PROJECT MANUAL

PROJECT NO. OEMA-2025-046

Generator Replacement
25B-2431
WINNEBAGO COUNTY JUVENILE DETENTION CENTER
Rockford, Illinois

OLLMANN ERNEST MARTIN ARCHITECTS
200 South State Street
Belvidere, Illinois 61008
815-544-7790 Phone

PROJECT MANUAL

PROJECT NO. OEMA – 2025-046

Generator Replacement
25B-2431
Winnebago County
Juvenile Detention Center
5350 Northrock Dr.
Rockford, Illinois 61103

A SINGLE CONTRACT FOR:
ELECTRICAL WORK

OLLMANN ERNEST MARTIN ARCHITECTS
200 SOUTH STATE STREET
BELVIDERE, ILLINOIS 61008

August 5, 2025

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END OF DOCUMENT 000111

Winnebago County - Purchasing Department

404 Elm Street Room 202

Rockford, Illinois 61101

(815)319-4380 Purchasing@purchasing.wincoil.gov

INVITATION FOR BIDS	**25B-2431**	**ISSUE DATE**	**08/19/2025**
IFB TITLE	**GENERATOR REPLACEMENT – JUVENILE DETENTION CENTER**		
IFB DUE DATE	**09/18/2025**	**DUE TIME (CST)**	**10:00 AM**
SUBMIT ONE (1) ORIGINAL, PLUS ONE (1) COPY		**BOND REQUIRED:**	**NONE**

You are hereby invited to submit your Bid for **GENERATOR REPLACEMENT – JUVENILE DETENTION CENTER**. The completed original Bid solicitation, and the required number of copies, must be received in a sealed envelope that has your name and address in the UPPER left corner and the attached **Bid Return Label** filled in and attached on the LOWER left corner.

Bids must be delivered by the date and time listed under Schedule of Events to:

Winnebago County Purchasing Department
404 Elm Street - Room 202
Rockford, IL 61101

OVERVIEW OF THE COUNTY OF WINNEBAGO

The County of Winnebago is a unit of local government in the State of Illinois with a current population of almost 300,000 as estimated by the US Census Bureau, within its 519 square miles. It is the 7th most populous County in Illinois. The governing body is the County Board, which is comprised of twenty members. The County has eighteen (18) constructed facilities in various locations totaling approximately 1,684,230 SF.

BID AWARD CRITERIA

The Base Bid for **GENERATOR REPLACEMENT – JUVENILE DETENTION CENTER** will be awarded to the lowest responsive, responsible Bidder/Contractor meeting specifications.

Mandatory Pre-Bid Meeting Location:
Winnebago County Juvenile Detention Center
5350 Northrock Dr. Rockford, IL 61103

GENERAL REQUIREMENTS

This is an Invitation for Bid. Bids will be opened and read aloud publicly on the Bid Opening Due Date and Time.

WHERE TO FIND THE SOLICIATION AND ANY ADDENDA

The solicitation and any addenda can be obtained at the County's official site for all Bids: https://wincoil.gov/departments/purchasing-department

SUBMISSION DATE AND TIME

No later than 10:00 AM (CST) on **Wednesday, September 18, 2025**— Bids received after the submittal time will be rejected. (Refer to Schedule of Events)

CONTACT PERSON: Kathy Clausen, Purchasing Coordinator purchasing@purchasing.wincoil.gov

SCHEDULE OF EVENTS

08/19/2025	IFB Solicitation is made available 10:00 AM
08/26/2025	**MANDATORY PRE-BID MEETING AND SITE VISIT AT 2:00 PM** 5350 Northrock Dr. Rockford, IL 61103
09/02/2025	Questions emailed to purchasing@purchasing.wincoil.gov by 4:00 PM
09/09/2025	Questions answered via Addendum sent and posted on website by 4:00 PM

09/18/2025	IFB submittals due by 10:00 AM

SUBMITTAL CHECKLIST REMINDERS

√	BID SUBMITTAL CHECKLIST
1.	Submit one (1) Original signed Bid, plus one (1) copy
2.	Bid Pricing & Schedule
3.	Bid Form
4.	Responsible Bidder for Public Works Projects – Provide appropriate certificate
5.	Business References Form
6.	Bidder's Subcontractor Form
7.	Bid Exception Form
8.	Use of the Bid Return Label

SECTION ONE: GENERAL CONDITIONS

AMERICANS WITH DISABILITIES ACT

The Bidder will comply with all applicable provisions of the Americans with Disabilities Act (Public Law 101-336, 42 USC 12101-12213) and all applicable Federal Regulations under the Act, including 28 CFR Parts 35 and 36.

CANCELLATION

The County of Winnebago reserves the right to cancel any Contract in whole or in part without penalty due to failure of the Bidder to comply with terms, conditions and specifications of their awarded Contract.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

The Bidder certifies, by submission of this Bid or acceptance of this Contract, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency. It further agree~~s~~ by submitting this Bid that it will include this clause without modification in all lower tier transactions, solicitations, bids, contracts, and subcontracts. Where the Bidder or any lower tier participant is unable to certify to this statement, it shall attach an explanation in their bid response.

Additionally, for all new Bidder's and Bidder's to be paid, the Purchasing Department will review the Federal and State Excluded Parties List System prior to requesting the Bidder be created in our accounting system.

CHANGES

The County of Winnebago reserves the right to make any desired change in the specifications after the same shall have been put under contract; but the change so made, with the price to be added or deducted from the contract price, therefore, shall be agreed upon in advance between County and the successful Bidder.

The Purchasing Department shall issue to the successful Bidder a written change order to the original contract; such change orders shall be binding upon both parties thereto and shall in no way invalidate or make void the terms of the original contract not modified by such change.

COMMENCEMENT OF WORK

The successful Contractor must not commence any billable work prior to the County's execution of the contract, issuance of a purchase order or until all required documents have been submitted. Work done prior to these circumstances shall be at the Contractor's risk.

COMPLIANCE WITH LAWS

All services, work and materials that in any manner affect the production, sale, or payment for the product or service contained herein must comply with all Federal, State, County and Municipal laws, statutes, regulations, codes, ordinances and executive orders in effect now or

later and whether or not they appear in this document, including those specifically referenced herein. The successful Bidder must be authorized to do business in the State of Illinois, and must be able to produce a Certificate of Good Standing with the State of Illinois upon request.

The Bidder must obtain all licenses, certificates and other authorizations required in connection with the performance of its obligations hereunder, and Bidder must require any and all Subcontractors to do so. Failure to do so is an event of disqualification and/or default and may result in the denial of this Bid and/or termination of this Agreement.

In the event Federal or State funds are being used to fund this Contract, additional certifications, attached as addenda, will be required. Lack of knowledge on the part of the Bidder will in no way be cause for release of this obligation. If the County becomes aware of violation of any laws on the part of the Bidder, it reserves the right to reject any Bid, cancel any Contract and pursue any other legal remedies deemed necessary.

COST OF THE BID

Expenses incurred in the preparation of Bids in response to this IFB is the Bidder's sole responsibility. There is no expressed or implied obligation by the County to reimburse any individual or firm for any costs incurred in preparing or submitting Bids, providing additional information when requested by the County, or for participating in any selection interviews.

DISPUTES

In case of disputes as to whether or not an item or service quoted or delivered meets specifications, the decision of the Director of Purchasing, or authorized representative, shall be final and binding to all parties.

ENTIRE AGREEMENT

These Standard Terms and Conditions of the Bid shall apply to any contract or order awarded as a result of this Bid except where special requirements are stated elsewhere in the Bid; in such cases the special requirements shall apply. Further, the written contract and/or order with referenced parts and attachments shall constitute the entire agreement and no other terms and conditions in any document, acceptance, or acknowledgement shall be effective or binding unless expressly agreed to in writing by the contracting authority.

DEVIATIONS, EXCEPTIONS OR ALTERNATES

Deviations, exceptions or alternates from terms, conditions, or specifications shall be described fully, on Bidder's letterhead, signed, and attached to the Invitation for Bid. In the absence of such statement, the Bid shall be accepted as in strict compliance with all terms, conditions, and specifications and the Bidder shall be held liable. Bidders are cautioned to avoid making deviations and exceptions to the specifications, which may result in rejection of their Bid. If deviations, exceptions or alternates are submitted, it is the County Director of Purchasing's sole and final decision whether specifications have been met and will be considered for award.

FREEDOM OF INFORMATION

Any responses and supporting documents submitted in response to a Bid will be subject to disclosure under the Illinois Freedom of Information Act. The County will assume that all information provided in a Bid is open to inspection or copying by the public unless clearly marked with the appropriate exception that applies under the Freedom of Information Act.

Additionally, if providing documents that you believe fall under an exception to the Freedom of Information Act, please submit both an un-redacted copy along with a redacted copy which has all portions redacted that you deem to fall under a Freedom of Information Act exception.

GOVERNING LAWS AND REGULATIONS

The Bidder is required to be familiar with and shall be responsible for complying with all Federal, State, and local laws, ordinances, rules, and regulations that in any manner affect the work. Knowledge of occupational license requirements and obtaining such licenses for the County of Winnebago and municipalities within the County are the responsibility of the Bidder.

HOLD HARMLESS CLAUSE

The Bidder covenants and agrees to indemnify, hold harmless and defend the County of Winnebago, its Board members, officers, employees, agents and servants from any and all claims for bodily injury, including death, personal injury, and property damage, including damage to property owned by County, and any other losses, damages, and expenses of any kind, including attorneys' fees, costs and expenses, which arise out of, in connection with, or by reason of services provided by the Bidder or any of its Sub-consultant(s) in any tier, occasioned by the negligence, recklessness, or intentionally wrongful conduct of the Bidder, or its Sub-consultant(s) in any tier, their officers, employees, servants or agents. In the event that the completion of the project (to include the work of others) is delayed or suspended as a result of the Bidder's failure to purchase or maintain the required insurance, the Bidder shall indemnify the County from any and all increased expenses resulting from such delay.

Should any claims be asserted against the County by virtue of any deficiency or ambiguity in the plans and specifications provided by the Bidder, the Bidder agrees and warrants that Bidder shall hold the County harmless and shall indemnify it from all losses occurring thereby and shall further defend any claim or action on the County's behalf.

INDEMNITY

The Bidder shall, at all times, fully indemnify, hold harmless, and defend the County of Winnebago and their officers, agents, and employees from and against any and all claims and demands, actions, causes of action, and cost and fees of any character whatsoever made by anyone whomsoever on account of or in any way growing out of the performance of this Contract by the Bidder and its employees, or because of any act or omission, neglect or misconduct of the Bidder, its employees and agents or its Subcontractors including, but not limited to, any claims that may be made by the employees themselves for injuries to their person or property or otherwise, and any claims that may be made by the employees themselves or by the Illinois Department of Labor for the Bidder's violation of the Illinois Prevailing Wage Act (820 ILCS 130/1 et seq.).

Such indemnity shall not be limited by reason of the enumeration of any insurance coverage or bond herein provided. Nothing contained herein shall be construed as prohibiting the County of Winnebago and their officers, agents, or its employees, from defending through the selection and use of their own agents, attorneys and experts, any claims, actions or suits brought against them.

The Bidder shall likewise be liable for the cost, fees and expenses incurred in the County of Winnebago's or the Bidder's defense of any such claims, actions, or suits. The Bidder shall be responsible for any damages incurred as a result of its errors, omissions or negligent acts and for any losses or costs to repair or remedy construction as a result of its errors, omissions or negligent acts.

NON-COLLUSION

The Bidder, by its officers, agents or representatives present at the time of filing this IFB, say that neither they nor any of them, have in any way directly or indirectly, entered into any arrangement or agreement with any other Bidder's, or with any public officer of the County of Winnebago, Illinois, whereby, the Bidder has not paid or is to pay to such Bidder or public officer any sum of money, anything of value or has not directly or indirectly entered into any arrangement or agreement with any other Bidder(s). Whereby, no inducement of any form or character other than that which appears upon the face of the IFB will be suggested, offered, paid or delivered to any person whomsoever to influence the acceptance of the said IFB or understanding of any kind whatsoever, with any person whomsoever to pay, deliver to, or share with any other person in any way or manner, any of the proceeds on the Contract sought by this IFB.

PROMPT PAYMENT ACT

The Bid should provide that all payments are subject to Local Governmental Prompt Payment Act.

PROTEST

Firms wishing to protest any IFB and/or awards shall notify the Director of Purchasing in writing within five (5) calendar days after the IFB due date/opening. The notification should include the IFB number, the name of the firm protesting and the reason why the firm is protesting the IFB. The Director of Purchasing will respond to the protest within five (5) calendar days.

RESERVATION OF RIGHTS

The County of Winnebago reserves the right to reject any or all Bids failing to meet the County specifications or requirements and to waive technicalities. If, in the County's opinion, the lowest Bid is not the most responsible Bid, considering value received for monies expended, the right is reserved to make awards as determined solely by the judgment of the County. Intangible factors, such as the Bidder's reputation and past performance, will also be weighed.

The Bidder's failure to meet the mandatory requirements of the IFB will result in the disqualification of the Bid from further consideration.

The County further reserves the right to reject all Bids and obtain goods or services through intergovernmental or cooperative agreements, or to issue a new and revised IFB.

Submission of a Bid confers no rights on the Bidder to a selection or to a subsequent Contract. All decisions on compliance, evaluation, terms and conditions shall be made solely at the County of Winnebago's discretion and shall be made in the best interest of the County.

RESPONSIBLE BIDDER FOR PUBLIC WORKS PROJECTS

A person (firm) who has the capability in all respects to perform fully the public works contract requirements, and the experience, personnel, reliability, facilities capacity, equipment, acceptable past performance and credit which will assure good faith performance. Responsible bidder for Public Works Projects means a bidder for public works projects advertised, awarded, and financed, in whole or in part, with county public funds, who meets all of the job specifications, including the following applicable criteria. Evidence of compliance is required for public works projects estimated to be over bidding threshold in value.

1. Certificates of insurance indicating the following coverages: general liability, workers' compensation, completed operations, and vehicle. Performance bonds, as required.
2. To qualify as a Responsible Bidder for Public Works Projects exceeding $30,000.00, or as defined in the most current Illinois Compiled Statutes for small purchases, the Responsible Bidder and Subcontractors must be a member of an organization that participates in an active apprenticeship and training programs approved and registered with the U.S. Department of Labor's Office of Apprenticeship and Training, or its successor, for each of the trades of work contemplated under the awarded contract. The required evidence shall include, but is not limited to, a copy of all applicable apprenticeship standards or Apprenticeship Agreement(s) for any apprentice(s) who will perform work on the public works project. Said requirements may also be satisfied if the Responsible Bidder and Subcontractors are active members of the Northwestern Illinois Building and Construction Trades Council or the Associated Builders and Contractors.
3. Compliance with all provisions of the Illinois Prevailing Wage Act, 820 ILCS 130/0.01 *et seq*. All contractors and sub-contractors, as determined by the contract, are required to turn in certified payrolls as specified in Illinois Public Act 94-0515, and follow all provisions of the Employee Classification Act, 820 ILCS 185/1 *et seq.*
4. Disclosure of the name and address of each subcontractor from whom the contractor has accepted a bid and/or intends to hire on any part of the project prior to the subcontractor commencing work on the Public Works project.
5. All bidders must provide three (3) projects of a similar nature as being performed in the immediate past five (5) years with the name, address, email, and telephone number of the contact person having knowledge of the project or three (3) references (name, address, email, and telephone number) with knowledge of the business practices of the contractor.

The provisions contained in the definitions of "*Responsible Bidder*" and "*Responsible Bidder for Public Works Projects*" shall not apply to grant, state or federally funded construction projects or

Illinois Department of Transportation projects if such application would jeopardize the receipt or use of federal, state or grant funds in support of such project.

SUBSTANCE ABUSE PREVENTION

The Substance Abuse Prevention on Public Works Act, Public Act 95-0635, prohibits the use of drugs and alcohol, as defined in the Act, by employees of the contractor and by employees of all approved subcontractors while performing work on a public works project. The contractor/subcontractor hereby certifies that it has a superseding collective bargaining agreement or makes the public filing of its written substance abuse prevention program for the prevention of substance abuse among its employees who are not covered by a collective bargaining agreement dealing with the subject as mandated by the Act.

Bidders and their subcontractors (if applicable) certifies that the entity has signed collective bargaining agreements that are in effect for all of its employees, and that deal with the subject matter of Public Act 95-0635, or certifies that the contracting entity has in place for all of its employees not covered by a collective bargaining agreement a written substance abuse prevention program that deals with subject of the Act, and will attach the substance abuse prevention program that meets or exceeds the requirements of Public Act 95-0635.

TERMINATION, CANCELLATION AND DAMAGES

The County may terminate based on the Bidder's breach or default. Unless the breach or default creates an emergency, as determined in the County's sole discretion, the Bidder shall be given notice and a five (5) day opportunity to cure before the termination becomes effective.

If the County terminates this Contract because of the Bidder's breach or default, the County shall have the right to purchase items or services elsewhere and to charge the Bidder any additional cost incurred, including but not limited to the cost of cover, incidental and consequential damages and the cost of re-bidding. The County may offset these additional costs against any sums otherwise due to the Bidder under this Bid or any unrelated Contract.

The County of Winnebago may terminate any Contract or agreement resulting from this IFB at any time for any reason by giving at least thirty (30) days' notices in writing to awarded Bidder. If the Contract is terminated by the County as provided herein, the Bidder will be paid a fair payment as negotiated with the County for the work completed as of the date of termination.

BIDDER'S RESPONSIBILITY FOR SERVICES PROPOSED

The Bidder must thoroughly examine and will be held to have thoroughly examined and read the entire IFB document. Failure of Bidder's to fully acquaint themselves with existing conditions or the amount of work involved will not be a basis for requesting extra compensation after the award of a Contract.

WITHDRAWAL OF BIDS

Bids may be modified or withdrawn by an authorized representative of the Bidder or by formal written notice prior to the final due date and time specified for Bid submission. Submitted Bids will become the property of the County of Winnebago after the Bid submission deadline.

However, no Bidder shall withdraw or cancel their Bid for a period of sixty (60) days after said advertised closing time for the receipt of Bids; the successful Bidder shall not withdraw or cancel

their Bid after having been notified by the Director of Purchasing that said Bid has been accepted by the County Board.

The Bidder, by signing the Bid Form, acknowledges, understands and abides by all of the above "Requirements for Bidding and Instructions to Bidders".

END OF SECTION ONE: GENERAL CONDITIONS

SECTION TWO: INSTRUCTION TO BIDDERS

1.1 INTRODUCTION/BACKGROUND

The Winnebago County Purchasing Department is seeking bid prices for Generator Replacement at the Juvenile Detention Center, 5350 Northrock Dr., Rockford, IL 61103.

1.2 COPIES OF IFB DOCUMENTS

- Only complete sets of IFB solicitation documents should be used for preparing bids. The County does not assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets.
- Complete set of IFB documents must be obtained on the County's website at: https://wincoil.gov/departments/purchasing-department
- Submitted Bids MUST include all forms and requirements as called for in the Invitation for Bids. Failure to include all necessary forms and licenses will result in a non-responsive bid.

1.3 EXAMINATION OF IFB DOCUMENTS

- Each Bidder shall carefully examine the IFB and other documents, and inform himself thoroughly regarding any and all conditions and requirements that may in any manner affect cost, progress, or performance of the work to be performed under the bid. Ignorance on the part of the Bidder shall in no way relieve him/her of the obligations and responsibilities assumed under the bid.
- Should a Bidder find discrepancies or ambiguities in, or omissions from, the specifications, or should he/she be in doubt as to their meaning, he/she shall at once notify the County by email at purchasing@purchasing.wincoil.gov by the **Schedule of Events deadline.**

1.4 INTERPRETATIONS, CLARIFICATIONS, AND ADDENDA

No oral interpretations will be made to any Bidder as to the meaning of the documents. Any inquiries or requests for interpretation must be received ***in writing*** **by the date specified, in the Schedule of Events,** emailed to purchasing@purchasing.wincoil.gov

All such changes or interpretation will be made in writing in the form of an addendum and, if issued, shall be posted on the County's website no later than five (5) business days prior to the established Bid due date. It shall be the Bidder's sole responsibility thereafter to find and download the addendum.

Each Bidder MUST acknowledge receipt of such addenda on the Bid Signature Form. All addenda are a part of the documents and each Bidder will be bound by such addenda, whether or not received by him/her. It is the responsibility of each Bidder to verify that he/she has received all addenda issued before bids are opened.

1.5 PREPARATION OF BIDS

Signature of the Bidder: The Bidder must sign the bid forms in the space provided for the signature. If the Bidder is an individual, the words "Doing Business As", or "Sole Owner" must appear beneath such signature. In the case of a Partnership, the signature of at least one of the partners must follow the firm name and the words "Member of the Firm" should be written beneath such signature.

If the Bidder is a limited liability company, the title of person signing the Bid on behalf of the limited liability company must be stated and evidence of his authority to sign the Bid must be submitted.

1.6 SUBMISSIONOFBIDS

A. Bids shall be submitted to the County of Winnebago at the designated location not later than the time and date for receipt of bids indicated in the IFB solicitation, or any extension thereof made by Addendum. The County's representative authorized to open the bids will decide when the specified time has arrived and no Bids received thereafter will be considered. Bids received after the time and date for receipt of Bids will be returned unopened.
B. Winnebago County Purchasing Department receives bids by paper only. Please DO NOT email or fax bids.
C. Each Bidder shall submit with his Bid the required evidence of his qualifications and experience.

1.7 REQUIRED COUNTY FORMS

Bidder shall complete and execute the forms specified in the IFB (Bid Signature Form and References), failure to provide executed documents may result in Bidder being determined to be not fully responsive to the IFB.

1.8 MODIFICATION OF BIDS

Written modification will be accepted from firms if addressed to the entity and address indicated in the Request for Bids and received prior to Bid due date and time. Prior to the time and date designated for receipt of Bids, any Bid submitted may be modified by delivery to the County Purchasing Department of a complete Bid as modified.

All emails shall be marked "Modified Bid" delivery shall comply with requirements for the original bid.

1.9 RESPONSIBILITY FOR BID

The Bidder is solely responsible for all costs of preparing and submitting the bid, regardless of whether a contract award is made by the County. *Unless otherwise specified by the Bidder, the County has no less than one hundred twenty (120) day to make a final selection.*

1.10 RECEIPT AND OPENING OF BIDS

The properly identified Bids received on time will be opened by the County Purchasing Department. Any Bid not received by the Purchasing Department on or before the deadline for receipt of bids designated in the solicitation or Addendum(s) will not be opened.

1.11 AWARD OF CONTRACT

A. The County reserves the right to waive any informality in any bid, or to re-advertise for all or part of the work contemplated. If bids are found to be acceptable, written notice will be given to the selected Bidder of the award of the contract. The County reserves the right to reject any and all bids.

B. If the award of a contract is annulled, the County may award the contract to another Bidder(s), or the work may be re-advertised or may be performed by other qualified personnel as the County decides.

C. A contract will be awarded to the Bidder(s) deemed to provide the services which are in the best interest of the County.

D. The County also reserves the right to reject the bid of a Bidder who has previously failed to perform properly or to complete contracts of a similar nature on time.

1.12 SUBCONTRACTORS

If applicable all subcontractors shall be identified on the form contained herein. Contractor shall require that the subcontractor comply with all Prevailing Wage Act requirements. The County of Winnebago reserves the right to reject any or all subcontractors.

1.13 ACCURACY DISCLAIMER

The Contractor shall thoroughly acquaint himself with the services required for the bid to fully understand the facilities, difficulties and restrictions attending to the execution of the bid. The Contractor will be allowed no additional compensation for his failure to be so informed.

1.14 CERTIFICATE OF INSURANCE AND INSURANCE REQUIREMENTS

The Bidder shall be responsible for all necessary insurance coverage as indicated below. Certificates of Insurance must be provided to the County of Winnebago within fifteen (15) days after award of contract or acceptance of the bid, with the County of Winnebago listed as additional insured as indicated. If the proper insurance forms are not received within the fifteen (15) day period, the contract may be awarded to the next selected Bidder/Bidder. Policies shall be written by companies licensed to do business in the State of Illinois and having an agent for service of process in the State of Illinois. Companies shall have an A.M. Best rating of VI or better.

INSURANCE	MINIMUM ACCEPTABLE LIMITS OF LIABILITY
1. Workers' Compensation	Statutory
2. Employers Liability	
A. Each Accident	$2,000,000
B. Each Employee-disease	$2,000,000
C. Policy Aggregate-disease	$2,000,000
3. Commercial Liability	
A. Per Occurrence	$5,000,000
B. General Aggregate	$5,000,000
1. General Aggregate - Per Project	$5,000,000
2. General Aggregate - Products/Completed	$5,000,000
4. Business Auto Liability	$2,000,000
5. General Umbrella Excess Liability	$5,000,000
6. Professional Errors and Omissions	
7. Environmental Impairment Liability	

The County of Winnebago shall be named as an Additional Insured on the General Liability and Vehicle Liability policies.

1.15 CHANGES IN INSURANCE COVERAGE:

The Bidder will immediately notify the Winnebago County Purchasing Department if any insurance has been cancelled, materially changed, or renewal has been refused and the Bidder shall immediately suspend all work in progress and take the necessary steps to purchase, maintain and provide the required insurance coverage(s) and limits.

If suspension of work should occur due to insurance requirements, upon verification by the County of required insurance, the County will notify Bidder when they can proceed with work. Failure to provide and maintain required insurance coverage(s) and limits could result in immediate cancellation of the Contract and the Bidder shall accept and bear all costs that may result due to the Bidder's failure to provide and maintain the required insurance.

END OF SECTION TWO: INSTRUCTION TO BIDDERS

SECTION THREE: BID SPECIFICATIONS

DETAILED SPECIFICATIONS – **SEE ATTACHED**

END OF SECTION THREE: SEE ATTACHED

SECTION FOUR: BID FORM

Name of Bidder			
Contact Person			
Address			
City, State, ZIP			
Telephone		**FEIN No.**	
Email(s)			

Company Information

Woman Business Enterprise (WBE)	Yes	☐	No	☐
Small Business Enterprise (SBE)	Yes	☐	No	☐
Minority Business Enterprise (MBE)	Yes	☐	No	☐
Veteran Owned Business (VOB)	Yes	☐	No	☐

If Yes, Check the Following Boxes that Apply:

BLACK/AFRICAN AMERICAN	☐	HISPANIC	☐
NATIVE AMERICAN OR ALASKA NATIVE	☐	ASIAN AMERICAN	☐

TO: Winnebago County Purchasing Department

The undersigned, being duly sworn, certifies they are an:

☐ OWNER/SOLE PROPRIETOR ☐ MEMBER OF PARTNERSHIP ☐ AN OFFICER OF CORPORATION ☐ MEMBER OF JOINT VENTURE

Further, as the Bidder, declares that the only person or parties interested in this bid as principals are those named herein; that this bid is made without collusion with any other person, firm or corporation; that he/she has fully examined the proposed forms of agreement and the scope of services or work specifications for the above designated service, and all other documents referred to or mentioned in the solicitation documents, specifications and attached exhibits, including Addenda.

(Bidder, must list below any and all Addenda or your offer will be rejected, as non-responsive)

No(s):_____and_____and _____issued thereto;

Further, the undersigned certifies and warrants that he/she is duly authorized to execute this certification/affidavit on behalf of the Bidder and in accordance with the Partnership Agreement or By-laws of the Corporation, and the laws of the State of Illinois and that this Certification is binding upon the Bidder and is true and accurate. The Affiant deposes and says that he/she has examined and carefully prepared this bid and has checked the same in detail before submitting this bid, and that the statements contained herein are true and correct.

Further, the Bidder certifies that he/she has provided equipment; supplies or services comparable to the items specified in this solicitation to the parties listed in the Business Reference Form and authorizes the County to verify references of business and credit at its option. Finally, the Bidder, if awarded a contract, agrees to do all other things required by the solicitation documents, and that he/she will take in full payment therefore the sums set forth in any resulting contract award

SIGNATURE OF BIDDER

SIGNATURE _____

Name and Title of Signer _____

Dated this _____ **day of** _____ **2025**

END OF SECTION FOUR: BID FORM

BID PRICING

BASE BID FOR DIESEL GENERATOR

Labor Costs: _____

Material Costs: _____

Permit Costs: _____

Other installation costs (i.e.: other than labor): _____

Number of Days to Complete: _____

Lead Time for Generator _____

ALTERNATE BID FOR NATURAL GAS GENERATOR

Labor Costs: _____

Material Costs: _____

Permit Costs: _____

Other installation costs (i.e.: other than labor): _____

Number of Days to Complete: _____

Lead Time for Generator _____

SECTION FIVE: BUSINESS REFERENCE FORM

The Bidder must list references for the last three (3) completed projects, listing company, name, address, contact person, telephone number and date of completion. If Bidder is a new business, provide references that will enable the County to determine if Bidder is responsible.

NAME	
CONTACT PERSON	
ADDRESS	
CITY, STATE, ZIP	
TELEPHONE	
EMAIL	

NAME	
CONTACTPERSON	
ADDRESS	
CITY, STATE, ZIP	
TELEPHONE	
EMAIL	

NAME	
CONTACTPERSON	
ADDRESS	
CITY, STATE, ZIP	
TELEPHONE	
EMAIL	

END OF SECTION FIVE: BUSINESS REFERENCE FORM

SECTION SIX: BIDDER'S SUBCONTRACTORS

NAME OF BIDDER	
CONTACT PERSON	

Will you employ subcontractors? Yes ☐ No ☐

If "YES", identify with each firm's name, address, telephone number and work to be subcontracted (attach more sheets if necessary).

SUBCONTRACTOR NAME	
CONTACT PERSON	
ADDRESS	
CITY, STATE, ZIPCODE	
TELEPHONE	
EMAIL	
WORK TO BE PROVIDED	

The Contractor will not change or use subcontractors not identified in this bid without prior written approval from the County of Winnebago.

A request for a change in subcontractors shall be made in writing and will include a description of any savings that may be realized in the execution of this contract, and must be passed on to the County of Winnebago.

END OF SECTION SIX: BIDDER'S SUBCONTRACTORS

SECTIONSEVEN: BID EXCEPTION FORM

Any and all exceptions to the Specifications, Scope of Services/Work, timing, description of work, quantities, units of measure, materials, equipment, affirmations, certifications, bond terms and conditions, contract document terms and conditions and/or any other part of this Bid MUST be clearly and completely indicated below.

EXCEPTIONS TAKEN: NO_____or Y E S _____(List below)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

END OF SECTIONSEVEN: BID EXCEPTION FORM

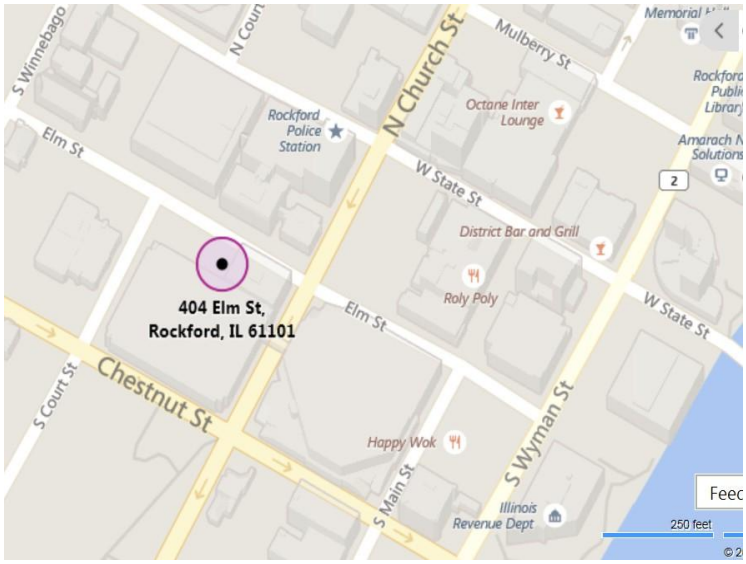
RETURN BID LABEL

The County of Winnebago, Illinois will receive sealed Bids at:

WINNEBAGO COUNTY
PURCHASING DEPARTMENT
404 ELM STREET, ROOM 202
ROCKFORD, ILLINOIS 61101

All Bids must be enclosed in sealed envelopes marked:

"GENERATOR REPLACEMENT – JUVENILE DETENTION CENTER"



ALL SUBMITTALS SHOULD BE LABELED ACCORDINGLY – PLEASE USE BELOW FOR YOUR CONVENIENCE

BID# **25B-2431**	**WINNEBAGO COUNTY** **PURCHASING DEPARTMENT** **404 ELM STREET, ROOM 202** **ROCKFORD, ILLINOIS 61101**
PURCHASING COORDINATOR: KATHY CLAUSEN	
BID NAME: **GENERATOR REPLACEMENT – JUVENILE DETENTION CENTER**	
BID DUE DATE/TIME: **09/18/2025 at 10:00 AM**	

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Fire-alarm wire and cable.
3. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 and ASTM B787 for stranded conductors.

D. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 FIRE-ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper, aluminum.
2. Type: One hole with standard barrels.
3. Termination: Compression or Crimp.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders and branch circuits:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance, feeders and branch circuits: Type THHN/THWN-2, single conductors in raceway

3.3 INSTALLATION OF CONDUCTORS AND CABLES

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

B. Complete raceway installation between conductor and cable termination prior to pulling conductors and cables.

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

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

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

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 280528 "Pathways for Electronic Safety and Security."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.

    a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
3. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1 inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

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

B. Make splices, terminations, and taps that are compatible with conductor material.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inch of slack.

3.6 IDENTIFICATION

A. Identify and color-code conductors

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Category 6 balanced twisted pair cable.
   2. Balanced twisted pair cable hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CATEGORY 6 BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 100 MHz.

B. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100 ohm, No. 24 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP).

E. Cable Rating: Plenum.

F. Jacket: White thermoplastic.

2.3 BALANCED TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.

B. General Requirements for Balanced Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables must be terminated with connecting hardware of same category or higher.

C. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
3. Marked to indicate transmission performance.

D. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standards.
   a. Category 6, unshielded balanced twisted pair cable must comply with IEC 60603-7-4.

4. Marked to indicate transmission performance.

2.4 SOURCE QUALITY CONTROL

A. Factory test balanced twisted pair cables according to TIA-568-C.2.

B. Cable will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

B. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
12. Provide strain relief.
13. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
14. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.

3.5 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

3.7 IDENTIFICATION

A. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.

B. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding hubs.
5. Grounding and bonding connectors.
6. Intersystem bonding bridge grounding connector.
7. Grounding and bonding busbars.
8. Grounding (earthing) electrodes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product indicated.

B. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control" Article, including the following:

1. Rod electrodes.
2. Ring electrodes.
3. Grounding arrangements and connections for separately derived systems.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Include the following:

a. Plans showing locations of grounding features described in "Field Quality Control" Article, including the following:

b.

1) Rod electrodes.
2) Ring electrodes.
3) Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, THHN/THWN-2, copper or tinned-copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Isolated Equipment Grounding Conductor:

1. General Characteristics: 600 V, THHN/THWN-2, copper or tinned-copper wire or cable, green color with one or more yellow stripes.

C. ASTM - Bare Copper Grounding and Bonding Conductor:

1. Referenced Standards: Complying with one or more of the following:

a. Soft or Annealed Copper Wire: ASTM B3
b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.2 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.3 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.4 GROUNDING AND BONDING HUBS

A. Description: Hubs with certified grounding or bonding locknut.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.5 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.6 GROUNDING AND BONDING BUSBARS

A. Description: Miscellaneous grounding and bonding device that serves as common connection for multiple grounding and bonding conductors.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

3.2 SELECTION OF GROUNDING AND BONDING CONDUCTORS

A. Conductors: Install solid conductor for 10 AWG and smaller, and stranded conductors for 8 AWG and larger unless otherwise indicated.

B. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.

C. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.

D. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.

E. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

F. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

G. Underground Grounding Conductors: Install bare tinned-copper conductor.

1. Bury at least 30 inch below grade.

3.3 SELECTION OF CONNECTORS

A. Conductor Terminations and Connections:

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

3.4 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. Conductors:

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

2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

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

g. Grounding and Bonding for Piping:

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

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

3. Electrodes:

   a. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.

      1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
      2) Use exothermic welds for below-grade connections.

4. Grounding at Service:

   a. Equipment grounding conductors and grounding electrode conductors must be connected to ground bus. Install main bonding jumper between neutral and ground buses.

5. Grounding Separately Derived Systems:

   a. Generator: Install grounding electrode(s) at generator location. Electrode must be connected to equipment grounding conductor and to frame of generator.

6. Equipment Grounding:

   a. Install insulated equipment grounding conductors with feeders and branch circuits.
   b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

      1) Feeders and branch circuits.
      2) Lighting circuits.
      3) Receptacle circuits.
      4) Single-phase motor and appliance branch circuits.
      5) Three-phase motor and appliance branch circuits.
      6) Flexible raceway runs.
      7) Armored and metal-clad cable runs.
      8) Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

   c. Isolated Grounding Receptacle Circuits: Install insulated equipment grounding conductor connected to receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.
   d. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install separate insulated equipment grounding

conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

3.5 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: Selected for applicable load criteria.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

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

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

D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

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

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

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

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All Stainless steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

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

PART 3 - EXECUTION

3.1 SELECTION

A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA NEIS 101
2. NECA NEIS 102.
3. NECA NEIS 105.
4. NECA NEIS 111.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by] NFPA 70. Minimum rod size must be 1/4 inch in diameter.

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

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

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC and ERMC may be supported by openings through structure members, in accordance with NFPA 70.

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

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

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch thick.
6. To Steel: Beam clamps MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 or Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

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

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

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

END OF SECTION 260529

SECTION 260533.13 - CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type HDPE and Type EPEC duct raceways and fittings.
4. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
5. Type ERMC-S duct raceways, elbows, couplings, and nipples.
6. Type FMC-S and Type FMC-A duct raceways.
7. Type FMT duct raceways.
8. Type IMC duct raceways.
9. Type LFMC duct raceways.
10. Type LFNC duct raceways.
11. Type PVC duct raceways and fittings.
12. Type RTRC-AG duct raceways and fittings.
13. Type RTRC-BG duct raceways and fittings.
14. Fittings for conduit, tubing, and cable.
15. Electrically conductive corrosion-resistant compounds for threaded conduit.
16. Solvent cements.

1.2 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
6. Type ERMC-S duct raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A duct raceways.
8. Type FMT duct raceways.
9. Type IMC duct raceways.
10. Type LFMC duct raceways.
11. Type LFNC duct raceways.

12. Type PVC duct raceways and fittings.
13. Type RTRC-AG duct raceways and fittings.
14. Type RTRC-BG duct raceways and fittings.
15. Fittings for conduit, tubing, and cable.
16. Electrically conductive corrosion-resistant compounds for threaded conduit.
17. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-A AND TYPE EMT-SS DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.2 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Material: Steel.
2. Options:

    a. Exterior Coating: Zinc.
    b. Interior Coating: Zinc.

c. Minimum Trade Size: trade size 3/4.
d. Colors: As indicated on Drawings.

2.3 TYPE HDPE AND TYPE EPEC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN EAZX; including UL 651A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL EAZX - Schedule 40 Electrical HDPE Underground Conduit (HDPE-40):
1. Dimensional Specifications: Schedule 40.
2. Options:

a. Minimum Trade Size: trade size 3/4.

D. UL EAZX - Schedule 80 Electrical HDPE Underground Conduit (HDPE-80):
1. Dimensional Specifications: Schedule 80.
2. Options:

a. Minimum Trade Size: trade size 3/4.

2.4 TYPE ERMC-A AND TYPE ERMC-SS DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYWV; including UL 6A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.5 TYPE ERMC-S DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYIX; including UL 6.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
1. Exterior Coating: Zinc.
2. Options:

a. Interior Coating: Zinc.
b. Minimum Trade Size: trade size 3/4.
c. Colors: As indicated on Drawings.

2.6 TYPE FMC-S AND TYPE FMC-A DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXUZ; including UL 1.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXUZ - Steel Flexible Metal Conduit (FMC-S):
1. Material: Steel.
2. Options:

a. Minimum Trade Size: trade size 3/4.
b. Colors: As indicated on Drawings.

2.7 TYPE FMT DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN ILJW; including UL Subject 1652.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL ILJW - Steel Flexible Metallic Tubing (FMT):

1. Options:

a. Minimum Trade Size: trade size 3/4.
b. Colors: As indicated on Drawings.

2.8 TYPE IMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYBY; including UL 1242.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYBY - Steel Intermediate Metal Conduit (IMC):

1. Options:

a. Exterior Coating: Zinc.
b. Interior Coating: Zinc.
c. Minimum Trade Size: trade size 3/4.
d. Colors: As indicated on Drawings.

2.9 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):
1. Material: Steel.
2. Options:

a. Minimum Trade Size: trade size 3/4.
b. Colors: As indicated on Drawings.

2.10 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DZYR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Dimensional Specifications: Schedule 40.
2. Options:

a. Minimum Trade Size: trade size 3/4.
b. Markings: For use with maximum 90 deg C wire,].

D. UL DZYR - Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
1. Dimensional Specifications: Schedule 80.
2. Options:

a. Minimum Trade Size: trade size 3/4.

b. Markings: For use with maximum 90 deg C wire For directional boring applications.

2.11 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DWTT - Fittings for Type ERMC, Type IMC, Type PVC, Type HDPE, Type EPEC, and Type RTRC Duct Raceways:
1. Listing Criteria: UL CCN DWTT; including UL 514B.
2. Options:

a. Material: Steel.
b. Coupling Method: Compression coupling, Raintight compression coupling with distinctive color gland nut.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

D. UL FKAV - Fittings for Type EMT Duct Raceways:
1. Listing Criteria: UL CCN FKAV; including UL 514B.
2. Options:

a. Material: Steel.
b. Coupling Method: Compression coupling, Raintight compression coupling with distinctive color gland nut.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

E. UL ILNR - Fittings for Type FMC Duct Raceways:

1. Listing Criteria: UL CCN ILNR; including UL 514B.

F. UL DXAS - Fittings for Type LFMC and Type LFNC Duct Raceways:

1. Listing Criteria: UL CCN DXAS; including UL 514B.

2.12 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FOIZ; including UL Subject 2419.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

2.13 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DWTT; including UL 514B.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Engineer for resolution of conflicting requirements.

B. Special Instructions Regarding HDPE Conduits: Although Article 353 of NFPA 70 permits use of HDPE conduits where encased in concrete aboveground, UL CCN EAZX listing requirements state that HDPE underground conduits are intended only for use where direct buried with or without being encased in concrete. Specified Type HDPE underground conduits are not permitted to be used aboveground on Project.

C. Outdoors:

1. Exposed: ERMC.
2. Concealed Aboveground: ERMC, IMC, EMT.
3. Direct Buried: PVC-80, PVC-40.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

D. Indoors:

1. Exposed
   a. Match Existing.

E. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Type EMT-A: Article 358 of NFPA 70 and NECA NEIS 102.
2. Type EMT-SS: Article 358 of NFPA 70 and NECA NEIS 101.
3. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
4. Type ENT: Article 362 of NFPA 70 and NECA NEIS 102.
5. Type HDPE and Type EPEC: Article 353 of NFPA 70 and NECA NEIS 111.
6. Type ERMC-A: Article 344 of NFPA 70 and NECA NEIS 102.
7. Type ERMC-SS: Article 344 of NFPA 70 and NECA NEIS 101.
8. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
9. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
10. Type FMC-A: Article 348 of NFPA 70 and NECA NEIS 102.
11. Type FMT: Article 360 of NFPA 70 and NECA NEIS 101.
12. Type IMC: Article 342 of NFPA 70 and NECA NEIS 101.
13. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
14. Type LFNC: Article 342 of NFPA 70 and NECA NEIS 111.
15. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
16. Type RTRC: Article 355 of NFPA 70 and NECA NEIS 111.
17. Expansion Fittings: NEMA FB 2.40.
18. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:

   a. Complete duct raceway installation before starting conductor installation.

b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.

c. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch of changes in direction.

d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.

e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

f. Support conduit within 12 inch of enclosures to which attached.

g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.

h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:

    1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    2) Where an underground service duct raceway enters a building or structure.
    3) Conduit extending from interior to exterior of building.
    4) Conduit extending into pressurized duct raceway and equipment.
    5) Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    6) Where otherwise required by NFPA 70.

i. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.

j. Do not install conduits within 2 inch of the bottom side of a metal deck roof.

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

l. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.

m. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.

n. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

    1) Termination fittings with shoulders do not require two locknuts.

o. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric

designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

2. Types EMT-A, ERMC-A, and FMC-A: Do not install aluminum duct raceways or fittings in contact with concrete or earth.
3. Types ERMC and IMC:

    a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.

4. Type ERMC-S-PVC:

    a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
    b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC duct raceway.
    c. Coat field-cut threads on PVC-coated duct raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

5. Types FMC, LFMC:

    a. Provide a maximum of 36 inch of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

6. Types PVC, HDPE, and EPEC:
    a. Comply with manufacturer's published instructions for solvent welding and fittings.
7. Duct Raceways Embedded in Slabs:

    a. Run duct raceways larger than metric designator 27 (trade size 1) below concrete slab] [Run duct raceways larger than metric designator 27 (trade size 1) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place duct raceway close to slab support. Secure duct raceways to reinforcement at maximum 10 ft (3 m) intervals.
    b. Arrange duct raceways to cross building expansion joints with expansion fittings at right angles to the joint.
    c. Arrange duct raceways to ensure that each is surrounded by minimum of 1 inch of concrete without voids.
    d. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.

8. Stub-ups to Above Recessed Ceilings:

    a. Provide EMT, IMC, or ERMC for duct raceways.

b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

9. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG. Install insulated throat metal grounding bushings on service conduits.

10. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

a. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
b. EMT: Provide compression, steel fittings. Comply with NEMA FB 2.10.
c. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

11. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping].
12. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.

a. Provide warning signs.

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

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

END OF SECTION 260533.13

SECTION 260533.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.
5. Hoods for outlet boxes.

PART 2 - PRODUCTS

2.1 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN QCIT; including UL 514A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT - Metallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Options:

a. Material: Sheet steel.
b. Sheet Metal Depth: Minimum 1.5 inch.

D. UL QCIT - Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

E. UL QCIT - Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Options:

a. Material: Sheet steel.
b. Sheet Metal Depth: minimum 1.5 inch.

F. UL QCIT - Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.

2.2 JUNCTION BOXES AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

a. Degree of Protection: Type 1.

D. UL BGUZ - Indoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

a. Degree of Protection: Type 1.

E. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

    a. Degree of Protection: Type 3R.

F. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

    a. Degree of Protection: Type 3R.

2.3 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
3. Wallplate-Securing Screws: Metal with head color to match wallplate finish.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:
1. Options:

    a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
    b. Wallplate Material: Galvanized steel.

2.4 HOODS FOR OUTLET BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria:

    a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.

b. Receptacle, Hood, Cover Plate, Gaskets, and Seals: UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.

3. Mounts to box using fasteners different from wiring device.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Retractable or Reattachable Hoods for Outlet Boxes:
1. Options:

a. Provides clear, weatherproof, "while-in-use" cover.

D. UL QCIT or QCMZ - Extra-Duty, While-in-Use Hoods for Outlet Boxes:
1. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
2. Options:

a. Provides clear, weatherproof, "while-in-use" cover.
b. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.1 PREPARATION

3.2 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:

a. Type 3R unless otherwise indicated.

2. Indoors:

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: Type 4.

3.3 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
2. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.
3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
5. Locate boxes so that cover or plate will not span different building finishes.
6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
9. Set metal floor boxes level and flush with finished floor surface.
10. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
11. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
12. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
13. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

    a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
    b. Provide gaskets for wallplates and covers.

14. Identification: Provide labels for boxes and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each box with engraved metal or laminated-plastic nameplate.

3.4 PROTECTION

A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.16

SECTION 260533.23 - SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface metal raceways and fittings.
2. Strut-type channel raceways and fittings.
3. Wireways and auxiliary gutters.

PART 2 - PRODUCTS

2.1 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN RJBT; including UL 5.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Sustainable Design Submittals: Prepare and submit the following documentation for adhesives and solvents used with nonmetallic components:

3. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL RJBT - Surface Metal Raceways and Fittings with Metal Covers:
1. Options:

a. Galvanized steel base with snap-on covers.
b. Manufacturer's standard enamel finish.

D. UL RJBT - Surface Metal Raceways and Fittings with Nonmetallic Covers:
1. Additional Characteristics: UL 94, V-0 requirements for self-extinguishing characteristics.
2. Options:

a. Galvanized steel base with snap-on covers.

2.2 STRUT-TYPE CHANNEL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:

    a. UL CCN RIUU; including UL 5B.
    b. UL 94, V-0 requirements for self-extinguishing characteristics.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Sustainable Design Submittals: Prepare and submit the following documentation for adhesives and solvents used with nonmetallic components:

3. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
4. Samples:

    a. Strut-Type Channel Raceway Nonmetallic Covers for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type, 12 inch long.

C. UL RIUU - Strut-Type Channel Raceways and Fittings with Metallic Covers:
1. Options:

    a. Manufacturer's standard enamel finish.

2.3 WIREWAYS AND AUXILIARY GUTTERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:

    a. UL CCN ZOYX; including UL 870.
    b. UL 94, V-0 requirements for self-extinguishing characteristics.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Sustainable Design Submittals: Prepare and submit the following documentation for adhesives and solvents used with nonmetallic components:

3. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL ZOYX - Metal Wireways and Auxiliary Gutters:
1. Additional Characteristics:

a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
b. Finish: Manufacturer's standard enamel finish.

2. Options:

a. Degree of Protection: Type 1 or Type 3R unless otherwise indicated.
b. Wireway Covers: Hinged type or Flanged-and-gasketed type unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Auxiliary Gutters: Article 366 of NFPA 70.
2. Surface Metal Raceway: Article 386 of NFPA 70.
3. Surface Nonmetallic Raceway: Article 388 of NFPA 70.

C. Special Installation Techniques:

1. Install surface raceways only where indicated on Drawings.
2. Install surface raceway with a minimum 2 inch radius control at bend points.
3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's published instructions. Tape and glue are unacceptable support methods.
4. Identification: Provide labels for surface raceways and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Provide warning signs.

D. After installation, protect surface raceways from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.23

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EPEC raceways and fittings.
2. Type ERMC-SS raceways, elbows, couplings, and nipples.
3. Type ERMC-S raceways, elbows, couplings, and nipples.
4. Type IMC raceways.
5. Type PVC raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Electrically conductive corrosion-resistant compounds for threaded conduit.
8. Solvent cements.
9. Duct accessories.
10. Handholes and boxes for exterior underground wiring.
11. Manholes for exterior underground wiring.
12. Utility structure accessories.
13. Duct sealing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Preinstallation Coordination Meeting(s): For underground ducts and raceways. Conduct meeting(s) at Project site before construction activity.

PART 2 - PRODUCTS

2.1 TYPE EPEC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651A and UL CCN EAZX.

B. Schedule 40 Electrical HDPE Underground Conduit (EPEC-40):

1. Dimensional Specifications: Schedule 40.
2. Options:

a. Minimum Trade Size: trade size 3/4.

C. Schedule 80 Electrical HDPE Underground Conduit (EPEC-80):

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Dimensional Specifications: Schedule 80.
3. Options:

a. Minimum Trade Size: [**Metric designator 16 (trade size 1/2)**] [**Metric designator 21 (trade size 3/4)**].

2.2 TYPE ERMC-SS RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 6A and UL CCN DYWV.

B. Stainless Steel Electrical Rigid Metal Conduit (ERMC-SS), Elbows, Couplings, and Nipples:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Material: Stainless steel.
3. Options:

a. Minimum Trade Size: [**Metric designator 16 (trade size 1/2)**] [**Metric designator 21 (trade size 3/4)**].
b. Colors: As indicated on Drawings.

2.3 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 6 and UL CCN DYIX.

B. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Exterior Coating: Zinc.
3. Options:

a. Interior Coating: [**Zinc with organic top coating**] [**Zinc**] [**Organic coating**].
b. Minimum Trade Size: [**Metric designator 16 (trade size 1/2)**] [**Metric designator 21 (trade size 3/4)**].
c. Colors: As indicated on Drawings.

2.4 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL CCN DZYR.

B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Dimensional Specifications: Schedule 40.
2. Options:

    a. Minimum Trade Size: trade size 3/4.
    b. Markings: For use with maximum 90 deg C wire, For directional boring applications.

C. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Dimensional Specifications: Schedule 80.
2. Options:

    a. Minimum Trade Size: trade size 3/4.
    b. Markings: For use with maximum 90 deg C wire, For directional boring applications.

2.5 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Metallic Fittings for Type ERMC, Type IMC, Type PVC, Type EPEC Raceways:

1. General Characteristics: UL 514B and UL CCN DWTT.
2. Options:

    a. Material: Steel.
    b. Coupling Method: Raintight compression coupling with distinctive color gland nut.
    c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
    d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.6 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL Subject 2419 and UL CCN FOIZ.

2.7 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.8 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

2.9 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:

    a. ASTM C858 for design and manufacturing processes.
    b. SCTE 77.

B. Source Quality Control:

1. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.
2. Polymer Concrete and Nonconcrete Handhole and Pull-Box Prototypes: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests must be for specified tier ratings of products supplied. Testing machine pressure gages must have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

    a. Tests of materials must be performed by independent testing agency.
    b. Strength tests of complete boxes and covers must be by independent testing agency or manufacturer. Qualified registered professional engineer must certify tests by manufacturer.

C. Precast Concrete Handholes and Boxes :

1. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover must form top of enclosure and must have load rating consistent with that of handhole or box.

2. Configuration: Units must be designed for flush burial and have integral closed bottom unless otherwise indicated.
3. Frame and Cover:

    a. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
    b. Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
    c. Weatherproof steel frame, with concealed-hinge steel access door assembly; tamper-resistant, captive, cover-securing bolts; hold-open ratchet assembly; and recessed cover handle.
    d. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
    e. Cover Legend: Molded lettering, "ELECTRIC".

4. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension must provide increased depth of 12 inch.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

5. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.
6. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional 12 inch vertically and horizontally to accommodate alignment variations.
7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
8. Handholes 12 inch wide by 24 inch long and larger must have inserts for cable racks and pulling-in irons installed before concrete is poured.

D. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover:

1. Description: Molded of sand, concrete, and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or combination.

2. Configuration: Units must be designed for flush burial and have integral closed bottom unless otherwise indicated.

3. Conduit Entrance Provisions: Conduit-terminating fittings must mate with entering ducts for secure, fixed installation in enclosure wall.
4. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
5. Duct Entrance Provisions: Duct-terminating fittings must mate with entering duct for secure, fixed installation in enclosure wall.

6. Handholes 12 inch wide by 24 inch long and larger must have factory-installed inserts for cable racks and pulling-in irons.
7. Options:

    a. Color: Green.

E. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover:

1. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
2. Configuration: Units must be designed for flush burial and have integral closed bottom unless otherwise indicated.
3. Frame and Cover:

    a. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
    b. Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
    c. Weatherproof steel frame, with concealed-hinge steel access door assembly; tamper-resistant, captive, cover-securing bolts; hold-open ratchet assembly; and recessed cover handle.
    d. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
    e. Cover Legend: Molded lettering, "ELECTRIC".

4. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension must provide increased depth of 12 inch.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

5. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.
6. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional 12 inch vertically and horizontally to accommodate alignment variations.
7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
8. Handholes 12 inch wide by 24 inch long and larger must have inserts for cable racks and pulling-in irons installed before concrete is poured.

    a.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify

Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

3.2 SELECTION OF UNDERGROUND DUCTS

A. Duct for Electrical Feeders and branch circuits: PVC-80, PVC-40 unless otherwise indicated.

B. Bored Underground Duct: EPEC-40, EPEC-80 unless otherwise indicated.

3.3 SELECTION OF UNDERGROUND ENCLOSURES

A. Handholes and Boxes:
   1. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin High-density plastic, structurally tested in accordance with SCTE 77 with 3000 lbf vertical loading.
   2. Cover design load must not exceed load rating of handhole or box.

3.4 EARTHWORK

A. Restoration: Restore area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

D. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures.

3.5 INSTALLATION OF DUCTS AND DUCT BANKS

A. Reference Standards:

   1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
   2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
2. Steel raceway, bends, and fittings in single duct run or duct bank must be of same type.
3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
4. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.
5. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch.
6. Curves and Bends:

    a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch, 12.5 ft, both horizontally and vertically, at other locations unless otherwise indicated.
    b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inch, 12.5 ft, both horizontally and vertically, at other locations unless otherwise indicated Use PVC heating bender for bending PVC conduit.
    c. Duct must have maximum of 180 degrees of bends between pull points.

7. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch of concrete for minimum of 12 inch on each side of coupling.

    a. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch below grade or floor level and do not terminate in hubs.
8. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inch o.c. for 5 inch duct, and vary proportionately for other duct sizes.

    a. Begin change from regular spacing to end-bell spacing 10 ft from end bell, without reducing duct slope and without forming trap in line.
    b. Grout end bells into structure walls from both sides to provide watertight entrances.

9. Duct Terminators for Entrances to Cast-in-Place Manholes and Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inch o.c. for 4 inch duct, and vary proportionately for other duct sizes.

    a. Begin change from regular spacing to terminator spacing 10 ft from terminator, without reducing duct line slope and without forming trap in line.

10. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

11. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig hydrostatic pressure.
12. Pulling Cord: Install 200 lbf test nylon cord in empty ducts.
13. Concrete-Encased Ducts and Duct Bank:

    a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes 6 inch or less in nominal diameter.
    b. Width: Excavate trench 3 inch wider than duct on each side.
    c. Depth: Install so top of duct envelope is at least 24 inch below finished grade in areas not subject to deliberate traffic, and at least 30 inch below finished grade in deliberate traffic paths for vehicles unless otherwise indicated. Install so top of duct envelope is below local frost line.
    d. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

    e. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch from edge of equipment base.

        1) Stub-ups must be minimum 4 inch above finished floor and minimum 3 inch from conduit side to edge of slab.

    f. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
    g. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
    h. Concrete Cover: Install minimum of 3 inch of concrete cover between edge of duct to exterior envelope wall, 2 inch between duct of like services, and 4 inch between power and communications ducts.
    i. Place minimum 6 inch of engineered fill above concrete encasement of duct.
    j. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

14. Direct-Buried Duct and Duct Bank:

    a. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inch in nominal diameter.
    b. Width: Excavate trench 3 inch wider than duct on each side.
    c. Depth: Install top of duct at least 36 inch below finished grade unless otherwise indicated.
    d. Set elevation of top of duct bank below frost line.
    e. Place minimum 3 inch of sand as bed for duct. Place sand to minimum of 6 inch above top level of duct.

f. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
g. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft of duct. Place spacers within 24 inch of duct ends. Stagger spacers approximately 6 inch between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
h. Install duct with minimum of 3 inch between ducts for like services and 6 inch between power and communications duct.
i. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inch over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.

15. Underground-Line Warning Tape: Bury conducting underground line no less than 12 inch above concrete-encased duct and duct banks and approximately 12 inch. Align tape parallel to and within 3 inch of centerline of duct bank. Provide additional warning tape for each 12 inch increment of duct-bank width over nominal 18 inch. Space additional tapes 12 inch apart, horizontally across width of ducts.
16. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Reference Standards:

1. Precast Concrete Handholes: Comply with ASTM C891 unless otherwise indicated.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Cast-in-Place Manholes:

a. Finish interior surfaces with smooth-troweled finish.
b. Knockouts for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inch hick, arranged as indicated.

2. Precast Concrete Handholes and Manholes:

a. Install units level and plumb and with orientation and depth coordinated with connecting duct to minimize bends and deflections required for proper entrances.
b. Unless otherwise indicated, support units on level bed of crushed stone or gravel graded from 1 inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

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

3. Elevations:
   a. Install handholes with bottom below frost line.
   b. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
   c. Where indicated, cast handhole cover frame integrally with handhole structure.

END OF SECTION 260543

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Molded-case circuit breakers (MCCBs).
3. Enclosures.

1.2 DEFINITIONS

A. GFEP: Ground-fault circuit-interrupter for equipment protection.

B. GFLS: Ground-fault circuit-interrupter for life safety.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
2. Enclosure types and details for types other than UL 50E, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).
5. Include evidence of qualified electrical testing laboratory listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
7. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600 V(ac).
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit breakers must be constructed using glass-reinforced insulating material. Current carrying components must be completely isolated from handle and accessory mounting area.

B. Circuit breakers must have toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. Circuit-breaker handle must be over center, be trip free, and reside in tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon must be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit-breaker tripping mechanism for maintenance and testing purposes.

C. Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings must be clearly marked on face of circuit breaker.

D. MCCBs must be equipped with device for locking in isolated position.

E. Lugs must be suitable for 90 deg C rated wire, sized in accordance with 75 deg C temperature rating in NFPA 70.

F. Standard: Comply with UL 489 with required interrupting capacity for available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: Enclosure must be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (UL 50E Types 3R, 12).

C. Conduit Entry: UL 50E Types 4, 4X, and 12 enclosures may not contain knockouts. UL 50E Types 7 and 9 enclosures must be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: Circuit-breaker operating handle must be externally operable with operating mechanism being integral part of box, not cover. Cover interlock mechanism must have externally operated override. Override may not permanently disable interlock mechanism,

which must return to locked position once override is released. Tool used to override cover interlock mechanism must not be required to enter enclosure in order to override interlock.

PART 3 - EXECUTION

3.1 SELECTION OF ENCLOSURES

A. Outdoor Locations: UL 50E, Type 3R.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
3. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
4. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
5. Install fuses in fusible devices.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
1. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test in accordance with NETA ATS Section 7.14 "Ground Fault Protection Systems, Low-Voltage."

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 263213.13 – DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged engine generators used to supply non-emergency power, with the following features:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Vibration isolation devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Blue Star Power Systems

2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.

C. Comply with NFPA 110 requirements for Level 2 EPSS.

D. UL Compliance: Comply with UL 2200.

E. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.

F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at building due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: -5 to 104 deg F.
2. Altitude: Sea level to 1000 feet.

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Standby.

D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.

E. EPSS Class: Engine generator shall be classified as a Class 24 according to NFPA 110.

F. Service Load: 250 kVA.

G. Power Factor: 0.8, lagging.

H. Frequency: 60 Hz.

I. Voltage: 480-V ac.

J. Phase: Three-phase, four wire, wye.

K. Governor: Adjustable isochronous, with speed sensing.

L. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

M. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

N. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time:

    a. Comply with NFPA 110, Type 10 system requirements.

2.4 DIESEL ENGINE

A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499.

E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 78 dBA or less.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least twice without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 37.

B. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

C. Fuel Filtering: Remove water and contaminants larger than 1 micron.

D. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

E. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:

1. Tank level indicator.
2. Fuel-Tank Capacity: Minimum 133 percent of total fuel required for planned operation plus fuel for periodic maintenance operations between fuel refills.
3. Leak detection in interstitial space.
4. Vandal-resistant fill cap.
5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.

F. Control and Monitoring Panel:

1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, for each phase or connected to a phase selector switch.

f. AC ammeter, for each phase or connected to a phase selector switch.
g. AC frequency meter.
h. Generator-voltage adjusting rheostat.

3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

a. Cranking control equipment.
b. Run-Off-Auto switch.
c. Control switch not in automatic position alarm.
d. Overcrank alarm.
e. Overcrank shutdown device.
f. Low-water temperature alarm.
g. High engine temperature prealarm.
h. High engine temperature.
i. High engine temperature shutdown device.
j. Overspeed alarm.
k. Overspeed shutdown device.
l. Low fuel main tank.

1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required for the indicated EPSS class.

m. Coolant low-level alarm.
n. Coolant low-level shutdown device.
o. Coolant high-temperature prealarm.
p. Coolant high-temperature alarm.
q. Coolant low-temperature alarm.
r. Coolant high-temperature shutdown device.
s. EPS load indicator.
t. Battery high-voltage alarm.
u. Low cranking voltage alarm.
v. Battery-charger malfunction alarm.
w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Remote manual stop shutdown device.
aa. Hours of operation.
bb. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

G. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Low water-temperature alarm.
3. High engine temperature prealarm.

4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Lamp test.
16. Low-cranking voltage alarm.
17. Generator overcurrent-protective-device not-closed alarm.

H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

I. Remote Emergency-Stop Switch: Flush; wall mounted unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator output rating.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide 12-lead alternator.

E. Range: Provide limited range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 15 percent on one step, full load.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Subtransient Reactance: 12 percent, maximum.

2.9 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: as recommended by manufacturer.

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

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Minimum Deflection: 1 inch.

C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115

PART 3 - EXECUTION

3.1 INSTALLATION.

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

1. Notify Owner no fewer than twoworking days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Comply with NECA 1 and NECA 404.

C. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

D. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases.
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

E. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

F. Exhaust System: Install Schedule 40 black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

G. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.2 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

C. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.3 IDENTIFICATION

A. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with Drawings and the Specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify that the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests according to IEEE 43.

            a) Machines Larger Than 200 hp: Test duration shall be 10 minutes. Calculate polarization index.

        2) Test protective relay devices.
        3) Verify phase rotation, phasing, and synchronized operation as required by the application.
        4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
        5) Perform vibration test for each main bearing cap.

6) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
7. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

F. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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

J. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.13

SECTION 263600 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 Scope

Furnish and install automatic transfer switches (3ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of a mechanically held power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.2 Acceptable Manufacturers

Automatic transfer switches shall be ASCO Series 300 (3ATS). Any alternate shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.3 Codes and Standards

The automatic transfer switches and accessories shall conform to the requirements of:

A. UL 1008 - Standard for Automatic Transfer Switches
B. CSA C22.2 No.178 – 1978
C. NFPA 70 - National Electrical Code
D. NFPA 110 - Emergency and Standby Power Systems
E. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
F. NEMA Standard ICS10-2005 (formerly ICS2-447) - AC Automatic Transfer Switches
G. NEC Articles 700, 701, 702
H. International Standards Organization ISO 9001: 2008 J. IEC 60947 – 6 – 1

PART 2 - PRODUCTS

2.1 Mechanically Held Transfer Switch

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include over current disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 800 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully- rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.2 Group ‘G’ Controller with Integrated User Interface Panel

A. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, inherent serial communications capability, and the ability to communicate via the Ethernet through optional communications module

C. A single controller shall provide single and three phase capability for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.1Hz. Time delay settings shall be accurate to ± 0.5% of the full scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C, and storage from -55 to + 85 degrees C.

D. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards.

E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. IEC 60947 – 6 – 1 Multiple Function Equipment Transfer Switching Equipment. 61000 - 4 Testing And Measurement Techniques - Overview
   a. IEC 61000 – 4 - 2 Electrostatic Discharge Immunity
   b. IEC 61000 – 4 - 3 Radiated RF Field Immunity
   c. IEC 61000 – 4 - 4 Electrical Fast Transient/Burst Immunity

2.3 Enclosure

A. The 3ATS shall be furnished in a NEMA type 3R enclosure unless otherwise shown on the plans.
B. Provide strip heater with thermostat for Type 3R enclosure requirements.
C. Controller shall be mounted on, visible, and operational through enclosure door.

PART 3 - OPERATIONS

3.1 Controller Display and Keypad

A. A 128*64 graphical LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through communications port. The following parameters shall only be adjustable via DIP switches on the controller.

1. Nominal line voltage and frequency
2. Single or three phase sensing on normal
3. Transfer operating mode configuration, (open transition, or delayed transition)

All instructions and controller settings shall be easily accessible, readable accomplished without the use of codes, calculations, or instruction manuals.

3.2 Voltage and Frequency Sensing

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup ,dropout, and trip settings capabilities (values shown as % of nominal unless otherwise specified.

Parameter	Sources	Dropout/Trip	Pickup/Reset
Undervoltage	N & E	70 to 98%	85 to 100%
Overvoltage	N & E	102 to116%	2% below trip
Underfrequency	N & E	85 to 98%	86 to 100%
Overfrequency	N & E	101 to 111%	2% below trip

B. Repetitive accuracy of all settings shall be within 1% at +25C

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency. *Note: Single phase sensing on emergency*

E. The backlit 128*64 graphical display shall have multiple language capability. Languages can be selected from the user interface.

3.3 Time Delays

A. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds. It shall be possible to bypass the time delay from the controller user interface.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes 59 seconds for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.

C. A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 or 4 seconds.

D. A time delay shall be provided on retransfer to normal, adjustable 0 to 9 hours 59 minutes 59 seconds. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

E. A cooldown time delay shall be provided on shutdown of engine generator, Adjustable 0 to 60 minutes 59 seconds.

F. All adjustable time delays shall be field adjustable without the use of special tools.

G. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minutes 59 seconds time delay in any of the following modes:

1. Prior to transfer only.

2. Prior to and after transfer.

3. Normal to emergency only.

4. Emergency to normal only.

5. Normal to emergency and emergency to normal.

6. All transfer conditions or only when both sources are available.

H. In the event that the alternate source is not accepted within the configured Failure to Accept time delay, the common alert indication shall become active.

I. The controller shall also include the following built-in time delay for delayed transition operation.

1. A time delay for the load disconnect position for delayed transition operation adjustable 0 to 5 minutes 59 seconds.

3.4 Additional Features

A. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down. setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed when the ATS is connected to the emergency source.

D. A single alarm indication shall light up the alert indicator and de – energize the configured common alarm output relay for external monitoring.

E. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).

F. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency (red) source, as determined by the voltage sensing trip and reset settings for each source.

G. LED indicating light shall be provided to indicate switch not in automatic mode (manual); and blinking (amber) to indicate transfer inhibit.

H. LED indicating light shall be provided to indicate any alarm condition or active time delay (red).

The following features shall be built – into the controller, but capable of being activated through keypad programming or the serial port only when required by the user:

I. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

J. A variable window in phase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents,and shall not require external control of power sources. The in phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in phase monitor shall be equal to ASCO feature 27.

K. An engine generator exercising timer shall be provided to configure weekly and bi- weekly automatic testing of an engine generator set with or without load for 20 minutes fixed. It shall be capable of being configured to indicate a day of the week, and time weekly testing should occur.

The following feature shall be built – into the controller, but capable of being activated through keypad programming, communications interface port, or additional hardware.

L. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency. This inhibit signal can be enabled through the keypad or serial port.

M. System Status - The controller LCD display shall include a "System Status" screen which shall be readily accessible from any point in the menu by depressing the "ESC" key. This screen shall display a clear description of the active operating sequences and switch position. For example,

Normal Failed
Load on Normal
TD Normal to Emerg
2min15s

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual are not permissible.

N. Self Diagnostics – The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

O. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication port with a network of transfer switches, locally (up to 4000 ft.). Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control, and setup of parameters.

P. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non – volatile memory.

1. Event Logging

    1. Data and time and reason for transfer normal to emergency
    2. Data and time and reason for transfer emergency to normal
    3. Data and time and reason for engine start
    4. Data and time engine stopped
    5. Data and time emergency source available
    6. Data and time emergency source not available

2. Statistical Data

    1. Total number of transfers
    2. Total number of transfers due to source failure
    3. Total number of day's controller is energized
    4. Total number of hours both normal and emergency sources are Available
    5. Total time load is connected to normal
    6. Total time load is connected to emergency
    7. Last engine start
    8. Last engine start up time
    9. Input and output status

4.1 Additional Features

A. Accessory Package - An accessory bundle shall be provided that includes:

1. A fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without load on a daily weekly, bi – weekly, or monthly basis.

2. Event log display that shows event number, time and date of events, event type, and reason (if applicable). A minimum of 300 events shall be stored.

3. RS – 485 communications port enabled.

4. Common alarm output contact.

(This feature shall be equal to ASCO accessory 11BE, and shall be capable of being activated for existing switches through optional accessory dongle).

B. Current Sensing Card - A load current metering card shall be provided that measures either single or three phase load current. It shall include current transformers (CT's) and shorting block. Parameters shall be able to be viewed via the user interface. (This feature shall be equal to ASCO accessory 23GA (single phase), 23GB (three phase), and shall be capable of being added to existing switches without modification).

C. Communications Module – Shall provide remote interface module to support monitoring of vendor's transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Features shall include:

1. Email notifications and SNMP traps of selectable events and alarms may be sent to a mobile device or PC.
2. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.
3. Web app interface requiring user credentials to monitor and control the transfer switch supporting modern smart phones, tablets and PC browsers. User will be able to view the dynamic one-line, ATS controls status, alarms, metering, event logging as well as settings.
4. Secure access shall be provided by requiring credentials for a minimum of 3 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-Bit AES encryption standard shall be supported for all means of connectivity.
5. Shall allow for the initiating of transfers, retransfers, bypassing of active timers and the activating/deactiviting of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment.
6. An event log displaying a minimum of three-hundred (300) events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.
7. Four (4) 100 Mbps Ethernet copper RJ-45 ports, two (2) serial ports, and LEDs for diagnostics.
8. DIN rail mountable.

This option shall be equivalent to ASCO accessory 72EE

D. Enclosure Heater - A 125 watt enclosure heater with transformer and thermostat (adjustable from 30° to 140 ° F) shall be provided for outdoor installations where type 3R, 4, are specified. (This feature shall be equal to ASCO accessory 44G, and shall be capable of being added to existing switches).

E. Surge Suppression – A TVSS with a surge current rating of 65kA shall be provided with individually matched fused metal oxide varistors (MOVs). It shall include LED status indication of normal operation, under voltage, power loss, phase loss or component failure. Shall include form C dry contacts for external alarm or monitoring. The unit shall be enclosed in a Noryl housing rated NEMA 4, 12, and X. Shall comply with UL 1449 3rd edition (This feature shall be equal to ASCO accessory 73, and shall be capable of being added to existing switches).

F. Power Meter – (This feature shall be equal to ASCO accessory 135L, or feature bundle accessory 150*).

The Power Meter shall conform to the requirements of:

1. UL 3111-1-Electrical Measuring and Testing Equipment
2. CAN/CSA-C22.2 No. 23-M89-CSA Safety Requirements for Electrical and Electronic Measuring and Test Equipment
3. The Power Meter shall be capable of operating without modification at a nominal frequency of 45 to 66Hz.

4. The Power Meter shall be rated for an operating temperature of -4°F to 158°F and a storage temperature of -22°F to 176°F. and shall be rated for an 85% non-condensing, relative humidity.

5. The Power Meter shall accept inputs from industry standard instrument transformers (120 VAC secondary PT's and 5A secondary CT's). Direct phase voltage connections, 0 to 600VAC nominal, shall be possible without the use of PT's.

6. The Power Meter shall accept single, 3 phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.
7. The Power Meter shall contain a built-in discrete contact to wire an ATS 14A auxiliary contact to indicate switch position.

8. The Power Meter shall accept AC voltage from the sensing lines for operation. Additional provisions shall be provided for external DC voltage input range 9-36 VDC with a nominal of 24 VDC.

9. The Power Meter shall be equipped with a continuous duty, long –life, 4 line x 20 character green backlit LCD

10. All setup parameters required by the Power Meter shall be stored in non- volatile memory and retained in the event of a control power interruption.

11. The Power Meter shall be flush mountable on a surface.

12. The Power Meter enclosure shall be sealed to IP-51 (NEMA 1) and the faceplate shall be sealed to IP-65 (NEMA 4). All push buttons shall be sealed tact switches.

13. The Power Meter shall send, when prompted, information to a central location equipped with a manufacturer supplied critical power management system or 3rd party monitor through manufacturer supplied communication modules. All 3rd party monitor must utilize industry standard open protocols Modbus/RTU.Modbus/TCP or SNMP.

14. An embedded RS-485 port will be provided which will enable communication at 9600, 19.2K, 38.4K, or 57.6K baud. DIP switches will be provided on the RS-485 port allowing a user to select 2-wire or 4-wire communication as well as the option to activate a terminating resistor on the port.

15. The Power Meter shall help facilities comply with NEC 220. It shall provide Maximum Demand calculations for the past 24 months, as per standards with 15 minute averages.

16. The following data will be available on the display and Modbus registers of the Power Meter:
    - *Line-to-neutral voltages (V_{AN}, V_{BN}, and V_{CN})*
    - *Line-to-neutral voltage average (V_{AVE})*
    - *Line-to-line voltages (V_{AB}, V_{BC}, and V_{CA})*

- *Line-Line voltage average (V_{LAVE})*
- *Current on each phase (I_A,I_B,and I_C)*
- *Current on the neutral conductor (I_N)*
- *Average current (I_{AVE})*
- *Active power, KW per phase and total (W_A,W_B,W_C, and WT)*
  - *Apparent power, KVA per phase and total (VAA, V_{AB}, V_{AC}, and V_{AT})*
  - *KWHours importing, exporting and net (KWH_{IMP}, KWH_{EXP}, and KWH_{NET})*
- *KVARHours leading, lagging and net ($KVARH_{LEAD}$, KVARLAG, and KVARHNET)*
- *Power factor (PF)*
- *Signal Frequency (Hz)*
- *Digital Input*

17. The Power Meter shall offer an LCD which can display no less than nine different languages.

18. Displaying each of the metered values shall be done through the use of menu scroll buttons. There will be an escape button which will be used to take the user back to the previous page or to cancel a setting change.
    Pressing escape no more than three times will return the user to the home screen.

19. For ease of operator viewing, the display can be configured to remain on continuously, with no detrimental effect on the life of the Power Meter.

20. The display's contrast shall be configurable in intervals of 10% (ranging 0%-100%).

21. Setup of a system requirements shall be allowed from the front of the Power Meter.

5.1 ATS Remote Annunciator

General

Provide and install ATS Remote Annunciators for monitoring and control of automatic transfer switches remotely over Ethernet.

A. Hardware Specifications

The ATS Remote Annunciator shall be listed to cUL-60950-1 and UL 1008 and include the following features and ratings*:*

- *User-configured labels with ATS names and power sources*
- *Dual 10/100 Base-T auto sensing and auto crossover Ethernet ports*
- *LED indication of source acceptability, switch position, common alarm, time delay and Ethernet link activity*
- *Push button for transfer/retransfer control operations and time delay bypass*
- *Push buttons for Alarm Silence and Lamp Test*
- *Key lock to enable and disable the transfer push button*
- *Audible and visual alarm to indicate Communication Error ATS Locked Out Failure to Synchronize Extended Parallel and any of the 8 user-configured discrete inputs*
- *Programmable watchdog timer that can generate a system reset upon timeout (minimum 1 sec)*
- *Factory reset capability*
- *100 ms power ride-through*

B. Software Specification

The ATS Remote Annunciator shall contain embedded web pages accessible via various web browsers with the following capabilities:

- *Configuration for protocol and communications management with the ability of auto discovering transfer switches on network*
- *Ability to create and print customized labels for ATS names and power sources*
- *The ability to choose a continuous or periodic audible alarm with customizable interval time*
- *View detailed packet status counters i.e. transmitted received and dropped packets with the ability to reset counters*
- *ATS source name configuration page which allows users to configure power source names and print labels*
- *Upgrade firmware from Ethernet network without interrupting equipment operation*

C. Communications

Dual 10/100 Base-T (RJ-45) Ethernet ports are provided to support TCP/IP communications for up to eight automatic transfer switches via individual remote connectivity modules or daisychained serial modules into a single Connectivity Module. Additional features include:

- *Supports Full Duplex Flow Control (IEEE 802.3x)*
- *3.3V power supply with 5V I/O tolerance*
- *Supports 3 LEDs to indicate traffic link speed and collision*

D. Mounting

The ATS Remote Annunciator is suitable for:

- *Surface mounting using mounting screws studs*
- *Flush Mount from behind a cutout section (Enclosure Door Mounting)*
- *Flush Mount from the front of a cutout section (Enclosure Door Mounting)*

E. Power Supply

The ATS Remote Annunciator shall be capable of accepting 24VDC, 120 VAC or 240 VAC power source.

F. Environmental

The ATS Remote Annunciator shall have an Ambient Operating Temperature range of -4 º to 158 º F (-20 º to +70 º C) @ 5~85% humidity and Ambient Storage Temperature of -40 º to 185 º F (-40 º to 85 º C).

PART 6 - ADDITIONAL REQUIREMENTS

6.1 Withstand and Closing Ratings

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings shall be as follows when used with specific circuit breakers:

ATS Size	**Withstand & Closing Rating MCCB (480v/60hz)**	**W/CLF**
30	22,000A	100,000
70 - 200	22,000A	200,000
230	25,000A	100,000
260 – 400	42,000A	200,000
600	50,000A	200,000
800 – 1200	65,000A	200,000
1600 – 2000	85,000A	200,000
2600 – 3000	100,000A	200,000

6.2 Tests and Certification

A. The complete 3ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001: 2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in

design/development, production, installation and servicing in accordance with ISO 9001: 2008.

6.3 Service Representation

A. The ATS manufacturer shall maintain a national service organization of company- employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 20 years.

C. For ease of maintenance, the transfer switch nameplate shall include drawing numbers and serviceable part numbers.

END OF SECTION 263600 – AUTOMATIC TRANSFER SWITCHES