listed and CSA certified.
   11. Colors shall be specified by the Owner.
   12. CAT6 modular jacks shall be:
      a. Hubbell
         1) HXJ6EI (Category 6 – Match Color of Outlets

2.3 FACE PLATES

A. All faceplates shall meet the following specifications
   1. Faceplates shall UL listed, CSA certified, and shall be constructed of high impact UL 94 V-0 rated thermoplastic.

B. Faceplates shall be compatible with standard NEMA openings and boxes.

C. Faceplates for single gang boxes shall be 2.75” W x 4.5” H 2.75 inch x 4.5 inch).

D. Faceplates for double gang boxes shall be 4.5” W x 4.5” H 4.5 inch x 114.3 mm).

E. Mounting screws shall #6-32 pan head Phillips/slotted and color matched to the faceplate.

F. Port size in each faceplate shall fit the CAT6 modular jack or snap-fit fiber optic, audio, and video modules for multi-media applications.

G. Faceplates shall be rear loading with a designation window.

H. Faceplates shall be provided with clear plastic and color matched label field covers, and shall provide ANSI/TIA/EIA-606-A compliant workstation outlet labeling.

I. Work area faceplates shall be:
   a. Hubbell (IFP series)
   b. IFP14W (4-port White)

2.4 CABLE

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A. Category 6 UTP
   1. Ceilings in the project are non-plenum,
   2. Non-plenum cable construction shall be four twisted pairs of 23AWG insulated solid conductors with a ripcord surrounded by a tight outer jacket.
   3. No minimum compliant cable will be accepted, this facility requires additional band width.
   4. The ripcord shall be directly underneath the outer jacket.
   5. Cable shall be marked with the manufacturer and pertinent information. UL, ETL, or CSA agency certification or verification markings shall be on the cable jacket according to the certifying agency's requirements.
   6. Color coding of pairs shall be as follows:
      a. Pair 1: white/blue; blue
      b. Pair 2: white/orange; orange
      c. Pair 3: white/green; green
      d. Pair 4: white/brown; brown
   7. Cable shall be supplied in 1000-foot spools or 1000 foot Reelex boxes.
   8. Cable shall exceed CAT6 transmission requirements specified in ANSI/TIA/EIA-568-C-2.
   9. Cable shall be UL and C(UL) listed.
   10. Cable shall exceed the requirements of TIA/TSB-155, 10 GB/S Ethernet operation over 40.46 yards channel length.
   11. CAT6 UTP horizontal distribution cable as specified in the contract documents shall be
      a. Mohawk Advancenet Cable
         1) Plenum M57193
         2) Riser M57202
         3) Non-plenum M57202

2.5 PATCH PANELS – CATEGORY 6

A. CAT6 patch panels shall be standard 8-position, RJ-45 style, un-keyed, FCC-compliant receptacle in 24 and 48 port configurations.

B. Panel frames shall be black powder coated 14 gauge steel with rolled edges on top and bottom for proper stiffness.

C. Panels shall accommodate a minimum of 24 ports for each rack mount unit (1 RMU=1.75 inches. 48 ports are recommended.

D. Panels shall be designed for 4-pair, 100 ohm balanced unshielded twisted pair (UTP) cable.

E. Panels shall terminate 26-22 AWG solid connectors

F. Panels shall have individual port identification numbers on the front and rear of the panel. Panels shall have the CAT6 designation visible from the front when installed.

G. Printed circuit boards shall be fully enclosed front and rear for physical protection.

H. Panel contacts shall accept a minimum of 2000 mating cycles without degradation of electrical or mechanical performance.

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I. Panel termination method shall follow the industry standard 110 IDC punch-down using a standard 110 impact termination tool.

J. CAT6 panels shall be backward compatible with existing category 3, 5, and 5E cabling systems for fit, form, and function.

K. CAT6 patch panels when installed shall exceed the link or channel performance requirements of ANSI/TIA/EIA-568-C.2.

L. CAT6 patch panels shall be able to accommodate 10G in a 40.46 yard channel per TSB-155.

M. CAT6 patch panels shall be:
   1. Hubbell (Nextspeed 6 series)
      a. 24 port – P6E24U
      b. 48 port – P6E48U

2.6 RACKS – FREE STANDING – 2 POST

A. Rack material shall be structural aluminum with durable black polyurethane powder coat finish.

B. Installed racks shall have a static load capacity of 500 lbs.

C. Racks shall be available in either 19 inch or 23 inch standard rack configurations

D. Tapped holes in the vertical rails for mounting of panels shall be #12-24 thread size. Coating shall not interfere with the thread fit.

E. The standard rack height shall be 7 feet 84 inches and have a capacity of 45RMU.

F. Rack base angles shall be pre-drilled for floor mounting and for assembly to vertical rails.

G. Racks shall accommodate expansion of cable capacity and added volume for CAT6 cabling.

H. Free standing racks and accessories shall be:
   1. Hubbell (Nextframe series)
      a. HPW84RR19

I. NOTE: Each basic rack delivered shall consist of equipment rack, isolation pads, 18” wide black ladder rack and mounts to secure to the rack, a vertical electrical 20 amp outlet strip (minimum of 6 receptacles) with mounting brackets.

2.7 CABLE MANAGEMENT – VERTICAL

A. See plans for locations.

2.8 CABLE MANAGEMENT – HORIZONTAL

A. See plans for locations.

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PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. Materials delivered to the site shall be stored in a clean, dry, and secured area, preferably indoors and shall not interfere with other construction activity.

B. Storage temperature shall adhere to the manufacturer's recommendations.

C. Handling of any materials packaged or un-packaged shall be in such a manner as to avoid damage to the item.

D. Installation of CAT6 cable shall be within the recommended temperature range specified by the manufacturer. Cable installation temperature shall above 50 f is recommended.

3.2 PREPARATION

A. Cable Pathways and Firestops
   1. Cable pathways including but not limited to conduit, cable trays, ladder racks, raceway, slots, sleeves, etc. shall be located and mounted according to the contract drawings and manufacturers installation instructions. Pathways shall not be installed in wet areas.
   2. Cable pathway fill ration, bend radius, run length, number of bends, and proximity to EMI sources shall be in accordance with ANSI/TIA/EIA-569-D. Maximum cable count of the initial installation shall not exceed 40% fill ration in any one pathway.
   3. In accordance with NEC power wiring and communications cabling shall not share the same pathway or outlet unless separated by a physical barrier.
   4. Cable pathways shall be secured to a structural member of the building or permanent wall studs. Wall surfaces for raceway mounting should be finished complete.
   5. Metallic pathways shall be electrically continuous, free of sharp edges, and properly bonded to an approved ground. EMI sources such as ballasts, motors, and bus conductors shall be avoided by using proper separation distances.
   6. Pathways that penetrate fire-rated barriers shall be fire stopped according to local codes and recognized practices. Fire stop materials or devices shall be qualified to UL 1479 in accordance with ASTM E814. Fire stop method shall have the Architect/PE approval.
   7. core drilling of holes for fire-rated poke through outlet devices shall have approval of the structural engineer or PE on the contract drawings prior to starting the work.
   8. Pathways for vertical cable runs such as slots and sleeves shall be installed in the proper location in accordance to applicable codes and standards.

B. Telecommunication Rooms and Equipment Rooms
   1. Telecommunication Room (TR) layout and location shall be in accordance with the guidelines of ANSI/TIA/EIA-569-D TR's shall not be installed in wet areas, near EMI sources, or caustic chemicals.
   2. Layouts of rack, cabinet, or enclosure locations shall be according to the approved submittal drawings.
   3. Racks and cabinets shall be secured to the floor suing proper anchors and fasteners.
   4. Mount and assemble racks, cabinets, brackets, and enclosures per the manufacturer's installation instructions. Mount patch panels and cable management accessories in the specified sections.
   5. Adjoining pathways (ladder rack, cable tray, etc.) shall be properly secured and positioned to allow adequate bend radius of cables entering the rack or cabinet.

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C. Wall outlets and recessed wall boxes
   1. Wall outlet and cable drop pathway location shall be according to contract drawings. Guidelines from ANSI/TIA/EIA -569-B should be followed for location with electrical outlets, and outlet height above finished floor.
   2. Outlet boxes shall be fastened securely to a wall stud or structural element in a manner that permits flush mounting of the faceplate with the finished wall.
   3. Multi-connect boxes shall be installed in a manner to comply with separation rules for power and communications wiring in close proximity.
   4. Refer to specific manufacturer's recommendations for wall outlet selection, cable deployment, and termination of jacks into faceplates.

D. Surface housings and MUTOA outlets
   1. Raceway or conduit should be deployed to the surface housing location for through wall cable entry. Cut the wall opening to match the location in the housing base.
   2. Layout mounting holes onto the desired wall location. For wallboard, concrete, or cinder block walls drill to the proper depth and install anchors.
   3. Always use the appropriate wall anchors for the wall material being anchored to. Installing mounting screws without using anchors will not be permitted. Mounting to studs is preferred.
   4. Mount base plate or surface box or MUTOA to outlet location using the proper fasteners. Note: furniture and wall outlet applications require mounting of the base plate prior to cable pulling and connector termination.
   5. Install cover and base plates.
   6. Refer to detailed manufacturer's guidelines for cable deployment and termination of jacks into surface housings. Due to the larger size of CAT6 cables proper cable bend radius must be maintained. Certain restrictions may apply when dressing CAT6 cabling in to surface housings.

3.3 INSTALLATION

A. Cable Support
   1. The contractor shall install all supports for cables specified in this section. Traditional ladder rack shall be used in each Telecommunication Room. Basket and J-hooks shall be used for horizontal cable support.
   2. Cable supports shall be spaced randomly but no further than 5'-0"apart.
   3. The Contractor shall provide all incidental cable management products required for a complete and neat cabling installation. Incidental products include but are not limited to sleeves or conduit raceways required to protect exposed cabling.
   4. A horizontal conduit system consists of conduits radiating from the telecommunications Room to the workstation outlets in the floor, walls, ceilings, and columns of the building. When using a conduit distribution system utilize the most direct route following the building lines.
   5. Provide a minimum of 1-inch conduit to each workstation location from the cable tray for voice and data cables.
   6. Conduit fill ratios shall not exceed 40%. Contact the cable manufacturer to get recommendations on fill rates.
   7. No conduit run should be designed with more than two (2)-90 degree bends between pull points or pull boxes. If a run requires more than two (2)-90 degree bends install a pull box.
      a. Exceptions to this shall be as follows:

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1) The total run is not longer than 33 feet.
2) The conduit size is increased to the next trade size larger.
3) One of the bends is located within 12 inches of the cable feed end (this exception only applies to placing operations where cable is pushed around the first bend).

8. All conduits shall be equipped with a contiguous length of plastic or nylon pull string with a minimum rating of 200 lbs (90 Kg).
9. A conduit run shall not be designed with continuous closed sections longer than 100 feet without pull points or pull boxes installed.
10. All conduits should terminate above on the installed ladder racks or cable tray and allow for proper cable racking. Cable materials should be considered in areas that have excessive distance between the conduit and ladder rack.
11. Trays and conduits located within the ceiling shall protrude into the room a distance of 1 to 2 inches without a bend and at least 8 feet above finished floor. Clear unobstructed access to the ladder rack and conduits shall be provided within Telecommunications Rooms.
12. Conduits entering through the floor shall terminate at least two (2) inches above the finished floor.
13. Locate slot/sleeve systems in places where pulling and termination will provide the easiest access.
14. If possible locate sleeves, slots, and/or conduits on the left side of the room. This placement enhances the use of wall space from left to right.
15. When possible entrance conduit and distribution conduit/cable tray should enter/exit on the same wall. If this is not possible provide and install ladder rack inside the room for distribution from wall to wall.
16. All floor penetrations shall be core drilled with a maximum of 1/4 inch size greater than the exterior diameter of the riser conduit.
17. Conduits entering through a wall shall be reamed, bushed, and terminated as close as practicable to the terminating rack or wall.
18. Terminations above the suspended ceiling shall terminate no less than 3 inches above the finished ceiling and shall be finished with a bush opening.
19. All conduit shall be labeled for easy identification. Label once in each room.
20. All floor penetrations shall be at columns, exterior walls, or in equipment rooms.
21. Cables shall be supported at the height of the bottom flange of structural beams using a rigid support method (I.E. threaded rod, beam clamps, etc.)
22. Do not support cables from duct work, sprinkler piping, water piping, waste/vent piping, conduit, ceiling wire, or other support systems.
23. The conduits or sleeve will be installed per TIA/EIA-569-B and shall have all penetrations sealed with an approved fire stop product.
24. Provide independent support systems for each low voltage cabling system.

B. Cable
1. CAT6 cable will be run for data. Certain environments may require the use of different cables and/or cable jackets.
2. All terminations shall utilize T568B wiring. The Contractor shall be responsible for removing/replacing any wiring that is not in compliance with this requirement at no additional cost to the owner.
3. Maximum cable lengths to be 295 feet including the service loop. Provide all necessary installation materials, tools, and equipment to perform insulation displacement type terminations at all communications outlets and patch panels.

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4. All communication cabling that has become abandoned as part of new renovation, previous renovation, or used as temporary communication cables during the construction process shall be completely removed.
5. Refer to detailed manufacturers guidelines for deployment of CAT6 cable. Certain restrictions apply and specific techniques are recommended.
6. All cabling shall be installed in accordance with the manufacturers written bend radius and pulling tensions. General industry guidelines recommend the following:
    a. Tensile loading of a single 4-pair copper UTP cable shall not exceed 25 LBF
    b. Bend radius of a single 4-pair copper UTP cable shall be a minimum of 4 times the diameter of the cable.
7. All conduits and conduit sleeve shall have bushings or grommets installed prior to the installation of communications cables to avoid damage and abrasions to the cable sheathing and insulation. If bushings are not installed by the electrical contractor the communications cabling contractor shall furnish and install bushings prior to pulling communications cabling.
8. Horizontal cable length for 4-pair copper UTP cables shall not exceed 295 feet. The contractor is responsible for reviewing the plans and specifications prior to bidding and installation and shall notify the Communications Design Engineer of cable runs that may exceed 295 feet.
9. Splices shall not be permitted in any voice or data cable unless otherwise specified or shown on the drawings.
10. Copper cables shall not be placed near sources of extreme heat (I.E. boilers, radiators, heat coils, etc.).
11. Maintain cable twists for all UTP cables. For terminations, cable sheathing shall be stripped back no more than 1/2 inch from the termination point for all CAT6 cables.
12. All cables shall be supported by cable tray, cable runway, or J-hooks. When large quantities of cables leave trays or runways, cables shall be supported by drop-outs or cable support hardware manufactured specifically for the purpose of supporting cables. J-hooks shall be installed a minimum of every 5 feet and cabling shall maintain minimal deflection and strain (less than 12" deflection). Cables shall not be supported from ceiling grid wires. Cables shall not run above steel joists.
13. All cables shall be separated and bundled into like groups.
14. Service loops shall be provided at both ends of installed horizontal and backbone cabling. A 12" service loop shall be installed in the ceiling space near workstation outlets (excessive cable shall not be coiled in outlet boxes). A 10 foot service loop shall be provided in Telecommunication rooms and shall be installed to allow for future equipment rack/cabinet relocations without the need to re-terminate patch panels. The 10 foot service loop shall be neatly bundled and secured in the ceiling space with large D-rings or placed in cable trays. Cable slack and service coils shall be stored properly above the ceiling or under the access floor. A "figure-eight" service loop is recommended for CAT6 cabling to reduce EMI coupling. Loose random bundling is recommended.
15. Any cabling installed in equipment rooms shall be neatly placed in cabling trays, cabling runways, or horizontal and vertical rack/cabinet cable management devices.
16. Only Velcro straps shall be utilized for cable bundling. Tie wraps, zip ties, and other such rigid devices will not be permitted when bundling cables.
17. Maintain the following separation distances between cables, other system cables, and other building systems:
    a. One (1) foot from fluorescent lights
    b. One (1) foot from power cables in parallel

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c. One (1) foot from electrical conduits or other system cables and electrical equipment
d. Four (4) feet from motors and transformers
e. Three (3) feet from hot water piping and other mechanical equipment
f. Ten (10) feet from bus conductors or high current branch circuits
g. All low voltage cables shall be run parallel or at right angles to building structural framework. Do not run cables diagonally across ceiling space without written authorizations by the Communications design Engineer or the Owners Representative.
h. Communications cabling that must cross power cables or conduit shall cross at a 90 degree angle and shall not make physical contact.

18. Fire seal around all cables running through rated floors and walls. Firestop all cables and pathways that penetrate fire-rated barriers using approved methods, materials and in accordance with all local codes.
19. Contractor shall install a spare pull string with every outlet installed.
20. Do not install cable in wet areas, or in proximity to hot water pipes and boilers.
21. Termination ends of cables shall be clean and free from crush marks, cuts, or kinks left from pulling operations. Installed cable jackets shall have no abrasions with exposed conductor insulation or bare copper "shiners". The contractor shall be responsible for replacing any damaged cables.
22. Backbone cables shall be installed and bundled separately from horizontal distribution cables. Backbone and horizontal cable bundles shall be loose and random.
23. Back bone cables spanning more than three floors shall be supported at the top of the cable run with wire mesh grip and on alternating floors unless otherwise specified by local codes or manufacturers guidelines.
24. Vertical runs of backbone cables entering each Telecommunications Room shall be securely fastened along a properly prepared wall in the room on each floor. Provide cable ladders.

C. Communications Infrastructure
1. Maximum cable lengths shall be 295 feet including the service loop. Provide all necessary installation materials, tools and equipment.
2. Support and secure cables at patch panel using rear able management bracket, spools or management devise.
3. Cross-connects shall be completed as per the construction schedule.

D. Racks and Enclosures
1. Freestanding equipment racks and enclosures shall be protected of all dust, debris, and other environmental elements during construction until the punch list walk through.
2. Each rack or enclosure shall have a dedicated #6 AWG ground wire to a grounding busbar or building ground as defined by the NEC.
3. Secure racks and enclosures to the floor using the manufacturers rack installation kit.

E. Category 6 Jacks
1. Refer to specific manufacturer's guidelines for termination of jacks and dressing CAT6 cables inside wall outlets and surface housings. Due to the larger size of CAT6 cable service coils in outlet boxes and surface housings are not recommended.
2. Terminate all jacks according to manufacturer's instructions.
3. All jacks shall be wired using T568B.

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4. The contractor shall maintain wiring pair twists as close as possible to the point of termination to assure 10G Base-T performance. Minimize the length of exposed pairs from the jacket to the IDC termination point during installation.
5. The length of wiring pair un-twist in each termination shall be less than 0.5 inches.
6. Jacks shall be properly mounted in plates, frames, or housings with dust caps fully installed over IDC contacts.
7. Horizontal cables extending from mounted jacks shall maintain a minimum bend radius of at least 4 times the cable diameter unless space is restricted. Note: refer to specific manufacturers recommendations for restricted cable bend radius.
8. Cable terminations shall minimize tensile or bending strain on the IDC contacts after assembly of the faceplate or housing to the wall outlet.

F. F. Category 6 Patch Panels
1. Properly mount patch panels into the designated rack, cabinet, or bracket locations with the #12-24 screws provided
2. Terminate cables behind the patch panel according to the manufacturer's installation instructions.
3. To insure proper performance the contractor shall maintain wiring pair twists as close as possible to the point of termination and minimize the length of exposed pairs from the jacket to the ICD termination point during installation.
4. The length of wiring pair un-twist in each termination shall be less than 0.5 inches and shall be kept to a minimum.
5. Each terminated and dressed cable shall be maintained perpendicular to the rear cover using the recommended cable management hardware.
6. Horizontal or backbone cables extending from the rear panel terminations shall maintain a minimum bend radius of at least 4 times the cable diameter.
7. Cable terminations shall have a minimal tensile or bending strain on panel IDC contacts in each installed location.
8. Panels shall be properly labeled on the front and back with the cable number and port connections for each port.

G. Harsh Environment Housing and Connectivity
1. Mount connector housing from the front of the device. Install gasket or optional protective cap before mounting connector housing into device.
2. Secure connector housing to device using supplied plastic nut. Tighten nut with 6-7 inch/pounds of torque.
3. Ensure that mounting surface is clean and free of debris.
4. Installing the jack into the mounted connector housing.
5. Install the terminated jack into the mounted connector housing by tilting the jack and securing the fixed latch in the connector opening. Rotate the jack securing the spring latch.
6. Clean and remove any obstructions from the surface that the wall plate assembly will be installed against.
7. Place washers provided with hi-impact series plates onto screws. Align rubber gasket on the back side of plate prior to installing to the box/wall by placing screws through plate and rubber gasket.
8. Secure the wall plate assembly to box/wall by tightening screws with 5 inch/pounds of torque.
9. Attach patch cords and field terminate plug assemblies (sold separately) to the mounted connector.

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H. Grounding and bonding systems, basic guidelines
   1. Telecommunications grounding and bonding system shall be installed in accordance with NEC requirements and per the guidelines of ANSI J-STD-607-A.
   2. The telecommunications main grounding busbar (TMGB) shall be bonded to the building main electrical service ground (grounding electrode conductor or GEC) using approved lugs or exothermic weld methods. Bonding to the GEC or TMGB with sheet metal screws is prohibited.
   3. The telecommunications bonding backbone shall be a minimum of #6 AWG copper wire conductor. A telecommunications grounding busbar (TGB) shall be installed in the Telecommunications Room on each floor, and call be bonded to the TBB. All metal racks, cabinets, pathways, and enclosures shall be bonded to the TGB.
   4. Telecommunications equipment shall be grounded according to manufacturer's instructions and in accordance with all applicable codes.
   5. All metallic pathways including conduit, raceway ladder, or cable trays shall be electrically continuous and shall be bonded to ground on each end.
   6. OSP cable entering the building or backbone cables having metal sheaths shall have isolation protections. Isolation protectors shall be bonded to the TMGB.

3.4 LABELING

A. General
   1. All labels shall be permanent and machine generated by a labeling machine as follows:
      a. Labels shall be on a permanent polyester material, clear in color.
      b. Lettering shall be black in color.
      c. Hand written labels will not be permitted.
   2. The Contractor shall coordinate the labeling scheme with the Owner prior to producing and installing any labels. The Contractor shall provide samples of finished installations at a pre-installation meeting with the Owner prior to completing the installation. In general, the labeling scheme shall be: IDF Room # - Room # - Jack #.
   3. Surfaces shall be cleaned before attaching labels. All labels shall be attached firmly and vertically plumb on equipment, faceplates, patch panels, termination blocks, etc.
   4. All labeling of cables, equipment, and components shall be included in as-built documentation, floor plan drawings, schematic designs, and test reports.

B. Cabling
   1. All structured cables (horizontal and backbone) shall be labeled at both ends within 6" of cable termination point. Where voice backbone cables extend behind termination blocks cable labels shall be placed at a location on the cable where the labels are visible from the front of the termination block.
   2. Labels shall have and adhesive backing and shall wrap completely around the circumference of the cable jacket. Label and lettering shall be of an appropriate size with regards to the cable diameter.

C. Equipment Racks, Termination Hardware, and Faceplates
   1. The Contractor shall coordinate the labeling scheme with the Owner prior to producing and installing any labels. The Contractor shall provide samples of finished installations at a pre-installation meeting with the Owner prior to completing the installation.

3.5 TESTING

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A. Category 6 Cable Testing
   1. Permanent link testing shall be completed on all horizontal (station) cables. The Contractor shall be responsible for supplying a channel warranty but the Owner requires that the contractor supplies all the manufacturer's patch cords per the contract.
   2. CAT6 cabling systems shall be tested as an installed horizontal permanent link configuration. Jacks and faceplates shall be assembled, complete and properly mounted into outlet boxes. Panels shall be terminated complete and fully dressed with proper cable management.
   3. All CAT6 cables shall be properly labeled prior to testing. Test results shall be in numerical order by Cable ID.
   4. All wiring shall be certified to meet or exceed the specifications as set forth in TIA-568C for CAT6 requirements for permanent link. All tests shall be performed to 250 Mhz.
   5. Test results shall include the following information for each pair of each cable installed:
      a. Name of the person performing the test.
      b. Test equipment manufacturer and model number.
      c. Cable ID.
      d. Date of Test
      e. Wire map (pin to pin connectivity and polarity check)
      f. Length (in feet)
      g. Insertion loss
      h. Near end cross talk (Next)
      i. Power sum near end crosstalk (PSNEXT)
      j. Equal level far end crosstalk (ELFEXT)
      k. Power sum equal level far end crosstalk (PSELFEXT)
      l. Return loss
      m. Delay skew
      n. Attenuation to crosstalk ratio (ACR)

B. A "PASS" indication shall be obtained for each link using (at minimum) a level III tester that complies with TIA/EIA-568-B.2 field test requirements.

C. Correct all malfunctions and "FAIL" when detected and re-test to demonstrate compliance.

D. Record test results for each cable and provide to the General Contractor for the Owners review. All cables shall "PASS" as a condition of installation acceptance.

3.6 CONTRACT CLOSEOUT REQUIREMENTS

A. Closeout Documentation. The Contractor shall assemble all closeout documentation required below and provide it digitally in a PDF, searchable (when applicable), format on a compact disc, thumb drive or other compatible digital device unless otherwise specified below. This documentation shall be kept separate from other similarly required documents and provided to the City of Madison Information Technology representative for review and approval. The documentation shall be provided and indexed as follows:
   1. Index of contents
   2. Pre-installation test results, one complete set in approved format indicating all pre-installation tests met or exceeded the specification
   3. Post-installation test results, one complete set in approved format showing all post installation terminations met or exceeded the specification
   4. As-Builts

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a. The Contractor shall maintain through the construction process a paper set of as-built documentation. Upon completion of the installation and verification by the Owner and Design Engineer that all documentation is complete the contractor shall provide the Design Engineer with the paper plans for inclusion into a digital as-built design set.
b. Complete floor plan as-builts shall indicate all of the following information:
    1) Include detailed information of cable and pathway layouts, locations of pullpoints/boxes, and other such products and equipment installed.
    2) Locate all work station outlets, camera, locations and other such data drops; provide the correct alpha numeric cable assigned to each location.
    3) Where product/equipment locations are dimensionally located provide the installed dimensions by either circling the design dimension if correct or providing the field correct dimension. Provide all dimensions for installations not originally dimensioned in the design.
    4) Any deviation in location of an installation shall be noted on the drawings regardless of the reason for change. Items grossly not installed in their intended location shall be "X" out and drawn in the installed location
    5) Indicate all items added or deleted to the contract through change order or other such means. Provide the document number that caused the change.
c. Provide complete details of final installation of all racks and equipment. Provide the alpha-numeric numbers (range low to high) assigned to each patch panel on a rack.

5. Operation and Maintenance information, all of the following items shall be grouped by like item for a specific product or piece of equipment.
    a. A complete set of all submittals
    b. A complete set of all installation instructions for products and equipment installed. Only one
        1) copy of each product or piece of equipment needs to be supplied.
    c. A complete set of all operation instructions for products and equipment installed
    d. A complete set of all maintenance/care instructions for products and equipment installed
6. Warranty/guarantee Information
    a. Provide signed contractors warranty letter for installation and service for the period of one (1) year.
    b. Provide manufacturer's warranty/guarantee information for all products and equipment installed. Verify with all plans and specifications the required terms of warranties/guarantees. If none are specified provide the default manufacturer's warranty/guarantee.

B. Owner Training. The Contractor shall provide Owner Training as needed on all Division 27 installations. The contractor shall verify with the City of Madison Information Technology representative as to what items will be trained, how much training will be necessary and coordinate training dates and times.

END OF SECTION 27 00 05

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SECTION 27 05 29

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

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

C. Section 27 05 33.13 - Conduit for Communications Systems: Additional support and attachment requirements for conduits.

D. Section 27 10 00 - Structured Cabling.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

1.4 ADMINISTRATIVE REQUIREMENTS

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A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.5 SUBMITTALS

A. See Division 01 - General Requirements or See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.6 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. TIA-569.
      b. NFPA 70.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

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B. Conduit Supports: Straps and clamps suitable for conduit to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:
   1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   2. Comply with MFMA-4.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
      b. Comply with MFMA-4.
      c. Channel Material: Use galvanized steel.
   4. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

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F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners in accordance with manufacturer's recommended torque settings.

K. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 27 05 29

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SECTION 27 05 33.13

CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel intermediate metal conduit (IMC).

B. Stainless steel intermediate metal conduit (IMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Galvanized steel electrical metallic tubing (EMT).

E. Stainless steel electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 07 84 00 - Firestopping.

1.3 REFERENCE STANDARDS

A. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

B. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

C. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

D. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

E. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

G. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

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J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.

O. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

P. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

Q. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

R. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

T. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

U. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

V. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, PVC-coated galvanized steel rigid metal conduit (RMC).

C. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

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D. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or inside-plant flexible nonmetallic communications raceway/innerduct.

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

G. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or schedule 80 rigid PVC conduit.

H. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

I. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

J. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit (RMC).
   1. Corrosive locations include, but are not limited to:

K. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70 and TIA-569.

B. Provide conduit, fittings, supports, and accessories required for complete communications pathway.

C. Provide products listed, classified, and labeled as suitable for purpose intended.

D. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

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2.3 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.4 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
   3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
   4. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

C. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
   5. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.6 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

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A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.7 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
   4. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.8 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage.

B. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
   3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
      a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

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3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Galvanized Steel Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

D. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

E. Galvanized Steel Electrical Metallic Tubing (EMT): Install in accordance with NECA 101.

F. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

G. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Arrange conduit to maintain adequate headroom, clearances, and access.

H. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

I. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
   2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
   3. Use suitable adapters where required to transition from one type of conduit to another.
   4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
   5. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
   6. Secure joints and connections to provide mechanical strength and electrical continuity.

J. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves and/or slots for penetrations as indicated or as required to facilitate installation.
   4. Conceal bends for conduit risers emerging above ground.
   5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations

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are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings or approved flexible connections to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where conduits are subject to earth movement by settlement or frost.

L. Provide grounding and bonding.

3.3 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of cables.

END OF SECTION 27 05 33.13

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SECTION 28 13 00

ACCESS CONTROL SYSTEM (KEYSCAN)

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. PS 1 - Structural Plywood; 2023.

B. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.2 SUMMARY

A. The City of Madison Information Technology Department has been assisting other City agencies with standardizing facilities through the use of access cards, key fobs, and punch pads. All hardware is installed locally at the facility while software controls access to various doors remotely.

B. These specifications describe the materials, equipment, and installation requirements to install an integrated, computerized access control and alarm monitoring system utilized by the City of Madison Information Technology (CoM-IT) Department.

C. The ACS System Contractor shall be responsible for verifying equipment requirements, locations, and coordination with the General Contractor and all other necessary trades as needed for a complete installation.

D. The ACS System Contractor shall be aware that the installation plans and specifications are for two (2) independent buildings on two (2) separate fire alarm systems and shall be wired as such. Refer to the Part 3-Exectuion for additional details.

1.3 RELATED SPECIFICATIONS

A. 01 31 23 Project Management Web Site

B. 01 33 23 Submittals

C. 08 71 00 Door Hardware

D. 14 21 00 Electric Traction Elevator

E. 27 05 00 Basic Communication Systems Requirements

1.4 RELATED DRAWINGS

A. Refer to all Electrical drawings for locations of distribution panels and equipment as it relates to standard line voltage locations.

B. Refer to all Technical drawings for locations of Access Control System (Keyscan) equipment.

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C. Refer to the door hardware schedule and Architectural floor plans for information relating to door access locations and specific hardware requirements.

1.5 REFERENCES

A. The system shall comply with the standards, codes and regulations of the following regulatory bodies:
   1. Underwriters Laboratories (UL) Std No. 294 – Access Control System Units
   2. Canadian Standards Association (CSA) Std C22.2 No. 205-M1983 – Signal Equipment
   3. CE Standards
      a. EN 55022 RF Emissions
      b. EN 55024 RF Immunity
      c. EN 60950-1 Equipment Safety
   4. FCC Subpart B – RF Emissions
   5. Industry Canada ICES 003 Emissions
   6. RoHS

1.6 CONTRACTOR QUALIFICATIONS

A. The Contractor installing the ACS system shall:
   1. Be a certified Keyscan Enterprise Partner
   2. Utilize installers who are Keyscan Enterprise Certified Technicians
   3. Be able to provide 24/7 support during the warranty period of this project
   4. Be able to respond and repair most components within 4 hours of notification

1.7 SUBMITTALS

A. The Contractor shall provide a complete submittal package in a timely manner to allow sufficient review time prior to ordering the system components required for a complete installation. The contractor shall be solely responsible for any equipment, purchased/ordered/delivered that is not approved of during the submittal review process.

B. The complete submittal package shall include but not be limited to the following:
   1. All certifications of the contractor and contractor's installation team. Certifications shall be current from the start of the contract through the end of the warranty period.
   2. Cut sheets indicating, shop drawings, performance data, and other such information that will indicate the component being installed matches the component that was specified.
   3. Cut sheets and shop drawing of Contractors recommendations for tags and labels.

1.8 WARRANTY

A. The Contractor shall warrant for one year the complete installation of equipment and components associated with this contract and installation. Contractors warranty shall be in the form of a written letter on company letterhead referring to the contract information, dates of installation and acceptance, signed by an authorized representative of the Contractors Company.
   1. The Contractors warranty shall include but not be limited to the following:
      a. Transportation to and from the location as often as needed during the warranty period.
      b. All labor and materials necessary to properly and thoroughly trouble shoot the system.

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c. All fees associated with the shipping of any component that needs to be returned or supplied by the manufacturer for repair or replacement.
d. All labor and materials required to remove, repair, replace, or re-install any component.

B. The Contractor shall also provide all manufacturers warranties/guarantees associated with installed components of the completed installation.

1.9 QUALITY ASSURANCE

A. The Contractor shall be responsible for coordinating their Work with other trades and divisions as needed for a complete installation. This shall include pre-installation meetings for locating equipment, conduit, cabling, control devices, and other materials and equipment required by this installation.

B. The General Contractor (GC) shall be responsible for ensuring that all doors requiring controlled access are properly prepared and installed per the contract documents. The GC shall further be responsible for ensuring all project coordination, pre-installation meetings, submittals and other such project management responsibilities are conducted efficiently and according to the project specifications and schedules.

PART 2 PRODUCTS

2.1 EXISTING SYSTEM PRODUCTS OVERVIEW

A. The City of Madison Information Technology Department (CoM IT) owns and operates a fully licensed copy of the Keyscan Access Control System software.
1. The Keyscan Access Control System (ACS) provides controlled access to secured doors and elevators through the use of electronic door latches, proximity readers, control panels, and a proprietary software program.
2. The Keyscan software allows CoM-IT and the facility the Owner to customize multiple levels of access and system performance through any combination of the following:
a. Calendar and time based lock/unlock controls
b. Group access control for common personnel groups
c. Individual access control for specialized access control
d. Elevator access control for accessing/not accessing various floors
e. Temporarily disable access control for a specified time period
f. Remotely unlock/lock a door
g. Lockdown a facility from one location
h. Provide customizable alert notifications

2.2 NEW EQUIPMENT AND COMPONENTS

A. The Contractor guarantees that all equipment and components shall be furnished new, undamaged, free of defects, and conform to the drawings and specifications of this contract. The contractor is solely responsible for replacing any damaged or defective item.

B. New ACS components on interior and exterior access doors shall be able to be integrated with the Owners existing system.

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2.3 DISTRIBUTION SUPPLY PANEL (AC-DS-1)

A. AC-DS-1 brings line voltage into the ACS system with the following performance specifications:
   1. Input
      a. 115VAC, 60Hz, 1.45A
   2. Output
      a. Eight (8) PTC protected outputs
      b. 16VAC output
      c. 16VAC @ 10amp (175 VA) supply current (1.25 amp per device, 2.5 amp max.)
      d. Outputs rated @ 2.5 amp
      e. Main fuse rated @ 15 amp/32V
      f. Surge suppression
   3. Miscellaneous electrical information
      a. Operating temperature 0º C to 49ºC ambient
      b. 81.89 /hr
      c. System AC input VA requirement 166.75 AV
   4. Miscellaneous required features
      a. AC power LED indicators
      b. Illuminated master power disconnect circuit breaker with manual reset
   5. Agency approvals
      a. UL 294 listed for Access Control System Units
      b. CUL listed-CSA Standard C22.2 No 205-M1983 Signal Equipment

B. AC-DS-1 shall be:
   1. Altronix, AL168175CB
   2. Pre-approved equal

2.4 POWER SUPPLY PANEL (AC-PS-1)

A. The AC-PS 1 brings line voltage from the AC-DS-1, reduces then distributes the voltage to the Access Security Panels (AC-SEC-1) with the following performance specifications:
   1. Input
      a. 115VAC, 60Hz, 1.9A
      b. Power supply input options
         1) One (1) common power input for ACM8 and lock power (factory installed)
         2) Two (2) isolated power inputs; one (1) to power the ACM8 and one (1) for lock accessory power, (external power supply is required). Current is determined by the power supply connected, not to exceed a maximum of 10 amp total
      c. Eight (8) Access Control System trigger inputs with the following options:
         1) Eight (8) normally open (NO) inputs
         2) Eight (8) open collector inputs
         3) Any combination of the above
   2. Output
      a. 12VDC or 24VDC @ 6 amp supply current
      b. Eight (8) independently controlled outputs with the following options:
         1) Eight (8) Fail-Safe and/or Fail-Secure power outputs
         2) Eight (8) form “C” 5 amp rated relay outputs
         3) Any combination of the above
      c. Eight (8) auxiliary power outputs (un-switched)

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d. Output fuses rated @ 3.5 amp
e. Filtered and electronically regulated outputs (built-in power supply).

3. Miscellaneous electrical information
   a. Operating temperature 0º C to 49ºC ambient
   b. BTU/hr:
      1) 12VDC = 36.85 /hr
      2) 24VDC = 73.70 /hr
   c. ACM8 board main fuse is rated at 10 amp
4. Battery backup
   a. Built-in charger for sealed lead acid or gel type batteries
   b. Power supply board maximum charge current 0.7 amp
   c. Automatic switch over to stand-by battery when AC fails
   d. Zero voltage drop when unit switches over to battery backup (AC failure condition)
   e. Battery fail and battery presence supervision (form "C" contact)
5. Miscellaneous required features
   a. Fire Alarm disconnect (latching or non-latching) is individually selectable for any or all of the eight (8) outputs.
   b. Fire Alarm disconnect input options:
      1) Normally open (NO) or normally closed (NC) dry contact input
      2) Polarity reversal input for FACP signaling circuit
   c. Alarm output relay indicates that FACP input is triggered (form "C" contact rated @ 1 amp 28VDC)
   d. Short circuit and thermal overload protection
   e. AC fail supervision (form "C" contact)
   f. Red LEDs indicate outputs are triggered (relays energized)
   g. Green LED indicates FACP disconnect is triggered
   h. AC input and DC output LED indicators
   i. Enclosure accommodates up to two (2) 12AH batteries
6. Agency approvals
   a. UL 294 listed for Access Control System Units
   b. CUL listed-CSA Standard C22.2 No 205-M1983 Signal Equipment

B. AC-PS 1 shall be:
   1. Altronix, AL600ULACM
   2. Pre-approved equal

2.5 READER POWER SUPPLY PANEL (AC-RPS-1)

A. The AC-RPS-1 brings lines voltage into the ACS to provide power to HID Signo readers. The power supply shall have the following performance specifications:
   1. Input
      a. 115VAC, 60Hz, 3.5A
   2. Output
      a. 12VDC or 24VDC selectable output
      b. 6A continuous supply current
      c. Filtered and electronically regulated output
      d. Short circuit and thermal overload protection
   3. Battery backup
      a. Built-in charger for sealed lead acid or gel type batteries
      b. Automatic switch over to stand-by battery when AC fails

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4. Supervision
    a. AC fail supervision (form “C” contacts)
    b. Notification trigger is selectable for 30 seconds (factory set) or 6 hours
    c. Low battery supervision (form “C” contacts)
    d. Battery presence supervision (form “C” contacts)
5. Visual indicators
    a. AC input and DC output LED indicators
6. Temperature
    a. Operating 32 degrees Fahrenheit to 49 degrees C 32 degrees Fahrenheit to 120 degrees Fahrenheit).
    b. Storage -68 degrees Fahrenheit to 70 degrees C (-4 degrees Fahrenheit to 158 degrees Fahrenheit).
    c. Relative Humidity 85% +/- 5%.
    d. BTU/Hr (approx.):
        1) 12VDC: 37 /Hr.
        2) 24VDC: 74 /Hr.
    e. System AC Input VA requirement: 402.5VA.

B. AC-RPS-1 shall be:
1. Altronix AL600ULX
2. Pre-approved equal

2.6 EIGHT DOOR SECURITY PANEL (AC-SEC-1)

A. The AC-SEC-1 distributes the reduced voltage and control wiring to/from each door with an access control device.

B. AC-SEC-1 shall be:
1. Keyscan CA8500 – Eight Reader Access Control Panel

C. The AC-SEC-1 shall be provided, located and mounted by the Contractor

2.7 ONE DOOR SECURITY PANEL (AC-SEC-2)

A. The AC-SEC-2 distributes the reduced voltage and control wiring to/from each door to an IT telecommunications room.

B. AC-SEC-1 shall be:
1. Keyscan CA150 – Single Door Access Control Panel

C. The AC-SEC-2 shall be provided, located and mounted by the Contractor

2.8 ELEVATOR FLOOR ACCESS CONTROL PANEL (EFACP)

A. The EFACP distributes the reduced voltage and control wiring to the elevator equipment for providing access control to specific floors while providing general public access to others.

B. EFACP shall be:
1. Keyscan EC1500 – One Cab Elevator Floor Access Control Panel

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C. The EFACP shall be provided, located and mounted by the Contractor in the elevator machine room.

D. The EFACP requires two (2), 16.5VAC, 37 or 40VA transformers to be supplied and installed by the Contractor.

2.9 DOOR CONTROL DEVICES

A. The Contractor shall be responsible for verifying the Door Control Device (DCD) quantities and locations with the door hardware schedule.

B. DCD shall be:
   1. HID Global 40KNKS-00-000000– Signo 40 wall mount keypad reader, this reader accepts swipe monitoring of cards, key fobs, and other such devices as well as accepting personal identification numbers (PINs). If a keypad is not needed, the HID Global 40NKS-00-000000 Signo 40 or 20NKS-00-000000 Signo 20 can be used.
   2. The 40KN.KS-00-000000 shall be used for all locations including the elevator cab.

2.10 DOOR CONTROL CABLES

A. The following cables are required for a complete installation of the ACS, per controlled door:
   1. One (1) 22/6 shielded cable, required; to DCD
   2. One (1) 18/2 un-shielded cable, required; lock power
   3. One (1) 22/2 un-shielded cable, required; door contact
   4. One (1) 22/4 un-shielded cable, required but not used; for future request to exit sensors

B. At the Contractors option they may run a manufactured cable bundle containing all four (4) cables listed above. It shall be the sole responsibility of the contractor to appropriately size the conduits for the installation.

PART 3 EXECUTION

3.1 COOPERATION OF THE ACS CONTRACTOR

A. The Contractor shall be required to coordinate with all trades for a complete and timely installation. This includes attending all pre-installation meetings where equipment locations, conduit locations, and control devices will be installed or may be in conflict with the installation of other trades. The Contractor shall be solely responsible for any additional cost required for removing/replacing/modifying any completed work by other trades because the installation was not properly coordinated.

B. The Contractor shall coordinate with the Owners Representative from City IT for all information necessary to complete the installation and integration with the Owners existing hardware and software.

C. The Contractor shall verify with the appropriate Owners Representative for mounting heights of all hardware and equipment prior to installation. This shall be completed at a pre-installation walk through prior to rough-in.

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D. The Contractor shall coordinate with the elevator equipment installer the location and wiring of the EFACP.

E. The Contractor shall coordinate with the Owner's Representative from City IT to verify all requirements for all access controlled doors are properly coordinated and understood prior to roughing in the installation.

3.2 GENERAL EQUIPMENT MOUNTING

A. All ACS equipment shall be mounted to the 3/4" AC fire rated plywood panels provided and installed by the General Contractor. Contractor shall tape out all equipment prior to mounting to insure adequate space is allotted for the complete installation per the riser diagrams including all related conduits and cables.

B. The EFACP shall be mounted to the 3/4" AC fire rated plywood panels provided and installed by the General contractor in the elevator Equipment Room. The General Contractor shall coordinate the location of the plywood panels with the Elevator Equipment Contractor and the ACS Contractor prior to installation.

C. All equipment shall be neatly arranged so as to meet or exceed the manufacturer's recommended working space around each component.

D. Equipment to be installed on plywood mounting panels shall include but not be limited to the following:
   1. Distribution Service Panel (AC-DS-1)
   2. Power Supply Panel (AC-PS-1)
   3. Reader Power Supply Panel (AC-RPS-1)
   4. Access Control Panel (AC-SEC-1)
   5. Elevator Control Panel (EFACP), including transformers
   6. All required conduits and boxes for line voltage

3.3 GENERAL CONDUITS AND WIRING

A. This section shall apply to both the ACS Contractor and the Electrical Contractor. The following division of responsibilities shall apply:
   1. The Electrical Contractor shall be responsible for furnishing, installing, and connecting all conduits, connectors, conductors, and other related materials associated with providing line voltage to the ACS system as follows:
      a. Providing an 110V, 15A, dedicated circuit from the designated distribution panel to AC-DS-1 and AC-RPS-1 as described in Section 2.3 above.
      b. Providing line voltage from AC-DS-1 to AC-PS 1 as described in Section 2.4 above.
      c. Providing and installing the required 110V, 20A dedicated duplex outlet in the elevator Equipment Room. Coordinate the location with the ACS Contractor and the Elevator Contractor.
   2. The ACS Contractor shall be responsible for furnishing installing, and connecting all conduits, connectors, conductors and other related materials required to complete the installation of the low voltage wiring and door controller cabling.

B. All conduits shall be properly sized for the number of wires or wire bundles being pulled through the conduit. The Contractor shall verify with the manufacturer the recommended fill rate by conduit size and shall not exceed the recommendations.

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C. The contractor shall neatly lay out all conduits in such a fashion so as to minimize bending, crossovers, etc.

D. Bends, pull boxes, and pull points shall be sized and located as per all applicable codes and standards for the number of wires or wire bundles in the bend, pull box, pull point.

E. CAT6 cables from each AC-SEC-1 and the EFACP shall be neatly run in cable management equipment supplied and installed by the cabling contractor or conduits supplied and installed by the ACS Contractor as needed. The switch to be used for all ACS equipment shall be located in Telecom Room 021. Cables shall be labeled on both ends per the cabling specification.

F. The General Contractor and the ACS Contractor shall ensure the following Emergency Access requirements are properly installed and operational prior to the final Madison Fire Department inspection for occupancy.
    a. CoM IT shall provide a minimum of six (6) swipe cards to each installed Knox Box for emergency entrance. The cards shall be appropriately coded for entry at all controlled access doors.

3.4 ACS CONTROL OF ELEVATOR EQUIPMENT

A. The contractor shall coordinate the installation of all required ACS equipment in the elevator Equipment Room with the Elevator Equipment Contractor and the Electrical Contractor.

B. The Elevator Equipment Contractor shall provide and install a 6 conductor, shielded 18-gauge cable between the elevator equipment and the elevator cab for use with the ACS control equipment.

C. The Contractor shall coordinate with the Elevator Equipment Contractor for locating and installing the DCD device (2.7. above) in the elevator cab and for coordinating all wiring between the two systems to attain the desired control specification (3.4.D. below)

D. Prior to programming the elevator controls, coordinate with the City Project Manager and the appropriate representatives from City IT, for final control parameters.

3.5 EQUIPMENT IDENTIFICATION AND LABELING

A. The Contractor shall provide and install all equipment identification and labeling to the following specifications.
    1. Tags and labels shall be permanent rigid plastic or metal tags with engraved or machine stamped lettering. Hand written self stick or metal hand stamped tags will not be accepted.
    2. The Contractor shall work out the labeling scheme for doors with City IT, Owner, and Architect prior to ordering any labels or tags.
    3. The Contractor shall provide all labels and tags associated with this specification. This shall include the line voltage feed to each AC-DS-1 from the electrical distribution panel.

B. Panels and Boxes
    1. All panels and boxes shall be labeled on the outside cover that readily identifies the panel/box as a “Distribution Supply”, “Power Supply”, “Access Control Panel”,

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"Elevator Floor Access Control Panel", etc. An associated number shall also be on each tag and the number "1" shall be used even if there is only one of that type panel/box.

2. Access Control Panels shall have a card index inside the front cover of each door indicating the controller number, door number, and door location being served by that panel.

C. Conduits
   1. Line voltage from electrical distribution panels shall have conduits labeled on both ends as follows:
      a. At the distribution panel the line voltage conduit shall be labeled with the system supplied, and the ACS distribution supply panel number.
      b. In the Telecommunications Room the line voltage conduit label shall indicate the distribution panel and circuit number(s) controlling the supply line.
   2. Conduits between Access Control Panels and the controlled doors shall be labeled on both ends as follows:
      a. In the Telecommunications Room each conduit shall labeled with the door number(s) being supplied.
      b. Above the finished ceiling where the conduit is exposed prior to going into the wall space that serves the door the conduit shall be labeled with the Door Control Panel and Controller number associated with the door being served.
      c. If the conduit size is reduced as control cabling is supplied to doors along the run each change is conduit size shall be re-labeled as noted in 2.b. above.
   3. Conduits between equipment and components in the Telecommunications Room do not need to be identified.

3.6 INSTALLATION TESTING AND ACCEPTANCE

A. The CoM IT and the Owner shall be responsible for completing all software programming associated with the installation of this contract prior to the completion of the installation of the system components. It is the sole responsibility of the Contractor to notify the Owner no less than two (2) weeks in advance of completing the installation that all codes and time setting shall be prepared for final installation and testing.

B. The Contractor, CoM IT, and the Owner shall test each access control point with swipe cards and PINs to insure the door unlocks.

C. CoM IT shall test each door using the existing fully integrated software. This shall include but not be limited to the following:
   1. Remotely lock/unlock the doors
   2. Verify time clock feature works for locking doors
   3. Verify swipe cards and PINs work on all doors
   4. Verify emergency entrance cards for knox boxes work on all doors for the areas served.

D. The Contractor, CoM IT, and the Owner shall test the elevator floor access functions as follows:
   1. With swipe cards and PINs to ensure controlled access to all floors.
   2. With no swipe cards or PINs to ensure that the general public can only access the designated public floors and not controlled access floors.
   3. Verify time clock feature works for accessing floors

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E. A completed and accepted installation shall pass all of the above tests for all controlled access points.

F. The warranty period for the completed and accepted installation shall not begin until the date of the accepted general contract. The Contractor shall coordinate this date with the General Contractor.

END OF SECTION 28 13 00

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SECTION 28 46 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.2 RELATED REQUIREMENTS

A. Applicable provisions of Division 01 – General Requirements shall govern all work under this Section.

B. Section 14 21 00 - Electric Traction Elevators: For interface with fire alarm system.

C. Section 26 05 33.16 - Boxes for Electrical Systems.

1.3 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authorities having jurisdiction.

B. BAS: Building automation system.

C. DMNS: Distributed mass notification system.

D. ECS: Emergency communications system.

E. EoL: End-of-line.

F. EVACS: Emergency voice/audio communication systems.

G. FACU: Fire alarm control unit.

H. HVAC: Heating, ventilation, and air conditioning.

I. IDC: Initiating device circuit.

J. LAN: Local area network.

K. MNS: Mass notification system.

L. NAC: Notification appliance circuit.

M. NPLFA: Non-power-limited fire alarm.

N. PLFA: Power-limited fire alarm.

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O. SLC: Signaling line circuit.

P. SOO: Sequence of operation.

1.4 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 1225 - Standard for Emergency Services Communications; 2022.

K. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

L. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

M. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

N. UL 1711 - Amplifiers for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.
   2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.

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3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
4. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
5. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
6. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
7. Municipal Alarm Connections: Coordinate requirements for connection with municipality representative.
8. Notify engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
9. Elevators or Escalators: See Division 14.

B. Preinstallation Meetings:
1. Conduct meeting with facility representative to review devices, notification appliances, and equipment locations.
2. Conduct meeting with facility representative and other related equipment manufacturers to discuss fire alarm system interface requirements.
3. Conduct meeting to review anticipated installation of code-required smoke control requirements, product solutions, and SOO.
4. Convene one week before starting work for review of documented SOO for system applications.

C. Sequencing:
1. Verify exact termination locations required for boxes, enclosures, and equipment.
2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).
5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

D. Scheduling:
1. Arrange access to facility for data collection with facility representative.
2. Where work involves interruption of existing electrical or fire alarm system service, arrange interruption with Owner.
    a. Arrange test start and end with responsible reporting service. Confirm system normal operating mode and record as-found and as-left settings.
    b. Arrange work to disable individual devices or circuits for minimal disruption if possible.
    c. Arrange in accordance with NFPA 72 fire alarm system impairment requirements.
    d. Where required by AHJ, arrange systems or partial system out of service interruption in accordance with requirements of building, life safety, and fire codes (e.g., approved fire watch plus required notifications, tags at each fire department connection and control valve, and AHJ notification when excess hours).

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1.6 SUBMITTALS

A. See Division 01 - General Requirements for submittal procedures.

B. Evidence of designer qualifications.

C. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.

D. Shop Drawing Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by AHJ.
   2. NFPA 72 "Record of Completion", filled out to extent known at time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Annex A, Figure A.14.6.2.4, and complete listing of software required.
   4. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.
   5. Certification by manufacturer of FACU that system design complies with Contract Documents.

E. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.
   1. System zone boundaries and interfaces to fire safety systems.
   2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
   3. Include elevations and details of proposed equipment arrangements.
   4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
   5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
   6. Include requirements and control diagrams for interfacing with other systems.
   7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
   8. List of devices and notification appliances on each SLC, with spare capacity indicated.
   9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   11. Detailed drawing of graphic annunciators, displays, and interfaces.
   12. Certification by either FACU manufacturer or manufacturer of related equipment.
   13. Certification by FACU manufacturer that system design complies with Contract Documents.
   14. Certification by Contractor that system design complies with Contract Documents.

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F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Evidence of installer qualifications.

H. Evidence of maintenance contractor qualifications, if different from installer.

I. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test," filled out.

J. Operating and Maintenance Data: See Division 01 - General Requirements have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by AHJ.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

K. Project Record Documents: See Division 01 - General Requirements:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, and updated input/output chart.
      a. ECS: Voice messages by event.

L. Closeout Documents:
   1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.
   3. Certificate of Occupancy.
   4. Report on training results.

M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements for additional provisions.

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2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
3. In addition to items in quantities indicated in PART 2, furnish the following:
    a. Tools, software, and documentation necessary to modify fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, notification appliances, circuits, and zones, and changes to system description, and operation.
        1) ECS: Include same capability for evacuation and instructional messages.
    b. One copy of software not resident in read-only-memory.
    c. Extra Cabinet Keys: Two spare for each cabinet lock provided; label key number and corresponding cabinet identifier; collect and provide to Owner facility manager.
    d. System Floor Plans dimensioned and drawn to sclae with appropriate symbols, system wiring requirements, and other informaiotn required by the Department of Commerce. Four sets required Replacement Printer Ribbons.

1.7 WISCONSIN DEPARTMENT OF COMMERCE - FIRE ALARM SYSTEM PLAN APPROVAL

A. Where fire protection system plan approval is required, the contractor shall assist the Engineer in the preparation of the submittal. Refer to State Register April 2003, Department of Commerce Code, Chapter 61, paragraph 61.30(3) and table 61.30-3 for buildings where fire protection system plan approval is required. Submittal requirements and areas of responsibility are as follows;
    1. Fire Alarm System Floor Plans dimensioned and drawn to scale with appropriate symbols, system wiring requirements, and other information required by the Department of Commerce. Four sets of plans are required to be prepared and furnished to the Engineer by the electrical contractor.
    2. Copy of the fire alarm system control panel and device shop drawings. Four sets are required to be prepared and furnished to the Engineer by the electrical contractor.
    3. Fire alarm system voltage drop calculations and standby battery calculations. Four sets of calculations are required to be prepared and furnished to the Electrical Engineer by the electrical contractor.
    4. One set of fire alarm system specifications. Provided by the Electrical Engineer.
    5. Additional information required by the Department of Commerce relating to the specific system to be installed, system wiring requirements, calculations, or other components shall be prepared and furnished to the Engineer by the electrical contractor.
    6. Application for Approval to be completed and submitted by the Engineer.
    7. Permit approval fees: Paid by the Owner.

B. Contractor shall note the fire alarm system approval documents shall be submitted and approved prior to the installation of the system.

1.8 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: For duration of project, maintain at project site copy of each referenced document that prescribes execution requirements; bound together. Also, NFPA 72, relevant portions of other applicable codes, and instructions and guidelines of AHJ. Include in submittals upon completion.

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B. Designer Qualifications: NICET Level III (three) or Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.

C. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.
   1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least two years of experience installing fire alarm systems.
   3. Supervisor: Level III (three) or Level IV (four) certified fire alarm technician; furnish name and address.

D. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

F. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to AHJ.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

C. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify engineer and obtain direction before proceeding with work.

1.10 WARRANTY

A. Fire Alarm Control Units and Accessory Equipment: Provide minimum 3-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

B. Fire Alarm Manual Pull Stations: Provide minimum 1-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Fire Alarm System Detectors: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

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PART 2 PRODUCTS

2.1 FIRE ALARM SYSTEM

A. General Requirements:
1. Provide new fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. 36 CFR 1191 and ADA Standards.
   b. Requirements of AHJ.
   c. Applicable local codes.
   d. Contract Documents.
   e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
3. Fire Alarm System Products:
   a. Listed, classified, and labeled as suitable for purpose intended.
   b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
4. Fire Alarm System Design Information:
   a. Building Code: Comply with applicable building code.
      1) Principle Occupancy: As indicated on Architect code summary drawings.
      2) Principle Use: As indicated on Architect code summary drawings.
      3) Elevators: As indicated on Performance Elevator Consulting drawings and specifications..
      4) Fire Suppression System: Unsprinkled.
         a) Types:
         b) Elevator Hoistway: Provide detection, actuation, and dedicated annunciation for unsprinklered hoistways in accordance with NFPA 72.
   b. NFPA 72 Fire Alarm System Classification: Public emergency alarm reporting; auxiliary system.
   c. Smoke and Heat Detector Coverage: Partial or selective coverage in accordance with NFPA 72.
5. Provide fire alarm circuits in accordance with NFPA 70.
   a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
   b. Power Sources:
      1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
      2) Primary: Dedicated branch circuits from facility power distribution system.
      3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
   c. Wiring and Wiring Methods:
      1) General Requirements:
         a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.

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b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.
c) Special Occupancies: Comply with NFPA 70.
d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.

2) Fire Alarm Circuits:
a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.
b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
(1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
c) Power-Limited Fire Alarm (PLFA) Circuits:
(1) Provide identification for PLFA circuits in accordance with NFPA 70.

3) Fire-Rated Cables and Cable Systems:
a) Performance alternative approved by AHJ.
b) Provide cable fastening and listing requirements in accordance with NFPA 70. Provide indication of application, use cases, and product make and model for which listing applies.
c) Provide additional classification suffix marking on cable system; observable by AHJ.
d) ECS: Provide two-hour fire-rated protection for control equipment and circuits in accordance with NFPA 72.
e) Fire-Rated Cable in Accordance with NFPA 72:

6. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.
b. Pathway Class Designations:
1) Unless otherwise indicated or required, pathways to meet the following requirements:
a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

B. Fire Alarm System Interfaces and Control Functions:
1. UL 864 listed unless otherwise indicated.
2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.
5. Elevators:
a. Comply with ASME A17.1.
b. Elevator Shutoff:
1) For each elevator, provide output signal to stop elevator via addressable relay module and power isolation relay.

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c. Elevator Emergency Recall Operation:
   1) Elevator Lobby, Hoistway, and Machine Room Smoke Detectors: Elevator recall for fire fighters' service.
   2) In each elevator machine room, provide interface for each elevator car or group of elevator cars as determined by AHJ via separate addressable relay modules for each output signal below, where applicable.
      a) Recall elevator to designated (primary) level.
      b) Recall elevator to alternate level.
      c) Smoke detection in elevator machine room (fire fighter's hat light).

2.2 FIRE ALARM CONTROL UNITS AND RELATED EQUIPMENT

A. Fire Alarm Control Units and Related Equipment: Listed and labeled as complying with UL 864.

B. Provide cabinets and enclosures as indicated or as required to house system components.

C. Fire Alarm Control Unit (FACU): Addressable.
   1. SLCs and IDCs: Configurable for Class B or Class A with additional modules.
   2. NACs: Integral and programmable with synchronization modules or cards as required.
   3. Power Supply: 120 VAC, 60 Hz, supplying necessary power for FACU.
   4. User-Interface: Touchscreen display for system interfacing and service mode settings, include password and user credentials; configurable for custom actions and incorporates historical event log.
   5. Support self-testing detector capability.
   6. Remote Annunciator Support: Up to 10.

D. Basis of Design - Addressable Fire Alarm Control Unit (FACU): Honeywell International, Inc; Honeywell Gamewell-FCI; E3 Series Fire Alarm Panel; www.honeywell.com/#sle.
   1. System Capacity: Support up to 318 devices (159 detectors and 159 modules) on two integrated SLC loops; two NACs; Gamewell-FCI Model ILI-MB-E3 motherboard; Gamewell-FCI Model ILI-S-E3 intelligent loop expanders add two SLE loops; RS-485 panel bus modules connect up to 16 panels within 3,000 feet of FACU.
   2. Features: Panel LCD keypad system display; strobe synchronization; auto programming; 8,100 event history log; Boolean logic functions (AND, OR, XOR, NOT, TIMING, COUNT, and SCHEDULE); releasing up to eight independent hazards; UL 864-listed for post-fire smoke removal and active smoke control.
   3. Networking:
      a. Network Communications Circuit Serving Network Nodes: Interconnected using twisted pair copper wire media and required converters. Network nodes communicate in peer-to-peer fashion with other panels in system; up to 64 nodes. Provide Gamewell-FCI Model RPT-E3-UTP network repeater.
      b. Network nodes communicate in peer-to-peer fashion with all other panels in system. Loop interface modules incorporate dedicated programming, log functions, central processor unit, and control-by-event (CBE) programming. If loop becomes disabled, each remaining loop driver continues to communicate with remainder of network and maintain normal operation.
      c. Provide connected life safety services (CLSS) gateway for field programming and network connectivity. Include cloud-based inspection and test report delivery.

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4. Remote Interface Displays: Provide network graphic display, color touchscreen display, and panel LCD keypad display.

E. Emergency Communications System (ECS):
1. Comply with NFPA 1225.
2. Amplifiers listed and labeled as complying with UL 1711.
3. FACU Listed for ECS:
   a. Provide digitalmulti-channel ECS integrated with FACU and capable of automatic and manual paging, messaging, evacuation, and alerting on selective and all-call basis.
   b. Provide all-call and total evacuation necessary switch points of command, manual controls of evacuation and paging, per zone, prerecorded messaging for nonemergency voice notifications, door unlock provisions, and commands for speaker bypass, unless otherwise approved by Engineer and AHJ.
   c. Provide minimum of six switch points of command for speaker bypass, visual bypass, elevator recall bypass, door control bypass, HVAC bypass, and auxiliary bypass.
   d. Local and Remote Transponders:
      1) Audio hardware, including multiple primary and backup amplifiers, speaker circuit interfaces, power supplies, supervision hardware, cabinets, and battery backup systems may be configured to support multiple notification zones and packaged as audio transponders.
      2) Transponders considered system control equipment and located, installed, and interfaced accordingly.
      3) Provide firefighter's telephone or other ECS in accordance with NFPA 72.

F. Alarm Communication:
1. Public Emergency Alarm Reporting Systems:
   a. Provide accessories as required for interface as indicated and as required by AHJ.
   b. Provide municipality-approved master box with quantity of interface zones, coding, and timing as required by AHJ.
   c. Interface with FACU utilizing supervised wiring to relay modules with quantity of contacts as required for interface zones.

2.3 FIRE ALARM SYSTEM INITIATING DEVICES

A. Manufacturers:
1. Source Limitations: Furnish initiating devices produced by same manufacturer as FACUs where possible.

B. General Requirements:
1. Addressable Systems:
   a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.
   b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly permitted to be connected together as one zone, provide separate addressable monitoring point for each device in order to be individually identifiable by addressable FACU.

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2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.

C. Manual Fire Alarm Boxes/Pull Stations:
1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.

D. Spot-Type Detectors:
1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
3. Smoke Detectors:
a. Listed and labeled as complying with UL 268.
b. Provide sensor type (e.g., photoelectric, ionization) as indicated.

2.4 WIRE AND CABLE

A. General Requirements:
1. Comply with NFPA 70 listing and marking requirements for cables.
2. Provide cables as indicated or as required for connections between system components.
a. Data Cables for IP Network Connections: Unshielded twisted pair (UTP) complying manufacturer's minimum requirements.

2.5 ACCESSORIES

A. Provide components as indicated or as required for connection of fire alarm system to devices and other systems indicated.

B. Provide EoL resistors as required for wiring supervision.

C. Protective Covers for Fire Alarm Devices:
1. Listed to same standard as device being protected.
2. Outdoor Covers: Weather resistant, suitable for outdoor use; use only with outdoor-rated devices.

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3. Provide guards to protect devices where subject to mechanical damage; listed for use with detector.
    a. Protective Covers for Manual Pull Stations:
        1) Provide protective covers with hinged access for manual pull stations where indicated.
        2) Listed and labeled as complying with UL 38.
    b. Protective Covers for Detectors:
        1) Use only with specific devices approved under listing.

D. Framed Passive Graphic Maps:
1. Provide passive graphic maps, size as indicated or as required by AHJ.
2. Identify information required by AHJ, including the following:
    a. Location of FACUs and remote annunciators.
    b. Addressable Systems: Location of addressable initiating devices; identify room/area.
    c. Current location, labeled "YOU ARE HERE."
    d. North reference.
3. Utilize nomenclature consistent with FACU programming and device identification labels.
4. Provide concealed mounting hardware.

E. Battery Tester:
1. Provide listed equipment rated for VDC, VAC, and fire alarm system maximum amperage capacity, in-rush conditions, and correction factors.
2. Provide battery capacity tester.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that system capacities listed in manufacturer instructions align with designed system.

B. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.

C. Verify ratings, configurations, and characteristics of system components.

D. Verify rough-ins for field connections.

E. Verify that work likely to damage fire alarm system has been completed.

F. Verify that interior of building has been protected from weather.

G. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.

H. Verify that system bonding is in accordance with Section 26 05 26.

I. Do not energize system until deficiencies have been corrected.

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J. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.2 PREPARATION

A. Prior to installation, confirm environment of installation area is clean, and with ambient temperature, humidity, and ventilation requirements are per manufacturer's written instructions.
   1. Clean and vacuum in accordance with manufacturer's written instructions. Confirm equipment ventilation holes are absent of obstructions and free for air flow.
   2. Clean pathways thoroughly to remove foreign materials before installing conductors and cables.
   3. Clean dirt, debris, plaster, and other foreign materials from equipment enclosures, cabinets, and outlet boxes.
   4. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Follow tool requirements for installation, including torquing adjustments, as listed in manufacturer documentation.

C. Remove detector dust covers prior to system energization.

3.3 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:

B. Field Locations:
   1. Obtain Owner's approval of locations of devices and notification appliances before installation.
   2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
   3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.

C. Raceways and Supports:
   1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
   2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
   3. Install firestopping to preserve fire resistance rating of partitions and other elements.
      a. Minimum height for pathways to pass through floor or wall, if cable fastening is required, and routing in elevator hoistways in accordance with NFPA 70.

D. Wiring and Connections:
   1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
   2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.

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3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
5. Provide grounding and bonding in accordance with Section 26 05 26.
6. Comply with manufacturer's minimum cable sizes or ratings.
7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
8. Provide network wiring in accordance with NFPA 70.
9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
10. Fire-Rated Cables and Cabling Systems: Comply with listing requirements to maintain installation, including aspects of attachment surfaces, specific products, and requirements associated with vertical and horizontal routing.
11. See manufacturer's instructions for batteries.

E. Fire Alarm System Components:
1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
   a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.
3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

F. Branch Power:
1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.

G. System Identification:
1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 26 05 53.
2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
3. Mark location of disconnecting means for NPFLA circuits.
4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:

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1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:
1. Perform required tests of NFPA 72. Record measured values during operational checks.
2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.

C. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.

D. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

E. Inspect and test in accordance with manufacturer's instructions.

F. Inspect wiring and components for damage and defects.

G. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.

H. Perform additional requirements related to testing and inspection during system startup.

I. Test for interface with other systems.

J. Test shunt trips to verify operation.

K. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

M. Diagnostic Period: After successful completion of inspections and tests, operate system to normal mode for at least 14 days without system or equipment malfunctions.

3.5 SYSTEM STARTUP

A. Obtain Owner approval prior to performing system startup.

3.6 ADJUSTING

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A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust initiating device and notification appliance settings to achieve desired operation as indicated in submittals.

C. Measure power supply primary and secondary voltages, log values for records, and make appropriate adjustments.

D. Adjust alignment of equipment covers and doors. Provide keys and spare keys to Owner.

E. Reprint and reinstall damaged or misinstalled labels; maintain neat and square to installed location good workmanship - see NECA 1; maintain consistent placements for identification on products of similar type.

F. Adjust devices or notification appliances and associated bases to be flush and level.

G. Program system parameters according to requirements of Owner.

3.7 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. See Section 01 74 19 - Construction Waste Management and Disposal for field-generated construction waste requirements.

C. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.

D. Clean and repair existing materials and equipment that remain or are indicated for reuse.

E. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.

F. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.

G. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.

H. Repair scratched or marred exposed surfaces to match original factory finish.

I. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.8 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

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B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.

E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.

G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without system or equipment malfunctions.
   1. Record system operations and malfunctions.
   2. If malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.9 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Factory Instruction: At FACU manufacturer's authorized training facility.

B. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: One session precloseout.

C. Maintenance Technicians: Detailed training for electrical technicians on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, precloseout.

D. Use operation and maintenance documentation as primary instruction material; have paper copies available for attendees and supplement training material aids.

3.10 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals for additional submittals.

B. See Section 01 79 00 - Demonstration and Training for additional requirements.

C. Closeout Demonstration: Demonstrate operation of all functions to Owner.

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1. Be prepared to conduct any of required tests.
2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of FACU manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
5. Repeat demonstration until successful.

D. Occupancy will not occur prior to Substantial Completion.

E. Substantial Completion of project cannot be achieved until inspection and testing is successful and the following:
1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of fire alarm system has been given by AHJ.
6. Occupancy permit has been granted.
7. Specified precloseout instruction is complete.

3.11 PROTECTION

A. Protect installed fire alarm system from subsequent construction operations.

3.12 MAINTENANCE

A. Provide to Owner as alternate to base bid separate maintenance contract for service and maintenance of fire alarm system for entire warranty period to include work described below; include complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with detailed schedule.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond control of maintenance contractor.
3. Record keeping required by NFPA 72 and AHJ.

C. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within two hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.

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E. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28 46 00

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