Wayne State University

Electrical Reliability Upgrades – Bid Package #2
WSU Project Number 050-245285 (Shapero Hall)
629-245283 (Elliman Building)

Prevailing Wage Work

FOR:
Board of Governors
Wayne State University
Detroit, Michigan

Owner’s Agent:
Robert Kuhn, Sr. Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3712 / 313-577-3747 fax
ac6243@wayne.edu and copy ag5343@wayne.edu

Owner’s Representative:
Bill McVea, Project Manager
Facilities Planning & Management
Design & Construction Services
5454 Cass
Wayne State University
Detroit, Michigan 48202

Consultant:
MEP Engineers, LLC
30403 W. 13 Mile Road
Farmington Hills, Michigan 48334

November 6, 2014
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title Page</td>
<td>00001-1</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>00002-1</td>
</tr>
</tbody>
</table>

### Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract

- **00005** Information for Bidders 00005-1 thru 00005-2
- **00100** Instructions to Bidders 00100-1 thru 00100-5
- **00250** Notice of Pre-Bid Conference 00250-1 thru 00250-2
- **00300** Form of Proposal & Qualification Statement & Detailed Questionnaire 00300-1 thru 00300-7
- **00410** Prevailing Wage Rate Schedule 00410-1 thru 00410-3
- **00430** Payment Package Document Requirements 00430-1
- **00500** Agreement between Contractor and Owner for Construction 00500-1 thru 00500-9
- **00510** Form of Guarantee 00510-1
- **00700** General Conditions (A.I.A. A-201) 00700-1
- **00800** WSU Supplementary General Conditions of the Contract for Construction 00800-1 thru 00800-12
- **00850** Drawings 00850-1

### Division 1 - General Requirements

- **01000** General Requirements 01000-1 thru 01000-9
- **01010** Summary of Work (Includes Scope of Work) 01010-1
- **01010** Sample Emission Certificates 01010-2 thru 3
INFORMATION FOR BIDDERS

OWNER: Board of Governors
Wayne State University

PROJECT: Electrical Reliability Upgrades – Bid Package #2
Project No. 050-245285 (Shapero Hall)
629-245283 (Elliman Building)

LOCATION: Wayne State University
Shapero Hall  5501 Gullen Mall, Detroit, MI 48202
Elliman Bldg.  421 E. Canfield, Detroit, MI 48201
Detroit, Michigan 48202

OWNER'S AGENT: Robert Kuhn, Sr. Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3712 / 313-577-3747 fax
ac6243@wayne.edu & copy ag5343@wayne.edu

OWNER'S REPRESENTATIVE: Bill McVea, Project Manager
Facilities Planning & Management
Design & Construction Services
Wayne State University
5454 Cass Avenue
Detroit, Michigan 48202

Architect: MEP Engineers, LLC
30403 W. 13 Mile Road
Farmington Hills, Michigan 48334

SPECIAL NOTE: Right to reject any and all proposals, either in whole or in part and to waive any irregularities therein is reserved by the Owner.

BIDS ADVERTISED: November 6, 2014

BIDDING: Bidding documents may be obtained by vendors from the University Purchasing Web Site at http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html beginning October 31, 2014. When visiting the Web Site, click on the "Construction" link in green. Copies of the RFP will not be available at the pre-proposal meeting.

MANDATORY Pre-Bid Conference: November 13, 2014, 2:00p.m. local time, to be held at Wayne State University – FP&M Design & Construction Services
5454 Cass Ave., Conference Room 3, Detroit, MI, 48202. Late Arrivals may not be permitted to submit bids.

OPTIONAL Second Walk Through: (if needed) To be determined at the conclusion of the pre-bid conference, by those in attendance.

DUE DATE FOR QUESTIONS: Due Date for questions shall be November 20, 2014 at 12:00 Noon. All questions must be reduced to writing and emailed to the attention of Robert Kuhn, Sr. Buyer at ac6243@wayne.edu, copy to Robin Ellis - Watkins, Buyer at: ag5343@wayne.edu.

Bids Due: Sealed proposals for lump-sum General Contract will be received at the office of the Procurement & Strategic Sourcing located at 5700 Cass Avenue, Suite 4200, Detroit, MI 48202 on December 4, 2014, until 2:00 p.m. (local time).

No public bid opening will be held.
Bid Qualification Meeting: Bidders must be available for bid prequalification meeting the day following the bid opening. The lowest qualified bidder will be contacted and requested to meet with Facilities Planning & Management at their office located at 5454 Cass Avenue, Detroit, MI 48202. During the prequalification, the Vendor must provide a Project Schedule and a Schedule of Values, including a list of Contractor’s suppliers, subcontractors and other qualifications.

An unsigned contract will be given to the successful Contractor at the conclusion of the Pre Award meeting, if all aspects of the bid are in order. The Contractor has 5 business days to return the contract to the Project Manager for University counter signature. The contractor must also submit a Performance Bond as outlined above and a Certificate of Insurance in the same 5 business day period. In the event the Contractor fails to return the documents in this 5 day period, the University reserves the right to award the contract to the next most responsive bidder.

All available information pertaining to this project will be posted to the Purchasing web site at http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html. Information that is not posted to the website is not available/not known.
INSTRUCTIONS TO BIDDERS

OWNER:  
Board of Governors  
Wayne State University

PROJECT:  
Electrical Reliability Upgrades – Bid Package #2  
Project No. 050-245285 (Shapero Hall)  
629-245283 (Elliman Building)

LOCATION:  
Wayne State University  
Shapero Hall  5501 Gullen Mall, Detroit, MI 48202  
Elliman Bldg.  421 E. Canfield, Detroit, MI 48201,  
Detroit, Michigan 48202

OWNER’S AGENT:  
Robert Kuhn, Sr. Buyer  
WSU – Procurement & Strategic Sourcing  
5700 Cass, Suite 4200  
Detroit, Michigan 48202  
313-577-3712 / 313-577-3747 fax  
ac6243@wayne.edu & copy ag5343@wayne.edu

1. PROPOSALS

A. The Purchasing Agent will receive sealed Proposals for the work as herein set forth at the place and until the time as stated in the "Information for Bidders", a copy of which is bound herewith in these specifications. No public bid opening will be held.

B. Proposals shall be for a lump-sum General Contract for the entire work of the Project as provided in the Form of Proposal.

C. Proposals shall be submitted in duplicate on forms furnished with the Bidding documents. The forms must be fully filled out in ink or typewritten with the signature in longhand, and the completed forms shall be without alterations, interlineations, or erasures. Forms shall contain no recapitulations of the work to be done. Each proposal shall be delivered in an opaque sealed envelope, marked "PROPOSAL" AND SHALL BEAR THE NAME OF THE PROJECT AND THE NAME OF THE BIDDER. Proposals submitted by telephone or telegraph will not be accepted. Modifications by telephone or telegraph to previously submitted proposals will not be accepted.

D. (revised 5-29-2009) All base bids must be conforming to the detailed specifications and drawings provided by the University, including any Addenda issued. Voluntary Alternates will only be considered if the Contractor has also submitted a conforming base bid. Any stipulation of voluntary alternates or qualifications contrary to the Contract requirements made by the Bidder in or accompanying his proposal as a condition for the acceptance of the Contract will not be considered in the award of the Contract and will cause the rejection of the entire Proposal.

E. The competency and responsibility of Bidders will be considered in making the award. The Owner does not obligate himself to accept the lowest or any other bids. The Owner reserves the right to reject any and all bids and to waive any informalities in the Proposals.

2. PROPOSAL GUARANTEE (revised 3-22-2012)

A. A certified check or bank draft payable to the Owner, or satisfactory Bid Bond executed by the Bidder and Surety Company, in an amount equal to not less than five percent (5%) of the maximum proposal amount shall be submitted with each Proposal, which amount may be forfeited to the Board of Governors, Wayne State University, if the successful Bidder refuses to enter into a Contract within ninety (90) days from receipt of Proposals.
B. Bond must be issued by a Surety Company with an “A rating as denoted in the AM Best Key Rating Guide”

C. The bid deposit of all bidders except the lowest three will be returned within three (3) days after the bids are opened. After the formal Contract and bonds are approved, the bid deposit will be returned to the lowest three bidders, except when forfeited.

D. Bid bonds shall be accompanied by a Power of Attorney authorizing the signer of the bond to do so on behalf of the Surety Company.

E. Withdrawal of Proposals is prohibited for a period of ninety (90) days after the actual date of opening thereof.

3. **CONTRACT SECURITY (revised 3-22-2012)**

   A. The successful Bidder will be required to furnish a Performance Bond and Labor and Material Payment bond in an amount equal to 100% of the contract award amount, and include such cost in the Proposal, complying with the laws of the State of Michigan. The graduated formula no longer applies.

   B. Performance Bond and Labor and Material Payment Bond shall be from a surety company acceptable to the Owner and made payable as follows:

   (1) A bond for 100% of the contract award amount to the Board of Governors of Wayne State University, and guaranteeing the payment of all subcontractors and all indebtedness incurred for labor, materials, or any cause whatsoever on account of the Contractor in accordance with the laws of the State of Michigan relating to such bonds.

   (2) A bond for 100% of the contract award amount to the Board of Governors of Wayne State University to guarantee and insure the completion of work according to the Contract.

   C. The only acceptable Performance Bond shall be the AIA A312 – 2010.

   D. Bond must be issued by a Surety Company with an “A rating as denoted in the AM Best Key Rating Guide”.

4. **BOND CLARIFICATION**

   For bids below $50,000.00,

   A. Bid bond will not be required.

   B. Performance Bond will not be required.

5. **INSPECTION**

   A. Before submitting his Proposal, each Bidder shall be held to have visited the site of the proposed work and to have familiarized himself as to all existing conditions affecting the execution of the work in accordance with the Contract Documents. No allowance or extra consideration on behalf of the Contractor will subsequently be made by reason of his failure to observe the Conditions or on behalf of any subcontractor for the same reason.

6. **EXPLANATION TO BIDDERS AND ADDENDA**

   A. Neither the Owner nor Representative nor Purchasing Agent will give verbal answers to any inquiries regarding the meaning of drawings and specifications, and any verbal statement regarding same by any person, previous to the award, shall be unauthoritative.
B. Any explanation desired by Bidders must be requested of the Purchasing Agent in writing, and if explanation is necessary, a reply will be made in the form of an Addendum, a copy of which will be forwarded to each Bidder registered on the Bidders’ List maintained by Procurement & Strategic Sourcing.

C. All addenda issued to Bidders prior to date of receipt of Proposals shall become a part of these Specifications, and all proposals are to include the work therein described.

7. INTERPRETATION OF CONTRACT DOCUMENTS

A. If any person contemplating submitting a bid for the proposed Contract is in doubt as to the true meaning of any part of the drawings, specifications, or other Contract Documents, he may submit to the Purchasing Agent, a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the Contract Documents will be made by an addendum duly issued. A copy of such addendum will be mailed and delivered to each registered Bidder. Each proposal submitted shall list all addenda, by numbers, which have been received prior to the time scheduled for receipt of proposal.

8. SUBSTITUTION OF MATERIALS AND EQUIPMENT*

A. Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers’ or vendors’ names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided that the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance and function. It shall not be purchased or installed by the Contractor without the Architect’s written approval.

9. TAXES

A. The Bidder shall include in his lump sum proposal and make payment of all Federal, State, County and Municipal taxes, including Michigan State Sales and Use Taxes, now in force or which may be enacted during the progress and completion of the work covered.

10. REQUIREMENTS FOR SIGNING PROPOSALS AND CONTRACTS

A. The following requirements must be observed in the signing of proposals that are submitted:

(1) Proposals that are not signed by individuals making them shall have attached thereto a Power of Attorney, evidencing the authority to sign the Proposal in the name of the person for whom it is signed.

(2) Proposals that are signed for partnership shall be signed by all of the partners or by an Attorney-in-Fact. If signed by an Attorney-in-Fact, there must be attached to the Proposal a Power of Attorney evidencing authority to sign the Proposal, executed by the partners.

(3) Proposals that are signed for a corporation shall have the correct corporate name thereof and the signature of the President or other authorized officer of the corporation, manually written in the line of the Form of Proposal following the words "signed by". If such a proposal is signed by an official other than the President of the Corporation, a certified copy of resolution of the Board of Directors, evidencing the authority of such official to sign the bid, shall be attached to it. Such proposal shall also bear the attesting signature of the Secretary of the Corporation and the impression of the corporate seal.

11. QUALIFICATIONS OF BIDDERS

A. The Owner may request each of the three (3) low bidders to submit information necessary to satisfy the Owner that the Bidder is adequately prepared to fulfill the Contract. Such information may include past performance records, list of available personnel, plant and equipment, description of
work that will be done simultaneously with the Owner's Project, financial statement, or any other pertinent information. This information and such other information as may be requested will be used in determining whether a Bidder is qualified to perform the work required and is responsible and reliable.

12. SPECIAL REQUIREMENTS

A. The attention of all Bidders is called to the General Conditions, Supplementary General Conditions, and Special Conditions, of which all are a part of the Specifications covering all work, including Subcontracts, materials, etc. Special attention is called to those portions dealing with Labor Standards, including wages, fringe benefits, Equal Employment Opportunities, and Liquidated Damages.

B. Prior to award of the project, the apparent low bidder will be required to produce a schedule of values which will include the proposed subcontractors for each division of work and whether the subcontractor is signatory or non-signatory. A contract will not be issued to the apparent low bidder until this document is provided. A contractor will have one week to produce this document. If the required document is not received within this time, the bidder will be disqualified.


A. The Proposal shall be deemed as having been accepted when a copy of the Contract (fully executed by both the vendor and the appropriate signatory authority for the University), with any/all Alternates, Addenda, and Pre-Contract Bulletins, as issued by the office or agent of the Owner has been duly received by the Contractor. After signing the Contracts, the Contractor shall then return all copies, plus any required bonds and certificates of insurance, to the office of the Owner's Representative, at 5454 Cass, Wayne State University, Detroit, MI 48202. Construction will begin when the fully-executed contract has been returned to the Contractor.

14. TIME OF STARTING AND COMPLETION

A. It is understood that the work is to be carried through to substantial completion with the utmost speed consistent with good workmanship and to meet the established start and completion dates.

B. The Contractor shall begin work under the Contract without delay, upon receipt of a fully-executed contract from the Owner, and shall substantially complete the project ready for unobstructed occupancy and use of the Owner for the purposes intended within the completion time stated in the Contract.

C. The Contractor shall, immediately upon receipt of fully-executed contract, schedule his work and expedite deliveries of materials and performance of the subcontractors to maintain the necessary pace for start and completion on the aforementioned dates.

15. BIDDING DOCUMENTS

A. Bid specifications are not available at the University, but are available beginning November 7, 2014 through Wayne State University Procurement & Strategic Sourcing’s Website for Advertised Bids: http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html. The plans for this project can be viewed in advance and/or printed from the above website. Copies of the RFP will not be available at the pre-proposal meeting.

B. DOCUMENTS ON FILE (revised 12-2007)

(1) Wayne State University Procurement & Strategic Sourcing’s Website. All available information pertaining to this project will be posted to the Purchasing web site at http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html. Information that is not posted to the website is not available/not known.
(2) Notification of this Bid Opportunity has been sent to DUNN BLUE (for purchase of Bid Documents only), DODGE REPORTS, REED CONSTRUCTION, CONSTRUCTION NEWS and the CONSTRUCTION ASSOCIATION OF MICHIGAN (CAM).

(3) Please note: Effective December 1, 2007, bid notices will be sent only to those Vendors registered to receive them via our Bid Opportunities list serve. To register, to http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html, and click on the “Join our Listserve” link at the top of the page.
NOTICE OF MANDATORY PRE-BID CONFERENCE

PROJECT: Electrical Reliability Upgrades – Bid Package #2

PROJECT NOS.: WSU PROJECT NO. 050-245285 (Shapero Hall) 629-245283 (Elliman Building)

It is MANDATORY that each Contractor proposing to bid on this work must attend a pre-bid conference at the following location:

Wayne State University
FP&M Design & Construction Services
5454 Cass Ave., Conference Room 3
Detroit MI 48202

2:00p.m., local time, November 13, 2014

The purpose of this conference is to clarify the procedures, scope of work, and to identify any omissions and/or inconsistencies that may impede preparation and submission of representative competitive bids.

An attendance list shall be prepared and minutes of the conference shall be furnished to all those attending.

Any clarifications or corrections that cannot be made at the conference will be by Addendum.

For your convenience a map of the University and appropriate parking lots can be downloaded and printed from: http://campusmap.wayne.edu. Guest parking in any of the University student and guest lots is $7.00. A detailed list of Cash & Coin operated lots can be viewed at http://purchasing.wayne.edu/cash_and_credit_card_lots.php. Cash lots dispense change in quarters. Due to time constraints, Vendors are encouraged to avoid parking at meters on the street (especially blue “handicapped” meters).

All available information pertaining to this project will be posted to the Purchasing web site at http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_bid.html. Information that is not posted to the website is not available/not known.
AGENDA

I. Welcome and Introductions
   A. Wayne State University Representatives
   B. Vendor Representatives
   C. Sign in Sheet- be sure to include your fax number and email address (LEGIBLY) on the sign in sheet.

II. Brief Overview of Wayne State University
   A. Purpose and Intent of RFP.
   B. Detailed review of the RFP and the requirements for a qualified response.
   C. Review of all pertinent dates and forms that are REQUIRED for a qualified response.

III. Vendor Questions/Concerns/Issues
   A. Questions that can be answered directly by the appropriate person in this meeting will be answered and both question and answer will be recorded in the minutes of the meeting.
   B. Questions that need to be researched will be answered and a nature of clarification will be emailed to the appropriate ListServ. See http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_Bid_Listserve.html for a list of ListServ Bid Lists.
   C. Minutes will be emailed to all participants of the meeting within a reasonable amount of time. (be sure to include your email address/addresses on the sign in sheet)
   D. Questions and concerns that come up after this meeting are to be addressed to Robert Kuhn, Procurement & Strategic Sourcing. Discussion with other University members is seriously discouraged and could lead to disqualification from further consideration. All questions and answers will be recorded and emailed to all participants of the RFP.
   E. Due date for questions is November 20, 2014 at 12:00 P.M., 12:00 noon.

IV. Proposal Due Date- December 4, 2014 at 2:00 P.M., 2:00 p.m.

V. Final Comments

VI. Adjourn
OWNER: Board of Governors
Wayne State University

PROJECT: Electrical Reliability Upgrades – Bid Package #2

PROJECT NO.: WSU PROJECT NO. 050-245285 (Shapero Hall)
629-245283 (Elliman Building)

PROJECT TYPE: Electrical, General Work

PURCHASING AGENT: Robert Kuhn, Sr. Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3712/ 313-577-3747 fax
ac6243@wayne.edu & copy ag5343@wayne.edu

OWNER'S REPRESENTATIVE: Bill McVeal, Project Manager
Design & Construction Services
Facilities Planning & Management
Wayne State University
5454 Cass Avenue
Detroit, Michigan 48202

TO: Board of Governors
Wayne State University
Detroit, Michigan

BASE PROPOSAL for 629-245283 (Elliman Building):

The undersigned agrees to enter into an Agreement to complete the entire work of the Electrical Reliability Upgrades – Bid Package #2 project (WSU Project No. 629-245283 (Elliman Building) ) in accordance with the Bidding Documents for the following amounts (Include allowance):

__________________________ $ Dollars

BASE PROPOSAL for 050-245285 (Shapero Hall):

The undersigned agrees to enter into an Agreement to complete the entire work of the Electrical Reliability Upgrades – Bid Package #2 project (WSU Project No. 050-245285 (Shapero Hall) in accordance with the Bidding Documents for the following amounts (Include allowance):

__________________________ $ Dollars

BASE PROPOSAL:

Total Package Price: The undersigned agrees to enter into an Agreement to complete the entire work of the Electrical Reliability Upgrades – Bid Package #2 (WSU Project No. 629-245283 (Elliman Building), and 050-245285 (Shapero Hall) in accordance with the Bidding Documents for the following amounts (Include allowances):

__________________________ $ Dollars
ALTERNATES:
The following alternates to the base proposal(s) are required to be offered by the respective bidder. The undersigned agrees that the following amounts will be added to or deducted from the base bid as indicated, for each alternate which is accepted.

ALTERNATE NO. 1:
The undersigned agrees to enter into an agreement to complete the Alternate # 1 work of the Electrical Reliability Upgrades – Bid Package #2 (WSU Project No. 629-245283 (Elliman Building)) and to provide all labor and material associated with the removal and disposal of the existing underground 10,000 gallon diesel fuel tank.

(Select one) ADD $ Dollars
or
DEDUCT $ Dollars

If directed by the University, remove contaminated spoils off site to WSU specified landfill and provide manifest. Provide all labor, materials, and equipment to backfill excavation for the following price per ton. (Unit price shall include all overhead and profit.)

$ Dollars / ton

ALTERNATE NO. 2:
The undersigned agrees to enter into an agreement to complete the Alternate # 1 work of the Electrical Reliability Upgrades – Bid Package #2 (WSU Project No. 629-245283 (Elliman Building)) and to provide all labor and material associated with the removal and turnover to the Owner of existing roof-mounted 275 KVA standby diesel emergency generator. Deliver to Owner’s storage at located at 1200 Holden St., Detroit, MI 48202. Includes removal of associated conduit and wiring back to ATS-1 located in the third floor mechanical room. Abandon in place associated fuel piping. Cap piping at both ends.

(Select one) ADD $ Dollars
or
DEDUCT $ Dollars

ALTERNATE NO. 3:
The undersigned agrees to enter into an agreement to complete the Alternate # 1 work of the Electrical Reliability Upgrades – Bid Package #2 (WSU Project No. 629-245283 (Elliman Building)) and to provide all labor and material provide and install new 15KV EPR insulated cables in the existing duct bank from Substation–A load break switches to new electrical manhole. Also includes labor to install DTE furnished 15KV EPR insulated cables from the DTE manhole to the new electrical manhole. This alternate is dependent on testing for moisture for existing 15KV paper and lead primary cables exposed and cut in new electrical manhole. (Note: Testing of existing 15KV paper and lead primary cables shall be included in Base Bid.)

(Select one) ADD $ Dollars
or
DEDUCT $ Dollars

Allowance:

- **Electrical Reliability Upgrades – Bid Package #2 project (WSU Project No. 629-245283 (Elliman Building)) base bid shall include** an allowance to cover costs associated with premium time associated with overtime work per Specification Section 012100. Allowance will also be used to cover additional costs for extended rental of generator and fuel if Alternate #3 is accepted. The allowance expenditure must be accounted for and approved in advance by WSU during the construction phase of the project, unused allowances will be returned to the University.

$40,000 Dollars

Allowance:

- **Electrical Reliability Upgrades – Bid Package #2 project (WSU Project No. 050-245285 (Shapero Hall)) base bid shall include** an allowance to cover costs associated with premium time associated with overtime work per Specification Section 012100. The allowance expenditure must be accounted for and approved in advance by WSU during the construction phase of the project, unused allowances will be returned to the University.
$5,000 Dollars

LAWN REPLACEMENT:
The undersigned agrees that, in the event of existing lawn or landscaping damage, due to the Contractor's work, that has not been properly addressed and repaired to the satisfaction of the University, the University may repair/replace the lawn and/or landscaping, and that the expense will be at a unit cost of $10.00 per square yard for lawn, and landscaping at a rate of 1.5 times the cost of said repairs, the full cost of which shall be reimbursed by the contractor.

CONTRACT CHANGE
ORDERS: (revised 4-01-2011)
The undersigned agrees to the following pricing formula and rates for changes in the contract work:

1. For subcontract work, Contractor's markup for handling, overhead, profit and bonding on subcontractors sell price, shall not exceed 5%.

   1.1. For subcontract work that is provided on a time and material basis, the subcontractor shall be permitted a single markup for handling, overhead, profit and bonding of 5%. When a markup is identified in the subcontractor's hourly labor rate, additional markup on labor is not permitted.

   1.1.1 For changes that are based upon a lump sum value, subcontractor shall provide all labor and material back-ups to ensure that duplicative charges are avoided and authorized mark-ups for OH&P can be confirmed.

2. For work by his own organization, Contractor's markup for job* and general overhead, profit and bonding shall not exceed 5% of the net labor** and material costs.

Within 14 days of the project's contract execution Contractor shall provide to the Owner; Subcontractor's hourly labor rate breakdown details. This requirement shall extend to the lowest level of subcontractor participation.

   * Job and general overhead includes supervision and executive expenses; use charges on small tools, scaffolding, blocking, shores, appliances, etc., and other miscellaneous job expenses.

   ** Net labor cost is the sum of the base wages, fringe benefits established by governing trade organizations, applicable payroll taxes, and increased expense for contractor's liability insurance (Workman's Compensation, P.L. and P.D.).

TIME OF COMPLETION: (revised 4-01-2011)
The Contract is expected to be fully executed on or about 25 calendar days after successful bidder qualification and recommendation of award. The undersigned agrees to start construction immediately after receipt of a fully executed contract, and to complete the work as follows:

Substantial Completion will be completed no later than 050 Shapero Hall (May 29, 2015) and 629 Elliman (September 30, 2015).

LIQUIDATED DAMAGES:
It is understood and agreed that, if project is not completed within the time specified in the contract plus any extension of time allowed pursuant thereto, the actual damages sustained by the Owner because of any such delay, will be uncertain and difficult to ascertain, and it is agreed that the reasonable foreseeable value of the use of said project by Owner would be the sum of $250.00 per day, Two Hundred Fifty Dollars per day, and therefore the contractor shall pay as liquidated damages to the Owner the sum of $250.00 per day, Two Hundred Fifty Dollars per day for each day's delay in substantially completing said project beyond the time specified in the Contract and any extensions of time allowed thereunder.
TAXES: The undersigned acknowledges that prices stated above include all applicable taxes of whatever character or description. Michigan State Sales Tax is applicable to the work. Bidder understands that the Owner reserves the right to reject any or all bids and to waive informalities or irregularities therein.

ADDENDA: The undersigned affirms that the cost of all work covered by the following Addenda are included in the lump sum price of this proposal.

Addendum No.____ Date___________ Addendum No.____ Date___________
Addendum No.____ Date___________ Addendum No.____ Date___________
Addendum No.____ Date___________ Addendum No.____ Date___________
Addendum No.____ Date___________ Addendum No.____ Date___________
Addendum No.____ Date___________ Addendum No.____ Date___________

CONTRACTOR’S PREQUALIFICATION STATEMENT & QUESTIONNAIRE:

Our Minimum Requirements for Construction Bids are:

WSU considers this project:

Electrical, General Work.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Small Project bid less than $50,000</th>
<th>Medium Project bid between $50,001 and $250,000</th>
<th>Large Project bid between $250,001 and $2 million</th>
<th>Very Large Project bid greater than $2 million</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMR Rating (Experience Modification Rating)</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
</tr>
<tr>
<td>Bondable Vendor</td>
<td>N.A.</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Length of Time in Construction Business</td>
<td>2 Years</td>
<td>3 Years</td>
<td>5 Years</td>
<td>5 Years</td>
</tr>
<tr>
<td>Demonstrated Experience in Projects Similar in Scope and Price in the last 3 years</td>
<td>1 or more</td>
<td>1 or more</td>
<td>2 or more</td>
<td>3 or more</td>
</tr>
<tr>
<td>Unsuccessful Projects on Campus in last 3 years</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
</tr>
<tr>
<td>Failure to comply with Prevailing Wage and/or Project Labor requirements</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
</tr>
<tr>
<td>Withdrawn University Bid (with or without Bond forfeiture) within the last 3 years **</td>
<td>1 or less</td>
<td>1 or less</td>
<td>1 or less</td>
<td>1 or less</td>
</tr>
<tr>
<td>Company currently not in Chapter 11 of the</td>
<td>1 Year</td>
<td>2 Years</td>
<td>3 Years</td>
<td>3 Years</td>
</tr>
</tbody>
</table>

**Note:**

- **EMR Rating (Experience Modification Rating)**: 1.0 or Less
- **Bondable Vendor**: N.A. Required
- **Length of Time in Construction Business**: 2 Years 3 Years 5 Years 5 Years
- **Demonstrated Experience in Projects Similar in Scope and Price in the last 3 years**: 1 or more 1 or more 2 or more 3 or more
- **Unsuccessful Projects on Campus in last 3 years**: None Allowed None Allowed None Allowed None Allowed
- **Failure to comply with Prevailing Wage and/or Project Labor requirements**: None Allowed None Allowed None Allowed None Allowed
- **Withdrawn University Bid (with or without Bond forfeiture) within the last 3 years**: 1 or less 1 or less 1 or less 1 or less
- **Company currently not in Chapter 11 of the**: 1 Year 2 Years 3 Years 3 Years
US Bankruptcy Code

** Withdrawal of a bid is subject to the University suspension policy, for a period up to one year.

** Contractors must complete the following information to determine their eligibility to participate in this bid. This information is required with your Bid to the University

Failure to complete this form in its entirety will result in your bid being disqualified.

Check one of the following on the makeup of your company:

- [ ] Corporation
- [ ] Individual
- [ ] Partnership
- [ ] Joint Venture
- [ ] Other (Explain)

1. How many years has your organization been in business as a contractor? ________________

2. How many years has your organization been in business under its present business name? ________________

3. List states in which your organization is legally qualified to do business. ________________

4. Provide the Name and Address of your Liability Insurance Carrier. ________________

5. What is your current EMR Rating? ________________

   The minimum requirement is an EMR Rating of 1.0 or less for all projects. Bidders with a rating higher than 1.0 understand that their bid may be disqualified, at the sole discretion of the University.

6. What percentage of work performed on projects are by company employees; excluding any hired subcontracting and outsourced relationships, for the bid submitted? _______ %

7. What percentage of work performed on your companies behalf are by subcontracted business relationships; disallowing 1099 contracting work forces, for the bid submitted? _______ %

8. Have you ever failed to complete any work awarded to you? If so, attach a separate sheet of explanation. Include the name of the Project, the customer, the dates of the work, and the amount of the contract?

9. Have you withdrawn a bid after a University bid opening and/or refused to enter into a contract with the University upon notification of award within the last 3 years? If so, state the Project Name and Number, and the date of bid submission below.

10. Has any officer or partner of your organization ever been an officer or partner of another organization that failed to complete a construction contract? If so, attach a separate sheet of explanation.

11. List the construction experience of the principals and superintendents of your company.
Wayne State University
WSU Project No. 050-245285 (Shapero Hall)
629-245283 (Elliman Building)

Name: __________________________ Title: ___________________________
_____________________________________________________________________
Name: __________________________ Title: ___________________________
_____________________________________________________________________
Name: __________________________ Title: ___________________________
_____________________________________________________________________

12. List the construction Projects, and approximate dates, when you performed work similar in Scope to this project.

Project: __________________________ Owner: ___________________________
Contract Amount: __________________________ Date Completed: _____________
Project: __________________________ Owner: ___________________________
Contract Amount: __________________________ Date Completed: _____________
Project: __________________________ Owner: ___________________________
Contract Amount: __________________________ Date Completed: _____________

13. List the construction Projects, and approximate dates, when you performed work similar in Dollar Amount to this project.

Project: __________________________ Owner: ___________________________
Contract Amount: __________________________ Date Completed: _____________
Project: __________________________ Owner: ___________________________
Contract Amount: __________________________ Date Completed: _____________
Project: __________________________ Owner: ___________________________
Contract Amount: __________________________ Date Completed: _____________

14. Is your Company “bondable”?   Yes ______ No ______

15. What is your present bonding capacity? $ _______________________

16. Who is your bonding agent?
NAME: ____________________________________________________________
ADDRESS: _________________________________________________________
PHONE: (_________________) ___________________________________________
CONTACT: ____________________________________________

17. Does your company agree to provide financial reports to the University upon request? Failure to agree may result in disqualification of your bid. Yes _____  No _____

18. Does your company agree that all of the Terms and Conditions of this RFP and Vendor’s Response Proposal become part of any ensuing agreement? Yes ______  No _____

19. Does your company agree to execute a contract containing the clauses shown in Section 00500 “Agreement Between Contractor and Owner for Construction”? Yes _____  No _____

If “No”, clearly note any exceptions to any information contained in the contract documents and include with your proposal.

20. Did your company quote based upon Prevailing Wage Rates? Yes _____  No _____

Note: Contractors submitting proposals for this project may, at the discretion of the University, be required to submit references including contact information to be used to assist in the post bid evaluation process for the subject project.

ACKNOWLEDGEMENT OF MINIMUM QUALIFICATIONS:

The undersigned has read and understands the minimum qualifications for University construction projects, and has completed the Prequalification section completely and accurately. The undersigned understands that a contractor, who fails to meet the minimum qualifications in the category identified for this project, will be disqualified from consideration for the project.

ACCEPTANCE OF PROPOSAL:

The undersigned agrees to execute a Contract, being the Wayne State University standard form titled “Agreement Between Contractor and Owner for Construction” (see section 00500 of the bid documents), provided that we are notified of the acceptance of our Proposal within ninety (90) days of the date set for the opening thereof.

The undersigned below understands that the bid will be disqualified if the Prequalification information above is not completed in its entirety.

NAME OF COMPANY: ____________________________________________

OFFICE ADDRESS: ____________________________________________

PHONE NUMBER: ____________________________ DATE______________

FAX NUMBER: ____________________________________________

SIGNED BY: ____________________________________________

Signature

(Please print or type name here)

TITLE: ____________________________________________

EMAIL ADDRESS: ____________ @ ____________________________
**Detailed Questionnaire**

Generator Information Required as Part of the Bid Documents  
Required to be Submitted with Bids

1. Project name:______________________________________________
2. Generator Size:_____________________________________________
3. Number of Generators:_______________________________________
4. Manufacturer of Generators that are included in bid:______________
5. Year Generator Engine Manufactured: ___________________________
6. New Source Performance Standard (NSPS), Subpart III Emission Limit Tier (typically Tier 2 or Tier 3); ___________________________
7. Emission Compliance specification for the specific engine stating engine’s emission for Nitrogen Oxides (NOx), Carbon Monoxide (CO), Particulate (PM), and HydroCarbons HC or NMHC). See attached sheet for sample.

   U.S. EPA Certificate of Conformity sheet specific to the engine or engine family of generator being submitted.  
   *See attached sheet for sample*
PREVAILING WAGE RATE SCHEDULE (revised 4-05-2010)

A. See also Page 00100-4 Section 12.B

B. Wayne State University requires all project contractors, including subcontractors, who provide labor on University projects to compensate at a rate no less than prevailing wage rates.

C. The rates of wages and fringe benefits to be paid to each class of laborers and mechanics by each VENDOR and subcontractor(s) (if any) shall be not less than the wage and fringe benefit rates prevailing in Wayne County, Michigan, as determined by the United States Secretary of Labor. Individually contracted labor commonly referred to as “1099 Workers” and subcontractors using 1099 workers are not acceptable for work related to this project.

D. To maintain compliance with State of Michigan Ordinances, Certified Payroll must be provided for each of the contractor’s or subcontractor’s payroll periods for work performed on this project. Certified Payroll should accompany all Pay Applications. Failure to provide certified payroll will constitute breach of contract, and pay applications will be returned unpaid, and remain so until satisfactory supporting documents are provided.

A Prevailing Wage Rate Schedule has been issued from the State of Michigan that is enclosed in this section

Additional information can be found on the University Procurement & Strategic Sourcing’s web site at the following URL address:

http://purchasing.wayne.edu/vendors/wage-rates.php

If you have any questions, or require rates for additional classifications, please contact:

Michigan Department of Consumer & Industry Services,
Bureau of Safety and Regulation, Wage and Hour Division,
7150 Harris Drive,
P.O. Box 30476,
Lansing, Michigan 48909-7976

http://www.michigan.gov/dleg/0,1607,7-154-27673_27706--,00.html

F. Wayne State University's Prevailing Wage Requirements:

When compensation will be paid under prevailing wage requirements, the University shall require the following:

A. The contractor shall obtain and keep posted on the work site, in a conspicuous place, a copy of all current prevailing wage and fringe benefit rates.

B. The contractor shall obtain and keep an accurate record showing the name and occupation of and the actual wages and benefits paid to each laborer and mechanic employed in connection with this contract.

C. The contractor shall submit a completed certified payroll document [U.S. Department of Labor Form WH 347] verifying and confirming the prevailing wage and benefits rates for all employees and subcontractors for each payroll period for work performed on this project. The contractor shall include copies of pay stubs for all employee or contract labor payments related to Wayne State University work. The certified payroll form can be downloaded from the Department of Labor website at http://www.dol.gov/whd/forms/wh347.pdf.

D. A properly executed sworn statement is required from all tiers of contractors, sub-contractors and suppliers which provide services or product of $1,000.00 or greater. Sworn statements must accompany applications for payment. All listed parties on a sworn statement and as a subcontractor must submit Partial or Full Conditional Waivers for the amounts invoiced on the payment application. A copy of the acceptable WSU Sworn Statement and Waiver will be provided to the awarded contractor.
E. Apprentices for a skilled trade must provide proof of participation in a Certified Apprenticeship Program and the level of hours completed in the program.

F. Daily project sign-in sheets and field reports for the project must be turned in weekly.

Note: Contractor invoices WILL NOT be processed until all listed certified payroll documents are received.

G. If the VENDOR or subcontractor fails to pay the prevailing rates of wages and fringe benefits and does not cure such failure within 10 days after notice to do so by the UNIVERSITY, the UNIVERSITY shall have the right, at its option, to do any or all of the following:

1. Withhold all or any portion of payments due the VENDOR as may be considered necessary by the UNIVERSITY to pay laborers and mechanics the difference between the rates of wages and fringe benefits required by this contract and the actual wages and fringe benefits paid;

2. Terminate this contract and proceed to complete the contract by separate agreement with another vendor or otherwise, in which case the VENDOR and its sureties shall be liable to the UNIVERSITY for any excess costs incurred by the UNIVERSITY.

3. Propose to the Director of Purchasing that the Vendor be considered for Debarment in accordance with the University’s Debarment Policy, found on our website at http://purchasing.wayne.edu/docs/appm28.pdf

Terms identical or substantially similar to this section of this RFP shall be included in any contract or subcontract pertaining to this project.

H. The current applicable prevailing wage rates as identified by the State of Michigan Department of Consumer & Industry Services, Bureau of Safety and Regulation, Wage and Hour Division are attached. Refer to item C above if additional information is required.

I. Prior to award of the project, the apparent low bidder will be required to produce a schedule of values which will include the proposed subcontractors for each division of work and whether the subcontractor is signatory or non-signatory. A letter of intent or contract will not be issued to the apparent low bidder until this document is provided. The apparent low bidder will have one week to produce this document. If the required document is not received within this time, the bidder will be disqualified, and the next low bidder will be required to provide this schedule of values.

SEE ATTACHED STATE PREVAILING WAGE INFORMATION
# Wayne County

## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 1 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos &amp; Lead Abatement Laborer</td>
<td>MLD</td>
<td>Asbestos &amp; Lead Abatement Laborer</td>
<td>10/1/2014</td>
<td>$40.25</td>
<td>$53.64</td>
<td>$67.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 ten hour days @ straight time allowed Monday-Saturday, must be consecutive calendar days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 ten hour days @ straight time allowed Monday-Saturday,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boilermaker</td>
<td>BO169</td>
<td>Boilermaker</td>
<td>8/14/2009</td>
<td>$54.70</td>
<td>$81.08</td>
<td>$107.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1st 6 months</td>
<td>$40.31</td>
<td>$59.49</td>
<td>$78.67</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2nd 6 months</td>
<td>$41.45</td>
<td>$61.21</td>
<td>$80.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3rd 6 months</td>
<td>$42.57</td>
<td>$62.88</td>
<td>$83.19</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4th 6 months</td>
<td>$43.69</td>
<td>$64.57</td>
<td>$85.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5th 6 months</td>
<td>$44.81</td>
<td>$66.24</td>
<td>$87.67</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6th 6 months</td>
<td>$46.03</td>
<td>$67.80</td>
<td>$89.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7th 6 months</td>
<td>$49.32</td>
<td>$73.01</td>
<td>$96.69</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8th 6 months</td>
<td>$51.58</td>
<td>$76.40</td>
<td>$101.21</td>
<td></td>
</tr>
</tbody>
</table>

**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
# Official 2014 Prevailing Wage Rates for State Funded Projects

## Issue Date: 10/24/2014  
Contract must be awarded by: 1/22/2015

## Page 2 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Overtime</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hourly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bricklayer</td>
<td>Bricklayer, stone mason, pointer, cleaner, caulkker</td>
<td>BR1 10/15/2014</td>
<td>$52.43 $78.65 $104.86</td>
<td>H H D D D D Y</td>
<td></td>
</tr>
<tr>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>First 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$31.87 $47.81 $63.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2nd 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$33.72 $50.60 $67.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3rd 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$35.57 $53.37 $71.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4th 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$37.42 $56.14 $74.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5th 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$39.27 $58.92 $78.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6th 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$41.12 $61.70 $82.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7th 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$42.97 $64.46 $85.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8th 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$44.82 $67.24 $89.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Carpenter Diver | CA 687 D | 6/25/2014 | $64.65 $93.14 $121.63 X X H X X H D Y |
| Four 10s allowed M-Sat; double time due when over 12 hours worked per day |
| Apprentice Rates: |          |            |                          |                |                   |
|                |          |            | 1st 6 months             |                |                   |
|                |          |            | $24.23 $32.71 $41.18     |                |                   |
|                |          |            | 2nd 6 months             |                |                   |
|                |          |            | $28.25 $38.73 $49.22     |                |                   |
|                |          |            | 3rd 6 months             |                |                   |
|                |          |            | $30.35 $41.88 $53.42     |                |                   |
|                |          |            | 4th 6 months             |                |                   |
|                |          |            | $32.44 $45.02 $57.60     |                |                   |
|                |          |            | 5th 6 months             |                |                   |
|                |          |            | $34.54 $48.17 $61.80     |                |                   |
|                |          |            | 6th 6 months             |                |                   |
|                |          |            | $36.63 $51.31 $65.98     |                |                   |
|                |          |            | 7th 6 months             |                |                   |
|                |          |            | $38.74 $54.48 $70.20     |                |                   |
|                |          |            | 8th 6 months             |                |                   |
|                |          |            | $40.82 $57.59 $74.36     |                |                   |

| Carpet and Resilient Floor Layer | CA1045 | 6/12/2014 | $49.21 $70.18 $91.14 X X H X X X D Y |
| (does not include installation of prefabricated formica & parquet flooring which is to be paid carpenter rate) |
| Apprentice Rates: |          |            |                          |                |                   |
|                |          |            | 1st 6 months             |                |                   |
|                |          |            | $24.23 $32.71 $41.18     |                |                   |
|                |          |            | 2nd 6 months             |                |                   |
|                |          |            | $28.25 $38.73 $49.22     |                |                   |
|                |          |            | 3rd 6 months             |                |                   |
|                |          |            | $30.35 $41.88 $53.42     |                |                   |
|                |          |            | 4th 6 months             |                |                   |
|                |          |            | $32.44 $45.02 $57.60     |                |                   |
|                |          |            | 5th 6 months             |                |                   |
|                |          |            | $34.54 $48.17 $61.80     |                |                   |
|                |          |            | 6th 6 months             |                |                   |
|                |          |            | $36.63 $51.31 $65.98     |                |                   |
|                |          |            | 7th 6 months             |                |                   |
|                |          |            | $38.74 $54.48 $70.20     |                |                   |
|                |          |            | 8th 6 months             |                |                   |
|                |          |            | $40.82 $57.59 $74.36     |                |                   |

| Carpenter | CA687Z1 | 6/24/2014 | $55.24 $79.04 $102.84 X X H X X H D Y |
| four 10s allowed Mon-Sat; double time due when over 12 hours worked per day |
| Apprentice Rates: |          |            |                          |                |                   |
|                |          |            | 1st year                 |                |                   |
|                |          |            | $33.82 $46.92 $60.00     |                |                   |
|                |          |            | 3rd 6 months             |                |                   |
|                |          |            | $36.21 $50.49 $64.78     |                |                   |
|                |          |            | 4th 6 months             |                |                   |
|                |          |            | $38.58 $54.05 $69.52     |                |                   |
|                |          |            | 5th 6 months             |                |                   |
|                |          |            | $40.97 $57.64 $74.30     |                |                   |
|                |          |            | 6th 6 months             |                |                   |
|                |          |            | $43.33 $61.17 $79.02     |                |                   |
|                |          |            | 7th 6 months             |                |                   |
|                |          |            | $45.72 $64.77 $83.80     |                |                   |
|                |          |            | 8th 6 months             |                |                   |
|                |          |            | $48.09 $68.32 $88.54     |                |                   |

Official Request #: 1490  
Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,  
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne  

Official Rate Schedule  
Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 3 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half Hourly</th>
<th>Double Overtime Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piledriver</td>
<td>CA687Z1P</td>
<td>$55.24 $79.04 $102.84</td>
<td>6/24/2014</td>
<td>X X H X X H D Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Four 10s allowed Monday-Saturday; double time due when over 12 hours worked per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- **1st 6 months:** $33.82 $46.92 $60.00
- **2nd 6 months:** $38.58 $54.05 $69.52
- **3rd 6 months:** $43.33 $61.17 $79.02
- **4th 6 months:** $48.09 $68.32 $88.54

<table>
<thead>
<tr>
<th>Cement Mason</th>
<th>Cement Mason</th>
<th>$50.05 $71.17 $92.28</th>
<th>10/15/2014</th>
<th>X X H H H D N</th>
</tr>
</thead>
</table>

**Apprentice Rates:**

- **1st 6 months:** $29.13 $39.45 $49.77
- **2nd 6 months:** $31.20 $42.54 $53.87
- **3rd 6 months:** $35.31 $48.67 $62.01
- **4th 6 months:** $39.46 $54.85 $70.23
- **5th 6 months:** $41.52 $57.91 $74.30
- **6th 6 months:** $45.67 $64.10 $82.52

<table>
<thead>
<tr>
<th>Cement Mason</th>
<th>CE514</th>
<th>$46.30 $64.89 $83.48</th>
<th>11/10/2011</th>
<th>H H D H H D N</th>
</tr>
</thead>
</table>

**Apprentice Rates:**

- **1st 6 months:** $26.77 $36.07 $45.36
- **2nd 6 months:** $28.68 $39.91 $48.13
- **3rd 6 months:** $32.50 $44.59 $56.66
- **4th 6 months:** $36.32 $50.26 $64.19
- **5th 6 months:** $38.24 $53.11 $67.98
- **6th 6 months:** $42.06 $58.79 $75.51

<table>
<thead>
<tr>
<th>Drywall</th>
<th>Drywall Taper</th>
<th>$44.41 $57.66 $70.91</th>
<th>9/5/2014</th>
<th>H H D D D D Y</th>
</tr>
</thead>
</table>

**Apprentice Rates:**

- **First 3 months:** $31.16 $37.79 $44.41
- **Second 3 months:** $33.81 $41.76 $49.71
- **Second 6 months:** $36.46 $45.73 $55.01
- **Third 6 months:** $39.11 $49.71 $60.31
- **4th 6 months:** $40.43 $51.69 $62.95

---

Official Request #: 1490  
Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,  
County: Wayne  
Project Number: 050-245285 SH 629-245283 EB  
Official Rate Schedule: Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
### Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015  
**Page 4 of 29**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Name</strong></td>
<td><strong>Description</strong></td>
<td><strong>Updated</strong></td>
<td><strong>Straight Time</strong></td>
<td><strong>Half</strong></td>
<td><strong>Double Time</strong></td>
</tr>
<tr>
<td>Electrician</td>
<td>Inside Wireman</td>
<td>10/2/2014</td>
<td>$58.91</td>
<td>$77.39</td>
<td>$95.87 H H H H H H D N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apprentice Rates:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$36.73</td>
<td>$44.12</td>
<td>$51.51</td>
</tr>
<tr>
<td>0-1000 hours</td>
<td></td>
<td></td>
<td>$38.58</td>
<td>$46.89</td>
<td>$55.21</td>
</tr>
<tr>
<td>1000-2000 hours</td>
<td></td>
<td></td>
<td>$40.43</td>
<td>$49.67</td>
<td>$58.91</td>
</tr>
<tr>
<td>2000-3500 hours</td>
<td></td>
<td></td>
<td>$42.27</td>
<td>$52.44</td>
<td>$62.59</td>
</tr>
<tr>
<td>3500-5000 hours</td>
<td></td>
<td></td>
<td>$45.97</td>
<td>$57.98</td>
<td>$69.99</td>
</tr>
<tr>
<td>5000-6500 hours</td>
<td></td>
<td></td>
<td>$49.67</td>
<td>$63.53</td>
<td>$77.39</td>
</tr>
<tr>
<td>6500-8000 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound and Communication Installer/Technician</td>
<td>EC-58-SC</td>
<td>10/2/2014</td>
<td>$37.48</td>
<td>$50.29</td>
<td>$63.09 H H H H H H D N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apprentice Rates:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$24.67</td>
<td>$31.07</td>
<td>$37.47</td>
</tr>
<tr>
<td>Period 1</td>
<td></td>
<td></td>
<td>$25.95</td>
<td>$32.99</td>
<td>$40.03</td>
</tr>
<tr>
<td>Period 2</td>
<td></td>
<td></td>
<td>$27.24</td>
<td>$34.93</td>
<td>$42.61</td>
</tr>
<tr>
<td>Period 3</td>
<td></td>
<td></td>
<td>$28.51</td>
<td>$36.83</td>
<td>$45.15</td>
</tr>
<tr>
<td>Period 4</td>
<td></td>
<td></td>
<td>$29.79</td>
<td>$38.75</td>
<td>$47.71</td>
</tr>
<tr>
<td>Period 5</td>
<td></td>
<td></td>
<td>$31.07</td>
<td>$40.67</td>
<td>$50.27</td>
</tr>
<tr>
<td>Period 6</td>
<td></td>
<td></td>
<td>$33.41</td>
<td>$44.22</td>
<td>$53.97</td>
</tr>
</tbody>
</table>

### Elevator Constructor

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elevator Constructor</td>
<td>8/7/2007</td>
<td>$56.46</td>
<td>$94.99</td>
<td>D D D D D D D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apprentice Rates:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$37.74</td>
<td>$58.93</td>
<td></td>
</tr>
<tr>
<td>1st Year Apprentice</td>
<td></td>
<td></td>
<td>$41.90</td>
<td>$66.94</td>
<td></td>
</tr>
<tr>
<td>2nd Year Apprentice</td>
<td></td>
<td></td>
<td>$43.98</td>
<td>$70.95</td>
<td></td>
</tr>
<tr>
<td>3rd Year Apprentice</td>
<td></td>
<td></td>
<td>$48.14</td>
<td>$78.96</td>
<td></td>
</tr>
<tr>
<td>4th Year Apprentice</td>
<td></td>
<td></td>
<td>$52.28</td>
<td>$84.96</td>
<td></td>
</tr>
</tbody>
</table>

---

**Official Request #: 1490**  
**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,  
**Project Number:** 050-245285 SH / 629-245283 EB  
**County:** Wayne

---

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Overtime</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glazier</td>
<td>Glazier GL-357</td>
<td>$47.35</td>
<td>$65.97</td>
<td>$84.58</td>
<td>H H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If a four 10 hour day workweek is scheduled, four 10s must be consecutive, M-F.

### Apprentice Rates:

<table>
<thead>
<tr>
<th></th>
<th>1st 6 months</th>
<th>2nd 6 months</th>
<th>3rd 6 months</th>
<th>4th 6 months</th>
<th>5th 6 months</th>
<th>6th 6 months</th>
<th>7th 6 months</th>
<th>8th 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$32.45</td>
<td>$33.94</td>
<td>$36.92</td>
<td>$38.41</td>
<td>$39.90</td>
<td>$41.39</td>
<td>$42.88</td>
<td>$45.86</td>
</tr>
</tbody>
</table>

### Heat and Frost Insulator

<table>
<thead>
<tr>
<th>Name Description</th>
<th>AS25S</th>
<th>$20.14</th>
<th>$29.14</th>
<th>H H H H H N</th>
</tr>
</thead>
</table>

### Heat and Frost Insulator and Asbestos Worker

<table>
<thead>
<tr>
<th>Name Description</th>
<th>AS25</th>
<th>$60.25</th>
<th>$76.00</th>
<th>$91.74</th>
<th>H H H H H D Y</th>
</tr>
</thead>
</table>

Four 10s must be worked for a minimum of 2 weeks consecutively, Monday thru Thursday. All hours worked in excess of 10 will be paid at double time. All hours worked on the fifth day, Monday thru Friday will paid at time and one-half.

### Apprentice Rates:

<table>
<thead>
<tr>
<th></th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$46.08</td>
<td>$49.23</td>
<td>$50.80</td>
<td>$53.95</td>
<td>$63.40</td>
</tr>
</tbody>
</table>

### Ironworker

<table>
<thead>
<tr>
<th>Name Description</th>
<th>IR-25-F1</th>
<th>$34.20</th>
<th>$46.45</th>
<th>$58.69</th>
<th>X X H X X H D Y</th>
</tr>
</thead>
</table>

Fence, Sound Barrier & Guardrail erection/installation and Exterior Signage work

Four ten hour work days may be worked during Monday-Saturday.

### Apprentice Rates:

<table>
<thead>
<tr>
<th></th>
<th>60% Level</th>
<th>65% Level</th>
<th>70% Level</th>
<th>75% Level</th>
<th>80% Level</th>
<th>85% Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$23.04</td>
<td>$24.37</td>
<td>$25.70</td>
<td>$27.02</td>
<td>$28.34</td>
<td>$29.67</td>
</tr>
</tbody>
</table>

### Official Request #: 1490

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,

Official Rate Schedule

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
**Official 2014 Prevailing Wage Rates for State Funded Projects**

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

**Page 6 of 29**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>IR-25-GZ2</th>
<th>$46.41</th>
<th>$58.07</th>
<th>$69.73</th>
<th>X</th>
<th>X</th>
<th>H</th>
<th>H</th>
<th>D</th>
<th>D</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siding, Glazing, Curtain Wall</td>
<td>4 tens may be worked Monday thru Thursday @ straight time.</td>
<td>9/4/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- **Level 1:** $29.48  
- **Level 2:** $31.59  
- **Level 3:** $33.71  
- **Level 4:** $35.83  
- **Level 5:** $37.94  
- **Level 6:** $40.06

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>IR-25-PE-Z1</th>
<th>$45.24</th>
<th>$55.53</th>
<th>$65.81</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>D</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-engineered Metal Work</td>
<td></td>
<td>6/3/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- 1st Year: $26.11  
- 3rd 6 month period: $28.23  
- 4th 6 month period: $30.36  
- 5th 6 month period: $32.48  
- 6th 6 month period: $34.61

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>IR-25-RF</th>
<th>$55.36</th>
<th>$82.91</th>
<th>$110.45</th>
<th>H</th>
<th>H</th>
<th>D</th>
<th>D</th>
<th>D</th>
<th>D</th>
<th>N</th>
</tr>
</thead>
</table>

**Apprentice Rates:**

- **Level 1:** $36.01  
- **Level 2:** $38.38  
- **Level 3:** $40.74  
- **Level 4:** $43.28  
- **Level 5:** $45.81  
- **Level 6:** $48.35

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>IR-25-RIG</th>
<th>$61.33</th>
<th>$91.67</th>
<th>$122.00</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigging Work</td>
<td></td>
<td>9/3/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- **Level 1 & 2:** $36.63  
- **Level 3:** $39.46  
- **Level 4:** $42.28  
- **Level 5:** $45.11  
- **Level 6:** $47.94

---

**Official Request #: 1490**  
**Requestor: Wayne State University**  
**Project Description: Shapero Hall & Elliman Building - Provide & Install Generators, copy**  
**Project Number: 050-245285 SH/ 629-245283 EB**  
**County: Wayne**  

**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Page 6 of 29
## Official 2014 Prevailing Wage Rates for State Funded Projects

### Issue Date: 10/24/2014
### Contract must be awarded by: 1/22/2015

#### Prevailing Wage Rate Schedule

<table>
<thead>
<tr>
<th>Classification Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half Hourly</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decking</td>
<td>IR-25-SD</td>
<td>9/4/2014</td>
<td>$53.29</td>
<td>$105.96</td>
</tr>
</tbody>
</table>

4 tens may be worked Monday thru Thursday @ straight time. If bad weather, Friday may be a make up day. If holiday celebrated on a Monday, 4 10s may be worked Tuesday thru Friday. Work in excess of 12 hours per day must be paid @ double time.

| Structural, ornamental, welder and pre-cast | IR-25-STR | 9/3/2014 | $61.46 | $122.21 |

4 tens may be worked Monday thru Thursday @ straight time. If bad weather, Friday may be a make up day. If holiday celebrated on a Monday, 4 10s may be worked Tuesday thru Friday. Work in excess of 12 hours per day must be paid @ double time.

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Levels</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>$36.05</td>
</tr>
<tr>
<td>3</td>
<td>$38.88</td>
</tr>
<tr>
<td>4</td>
<td>$41.70</td>
</tr>
<tr>
<td>5</td>
<td>$44.53</td>
</tr>
<tr>
<td>6</td>
<td>$47.36</td>
</tr>
<tr>
<td>7</td>
<td>$50.18</td>
</tr>
<tr>
<td>8</td>
<td>$53.01</td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- Levels 1 & 2: $36.05
- Level 3: $38.88
- Level 4: $41.70
- Level 5: $44.53
- Level 6: $47.36
- Level 7: $50.18
- Level 8: $53.01

| Industrial Door erection & construction | IR-25-STR-D | 9/4/2014 | $42.02 | $83.33 |

Laborer:

<table>
<thead>
<tr>
<th>Description</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>L33401-A-CC</td>
<td>$43.54</td>
</tr>
<tr>
<td>7/15/2013</td>
<td>$61.94</td>
</tr>
<tr>
<td>H H H H H H D D Y</td>
<td></td>
</tr>
</tbody>
</table>

Laborer, Construction Laborer, Demolition Laborer, Mason Tender, Carpenter Tender, Drywall Handler, Concrete Laborer, Cement Finisher Tender, Concrete Chute, and Concrete Bucket Handler

If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time.

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Work Hours</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1,000</td>
<td>$37.60</td>
</tr>
<tr>
<td>1,001-2,000</td>
<td>$38.79</td>
</tr>
<tr>
<td>2,001-4,000</td>
<td>$39.98</td>
</tr>
<tr>
<td>3,001-4,000</td>
<td>$42.35</td>
</tr>
</tbody>
</table>

Official Request #: 1490

**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Project Number: 050-245285 SH/ 629-245283 EB
County: Wayne

Page 7 of 29
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 8 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half Hourly</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Man (on sewer &amp; caisson work), Air, Electric or Gasoline Tool Operator, Concrete Vibrator Operator, Acetylene Torch &amp; Air Hammer Operator; Scaffold Builder, Caisson Worker</td>
<td>L33401-B-SB</td>
<td>7/16/2013</td>
<td>$43.80</td>
<td>$62.33</td>
<td>$80.85 H H H H H D Y</td>
</tr>
</tbody>
</table>

If conditions beyond the employer/employee's control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time.

| Furnace Battery Heater Tender, Burning Bar & Oxy-Acetylene Gun | L33401-D-HH | 7/16/2013 | $44.04 | $62.69 | $81.33 H H H H H D Y |

| Expediter Man, Top Man and/or Bottom Man (Blast Furnace Work or Battery Work) | L33401-E-EX | 7/16/2013 | $44.79 | $63.81 | $82.83 H H H H H D Y |

| Cleaner/Sweeper Laborer; Furniture Laborer | L33401-F-CL | 7/16/2013 | $38.09 | $53.76 | $69.43 H H H H H D Y |

| Lansing Burner, Blaster & Powder Man; Air, Electric or L33C Gasoline Tool Operator (Blast Furnace Work or Battery Work) | L33401-E-EX | 7/16/2013 | $44.29 | $63.06 | $81.83 X X H |

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
Official Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014

**Contract must be awarded by:** 1/22/2015

---

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and Hourly</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasterer Tender, Plastering Machine Operator</td>
<td>LPT-1</td>
<td>$43.54</td>
<td>$61.94</td>
<td>$80.33</td>
<td>X X H H H H D Y</td>
</tr>
</tbody>
</table>

If conditions beyond the employer/employee’s control prevent one or more hours of working during Mon-Fri, the employer may choose to work up to 10 hour straight time weekdays. Work may be scheduled up to 10 hours per Mon-Fri for the purpose of reaching 40 hours @ straight time. Make up days may also include 8 hours of work on Saturdays @ straight time.

**Apprentice Rates:**

- 0 - 1,000 hours: $37.60, $53.03, $68.45
- 1,001 - 2,000 hours: $38.79, $54.81, $70.83
- 2,001 - 3,000 hours: $39.98, $56.60, $73.21
- 3,001 - 4,000 hours: $42.35, $60.15, $77.95

**Laborer - Hazardous**

- Class A performing work in conjunction with site preparation and other preliminary work prior to actual removal, handling, or containment of hazardous waste substances not requiring use of personal protective equipment required by state or federal regulations; or a laborer performing work in conjunction with the removal, handling, or containment of hazardous waste substances when use of personal protective equipment level "D" is required.

- 0-1,000 work hours: $37.60, $53.03, $68.45
- 1,001-2,000 work hours: $38.79, $54.81, $70.83
- 2,001-3,000 work hours: $39.98, $56.60, $73.21
- 3,001-4,000 work hours: $42.35, $60.15, $77.95

Apprentice Rates:

- 0-1,000 work hours: $38.36, $54.17, $69.97
- 1,001-2,000 work hours: $39.59, $56.01, $72.43
- 2,001-3,000 work hours: $40.83, $57.87, $74.91
- 3,001-4,000 work hours: $43.30, $61.58, $79.85

Official Request #: 1490

---

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Project Number: 050-245285 SH/ 629-245283 EB
County: Wayne
## Official 2014 Prevailing Wage Rates for State Funded Projects

### Issue Date: 10/24/2014  
### Contract must be awarded by: 1/22/2015

#### Page 10 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laborer Underground - Tunnel, Shaft &amp; Caisson</td>
<td>Class I - Tunnel, shaft and caisson laborer, dump man, shanty man, hog house tender, testing man (on gas), and watchman.</td>
<td>LAUCT-Z1-1</td>
<td>$37.87</td>
<td>$48.66</td>
<td>$59.44 X X X X X X D Y</td>
</tr>
<tr>
<td>Class II - Manhole, headwall, catch basin builder, bricklayer</td>
<td>tender, mortar man, material mixer, fence erector, and guard rail builder.</td>
<td>LAUCT-Z1-2</td>
<td>$37.98</td>
<td>$48.82</td>
<td>$59.66 X X X X X X D Y</td>
</tr>
<tr>
<td>Class III - Air tool operator (jack hammer man, bush hammer man and grinding man), first bottom man, second bottom man, cage tender, car pusher, carrier man, concrete man, concrete form man, concrete repair man, cement invert laborer, cement finisher, concrete shoveler, conveyor man, floor man, gasoline and electric tool operator, gunnite man, grout operator, welder, heading dinky man, inside lock tender, pea gravel operator, pump man, outside lock tender, scaffold man, top signal man, switch man, track man, tugger man, utility man, vibrator man, winch operator, pipe jacking man, wagon drill and air track operator and concrete saw operator (under 40 h.p.).</td>
<td>LAUCT-Z1-3</td>
<td>$38.04</td>
<td>$48.91</td>
<td>$59.78 X X X X X X D Y</td>
<td></td>
</tr>
</tbody>
</table>

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Work Hours</th>
<th>Straight Time</th>
<th>Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1,000 work hours</td>
<td>$33.14</td>
<td>$41.56</td>
<td>$49.98</td>
<td></td>
</tr>
<tr>
<td>1,001-2,000 work hours</td>
<td>$34.10</td>
<td>$43.00</td>
<td>$51.90</td>
<td></td>
</tr>
<tr>
<td>2,001-3,000 work hours</td>
<td>$35.07</td>
<td>$44.45</td>
<td>$53.84</td>
<td></td>
</tr>
<tr>
<td>3,001-4,000 work hours</td>
<td>$37.01</td>
<td>$47.37</td>
<td>$57.72</td>
<td></td>
</tr>
</tbody>
</table>

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Work Hours</th>
<th>Straight Time</th>
<th>Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1,000 work hours</td>
<td>$33.18</td>
<td>$41.62</td>
<td>$50.06</td>
<td></td>
</tr>
<tr>
<td>1,001-2,000 work hours</td>
<td>$34.15</td>
<td>$43.07</td>
<td>$52.00</td>
<td></td>
</tr>
<tr>
<td>2,001-3,000 work hours</td>
<td>$35.12</td>
<td>$44.53</td>
<td>$53.94</td>
<td></td>
</tr>
<tr>
<td>3,001-4,000 work hours</td>
<td>$37.07</td>
<td>$47.45</td>
<td>$57.84</td>
<td></td>
</tr>
</tbody>
</table>

### Official Rate Schedule

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators, Electrical Reliability Upgrades – Bid Package #2  
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne

Page 10 of 29
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 11 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class IV - Tunnel, shaft and caisson mucker, bracer man, liner plate man, long haul dinky driver and well point man.</td>
<td>LAUCT-Z1-4</td>
<td>$38.22</td>
<td>$49.18</td>
<td>$60.14</td>
<td>X X X X X X D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9/6/2013</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- 0-1,000 work hours: $33.32 $41.83 $50.34
- 1,001-2,000 work hours: $34.30 $43.30 $52.30
- 2,001-3,000 work hours: $35.28 $44.77 $54.26
- 3,001-4,000 work hours: $37.24 $47.71 $58.18

| Class V - Tunnel, shaft and caisson miner, drill runner, keyboard operator, power knife operator, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars) | LAUCT-Z1-5 | $38.47 | $49.56 | $60.64 | X X X X D Y |
| | | 9/6/2013 |

**Apprentice Rates:**

- 0-1,000 work hours: $33.50 $42.10 $50.70
- 1,001-2,000 work hours: $34.50 $43.60 $52.70
- 2,001-3,000 work hours: $35.49 $45.09 $54.68
- 3,001-4,000 work hours: $37.48 $48.07 $58.66

| Class VI - Dynamite man and powder man. | LAUCT-Z1-6 | $38.80 | $50.05 | $61.30 | X X X X D Y |
| | | 9/6/2013 |

**Apprentice Rates:**

- 0-1,000 work hours: $33.75 $42.47 $51.20
- 1,001-2,000 work hours: $34.76 $43.99 $53.22
- 2,001-3,000 work hours: $35.77 $45.51 $55.24
- 3,001-4,000 work hours: $37.79 $48.53 $59.28

| Class VII - Restoration laborer, seeding, sodding, planting, cutting, mulching and topsoil grading and the restoration of property such as replacing mail boxes, wood chips, planter boxes and flagstones. | LAUCT-Z1-7 | $32.08 | $39.97 | $47.86 | X X X X D Y |
| | | 9/6/2013 |

**Apprentice Rates:**

- 0-1,000 work hours: $28.71 $34.91 $41.12
- 1,001-2,000 work hours: $29.38 $35.92 $42.46
- 2,001-3,000 work hours: $30.06 $36.94 $43.82
- 3,001-4,000 work hours: $31.41 $38.97 $46.52

---

**Official Request #:** 1490  
**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,  
**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Wayne  
**Official Rate Schedule**  
Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
Official 2014 Prevailing Wage Rates for State Funded Projects

Issue Date: 10/24/2014
Contract must be awarded by: 1/22/2015

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time</th>
<th>Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Landscape Laborer</td>
<td>Landscape Specialist includes air, gas, and diesel equipment operator, skidsteer (or equivalent), lawn sprinkler installer on landscaping work where seeding, sodding, planting, cutting, trimming, backfilling, rough grading or maintenance of landscape projects occurs.</td>
<td>6/26/2014</td>
<td>$28.58</td>
<td>$39.49</td>
<td>$50.39</td>
<td>X X H X X H D Y</td>
</tr>
<tr>
<td></td>
<td>Skilled Landscape Laborer</td>
<td>Small power tool operator, lawn sprinkler installers' tender, material mover, truck driver when seeding, sodding, planting, cutting, trimming, backfilling, rough grading or maintaining of landscape projects occurs</td>
<td>6/26/2014</td>
<td>$24.36</td>
<td>$33.16</td>
<td>$41.95</td>
<td>X X H X X H D Y</td>
</tr>
<tr>
<td></td>
<td>Marble Finisher</td>
<td>Marble Finisher</td>
<td>10/20/2014</td>
<td>$43.48</td>
<td>$54.29</td>
<td>$65.10</td>
<td>H H D D D D Y</td>
</tr>
</tbody>
</table>

Sundays paid at time & one half. Holidays paid at double time.

Marble Finisher
Marble Finisher
A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.

Apprentice Rates:

<table>
<thead>
<tr>
<th>Level</th>
<th>Straight Time</th>
<th>Half Time</th>
<th>Double Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>$19.04</td>
<td>$25.12</td>
<td>$31.20</td>
</tr>
<tr>
<td>Level 2</td>
<td>$20.24</td>
<td>$26.92</td>
<td>$33.60</td>
</tr>
<tr>
<td>Level 3</td>
<td>$27.01</td>
<td>$33.96</td>
<td>$40.90</td>
</tr>
<tr>
<td>Level 4</td>
<td>$28.47</td>
<td>$36.14</td>
<td>$43.82</td>
</tr>
<tr>
<td>Level 5</td>
<td>$29.99</td>
<td>$37.84</td>
<td>$45.70</td>
</tr>
<tr>
<td>Level 6</td>
<td>$31.61</td>
<td>$39.86</td>
<td>$48.10</td>
</tr>
<tr>
<td>Level 7</td>
<td>$33.30</td>
<td>$41.59</td>
<td>$49.87</td>
</tr>
<tr>
<td>Level 8</td>
<td>$34.79</td>
<td>$43.48</td>
<td>$52.17</td>
</tr>
</tbody>
</table>

Official Rate Schedule

Requestor: Wayne State University
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,
Project Number: 050-245285 SH/ 629-245283 EB
County: Wayne

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
## Official 2014 Prevailing Wage Rates for State Funded Projects

### Issue Date: 10/24/2014

### Contract must be awarded by: 1/22/2015

### Page 13 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>BR1-MM</th>
<th>10/17/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marble Mason</td>
<td>BR1-MM</td>
<td>Marble Mason</td>
<td>$50.29</td>
<td>$64.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Marble Mason</td>
<td></td>
<td>A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Level</th>
<th>Hourly</th>
<th>Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>$25.14</td>
<td>$32.65</td>
<td>$40.15</td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td>$28.20</td>
<td>$36.49</td>
<td>$44.78</td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>$33.41</td>
<td>$41.97</td>
<td>$50.53</td>
<td></td>
</tr>
<tr>
<td>Level 4</td>
<td>$36.15</td>
<td>$45.66</td>
<td>$55.17</td>
<td></td>
</tr>
<tr>
<td>Level 5</td>
<td>$38.42</td>
<td>$48.17</td>
<td>$57.92</td>
<td></td>
</tr>
<tr>
<td>Level 6</td>
<td>$42.07</td>
<td>$53.56</td>
<td>$65.05</td>
<td></td>
</tr>
<tr>
<td>Level 7</td>
<td>$42.74</td>
<td>$54.38</td>
<td>$66.02</td>
<td></td>
</tr>
<tr>
<td>Level 8</td>
<td>$43.67</td>
<td>$55.78</td>
<td>$67.88</td>
<td></td>
</tr>
</tbody>
</table>

### Operating Engineer

<table>
<thead>
<tr>
<th>Description</th>
<th>EN-324-A120</th>
<th>6/12/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane with boom &amp; jib or leads 120’ or longer</td>
<td>$57.11</td>
<td>$74.62</td>
</tr>
<tr>
<td>Crane with boom &amp; jib or leads 140’ or longer</td>
<td>$57.93</td>
<td>$75.85</td>
</tr>
</tbody>
</table>

Work in excess of 12 per day M-F shall be paid at double time.

### Compressor or welding machine

<table>
<thead>
<tr>
<th>Description</th>
<th>EN-324-CW</th>
<th>6/12/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in excess of 12 per day M-F shall be paid at double time.</td>
<td>$46.26</td>
<td>$58.35</td>
</tr>
</tbody>
</table>

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
**Official 2014 Prevailing Wage Rates for State Funded Projects**

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

<table>
<thead>
<tr>
<th>Classification Description</th>
<th>Name</th>
<th>Updated</th>
<th>Straight Time</th>
<th>Double Overtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forklift, lull, extend-a-boom forklift</td>
<td>EN-324-FL</td>
<td>6/12/2014</td>
<td>$53.57</td>
<td>$69.31</td>
</tr>
<tr>
<td>Fireman or oiler</td>
<td>EN-324-FO</td>
<td>6/12/2014</td>
<td>$45.23</td>
<td>$56.80</td>
</tr>
<tr>
<td>Regular crane, job mechanic, concrete pump with boom</td>
<td>EN-324-RC</td>
<td>6/12/2014</td>
<td>$56.25</td>
<td>$73.33</td>
</tr>
<tr>
<td>Regular engineer, hydro-excavator, remote controlled concrete breaker</td>
<td>EN-324-RE</td>
<td>6/12/2014</td>
<td>$55.28</td>
<td>$71.88</td>
</tr>
</tbody>
</table>

**Apprentice Rates:**
- 0-999 hours: $44.32  
- 1,000-1,999 hours: $45.99  
- 2,000-2,999 hours: $47.64  
- 3,000-3,999 hours: $49.30  
- 4,000-4,999 hours: $50.96  
- 5,000-5,999 hours: $52.62

<table>
<thead>
<tr>
<th>Classification</th>
<th>Updated</th>
<th>Straight Time</th>
<th>Double Overtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Engineer - DIVER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diver/Wet Tender/Tender/Rov Pilot/Rov Tender</td>
<td>GLF D</td>
<td>4/2/2014</td>
<td>$52.80</td>
</tr>
<tr>
<td>Operating Engineer - Marine Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diver/Wet Tender, Engineer (hydraulic dredge)</td>
<td>GLF-1</td>
<td>2/12/2014</td>
<td>$65.00</td>
</tr>
</tbody>
</table>

Holiday pay = $124.55 per hour, wages & fringes

**Subdivision of county:** all Great Lakes, islands therein, & connecting & tributary waters

**Operating Engineer - DIVER**
- Crane/Backhoe Operator, 70 ton or over Tug Operator, Mechanic/Welder, Assistant Engineer (hydraulic dredge), Leverman (hydraulic dredge), Diver Tender
  - GLF-2 | 2/12/2014 | $63.50 | $82.60 | $101.70 |

Holiday pay = $120.80 per hour, wages & fringes

**Official Rate Schedule**
- Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

---

**Wayne State University**  
**WSU Project No. 050-245285 (Shapero Hall) 629-245283 (Elliman Building)**

**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Statewide
**Official 2014 Prevailing Wage Rates for State Funded Projects**

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 15 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Updated Hourly</th>
<th>Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subdivision of county</strong></td>
<td>All Great Lakes, islands therein, &amp; connecting &amp; tributary waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction, Lattice Boom or Crane License Certification</td>
<td>GLF-2B</td>
<td>$64.50</td>
<td>$84.10</td>
<td>$103.70 X X H H H H D Y</td>
<td></td>
</tr>
<tr>
<td>Holiday pay = $123.30</td>
<td>2/12/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subdivision of county</strong></td>
<td>All Great Lakes, islands therein, &amp; connecting &amp; tributary waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs or more), Tug/Launch Operator, Loader, Dozer on Barge, Deck Machinery</td>
<td>GLF-3</td>
<td>$59.30</td>
<td>$76.30</td>
<td>$93.30 X X H H H H D Y</td>
<td></td>
</tr>
<tr>
<td>Holiday pay = $110.30 per hour, wages &amp; fringes</td>
<td>2/12/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subdivision of county</strong></td>
<td>All Great Lakes, islands therein, &amp; connecting &amp; tributary waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deck Equipment Operator, (Machineryman/Fireman), (4 equipment units or more), Off Road Trucks, Deck Hand, Tug Engineer, &amp; Crane Maintenance 50 ton capacity and under or Backhoe 115,000 lbs or less, Assistant Tug Operator</td>
<td>GLF-4</td>
<td>$53.60</td>
<td>$67.75</td>
<td>$81.90 X X H H H H D Y</td>
<td></td>
</tr>
<tr>
<td>Holiday pay = $96.05 per hour, wages &amp; fringes</td>
<td>2/12/2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subdivision of county</strong></td>
<td>All Great Lakes, islands therein, &amp; connecting &amp; tributary waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Engineer Hazardous Waste Class I</td>
<td>EN-324-HWCI-Z1A</td>
<td>$51.84</td>
<td>$67.86</td>
<td>$83.87 H H H H H H D Y</td>
<td></td>
</tr>
<tr>
<td>Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye protection.</td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Duration</th>
<th>Hourly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st 6 months</td>
<td>$41.63</td>
</tr>
<tr>
<td>2nd 6 months</td>
<td>$43.23</td>
</tr>
<tr>
<td>3rd 6 months</td>
<td>$44.83</td>
</tr>
<tr>
<td>4th 6 months</td>
<td>$46.43</td>
</tr>
<tr>
<td>5th 6 months</td>
<td>$48.03</td>
</tr>
<tr>
<td>6th 6 months</td>
<td>$49.64</td>
</tr>
</tbody>
</table>

### Official Rate Schedule

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,  
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne  

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Page 15 of 29
<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level B &amp; C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.</td>
<td>EN-324-HWCI-Z1B</td>
<td>1/20/2012</td>
<td>$50.89</td>
<td>$66.43</td>
<td>$81.97 H H H H H H D Y</td>
</tr>
<tr>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st 6 months</td>
<td>$40.97</td>
<td>$51.85</td>
<td>$62.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd 6 months</td>
<td>$42.52</td>
<td>$54.17</td>
<td>$65.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd 6 months</td>
<td>$44.07</td>
<td>$56.50</td>
<td>$68.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th 6 months</td>
<td>$45.64</td>
<td>$58.86</td>
<td>$72.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th 6 months</td>
<td>$47.19</td>
<td>$61.19</td>
<td>$75.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th 6 months</td>
<td>$48.74</td>
<td>$63.51</td>
<td>$78.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level D - Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HWCI-Z1D</td>
<td>1/20/2012</td>
<td>$49.59</td>
<td>$64.48</td>
<td>$79.37 H H H H H H D Y</td>
</tr>
<tr>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st 6 months</td>
<td>$40.06</td>
<td>$50.49</td>
<td>$60.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd 6 months</td>
<td>$41.54</td>
<td>$52.71</td>
<td>$63.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd 6 months</td>
<td>$43.04</td>
<td>$54.96</td>
<td>$66.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th 6 months</td>
<td>$44.53</td>
<td>$57.19</td>
<td>$69.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th 6 months</td>
<td>$46.02</td>
<td>$59.42</td>
<td>$72.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th 6 months</td>
<td>$47.50</td>
<td>$61.65</td>
<td>$75.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HWCI-Z1DCL</td>
<td>1/20/2012</td>
<td>$49.34</td>
<td>$64.11</td>
<td>$78.87 H H H H H H D Y</td>
</tr>
<tr>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st 6 months</td>
<td>$39.89</td>
<td>$50.23</td>
<td>$60.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd 6 months</td>
<td>$41.36</td>
<td>$52.44</td>
<td>$63.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd 6 months</td>
<td>$42.83</td>
<td>$54.64</td>
<td>$66.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th 6 months</td>
<td>$44.31</td>
<td>$56.86</td>
<td>$69.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th 6 months</td>
<td>$45.79</td>
<td>$59.08</td>
<td>$72.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th 6 months</td>
<td>$47.27</td>
<td>$61.30</td>
<td>$75.33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators, copy
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 17 of 29

#### Operating Engineer Hazardous Waste Class II

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye protection.</td>
<td>EN-324-HWCI1-Z1A</td>
<td>1/20/2012</td>
<td>$47.61</td>
<td>$61.51</td>
<td>$75.41 H H H H H D Y</td>
</tr>
</tbody>
</table>

Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.

| Level B & C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing. | EN-324-HWCI1-Z1B | 1/20/2012 | $46.66 | $60.09 | $73.51 H H H H H D Y |

Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.

| Level D - Coveralls, safety boots, glasses or chemical splash goggles and hard hats. | EN-324-HWCI1-Z1D | 1/20/2012 | $45.36 | $58.14 | $70.91 H H H H H D Y |

Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.

| Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats. | EN-324-HWCI1-Z1DCL | 1/20/2012 | $45.11 | $57.76 | $70.41 H H H H H D Y |

Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.

### Operating Engineer Hazardous Waste Crane w/ Boom & Jib leads 140' or longer

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye protection.</td>
<td>EN-324-HW140-Z1A</td>
<td>1/20/2012</td>
<td>$54.49</td>
<td>$71.83</td>
<td>$89.17 H H H H H D Y</td>
</tr>
</tbody>
</table>

Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.

---

**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

---

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,  
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne
### Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

<table>
<thead>
<tr>
<th>Classification Name</th>
<th>Description</th>
<th>Updated</th>
<th>Straight Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hourly</td>
<td>Half</td>
<td></td>
</tr>
<tr>
<td>Level B &amp; C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.</td>
<td>EN-324-HW140-Z1B</td>
<td>$53.54</td>
<td>$70.41</td>
<td>$87.27</td>
<td>H H H H H H H Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level D Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HW140-Z1D</td>
<td>$52.24</td>
<td>$68.46</td>
<td>$84.67</td>
<td>H H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HW140-Z1DCL</td>
<td>$51.99</td>
<td>$68.08</td>
<td>$84.17</td>
<td>H H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operating Engineer Hazardous Waste Crane w/ Boom & Jib leads 220' or longer**

<table>
<thead>
<tr>
<th>Classification Name</th>
<th>Description</th>
<th>Updated</th>
<th>Straight Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hourly</td>
<td>Half</td>
<td></td>
</tr>
<tr>
<td>Level A - Fully encapsulating chemical resistant suit w/ pressure demand, full face piece SCBA or pressure demand supplied air respirator w/ escape SCBA. The highest available level of respiratory, skin and eye protection.</td>
<td>EN-324-HW220-Z1A</td>
<td>$54.79</td>
<td>$72.28</td>
<td>$89.77</td>
<td>H H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level B &amp; C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.</td>
<td>EN-324-HW220-Z1B</td>
<td>$53.84</td>
<td>$70.86</td>
<td>$87.87</td>
<td>H H H H H H H Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day. Level D Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>$85.27</td>
<td>H H H H H H D Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EN-324-HW220-Z1D</td>
<td>$52.54</td>
<td>$68.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/20/2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 10 hour days may be worked Monday-Thursday with Friday as a straight-time make up day.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Wayne

---

**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
### Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HW220-Z1DCL</td>
<td>1/20/2012</td>
<td>$52.29</td>
<td>$68.53</td>
<td>$84.77</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operator and Concrete Pump with boom Operator</td>
<td>Level D When Capping Landfill Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HWRC-Z1DCL</td>
<td>$49.69</td>
<td>$64.63</td>
<td>$79.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operator and Concrete Pump with boom Operator</td>
<td>Level D - Coveralls, safety boots, glasses or chemical splash goggles and hard hats.</td>
<td>EN-324-HWRC-Z1D</td>
<td>$50.56</td>
<td>$65.94</td>
<td>$81.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Engineer Hazardous Waste Regular Crane, Job Mechanic, Dragline Operator, Boom Truck Operator, Power Shovel Operator and Concrete Pump with booms</td>
<td>Level B &amp; C protection. B - Pressure demand, full face SCBA or pressure demand supplied air respirator w/ escape SCBA w/chemical resistant clothing. C - Full face piece, air purifying canister-equipped respirator w/chemical resistant clothing.</td>
<td>EN-324-HWRC-Z1B</td>
<td>$51.86</td>
<td>$67.89</td>
<td>$83.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

---

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Engineer Steel Work</td>
<td>Forklift, 1 Drum Hoist</td>
<td>EN-324-ef</td>
<td>9/5/2014</td>
<td>$58.16</td>
<td>$76.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 120’ boom or longer</td>
<td>EN-324-SW120</td>
<td>9/5/2014</td>
<td>$60.86</td>
<td>$80.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 120’ boom or longer w/ Oiler</td>
<td>EN-324-SW120-O</td>
<td>9/5/2014</td>
<td>$61.86</td>
<td>$81.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 140’ boom or longer</td>
<td>EN-324-SW140</td>
<td>9/5/2014</td>
<td>$62.04</td>
<td>$82.19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 140’ boom or longer W/ Oiler</td>
<td>EN-324-SW140-O</td>
<td>9/5/2014</td>
<td>$63.04</td>
<td>$83.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boom &amp; Jib 220’ or longer</td>
<td>EN-324-SW220</td>
<td>9/5/2014</td>
<td>$62.31</td>
<td>$82.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 220’ boom or longer w/ Oiler</td>
<td>EN-324-SW220-O</td>
<td>9/5/2014</td>
<td>$63.31</td>
<td>$84.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boom &amp; Jib 300’ or longer</td>
<td>EN-324-SW300</td>
<td>9/5/2014</td>
<td>$63.81</td>
<td>$84.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 300’ boom or longer w/ Oiler</td>
<td>EN-324-SW300-O</td>
<td>9/5/2014</td>
<td>$64.81</td>
<td>$86.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boom &amp; Jib 400’ or longer</td>
<td>EN-324-SW400</td>
<td>9/5/2014</td>
<td>$65.31</td>
<td>$87.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane w/ 400’ boom or longer w/ Oiler</td>
<td>EN-324-SW400-O</td>
<td>9/5/2014</td>
<td>$66.31</td>
<td>$88.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crane Operator, Job Mechanic, 3 Drum Hoist &amp; Excavator</td>
<td>EN-324-SWCO</td>
<td>9/5/2014</td>
<td>$60.50</td>
<td>$79.88</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Apprentice Rates:

<table>
<thead>
<tr>
<th>Hours</th>
<th>Rate</th>
<th>Rate</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-999 hours</td>
<td>$47.87</td>
<td>$61.43</td>
<td>$75.00</td>
</tr>
<tr>
<td>1,000-1,999 hours</td>
<td>$49.81</td>
<td>$64.35</td>
<td>$78.88</td>
</tr>
<tr>
<td>2,000-2,999 hours</td>
<td>$51.74</td>
<td>$67.24</td>
<td>$82.74</td>
</tr>
<tr>
<td>3,000-3,999 hours</td>
<td>$53.68</td>
<td>$70.15</td>
<td>$86.62</td>
</tr>
<tr>
<td>4,000-4,999 hours</td>
<td>$55.62</td>
<td>$73.07</td>
<td>$90.50</td>
</tr>
<tr>
<td>5,000 hours</td>
<td>$57.56</td>
<td>$75.97/$94.38</td>
<td>$1490</td>
</tr>
</tbody>
</table>

---

**Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.**

---

**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,

---

**Official Rate Schedule**

---

**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Wayne

---

**Page 20 of 29**
### Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane Operator w/ Oiler</td>
<td>EN-324-SWCO-O</td>
<td>9/5/2014</td>
<td>$61.50 $81.38 $101.26 H H D H H D D Y</td>
</tr>
<tr>
<td>Compressor or Welder Operator</td>
<td>EN-324-SWCW</td>
<td>9/5/2014</td>
<td>$53.15 $68.86 $84.56 H H D H H D D Y</td>
</tr>
<tr>
<td>Hoisting Operator, 2 Drum Hoist, &amp; Rubber Tire Backhoe</td>
<td>EN-324-SWHO</td>
<td>9/5/2014</td>
<td>$59.86 $78.92 $97.98 H H D H H D D Y</td>
</tr>
<tr>
<td>Oiler</td>
<td>EN-324-SWO</td>
<td>9/5/2014</td>
<td>$51.64 $66.59 $81.54 H H D H H D D Y</td>
</tr>
<tr>
<td>Tower Crane &amp; Derrick where work is 50' or more above first level</td>
<td>EN-324-SWTD50</td>
<td>9/5/2014</td>
<td>$61.59 $81.52 $101.44 H H D H H D D Y</td>
</tr>
<tr>
<td>Tower Crane &amp; Derrick 50' or more w/ Oiler where work station is 50' or more above first level</td>
<td>EN-324-SWTD50-O</td>
<td>9/5/2014</td>
<td>$62.59 $83.02 $103.44 H H D H H D D Y</td>
</tr>
<tr>
<td>Operating Engineer Underground</td>
<td>Class I Equipment</td>
<td>EN-324A1-UC1</td>
<td>$51.74 $66.98 $82.22 H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td>Class II Equipment</td>
<td>EN-324A1-UC2</td>
<td>$47.01 $59.89 $72.76 H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td>Class III Equipment</td>
<td>EN-324A1-UC3</td>
<td>$46.28 $58.79 $71.30 H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td>Class IV Equipment</td>
<td>EN-324A1-UC4</td>
<td>$45.71 $57.94 $70.16 H H H H H D Y</td>
</tr>
<tr>
<td></td>
<td>Master Mechanic</td>
<td>EN-324A1-UMM</td>
<td>$51.99 $67.81 $83.63 H H H H H D Y</td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- 0-999 hours: $41.79 $52.45 $63.12
- 1,000-1,999 hours: $43.32 $54.75 $66.18
- 2,000-2,999 hours: $44.84 $57.03 $69.22
- 3,000-3,999 hours: $46.36 $59.31 $72.26
- 4,000-4,999 hours: $47.89 $61.61 $75.32
- 5,000-5,999 hours: $49.41 $63.89 $78.36

- Official Request #: 1490
- Requestor: Wayne State University
- Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,
- Project Number: 050-245285 SH/629-245283 EB
- County: Wayne
- Official Rate Schedule
- Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

**Page 22 of 29**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half Hourly</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painter</td>
<td>Painter (8 hours of repaint work performed on Sunday shall be paid time &amp; one half rate)</td>
<td>PT-22-P</td>
<td>10/8/2014</td>
<td>$42.82</td>
<td>$55.63</td>
<td>$68.43</td>
</tr>
</tbody>
</table>

Four 10s allowed Monday-Thursday with Friday makeup day if job down due to weather, holiday or other conditions beyond the control of the employer.

**Apprentice Rates:**

| First 6 months | $30.02 | $36.43 | $42.83 |
| Second 6 months | $33.86 | $42.19 | $50.51 |
| Third 6 months | $35.14 | $44.11 | $53.07 |
| Fourth 6 months | $36.42 | $46.03 | $55.63 |
| Fifth 6 months | $37.70 | $47.95 | $58.19 |
| Final 6 months | $38.98 | $49.87 | $60.75 |

**Pipe and Manhole Rehab**

<table>
<thead>
<tr>
<th>TM247</th>
<th>General Laborer for rehab work or normal cleaning and cctv work-top man, scaffold man, CCTV assistant, jetter-vac assistant</th>
<th>$27.20</th>
<th>$36.70</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>H</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM247-2</td>
<td>Tap cutter/CCTV Tech/Grout Equipment Operator: unit driver and operator of CCTV; grouting equipment and tap cutting equipment</td>
<td>$31.70</td>
<td>$43.45</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
</tr>
<tr>
<td>TM247-3</td>
<td>CCTV Technician/Combo Unit Operator: unit driver and operator of cctv unit or combo unit in connection with normal cleaning and televising work</td>
<td>$30.45</td>
<td>$41.57</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
</tr>
<tr>
<td>TM247-4</td>
<td>Boiler Operator: unit driver and operator of steam/water heater units and all ancillary equipment associated</td>
<td>$32.20</td>
<td>$44.20</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
</tr>
<tr>
<td>TM247-5</td>
<td>Combo Unit driver &amp; Jetter-Vac Operator</td>
<td>$32.20</td>
<td>$44.20</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
</tr>
<tr>
<td>TM247-6</td>
<td>Pipe Bursting &amp; Slip-lining Equipment Operator</td>
<td>$33.20</td>
<td>$45.70</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
</tr>
</tbody>
</table>

**Official Request #:** 1490  
**Official Rate**

### Schedule

**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,  
**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Statewide

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Page 22 of 29
### Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

**Page 23 of 29**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Updated</th>
<th>Straight Time and a Half Hourly</th>
<th>Double Time Hourly</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pipefitter</td>
<td>PF-636</td>
<td>6/30/2014</td>
<td>$66.73</td>
<td>$87.93</td>
<td>$105.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td>$26.93</td>
<td>$35.28</td>
<td>$42.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pipefitter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pipefitter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plasterer</td>
<td>BR1P</td>
<td>11/1/2012</td>
<td>$45.04</td>
<td>$67.56</td>
<td>$90.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Plasterer</td>
<td>PL67</td>
<td>9/8/2010</td>
<td>$44.72</td>
<td>$60.11</td>
<td>$75.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plasterer</td>
<td></td>
<td></td>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>

---

**Official Request #:** 1490  
**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,  
**County:** Wayne  
**Project Number:** 050-245285 SH/ 629-245283 EB  
**Official Rate Schedule**  
Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

---

**PREVAILING WAGE RATE SCHEDULE**  
00410 - 25
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 24 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plumber</td>
<td>Plumber</td>
<td>PL-98</td>
<td>7/18/2013</td>
<td>$64.45</td>
<td>$84.87</td>
<td>$101.29 H H D D D Y</td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- **Period 1:** $19.93, $26.43, $32.93
- **Period 2:** $23.90, $31.40, $38.90
- **Period 3:** $30.60, $39.19, $47.77
- **Period 4:** $31.23, $40.13, $49.03
- **Period 5:** $32.39, $41.87, $51.35
- **Period 6:** $33.54, $43.59, $53.65
- **Period 7:** $34.69, $45.32, $55.95
- **Period 8:** $35.86, $47.07, $58.29
- **Period 9:** $37.01, $48.80, $60.59
- **Period 10:** $38.16, $50.53, $62.89

| Roofer          | Commercial Roofer | RO-149-WOM | 8/18/2008 | $48.46 | $62.29 | $76.62 H H D H D N |

**Apprentice Rates:**

- **Apprentice 1:** $32.62, $39.86, $48.04
- **Apprentice 2:** $36.80, $44.80, $53.30
- **Apprentice 3:** $38.22, $46.93, $56.14
- **Apprentice 4:** $39.25, $48.48, $58.20
- **Apprentice 5:** $40.47, $50.30, $60.64
- **Apprentice 6:** $41.87, $52.40, $63.44

| Sewer Relining | Class I-Operator of audio visual CCTV system including remote in-ground cutter and other equipment used in conjunction with CCTV system. | SR-I | 5/6/2014 | $42.26 | $57.09 | $71.91 H H H H H D N |

|                | Class II-Operator of hot water heaters and circulation system; water jetters; and vacuum and mechanical debris removal systems and those assisting. | SR-II | 5/6/2014 | $40.73 | $54.79 | $68.85 H H H H H D N |

---

**Official Request #:** 1490  
**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,  
**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Statewide  
**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

---
### Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

#### Page 25 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet Metal Worker</td>
<td>SHM-80</td>
<td>$61.83</td>
<td>$78.74</td>
<td>$95.65</td>
<td>H</td>
<td>D</td>
</tr>
<tr>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st &amp; 2nd Periods Indentured after 6-1-11</td>
<td></td>
<td>$39.18</td>
<td>$46.79</td>
<td>$54.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd &amp; 4th Periods Indentured after 6-1-11</td>
<td></td>
<td>$40.88</td>
<td>$49.34</td>
<td>$57.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th &amp; 6th Periods Indentured after 6-1-11</td>
<td></td>
<td>$42.56</td>
<td>$51.86</td>
<td>$61.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7th &amp; 8th Periods Indentured after 6-1-11</td>
<td></td>
<td>$44.25</td>
<td>$54.40</td>
<td>$64.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9th &amp; 10th Periods Indentured before 6-1-11</td>
<td></td>
<td>$51.92</td>
<td>$64.44</td>
<td>$76.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Siding and decking | SHM-80-SD | $42.07 | $54.28 | $66.48 | H | H | H | H | H | D | Y |
| Apprentice Rates: | | | | | | |
| 1st Period | | $28.05 | $36.47 | $44.89 | |
| 2nd Period | | $41.16 | $50.63 | $60.11 | |
| 3rd Period | | $43.27 | $53.80 | $64.33 | |
| 4th Period | | $45.37 | $56.95 | $68.53 | |
| 5th Period | | $47.48 | $60.11 | $72.75 | |
| 6th Period | | $49.58 | $63.27 | $76.95 | |
| 7th Period | | $51.69 | $66.43 | $81.17 | |
| 8th Period | | $53.79 | $69.58 | $85.37 | |
| 9th Period | | $55.90 | $72.75 | $89.59 | |
| 10th Period | | $58.00 | $75.89 | $93.79 | |

**Official Rate Schedule**

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators  
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne  
County: Wayne
Official 2014 Prevailing Wage Rates for State Funded Projects

Issue Date: 10/24/2014
Contract must be awarded by: 1/22/2015

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrazzo</td>
<td>Terrazzo Finisher</td>
<td>BR1-TRF</td>
<td>$43.97 $55.03 $66.08</td>
<td>H H D H D D D Y</td>
<td>10/17/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terrazzo Worker</td>
<td>BR1-TRW</td>
<td>$49.73 $63.67 $77.60</td>
<td>H H D H D D D Y</td>
<td>10/17/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tile Finisher</td>
<td>BR1-TF</td>
<td>$43.50 $54.32 $65.14</td>
<td>H H D H D D D Y</td>
<td>10/17/2014</td>
<td></td>
</tr>
</tbody>
</table>

Apprentice Rates:

Level 1  | $19.04 $25.12 $31.20  
Level 2  | $20.24 $26.92 $33.60  
Level 3  | $27.01 $33.96 $40.90  
Level 4  | $28.47 $36.14 $43.82  
Level 5  | $29.99 $37.84 $45.70  
Level 6  | $31.61 $39.86 $48.10  
Level 7  | $33.30 $41.59 $49.87  
Level 8  | $34.79 $43.48 $52.17

Apprentice Rates:

Level 1  | $25.14 $32.65 $40.15  
Level 2  | $28.20 $36.49 $44.78  
Level 3  | $33.41 $41.97 $50.53  
Level 4  | $36.15 $45.66 $55.17  
Level 5  | $38.42 $48.17 $57.92  
Level 6  | $42.07 $53.56 $65.05  
Level 7  | $42.74 $54.38 $66.02  
Level 8  | $43.67 $55.78 $67.88

Apprentice Rates:

Level 1  | $19.04 $25.12 $31.20  
Level 2  | $20.24 $26.92 $33.60  
Level 3  | $27.01 $33.96 $40.90  
Level 4  | $28.47 $36.14 $43.82  
Level 5  | $29.99 $37.84 $45.70  
Level 6  | $31.61 $39.86 $48.10  
Level 7  | $33.30 $41.59 $49.87  
Level 8  | $34.79 $43.48 $52.17 Official Request #: 1490

Official Rate Schedule

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators,  
Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne  

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Page 27 of 29

<table>
<thead>
<tr>
<th>Classification</th>
<th>Name</th>
<th>Description</th>
<th>Last Updated</th>
<th>Straight Time and a Half</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tile Layer</strong></td>
<td>BR1-TL</td>
<td>$49.68  $63.59  $77.50</td>
<td>10/17/2014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A 4 ten workweek may be worked Monday thru Thursday or Tuesday thru Friday.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Apprentice Rates:**

- **Level 1**  
  $25.14  $32.65  $40.15
- **Level 2**  
  $28.20  $36.49  $44.78
- **Level 3**  
  $33.41  $41.97  $50.53
- **Level 4**  
  $36.15  $45.66  $55.17
- **Level 5**  
  $38.42  $48.17  $57.92
- **Level 6**  
  $42.07  $53.56  $65.05
- **Level 7**  
  $42.74  $54.38  $66.02
- **Level 8**  
  $43.67  $55.78  $67.88

**Truck Driver**

- **on all trucks of 8 cubic yard capacity or less (except dump trucks of 8 cubic yard capacity or over, tandem axle trucks, transit mix and semis, euclid type equipment, double bottoms and low boys)**
  - **TM-RB1**  
    $41.92  $37.85  H H H H H H Y  
    8/8/2013

- **of all trucks of 8 cubic yard capacity or over**
  - **TM-RB1A**  
    $41.30  $38.00  H H H H H H Y  
    8/8/2013

- **on euclid type equipment**
  - **TM-RB1B**  
    $41.45  $38.23  H H H H H H Y  
    8/8/2013

**Underground Laborer Open Cut, Class I**

<table>
<thead>
<tr>
<th>Construction Laborer</th>
<th>LAUC-Z1-1</th>
<th>$37.72  $48.43  $59.14  X X X X X X D Y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apprentice Rates:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1,000 work hours</td>
<td>$32.94</td>
<td>$41.26  $49.58</td>
</tr>
<tr>
<td>1,001-2,000 work hours</td>
<td>$33.90</td>
<td>$42.70  $51.50</td>
</tr>
<tr>
<td>2,001-3,000 work hours</td>
<td>$34.85</td>
<td>$44.13  $53.40</td>
</tr>
<tr>
<td>3,001-4,000 work hours</td>
<td>$36.76</td>
<td>$46.99$57.22 Official Request #: 1490</td>
</tr>
</tbody>
</table>

**Official Rate Schedule**

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Requestor: Wayne State University  
Project Description: Shapero Hall & Elliman Building - Provide & Install Generators, Project Number: 050-245285 SH/ 629-245283 EB  
County: Wayne
## Official 2014 Prevailing Wage Rates for State Funded Projects

**Issue Date:** 10/24/2014  
**Contract must be awarded by:** 1/22/2015

### Classification Last Straight Time and a Double Overtime

| Classification | Name Description Updated Hourly |  |  |  |  |  |  |  |
|----------------|---------------------------------|---|---|---|---|---|---|
| Underground Laborer Open Cut, Class II | Mortar and material mixer, concrete form man, signal man, well point man, manhole, headwall and catch basin builder, guard rail builders, headwall, seawall, breakwall, dock builder and fence erector. | LAUC-Z1-2 | $37.83 | $48.60 | $59.36 | X | X | X | X | X | D | Y | 10/25/2013 |
| Underground Laborer Open Cut, Class III | Air, gasoline and electric tool operator, vibrator operator, drillers, pump man, tar kettle operator, bracers, rodder, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars, etc.), cement finisher, welder, pipe jacking and boring man, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger man, and directional boring man. | LAUC-Z1-3 | $37.88 | $48.67 | $59.46 | X | X | X | X | X | D | Y | 9/5/2013 |
| Underground Laborer Open Cut, Class IV | Trench or excavating grade man. | LAUC-Z1-4 | $37.96 | $48.79 | $59.62 | X | X | X | X | X | X | D | Y | 9/5/2013 |
| Underground Laborer Open Cut, Class V | Pipe Layer | LAUC-Z1-5 | $38.02 | $48.88 | $59.74 | X | X | X | X | X | X | D | Y | 9/5/2013 |

### Apprentice Rates:

| Classification | Name Description Updated Hourly |  |  |  |  |  |  |  |
|----------------|---------------------------------|---|---|---|---|---|---|
| Underground Laborer Open Cut, Class II | Mortar and material mixer, concrete form man, signal man, well point man, manhole, headwall and catch basin builder, guard rail builders, headwall, seawall, breakwall, dock builder and fence erector. | LAUC-Z1-2 | $33.02 | $41.38 | $49.74 |  |  |  |  |  |  |  |  |  |
| Underground Laborer Open Cut, Class III | Air, gasoline and electric tool operator, vibrator operator, drillers, pump man, tar kettle operator, bracers, rodder, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars, etc.), cement finisher, welder, pipe jacking and boring man, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger man, and directional boring man. | LAUC-Z1-3 | $33.98 | $42.82 | $51.66 |  |  |  |  |  |  |  |  |  |  |
| Underground Laborer Open Cut, Class IV | Trench or excavating grade man. | LAUC-Z1-4 | $34.99 | $44.27 | $53.60 |  |  |  |  |  |  |  |  |  |  |
| Underground Laborer Open Cut, Class V | Pipe Layer | LAUC-Z1-5 | $36.87 | $47.15 | $57.44 |  |  |  |  |  |  |  |  |  |  |

### Apprentice Rates:

| Classification | Name Description Updated Hourly |  |  |  |  |  |  |  |
|----------------|---------------------------------|---|---|---|---|---|---|
| Underground Laborer Open Cut, Class II | Mortar and material mixer, concrete form man, signal man, well point man, manhole, headwall and catch basin builder, guard rail builders, headwall, seawall, breakwall, dock builder and fence erector. | LAUC-Z1-2 | $33.02 | $41.38 | $49.74 |  |  |  |  |  |  |  |  |  |  |
| Underground Laborer Open Cut, Class III | Air, gasoline and electric tool operator, vibrator operator, drillers, pump man, tar kettle operator, bracers, rodder, reinforced steel or mesh man (e.g. wire mesh, steel mats, dowel bars, etc.), cement finisher, welder, pipe jacking and boring man, wagon drill and air track operator and concrete saw operator (under 40 h.p.), windlass and tugger man, and directional boring man. | LAUC-Z1-3 | $33.98 | $42.82 | $51.66 |  |  |  |  |  |  |  |  |  |  |
| Underground Laborer Open Cut, Class IV | Trench or excavating grade man. | LAUC-Z1-4 | $34.99 | $44.27 | $53.60 |  |  |  |  |  |  |  |  |  |  |
| Underground Laborer Open Cut, Class V | Pipe Layer | LAUC-Z1-5 | $36.87 | $47.15 | $57.44 |  |  |  |  |  |  |  |  |  |  |

---

**Official Request #: 1490**  
**Requestor:** Wayne State University  
**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators,  
**Project Number:** 050-245285 SH/ 629-245283 EB  
**County:** Wayne  

---

**Official Rate Schedule**  
Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.
### Official 2014 Prevailing Wage Rates for State Funded Projects

#### Issue Date: 10/24/2014

**Contract must be awarded by:** 1/22/2015

---

**Classification**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Updated</th>
<th>Last Straight Time</th>
<th>Half Time</th>
<th>Double Time</th>
<th>Overtime Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground Laborer Open Cut, Class VI</td>
<td>Grouting man, top man assistant, audio visual television operations and all other operations in connection with closed circuit television inspection, pipe cleaning and pipe relining work and the installation and repair of water service pipe and appurtenances.</td>
<td>9/5/2013</td>
<td>$35.47</td>
<td>$45.06</td>
<td>$54.64 X X X X X D Y</td>
<td></td>
</tr>
<tr>
<td>Apprentice Rates:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1,000 work hours</td>
<td></td>
<td></td>
<td>$31.25</td>
<td>$38.73</td>
<td>$46.20</td>
<td></td>
</tr>
<tr>
<td>1,001-2,000 work hours</td>
<td></td>
<td></td>
<td>$32.10</td>
<td>$40.00</td>
<td>$47.90</td>
<td></td>
</tr>
<tr>
<td>2,001-3,000 work hours</td>
<td></td>
<td></td>
<td>$32.94</td>
<td>$41.26</td>
<td>$49.58</td>
<td></td>
</tr>
<tr>
<td>3,001-4,000 work hours</td>
<td></td>
<td></td>
<td>$34.63</td>
<td>$43.79</td>
<td>$52.96</td>
<td></td>
</tr>
</tbody>
</table>
| Underground Laborer Open Cut, Class VII             | Restoration laborer, seeding, sodding, planting, cutting, mulching and topsoil grading and the restoration of property such as replacing mail boxes, wood chips, planter boxes, flagstones etc. | 9/5/2013 | $32.09             | $39.99    | $47.88 X X X X X D Y |}

#### Apprentice Rates:

- 0-1,000 work hours: $28.72 $34.93 $41.14
- 1,001-2,000 work hours: $29.39 $35.93 $42.48
- 2,001-3,000 work hours: $30.07 $36.95 $43.84
- 3,001-4,000 work hours: $31.42 $38.98 $46.54 Official Request #: 1490

---

**Requestor:** Wayne State University

**Project Description:** Shapero Hall & Elliman Building - Provide & Install Generators, copy

**Project Number:** 050-245285 SH/ 629-245283 EB

**County:** Wayne

---

Every contractor and subcontractor shall keep posted on the construction site, in a conspicuous place, a copy of all prevailing wage and fringe benefit rates prescribed in a contract.

Page 29 of 29
WAYNE STATE UNIVERSITY
PAYMENT PACKAGE DOCUMENT REQUIREMENTS
(Revised 5-06-2011):

Review and comply with Section 410 of Bid Front End Documents.
Review and comply with Article 15 of the Supplemental General Conditions.

AIA DOCUMENT G702 & G703 – (or facsimile thereof) Payment Application Checklist:
- Correct Project Name – Found on your contract.
- Correct Project Number – Found on your contract.
- Purchase Order Number – Required prior to beginning work.
- Correct Application Number. (i.e. 1, 2, 3, etc.)
- Correct Period Reporting Dates – Applications support docs must be sequential and within application range.
- Approved & Executed Change Orders must be listed. (Cannot invoice for unapproved changes.)
- Schedule of values percentages and amounts match the approved Pencil Copy Review – Signed by the Architect, Contractor, and University Project Manager.
- Correct Dates – Back dating not accepted.
- Signed and Notarized.

SWORN STATEMENT – Checklist:
- List all contractors, sub-contractors, suppliers... ≥ $1000.00
- Contractor’s Sworn Statement amounts must coincide with Column “C” of the schedule of values document. Any unassigned or uncommitted value of contract shall be shown on an entry “Contractor – Unassigned” followed by the amount necessary to cause the „contracted to date‟ column of the sworn statement to equate with the schedule of value column totals.
- Current Date – Back dating not accepted.
- Signed and Notarized.
A Sworn Statement is required from every Sub Contractor on the job with a material purchase or sub-subcontract of $1,000 or more. (all the way down to the bottom tier)

DEPT. of LABOR FORM WH-347 – Certified Payroll Checklist: (Union and Non-Union)
- For every contractor & sub-contractors work, for each week within the application for payment reporting period. (For every „boot‟ on the floor representing the weeks within the application period)
- Wayne State University Project Number – Found on your contract.
- List ALL workers who have worked on the project site.
- Make sure workers addresses are listed.
- NO Social Security Numbers, if present they MUST be blackened out or listed in XXX-XX-1234 format.
- Work classifications based on the job specific Prevailing Wage Schedule descriptions. If you require rates for additional classifications, contact the Michigan Department of Consumer & Industry Services. (Refer to Section 410 of Bid Front End Documents.)
  http://www.cis.state.mi.us/bwuc/bsr/wh/revised_rates/whc_tbl.htm
- Apprenticeship program status – proof of enrolled program and current completion required for any workers paid at Apprenticeship rates.
- Rate of Pay verified against the Prevailing Wage Schedule with an hourly costs breakdown of fringes paid. (Refer to attachment for State of Michigan instructions and example)
- Authorized signatures on affidavit.

APPLICATION PACKAGE SUPPORTING DOCUMENTATION – Must accompany all package reporting periods: (Union and Non-Union)
- Copies of Pay Stubs may be required for each Certified Payroll period reported – (Social Security Numbers MUST be blackened out or listed in XXX-XX-1234 format. Pay stubs need to reflect claimed participation of fringes like Medical, Dental, Retirement or 1099 classification.)
- Proof of Ownership for any „Owner Operator‟ (Sole Proprieter) contractors not claiming their time under prevailing wage act. – (Must list their hours and dates worked on the WH-347 Form and enter EXEMPT on the income brackets.). The Owner Operator must provide copies of “DBA” registration form confirming status as exempt from prevailing wage requirements.
- Proof of Stored Materials – (Detailed Bill of Sale, certificate of insurance or endorsement page specifically insuring the stored materials, pictures, when large value. WSU reserves the right to on site verification of material. Stored material must be separated from ordinary inventory and labeled for WSU project.)
PAYMENT PACKAGE DOCUMENT REQUIREMENTS

Partial Unconditional Waivers – Must release the accumulated amount paid for work and be immediately provided, or provided with the subsequent application for payment. Waivers shall be provided for contractors, sub-contractors, and suppliers listed on the Sworn Statements. (This is required at all tiers)

Full Unconditional Waivers – Prime Contractor must deliver fully executed Full Unconditional Waiver upon receipt of final payment. Full Unconditional waivers may be required of sub-contractors and suppliers in advance of final Contractor payment on bonded projects. This requirement shall be determined on a project-by-project basis. Full Unconditional waivers shall be required in advance of or at the time of final payment on all non-bonded projects. Full Unconditional waivers shall be required in advance of or at the time of final payment on all non-bonded projects from all subcontractors and suppliers listed on Sworn Statements, or who have provided a notice of furnishing.

Partial Conditional Waivers – The Contractor shall provide a Partial Conditional Waivers covering the entire amount of the application for payment. For non-bonded Projects – A partial conditional waiver from all subcontractors must accompany any application for payment within which a subcontractor draw is included.

Sworn Statements – Required for all Sub Contractors, and Sub-subcontractors (etc.) with any contracts or purchases exceeding $1,000.

**FINAL PAYMENT EXCHANGE – Checklist:**

- Clear and concise As-Built drawings.
- Operation and Maintenance Manuals.
- Required training must be completed (if applicable).
- Warranty of work in accordance with project documents.
- Certificate of Substantial Completion.
- Full Unconditional Waiver

The Project Manager may provide additional requirements as may apply to individual jobs

Revised 5-6-2011
AGREEMENT BETWEEN THE UNIVERSITY AND CONTRACTOR
FOR CONSTRUCTION SERVICES (rev 6-2013)

Executed as of the _____ day of __________, 2014 by and between:

The Board of Governors, Wayne State University
Detroit, Michigan 48202
(The University),

and

CONTRACTOR'S NAME
CONTRACTOR'S ADDRESS

regarding

Electrical Reliability Upgrades – Bid Package #2
WSU Project No. 050-245285 (Shapero Hall)
629-245283 (Elliman Building)
In consideration of the mutual covenants and conditions contained herein, the Parties agree as follows:

**Article 1 - Scope of Work**

1.1 This Agreement provides for **Provide and install generators, UPS systems, and wiring as required for each of the two buildings, located at: Shapero Hall 5501 Gullen Mall, Detroit, MI 48202 and the Elliman Bldg., at 421 E. Canfield, Detroit, MI 48201**. The documents listed in Article 4 fully define the scope of work.

1.2 The Contractor shall furnish all the labor, materials, equipment, services, and supervision to perform all the work shown on the drawings and specifications listed in Article 18, including any addenda issued during the bid phase, and approved change orders issued during the construction phase.

1.3 The Contractor shall notify the University in writing within five (5) calendar days when the Contractor discovers any condition that will affect the contract amount or the completion date.

**Article 2 - Time of Completion**

2.1 The work to be performed under this Agreement shall commence upon the Contractor’s receipt of a fully-executed Agreement, and substantial completion shall be achieved by:

- 050 Shapero Hall: May 29, 2015
- Elliman: September 30, 2015

**Article 3 - The Contract Sum**

3.1 The University shall pay the Contractor a "lump sum/not-to-exceed (pick one)" amount of $$$$$$$ ("Amount in words 00" /100 dollars) for the performance of all work associated with the Contractor’s Base Bid "and Alternates (List)".

3.2 The University may, at its sole discretion, during the life of the contract, award the following alternates at the amounts indicated: "(If section 3.2 is not used, delete all text and enter Deleted)"

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate #1</td>
<td></td>
</tr>
<tr>
<td>Alternate #2</td>
<td></td>
</tr>
<tr>
<td>Alternate #3</td>
<td></td>
</tr>
</tbody>
</table>

3.3 In the event additional work becomes necessary, the following unit prices will apply: "(If section 3.3 is not used, delete all text and enter Deleted)"

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>

**Article 4 - The Contract Documents**

4.1 The Contract Documents shall consist of this Agreement, the drawings and specifications as listed in Article 18, the General Conditions of the Contract for Construction as defined by AIA Document A201 1970 Edition, except as otherwise provided herein, and Wayne State University's Supplementary General Conditions 1997 Edition.

4.2 For any inconsistencies found among or between these Contract Documents, the language contained in this Agreement shall prevail over all other documents and the Supplementary General Conditions shall prevail over the General Conditions. In the event of a conflict between the Drawings and Specifications, the requirement for the higher quantity and/or higher quality shall prevail.
Article 5 – Examination of Premises

5.1 The Contractor acknowledges that the University provided the opportunity for a thorough examination of the project site and its surroundings and that the Contractor knows of no conditions preventing accomplishment of the full scope of work within the time and for the amount specified in this Agreement.

5.2 The University will deny all claims for additional time and/or cost for conditions that could have been reasonably discovered during such an examination.

Article 6 - The Architect/Engineer

6.1 The Architect/Engineer for this project is:

"(List the Architect and Engineer separately if appropriate)"

MEP Engineers, LLC
30403 W. 13 Mile Road
Farmington Hills, Michigan 48334
(Architect Phone No / Fax No)

6.2 The University will appoint a Project Manager who will be the University's point of contact for all matters of contract administration including, but not limited to, interpretation of documents, defining the scope of work, approving work schedules, and approving contract payments.

Article 7 - Additional Work

7.1 The University reserves the right to let other Agreements in connection with this work. The Contractor will afford other Contractors or the University’s own workforce reasonable opportunity for the delivery and storage of their material and for the performance of their work and shall properly connect and coordinate its work with theirs.

7.2 If any part of the Contractor’s work depends for proper execution or results upon the work of another Contractor or the University’s own workforce, the Contractor shall inspect and promptly report to the University’s Project Manager any defects in such work that render it unsuitable for such proper execution and results. The Contractor’s failure to so inspect and report shall constitute an acceptance of the work of others as fit and proper for reception of the Contractor’s work and as a waiver of any claim or defense against the University or other contractor which relies in whole or in part upon the contention that such work was unsuitable for proper execution and resolution.

Article 8 – Dispute Resolution

8.1 Jurisdiction over all claims, disputes, and other matters in question arising out of or relating to this contract or the breach thereof, shall rest in the Court of Claims of the State of Michigan. No provision of this agreement may be construed as Wayne State University’s consent to submit any claim, dispute or other matter in question for dispute resolution pursuant to any arbitration or mediation process, whether or not provisions for dispute resolution are included in a document which has been incorporated by reference into this agreement. Specifically, all references to Arbitration contained in the General Conditions are superseded by this Article.

8.2 In any claim or dispute by the Contractor against the University, which cannot be resolved by negotiation, the Contractor shall submit the dispute in writing for an administrative decision by the University’s Vice President for Finance and Administration, within 30 days of the end of negotiations. Any decision of the Vice President shall be made within 45 days of receipt from the Contractor and is final unless it is challenged by the Contractor by filing a lawsuit in the Court of Claims of the State of Michigan within one year of the issuance of the decision. The Contractor agrees that appeal to the Vice President is a condition precedent to filing suit in the Michigan Court of Claims.

8.3 For purposes of this section, the “end of negotiations” shall be deemed to have occurred when:

8.3.1 Either party informs the other that pursuant to this section, negotiations are at an impasse; or
8.3.2 The Contractor submits the dispute in writing to the Vice President.

8.4 Unless otherwise agreed by the University in writing, and notwithstanding any other rights or obligations of either of the parties under any Contract Documents or Agreement, the Contractor shall continue with the performance of its services and duties during the pendency of any negotiations or proceedings to resolve any claim or dispute, and the University shall continue to make payments in accordance with the Contract Documents; however, the University shall not be required or obligated to make payments on or against any such claims or disputes during the pendency of any proceeding to resolve such claims or disputes.

**Article 9 - Termination for Convenience**

9.1 Upon thirty days written notice to the Contractor, the University may, without cause and without prejudice to any other right or remedy of the University, elect to terminate the contract. In such case, the Contractor shall only be paid (without duplication of any items), using a Close out Change Order, for the following:

9.1.1 For completed and acceptable work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

9.1.2 For expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted work, including fair and reasonable sums for overhead and profit on such expenses.

9.2 The Contractor shall not be paid on account of loss of anticipated profits or revenue, delay or disruption, or other economic loss arising out of or resulting from such termination. For purposes of this section, "fair and reasonable sums for overhead and profit" shall be determined by reference to Michigan law, without reference to principles used for such determinations in arbitration.

**Article 10 - Progress Payments**

10.1 On or before the 20th day of each month, the Contractor shall submit a written application for payment, using form AIA G702, to the Architect/Engineer and the University's Project Manager for review. The Architect/Engineer shall have ten (10) calendar days to accept or reject the Contractor's application for payment. Acceptable applications for payment shall then be submitted to the University for Payment of authorized amount(s) within thirty (30) calendar days of receipt by the University's Project Manager.

10.2 The application for payment shall contain a full schedule of values organized and sorted by subcontractor, by Construction Specifications Institute standard work categories, or in another format acceptable to the University.

10.3 Monthly progress payments shall show the percentage of work installed as of the date of the application, less amount previously installed and the amount due for the application period. The Contractor shall deduct a 10% retainage from the balance due for each progress payment and indicate the net amount due on each application.

10.4 When 50% of the work associated with this Agreement is installed, the Contractor shall not deduct additional retainage from the balance due from the University. When substantial completion is achieved and acknowledged by the Architect/Engineer, the Contractor and the University in writing, the University shall remit to the Contractor all but 2% of the retainage. The remaining 2% shall be retained by the University until the final payment is authorized and remitted to the Contractor.

**Article 11 - Acceptance and Final Payments**

11.1 Final payment shall be due thirty (30) days after the completion of the work, including all punch list items,
provided the work is fully completed and the Agreement fully performed.

11.2 Upon receipt of written notice that the work is ready for final inspection and acceptance, the Architect/Engineer shall promptly inspect the work. When the Architect/Engineer concludes that the work is acceptable and the Agreement to be fully performed, the Architect/Engineer shall promptly issue a final certificate with an original signature, stating that the work provided is complete and acceptable and that the entire remaining balance found to be due the Contractor shall be remitted by the University once the final application for payment is received.

11.3 If, after the work has been substantially completed, full completion thereof is materially delayed through no fault of the Contractor, and the Architect/Engineer so certifies, the University shall, upon certificate of the Architect/Engineer, and without terminating the Contract, make payments of the balance due for that portion of the work fully completed and accepted. Such payments shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

**Article 12 - Non-Discrimination**

12.1 The Contractor agrees that it will not discriminate against any employee or applicant for employment, to be employed in the performance of this Agreement, with respect to hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment, because of race, color, religion, sex, age, national origin, or ancestry. Breach of this covenant may be regarded as material breach of this Agreement.

12.2 The Contractor further agrees that it will, in all subcontracts relating to the performance of the work under this Agreement, provide in its subcontracts that the subcontractor will not discriminate against any employee or applicant for employment, to be employed in the performance of such contract, with respect to hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment because of race, sex, age, color, religion, national origin or ancestry. Breach of this covenant may also be regarded as a material breach of this Agreement.

**Article 13 – Laborers and Mechanics**

13.1 All laborers and mechanics must be covered by Worker's Compensation and Employer's Liability Insurance as required by Federal and Michigan law. The Contractor shall also require all of its Subcontractors to maintain this insurance coverage.

13.2 The Contractor acknowledges and shall abide by the University's prohibition on use of 1099 independent contractors and owner/operator business entities. The Contractor shall ensure that all classifications of laborers and construction mechanics performing Work on the Project job site are employees of the Contractor or any Trade Contractor for any tier thereof, and that each worker is covered by workers compensation insurance.

**Article 14 - Prevailing Wages**

14.1 The Contractor and each subcontractor shall pay to each class of mechanics and laborers not less than the wage and fringe benefit rates prevailing in the Detroit Metropolitan Area, as determined by the United States Department of Labor. The Contractor shall post on site, in a conspicuous place, a copy of all applicable wage and benefit rates, and shall provide the University with a copy of the applicable wage and benefit rates.

14.2 The Contractor and each subcontractor shall keep an accurate record showing the name and occupation of and the actual benefits and wages paid to each laborer and mechanic employed in connection with this contract. The Contractor and each subcontractor shall make certified payroll records available to the University's representatives upon request.

14.3 If a Contractor or subcontractor fails to pay the prevailing rates of wages and fringe benefits and does not cure such failure within ten (10) days after notice to do so by the University, the University shall have the
right, at its option, to do any or all of the following:

14.3.1 Withhold all or any portion of payments due the Contractor as may be considered necessary by the University to pay laborers and mechanics the difference between the rates of wages and fringe benefits required by this Agreement and the actual wage and fringe benefits paid.

14.3.2 Terminate part or all of this Agreement or any subagreement and proceed to complete the Agreement or subagreement by separate agreement with another Contractor or otherwise, in which case the Contractor and its sureties shall be liable to the University for any excess costs incurred by the University.

14.4 The Contractor shall include terms identical or substantially similar to this section in any Agreement or subagreement pertaining to the project.

**Article 15 - Save Harmless**

15.1 The Contractor shall indemnify, defend and hold harmless the University, its agents and employees from any and all loss, damage, claims, and causes of action whatsoever, including all costs, expenses and attorneys' fees arising out of Contractor's performance of obligations under the terms and conditions of this agreement. Such responsibility shall not be construed as liability for damage caused by or resulting from the negligence of the University, its agents other than the Contractor, or its employees.

**Article 16 - Liquidated Damages**

16.1 It is understood and agreed that, if the project is not completed within the time specified in the Agreement plus any extension of time allowed pursuant thereto, the actual damages sustained by the University because of any such delay will be uncertain and difficult to ascertain, and it is agreed that the reasonable foreseeable value of the use of said project by the University would be the sum of $250.00 per day, Two Hundred Fifty Dollars per day. Therefore, the Contractor shall pay as liquidated damages to the University the sum of $250.00 per day, Two Hundred Fifty Dollars per day for each day's delay in substantially completing said project beyond the time specified in this Agreement and any extensions of time allowed thereunder.

"ENTER N/A FOR ABOVE AMOUNT IF NO LIQUIDATED DAMAGES"

**Article 17 - Interpretation**

17.1 This Agreement shall be interpreted and construed according to the laws of the State of Michigan.

17.2 If one part of this Agreement is found to be void by legal or legislative action, the remainder of the contract remains in full effect.
Article 18 - Drawings and Specifications

18.1 The Technical Specifications and the Project Manual dated October 31, 2014, and the following List of Drawings represents the scope of work as defined in the Contract Documents from Article 4.

### DRAWINGS

<table>
<thead>
<tr>
<th>Drawing No.:</th>
<th>Description</th>
<th>Dated</th>
</tr>
</thead>
<tbody>
<tr>
<td>050 Shapero Drawings:</td>
<td>E-00</td>
<td>Title Sheet</td>
</tr>
<tr>
<td></td>
<td>E1-01</td>
<td>Electrical Schedules, Symbols, &amp; Abbreviations</td>
</tr>
<tr>
<td></td>
<td>E2-02</td>
<td>Basement Floor Emergency Power Plan</td>
</tr>
<tr>
<td></td>
<td>E2-03</td>
<td>First Floor Emergency Power Plan</td>
</tr>
<tr>
<td></td>
<td>E2-04</td>
<td>Second Floor Emergency Power Plan</td>
</tr>
<tr>
<td></td>
<td>E2-05</td>
<td>Third Floor Emergency Power Plan</td>
</tr>
<tr>
<td></td>
<td>E2-06</td>
<td>Fourth Floor Emergency Power Plan</td>
</tr>
<tr>
<td></td>
<td>E5-07</td>
<td>Emergency Power Riser Diagram</td>
</tr>
<tr>
<td></td>
<td>001</td>
<td>Siemens Generator/Natural Gas Ctrl (for reference only)</td>
</tr>
<tr>
<td></td>
<td>001A</td>
<td>Siemens Generator/Natural Gas Ctrl (for reference only)</td>
</tr>
<tr>
<td>629 Elliman Drawings:</td>
<td>T-00</td>
<td>Title Sheet</td>
</tr>
<tr>
<td></td>
<td>C-01</td>
<td>Electrical Site Grading &amp; Utilities Plan</td>
</tr>
<tr>
<td></td>
<td>C-02</td>
<td>Site Details</td>
</tr>
<tr>
<td></td>
<td>S-01</td>
<td>General Structural Notes &amp; Special Instructions</td>
</tr>
<tr>
<td></td>
<td>S-02</td>
<td>Partial Third Floor Framing Plan and Details</td>
</tr>
<tr>
<td></td>
<td>S-03</td>
<td>Generator Pad Plan Details and General Notes</td>
</tr>
<tr>
<td></td>
<td>S-04</td>
<td>Automatic Transfer and Primary Switchgear Pads</td>
</tr>
<tr>
<td></td>
<td>E1-01</td>
<td>Electrical Schedules, Symbols &amp; Abbreviations</td>
</tr>
<tr>
<td></td>
<td>ED-02</td>
<td>Roof Electrical Power Demolition Plan</td>
</tr>
<tr>
<td></td>
<td>ED-03</td>
<td>Electrical Power Demolition Oneline Diagram</td>
</tr>
<tr>
<td></td>
<td>ES-04</td>
<td>Electrical Power Site Plan</td>
</tr>
<tr>
<td></td>
<td>E2-05</td>
<td>Basement Floor Power Plan Partial</td>
</tr>
<tr>
<td></td>
<td>E2-06</td>
<td>Enlarged Electrical Site Plan</td>
</tr>
<tr>
<td></td>
<td>E2-07</td>
<td>Third Floor UPS Power Plan</td>
</tr>
<tr>
<td></td>
<td>E5-08</td>
<td>Emergency Power Oneline Diagram</td>
</tr>
<tr>
<td></td>
<td>E5-09</td>
<td>UPS Power Oneline Diagram</td>
</tr>
<tr>
<td></td>
<td>E6-10</td>
<td>Electrical Details</td>
</tr>
<tr>
<td></td>
<td>E6-11</td>
<td>Electrical Details</td>
</tr>
<tr>
<td></td>
<td>001</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
</tr>
<tr>
<td></td>
<td>001A</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
</tr>
<tr>
<td></td>
<td>001B</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
</tr>
<tr>
<td></td>
<td>001C</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
</tr>
</tbody>
</table>
WAYNE STATE UNIVERSITY
WSU Project No. 050-245285 (Shapero Hall)
629-245283 (Elliman Building)

IN WITNESS WHEREOF the parties to these presents have hereunto set their hands as of the day and year first written above.

Signed, sealed and delivered in the presence of:

CONTRACTOR’S NAME GOES HERE

By__________________________________
signature

Please print name here

____________________________________
Date signed

____________________________________
Title

_____________________________
Witness

THE BOARD OF GOVERNORS of WAYNE STATE UNIVERSITY

By

_____________________________
Richard J. Nork, Vice President for Finance and Facilities

____________________________________
Date signed

Form Contract Approved by OGC 06/13 – LG
File_reference_here
FORM OF GUARANTEE

PROJECT:   Electrical Reliability Upgrades – Bid Package #2

OWNER:   BOARD OF GOVERNORS, WAYNE STATE UNIVERSITY

CONTRACTOR:  

DATE:  

Know all men by these presents that, in consideration of my (our) having been awarded the Contract or Subcontract for complete furnishing and installation of:

Electrical Reliability Upgrades – Bid Package #2 (050-245285 (Shapero Hall) 629-245283 (Elliman Building) )

For:  Board of Governors, Wayne State University

In conformity with drawings and specifications prepared by Architect or Engineer, MEP Engineers, LLC, and known as the buildings indicated above, I (we) do hereby agree that, should I (we) be notified that the said work has proved faulty, etc., that I (we) will return to the buildings within three (3) working days of the receipt of such notice, and will furnish the necessary labor and material to repair such work to the satisfaction of the Owner and without cost to the Owner.

The Agreement shall remain in full force and effect for a one year period (DATE TBD)

WITNESS:

signed:  

Subcontractor

by:  

address:  

city/state/zip:

signed:  

General Contractor

by:

(THIS FORM TO BE FILED IN DUPLICATE.)
GENERAL CONDITIONS (Revised 10-2009)

A. Although AIA Document A201 - Twelfth Edition (April 1970) - "General Conditions of the Contract for Construction" is not bound herein, it forms a part of these construction documents.

B. A reference copy of AIA Document A201 - Twelfth Edition (April 1970) - "General Conditions of the Contract for Construction" is on file at the following location:

Wayne State University
Finance & Facilities Management
Procurement & Strategic Sourcing
Academic / Administrative Services Building
5700 Cass Avenue
Detroit Michigan 48202
SUPPLEMENTARY GENERAL CONDITIONS

OF

THE CONTRACT FOR CONSTRUCTION

Facilities Planning & Management - Design & Construction Services

Wayne State University
WSU SUPPLEMENTARY GENERAL CONDITIONS
OF THE
CONTRACT FOR CONSTRUCTION

NOTE: The following items related to A.I.A. General Conditions, A.I.A. Document A-201 - Twelfth Edition (April 1970), by specific number being amended to. These items, as amendments, shall have precedence over the article being amended.

ARTICLE 1 - CONTRACT DOCUMENTS

1.1 DEFINITIONS

1.1.5 The Agreement

The Agreement executed by the Contractor and the Owner.

1.2 EXECUTION, CORRELATION, INTENT, AND INTERPRETATIONS

1.2.6 "General Conditions and "Supplementary General Conditions" apply with equal force to all Contractors, Subcontractors work, and extra work required under this Contract.

1.2.7 Precedence of Drawings and Specifications.

The Agreement has precedence over WSU Supplementary General Conditions.

WSU Supplementary General Conditions have precedence over A.I.A. A-201 General Conditions of the Contract.

Specifications have precedence over drawings. Full-size drawings have precedence over scale drawings. Large-scale plans and details have precedence over small-scale plans and details. Figured dimensions have precedence over plans and elevations.

ARTICLE 2 - ARCHITECT

2.1 DEFINITION

2.1.1 The term Architect or Architect/Engineer as used in these specifications refers to Facilities Planning and Management - Design Services, and/or Consulting Architect/Engineer.

2.2 ADMINISTRATION OF THE CONTRACT

2.2.16 The Architect will assign Field Representatives to make periodic visits to the project for the purpose of assisting the Architect in carrying out his field responsibilities at the site. The duties, responsibilities and limitations of authority of any such Field Representative shall be as follows:

a. Explain Contract Documents: Assist the Contractor via the Contractor's Superintendent to understand the intent of the Contract Documents.

b. Observations: Conduct on-site observations and spot checks of the work in progress as a basis for determining conformance of the work, material, and equipment with the Contract Documents.

c. Additional Information: Obtain from the Architect, additional details or information, if and when required, at the job site for proper execution of the work.

d. Modifications: Consider and evaluate suggestions or modifications that may be submitted by the Contractor and report them with recommendations to the Architect for final decision.

e. Construction Schedule and Completion: Be alert to the completion, and report same to the Architect. When the construction work has been completed in accordance with the
Contract Documents, advise the Architect that the work is ready for general inspection and acceptance.

f. Job Conferences: Attend and report to the Architect on all required conferences held at the job site.

g. Observe Tests: See that tests which are required by the Contract Documents are actually conducted; observe, record and report to the Architect all details relative to the test procedures; and advise the architect's office in advance of the schedules of tests.

h. Inspection by Others: If inspectors, representing local, state or federal agencies having jurisdiction over the project, visit the job site, accompany such inspectors during their trips through the project, record the outcome of these inspections, and report same to the Architect's office.

i. Shop Drawings: Do not permit the installation of any materials and equipment for which shop drawings are required unless such drawings have been duly approved and issued by the Architect.

j. Contractor's Requisitions for Payment: Review and make recommendations to the Architect for disposition.

k. List of Items for Correction: After substantial completion, make a list of items for correction before final inspection and check each item as it is corrected.

l. Owner's Occupancy of the Building: If the Owner occupies (to any degree) the building prior to actual completion of the work by the Contractor, be especially alert to possibilities of damage to completed work prior to the acceptance of the building.

m. Owner Existing Operation: In the case of additions to or Demolitions of an existing facility, which must be maintained as an operational unit, be alert to conditions on the job site which may have an effect on the Owner's existing operation.

n. Limitations of Authority: Do not become involved in any of the following areas of responsibility unless specific exceptions are established by written instructions issued by the Architect.

   aa. Do not authorize deviations from the Contract Documents.
   bb. Avoid conducting any test personally.
   cc. Do not enter into the area of responsibility of the Contractor's field superintendent.
   dd. Do not expedite job for Contractor unless so instructed by the Architect.
   ee. Do not advise on or issue directions relative to any aspect of the building technique or sequence unless a specific technique or sequence is called for in the Specifications or by written instructions from the Architect.
   ff. Do not approve shop drawings or samples.
   gg. Do not authorize or advise the Owner to occupy the Project, in whole or in part, prior to the final acceptance of the building.
   hh. Do not issue a Certificate for Payment.

ARTICLE 3 - OWNER

3.5 OWNER'S RIGHT TO DO WORK
3.5.1 The Owner may exercise his right, which is hereby acknowledged by the Contractor, to let independent of the Contract for the work herein specified, any other work on the premises even if of like character and trades, and the Owner shall not be liable for any damage, loss or expense incurred by the Contractor through the fault of any other Contractor so employed by the Owner. The Contractor acknowledges the necessity of work by others, to be performed at approximately the same time as the work hereunder, and agrees to perform his work in full cooperation with the work of such other trades and/or Contractors, partially or entirely completed, by such other trades and/or Contractors, or by the Owner, when, in the opinion of the Architect, such access or use is necessary for the performance and completion of any portion or all of the work of others or of any work on the site.

3.6 OWNER'S ACCESS AND PARTIAL OCCUPANCY

3.6.1 The Owner shall have access to the work at all times, and at his election, may from time to time (prior to the stipulated contract completion date) occupy any of the units or parts of the project as the work in connection therewith is complete to such a degree as will, in the opinion of the Owner, permit their temporary or permanent use. The Owner will, prior to any such partial occupancy, give notice to the Contractor thereof and such occupancy shall be upon the following terms:

a. Such occupancy shall not constitute an acceptance of work not performed in accordance with the Contract nor shall such occupancy relieve the Contractor of liability to perform any work by the Contract by not complete at the time of occupancy.

b. Except as otherwise provided by an agreement at the time of such partial occupancy, the Contractor shall be relieved of all maintenance costs on units or parts so occupied.

c. The Contractor shall not be responsible for wear and tear or damage resulting from partial occupancy.

d. The Owner shall assume risk of loss with respect to any unit or part so occupied.

e. The Contractor shall, if required by the Owner, furnish heat, light, water, or other such services to the units or parts occupied and the Owner shall make proper remuneration therefore to the Contractor.

3.6.2 The Contractor agrees that the Owner shall have the right, after seven (7) days' written notice to the Contractor, to place and install as much equipment and machinery during the progress of the work as is possible before the completion of the various parts of the work; and further agrees that such placing and installation of equipment shall not in any way evidence the completion of the work or any portion thereof, nor signify the Owner's acceptance of the work or any portion thereof. Should the Owner place or install such equipment and machinery with his own forces he shall be responsible for any damage to work of the Contractor caused by the Owner's work or workmen. Should the Owner have such placement or installation performed by another Contractor, then the Owner shall require said Contractor to be responsible for all such damage caused by his work, his workers, or his subcontractors.

ARTICLE 4 - CONTRACTOR

4.4 LABOR AND MATERIALS

4.4.3 All materials shall be so delivered, stored and handled to prevent the inclusion of foreign materials and the damage of materials by water or breakage. Packaged materials shall be delivered and stored in original packages until ready for use. Packages or materials showing evidence of water or other damage shall be rejected. All materials shall be of the respective qualities specified herein.

4.4.4 The Contractor shall be responsible for the proper care and protection of all his materials, equipment, etc., delivered at the site. Building materials, equipment, etc., may be stored on the premises subject to the approval of the Architect.

4.4.5 To insure timely availability of critical materials in case of national emergency, the Contractor may order his subcontractors to proceed with fabrication of the same earlier than required by normal
sequence of construction. In the event storage facilities are not available on the site or at the source of fabrication, the Owner will endeavor to provide such storage space as may be available to care for same. Where this is necessary, the Contractor shall be paid for all stored material on the Owner's property or on the properties approved by the Owner upon approval of certified invoices. It shall be the Contractor's obligation to pay for all handling costs and damage to this material. The Contractor shall protect this property against damage.

4.6 TAXES

4.6.1 The Bidder shall include in his proposal and make payment of all Federal, State, County and Municipal taxes including Michigan State Sales and Use Taxes, now in force or which may be enacted during the progress and completion of the work covered.

4.7 PERMITS, FEES AND NOTICES

4.7.3 The Contractor shall pay highway or DPW fees for damages to sidewalks, streets, or other public property or to any public utilities.

4.7.4 Permits and licenses of a temporary nature necessary for the execution of the work shall be secured and paid for by the Contractor.

4.7.5 Except for the General Building Permit (which is not required), the Contractor shall secure and pay for all other required permits, including the following:

<table>
<thead>
<tr>
<th>Category</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>State of Michigan</td>
</tr>
<tr>
<td>Plumbing</td>
<td>State of Michigan</td>
</tr>
<tr>
<td>Mechanical</td>
<td>State of Michigan</td>
</tr>
<tr>
<td>Elevator</td>
<td>City of Detroit</td>
</tr>
</tbody>
</table>

4.7.6 The Contractor shall secure certificates of inspection and of occupancy that may be required by authorities having jurisdiction over the work. These certificates shall be delivered to the Architect upon completion of the work.

4.9 SUPERINTENDENT

4.9.2 The Contractor shall give sufficient supervision to the work, using his best skill and attention. He shall carefully study and compare all drawings, specifications, and other instructions, and shall at once report to the Architect any error, inconsistency, or omission which he may discover, but he shall not be held responsible for their existence or discovery.

4.9.3 The Contractor's superintendent shall periodically inspect the entire project to make certain that all of the stipulations of all of the articles of the General Conditions are being observed.

4.12 DRAWINGS AND SPECIFICATIONS AT THE SITE

4.12.1.1 Refer to Paragraph 4.12.1, of A.I.A. General Conditions of the Contract for Construction. Modify the last sentence of this paragraph to read:

"The Drawings, marked to record all changes made during construction, shall be incorporated in the Contractor's 'Informational Package'."

4.12.2 As a basic and interim step for the fulfillment of the "Informational Package", accurate records of all non-structural underground and concealed work shall be kept, including, but not limited to, all piping, conduit, equipment, and drainage and tunnel work. In addition, such records shall be
available for review during various steps of the project.

4.13 SHOP DRAWINGS AND SAMPLES

4.13.9 Immediately before and as a condition of substantial completion, the Contractor shall provide the Owner an "Informational Package" and instructional sessions on the operation, maintenance, and service of the facility. The "Informational Package" shall include:

1. One (1) set of transparency (sepia) of the approved shop drawings and descriptive material submitted during construction. Any shop documents unobtainable in sepia shall be supplied in three (3) sets.

2. One (1) set of transparency (sepia) of constructional shop drawings with all installation revisions incorporated to reflect the as-built condition. Examples of constructional shop drawings are dimensioned conduit, piping and ductwork layout drawings.

3. Three (3) sets of instructional manuals on the installation, operation, maintenance and service of equipment and systems, including parts lists.

Examples of Specific Information Required:

1. Electrical
   a. Conduit layout of light, power, and special systems, indicating dimensionally the locations and size of runs; circuit grouping and conductor size and number in conduit runs.
   b. System description and elementary diagrams, connection and interconnection diagrams, and device internal diagrams.

2. Mechanical
   a. Piping and ductwork layout indicating dimensionally the location and size of the runs.
   b. Description and diagrams of control systems.

Following the submittal of the "Informational Package", the Contractor shall schedule and provide, at the Owner's convenience, instructional sessions for Owner's personnel to acquaint them with the operation, maintenance, and service of the system.

3. Elevators
   a. Elementary diagrams and description of sequence of operation of the system control components, connection and interconnection diagrams, and device internal diagrams.

ARTICLE 5 - SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.3 Delete Article 5.2.3 in its entirety.

5.2.4 Delete Article 5.2.4 in its entirety.

ARTICLE 7 - MISCELLANEOUS PROVISIONS (Revised 6-13-2011)

7.5 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND
7.5.1 The successful Bidder will be required to furnish a Performance Bond and Labor and Material Payment bond in an amount equal to 100% of the contract award amount, and include such cost in the Proposal, complying with the laws of the State of Michigan. The graduated formula no longer applies.

A. Performance Bond and Labor and Material Payment Bond shall be from a surety company acceptable to the Owner and made payable as follows:

(1) A Labor and Material Payment bond for 100% of the contract award amount to the Board of Governors of Wayne State University, and guaranteeing the payment of all subcontractors and all indebtedness incurred for labor, materials, or any cause whatsoever on account of the Contractor in accordance with the laws of the State of Michigan relating to such bonds.

(2) A Performance bond for 100% of the contract award amount to the Board of Governors of Wayne State University to guarantee and insure the completion of work according to the Contract.

B. The only acceptable Performance Bond shall be the AIA A312 – 2010.

C. The Contractor shall include with his bid evidence of his ability to obtain a Performance Bond in the amount of 100% of the bid amount, and in accordance with the terms and conditions outlined in this section, such evidence shall be project specific and shall be submitted on a form provided by the Surety or Agent thereof.

7.7 ROYALTIES AND PATENTS

7.7.1 The Contractor hereby agrees to indemnify, protect and save harmless the Architect and the Owner from and against any and all liability, loss or damage, and to reimburse the Owner and the Architect for any expenses, including legal fees and disbursements to which the Owner or the Architect may be put because of claims of litigation on account of infringement or alleged infringement of any letters patent or patent rights by reason of the work or materials, equipment, or other items used by the Contractor in its performance.

7.9 INTEREST

7.9.1 Delete Article 7.9 in its entirety.

ARTICLE 8 - TIME

8.1 DEFINITIONS

8.1.3 The Date of Substantial Completion of the Work is the Date certified by the Architect when construction of the entire work is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy the Work for the use for which it is intended. It is the beginning date for the guarantees on all the Project Work.

8.3.5 LIQUIDATED DAMAGES

It is understood that if said Contract is not completed within the time specified in the Contract plus any extension of time thereto, the Contractor shall pay Liquidated Damages to the Owner as set forth in Article 11 of the Agreement between Contractor and Owner for Construction.

ARTICLE 9 - PAYMENT AND COMPLETION

9.3 PROGRESS PAYMENTS

9.3.1 On or before the 20th day of each month, the Contractor shall submit to the Architect on the Owner's Standard Form, a written application for payment showing the proportionate value of the work installed to date from which shall be deducted, a reserve of 10% and all previous payments,
and the balance of the amount as approved by the Architect shall be due and payable to the Contractor on or about the 15th day of the succeeding month.

9.3.2.2 No payments will be made because of materials or equipment stored off the site, except as provided for in Subparagraph 4.4.5 of the Supplementary General Conditions or other special cases the Owner may approve.

9.6 FAILURE OF PAYMENT

9.6.1 Delete Article 9.6 in its entirety.

ARTICLE 11 - INSURANCE (Revised 3-22-2012)

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than any limits of liability specified herein, or required by law, whichever is greater, and shall include contractual liability insurance as applicable to the Contractor's obligations under Paragraph 4.18.

During the life of the Contract, the Contractor shall maintain the following types of insurance:

A. General Requirements

<table>
<thead>
<tr>
<th>Type of Insurance</th>
<th>Minimum Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Comprehensive General Liability</td>
<td>Bodily Injury $500,000 each person $1,000,000 aggregate</td>
</tr>
<tr>
<td></td>
<td>Property Damage $500,000 each occurrence $1,000,000 aggregate or $2,000,000 combined single limit (CSL)</td>
</tr>
<tr>
<td>2. Fire Legal Liability</td>
<td>$100,000</td>
</tr>
<tr>
<td>3. Comprehensive Automobile</td>
<td>Bodily Injury $500,000 each person $1,000,000 each accident</td>
</tr>
<tr>
<td>Liability (including</td>
<td>Property Damage $500,000 each accident</td>
</tr>
<tr>
<td>Hired and non-owned</td>
<td>or $2,000,000 combined single limit (CSL)</td>
</tr>
<tr>
<td>vehicles)</td>
<td></td>
</tr>
<tr>
<td>4. Workers’ Compensation</td>
<td>Statutory - Michigan $100,000</td>
</tr>
<tr>
<td>(Employer’s Liability)</td>
<td></td>
</tr>
<tr>
<td>5. Property - All Risk</td>
<td>In an amount sufficient to cover the total value of the contractor's property in the care, custody or control of WSU.</td>
</tr>
</tbody>
</table>

B. Maximum Acceptable Deductibles

<table>
<thead>
<tr>
<th>Type of Insurance</th>
<th>Maximum Deductible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive General Liability</td>
<td>$5,000</td>
</tr>
<tr>
<td>Fire Legal Liability</td>
<td>$5,000</td>
</tr>
<tr>
<td>Comprehensive Automobile Liability</td>
<td>-0-</td>
</tr>
<tr>
<td>Workers’ Compensation</td>
<td>-0-</td>
</tr>
<tr>
<td>Property - All Risk</td>
<td>$500</td>
</tr>
</tbody>
</table>

11.1.3 The Board of Governors, Wayne State University, shall be named as an additional insured but only with respect to accidents arising out of the performance of said contract. The contractor shall prepare a certificate of insurance which shall name the “Office of Risk Management; 5700 Cass
Avenue” as the Wayne State University certificate holder.

11.1.3.1 The Contractor shall either 1) require each of his Subcontractors to procure and to maintain during the life of his subcontract, Subcontractors' Comprehensive General Liability, Automobile Liability and Property Damage Liability Insurance of the type and in the same amounts as specified in the Subparagraph, or 2) insure the activity of his subcontractors in his own policy.

11.2 OWNER'S LIABILITY INSURANCE

Delete Article 11.2 in its entirety.

11.3 PROPERTY INSURANCE

Delete Article 11.3 in its entirety and replace with the following:

11.3.1 The Contractor shall purchase and maintain property insurance upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the Owner, the Contractor, Subcontractors, and sub-subcontractors in the work and shall insure against the perils of Fire, Extended Coverage, Vandalism, and Malicious Mischief.

11.3.2 The Owner and Contractor waive all rights against each other for damages caused by fires or other perils to the extent covered by insurance provided under Subparagraph 11.3.1. The Contractor shall require similar waivers by Subcontractors and sub-subcontractors in accordance with Clause 5.3.1.5.

11.3.3 Insurance must be issued by an insurance company with an “A rating as denoted in the AM Best Key Rating Guide”.

ARTICLE 12 - CHANGES IN THE WORK

12.1 CHANGE ORDERS

12.1.8 Percentage markups in pricing under Subparagraphs 12.1.3.1, 12.1.3.3, and 1.2.4 shall be as limited in the Contract Documents. Unit price of Subparagraph 12.1.3.2 shall represent total unit cost to the Owner and shall include the Contractor's markup for overhead and profit.

ARTICLE 14 - TERMINATION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 If the work is stopped for a period of thirty days under any order of any court or other public authority having jurisdiction, or as a result of any act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of the contractor or a subcontractor or their agents or employees or other persons performing any of the Work under a contract with the contractor, then the contractor may, upon seven days' written notice to the Owner and the Architect, terminate the contract and recover from the Owner payment for all Work executed and for any proven loss sustained upon any materials, equipment, tools, construction equipment, and machinery, including reasonable profit and damages.

ARTICLE 15 - ADDITIONAL CONDITIONS

15.1 SUBSTITUTION OF MATERIALS AND EQUIPMENT

15.1.1 Whenever a material, article, or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors, which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance, and function. It shall not be purchased or installed by the Contractor without the Architect's written approval.
15.2 NON-DISCRIMINATION PROVISION AND WAGE AND HOUR ACT

15.2.1 During the performance of this contract, the Contractor agrees as follows:

15.2.1.1 The Contractor shall not discriminate against any employee or applicant for employment because of sex, race, creed, color, age, or national origin. The Contractor will take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their sex, race, age, creed, color, or national origin.

15.2.1.2 Such action shall include but not be limited to, the following: employment; upgrading; demotion; or transfer; recruitment or recruitment advertising; layoff or terminations; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this non-discrimination clause.

15.2.1.3 The Contractor will, in all solicitations, or advertisements for employees, placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to sex, race, creed, color, age or national origin.

15.2.1.4 The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or worker's representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of October 27, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

15.2.1.5 The Contractor will comply with all provisions of the Executive Order No. 11246 of October 27, 1965, and of the rules, regulations and relevant orders of the Secretary of Labor or other government agency or authority having jurisdiction.

15.2.1.6 The Contractor will furnish all information and reports required by Executive Order No. 11246 of October 27, 1965, and by the rules, regulations, and orders of the Secretary of Labor or other government agency or authority having jurisdiction, and will permit access to his books, records, and accounts by the administrative agency and the Secretary of Labor for the purposes of investigation to ascertain compliance with such rules, regulations and orders.

15.2.1.7 In the event of the Contractor's noncompliance with the non-discrimination clauses of this contract, or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further University contracts or federally-assisted contracts in accordance with procedure authorized in Executive Order No. 11246 of October 27, 1965, or by rule, regulation, or order of the Secretary of Labor or other government agency or authority having jurisdiction.

15.2.1.8 The Contractor will include in the provisions of Subparagraph 15.2.1.1 through 15.2.1.8 in every subcontract or purchase order unless exempted by rules, regulations or orders of the President's Committee on Equal Employment Opportunity issued pursuant to Section 204 of Executive Order No. 11246 of September 14, 1965, so that provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the Contractor becomes involved as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interest of the United States.

15.3 COMPLIANCE WITH COPELAND ANTI-KICKBACK ACT AND REGULATIONS

15.3.1 The Contractor shall comply with the Copeland Anti-Kickback Act and Regulations of the Secretary of Labor (29CFR, Part 3) which are herein incorporated by reference.

15.4 PREVAILING WAGES
15.4.1 Contractors and subcontractors shall pay all mechanics and laborers, including apprentices and trainees, no less than the wage and fringe benefit rates prevailing in the locality in which the work is performed. Wage and fringe benefit rates are determined by the Federal Government Department of Labor.

15.4.2 Classifications not provided in the schedule shall be determined prior to the award of the contract and shall be no less than the wage and fringe benefit rates determined by the Federal Department of Labor.

15.4.3 Contractors and subcontractors shall adhere to the ratios of apprentices to journey workers as determined by the Federal Department of Labor.

15.4.4 Contractors and subcontractors shall keep a copy of the prescribed wage and benefit rates posted at the construction site in a conspicuous place.

15.4.5 Contractors and subcontractors shall keep an accurate record of the name, occupation, and the actual benefits paid to each mechanic or laborer for the contract. This record shall be made available for reasonable inspection by the Federal Department of Labor and the Owner.
The Technical Specifications dated **October 27, 2014** and the following List of Drawings represent the scope of work as defined in the Contract Documents from Article 4.

### DRAWINGS

<table>
<thead>
<tr>
<th>Drawing No.:</th>
<th>Description</th>
<th>Dated</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-00</td>
<td>Title Sheet</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E1-01</td>
<td>Electrical Schedules, Symbols, &amp; Abbreviations</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-02</td>
<td>Basement Floor Emergency Power Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-03</td>
<td>First Floor Emergency Power Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-04</td>
<td>Second Floor Emergency Power Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-05</td>
<td>Third Floor Emergency Power Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-06</td>
<td>Fourth Floor Emergency Power Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E5-07</td>
<td>Emergency Power Riser Diagram</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001</td>
<td>Siemens Generator/Natural Gas Ctrl (for reference only)</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001A</td>
<td>Siemens Generator/Natural Gas Ctrl (for reference only)</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001B</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001C</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
<td>11-03-2014</td>
</tr>
</tbody>
</table>

### 629 Elliman Drawings:

<table>
<thead>
<tr>
<th>Drawing No.:</th>
<th>Description</th>
<th>Dated</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-00</td>
<td>Title Sheet</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>C-01</td>
<td>Electrical Site Grading &amp; Utilities Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>C-02</td>
<td>Site Details</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>S-01</td>
<td>General Structural Notes &amp; Special Instructions</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>S-02</td>
<td>Partial Third Floor Framing Plan and Details</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>S-03</td>
<td>Generator Pad Plan Details and General Notes</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>S-04</td>
<td>Automatic Transfer and Primary Switchgear Pads</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E1-01</td>
<td>Electrical Schedules, Symbols &amp; Abbreviations</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>ED-02</td>
<td>Roof Electrical Power Demolition Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>ED-03</td>
<td>Electrical Power Demolition Oneline Diagram</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>ES-04</td>
<td>Electrical Power Site Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-05</td>
<td>Basement Floor Power Plan Partial</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-06</td>
<td>Enlarged Electrical Site Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E2-07</td>
<td>Third Floor UPS Power Plan</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E5-08</td>
<td>Emergency Power Oneline Diagram</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E5-09</td>
<td>UPS Power Oneline Diagram</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E6-10</td>
<td>Electrical Details</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>E6-11</td>
<td>Electrical Details</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001A</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001B</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
<td>11-03-2014</td>
</tr>
<tr>
<td>001C</td>
<td>Siemens Generator/Fuel Oil Controls (for reference only)</td>
<td>11-03-2014</td>
</tr>
</tbody>
</table>
GENERAL REQUIREMENTS

GENERAL

A. CONTRACTOR'S RESPONSIBILITY

It is not the responsibility of the Architect/Engineer or Owner's Representative to notify the Contractor or subcontractors when to commence, to cease, or to resume work; nor in any way to superintend so as to relieve the Contractor of responsibility or of any consequences of neglect or carelessness by him or his subordinates. All material and labor shall be furnished at times best suited for all Contractors and subcontractors concerned, so that the combined work of all shall be properly and fully completed on the date fixed by the Contract.

The Contractor shall be responsible for all items contained in both the specifications and on the drawings for all trades. He shall be responsible for the proper division of labor according to current labor union agreements regardless of the division of responsibility implied in the contract documents.

B. CODES AND STANDARDS

Reference to standard specifications for workmanship, apparatus, equipment and materials shall conform to the requirements of latest specifications of the organization referenced, i.e., American Society for Testing Materials (ASTM), Underwriters Laboratories, Inc. (UL), American National Standards Institute, Inc. (ANSI), and others so listed in the Technical Specifications.

C. PERMITS, FEES AND NOTICES

See Supplementary General Conditions.

D. MEASUREMENTS

Before proceeding with each Work Item, Contractor shall locate, mark and measure any quantity or each item and report quantities to Engineer. If measured quantities exceed Engineer's estimate, Contractor shall obtain written authorization to proceed from Owner before executing Work required for that Work Item.

Measurement of quantities for individual Work Items will be performed by Contractor and reviewed by Engineer. Coordinate measurements with inspection as required in Section "Coordination."

Cost of Work included in Work Item for quantities as indicated in Contract Documents shall be included in Base Bid.

1. Additions to or deductions from lump sum price for quantities of each Work Item added to or deducted from Work respectively shall be at unit prices indicated in Bid Form and shall constitute payment or deductions in full for all material, equipment, labor, supervision and incidentals necessary to complete Work.

E. CONTRACTOR'S MEASUREMENTS

Before ordering material, preparing Shop Drawings, or doing any work, each Contractor shall verify, at the building, all dimensions which may affect his work. He assumes full responsibility for the accuracy of his figures. No allowance for additional compensation will be considered for minor discrepancies between dimensions on the drawings and actual field dimensions.

F. CONTINUITY OF SERVICE (Revised 3-26-2012)

Continuity of all existing services in the building shall be maintained throughout the construction period. Where it is necessary to tie into the existing electrical service, water or waste systems, it shall be done as directed by the Architect/Engineer. This Contract shall also provide temporary lines or bypasses that may be required to maintain
continuous service in the building. All utility shutdowns must be approved by the Owners Representative / Project Manager, not less than 7 business days prior to the event, so that proper notification can be posted.

G. SUBMITTALS

All submittals (except Shop Drawings) and samples required by the Specifications shall be submitted in triplicate unless otherwise specified for a particular item under an individual Specification Section.

Each sample shall be clearly identified on a tag attached, showing the name of the Project Consultant, the project number and title, the names of the Contractor, manufacturer (and supplier if same is not the manufacturer), the brand name or number identification, pattern, color, or finish designation and the location in the work.

Each submittal shall be covered by a transmittal letter, properly identified with the project title and number and a brief description of the item being submitted.

Contractor shall be responsible for all costs of packing, shipping and incidental expenses connected with delivery of the samples to the Project Consultant or other designated address.

If the initial sample is not approved, prepare and submit additional sets until approval is obtained.

Materials supplied or installed which do not conform to the appearance, quality, profile, texture or other determinant of the approval samples will be rejected, and shall be replaced with satisfactory materials at the Contractor's expense.

H. GENERAL/STANDARD ELECTRONIC EQUIPMENT AND INFRASTRUCTURE REQUIREMENTS (Revised 11-2008)

1. Compliance with WSU Standards for Communications Infrastructure
   A. All applicable work, products, materials and methods shall comply with the latest version of the “WSU Standards for Communications Infrastructure” except as where noted.
   B. This document is available at the following website/URL: http://networks.wayne.edu/WSU-Communications-Standards.pdf

2. Automation System Program Code
   A. All automation system uncompiled and compiled program codes, source codes, custom modules, graphical user interface screen shots and any other automation system programming data and material ( Program Code) shall be provided to the UNIVERSITY in hard copy and on CD Rom in an unencrypted format acceptable to the UNIVERSITY.
   B. Copyright for the Program Code shall be assigned to the UNIVERSITY for purposes of system maintenance.

PROTECTION OF OCCUPANCY (Revised 3-2006)

A. FIRE PRECAUTIONS

Take necessary actions to eliminate possible fire hazards and to prevent damage to construction work, building materials, equipment, temporary field offices, storage sheds, and other property. During the construction, provide the type and quantity of fire extinguishers and fire hose to meet safety and fire prevention practices by National Fire Protection Association (NFPA) Codes and Standards (available at http://www.nfpa.org/)

In the event that construction includes “hot work”, the contractor shall provide the Owner's Representative with a copy of their hot work policy, procedures, or permit program. No hot work activity (temporary maintenance, renovation, or construction by operation of a gas or electrically powered equipment which produces
flames, sparks or heat that is sufficient to start a fire or ignite combustible materials) shall be performed until such documents are provided. During such operations, all highly combustible or flammable materials shall be removed from the immediate working area, and if removal is impossible, same shall be protected with flame retardant shield.

Not more than one-half day's supply of flammable liquids such as gasoline, spray paint and paint solvent shall be brought into the building at any one time. Flammable liquids having a flash point of 100 degrees F. or below which must be brought into the building shall be confined in an Underwriters Laboratories (UL) labeled safety cans. The bulk supply of flammables shall be stored at least 75 feet from the building and other combustible materials. Spigots on drums containing flammable liquids are prohibited on the project site. Drums shall be equipped with approved vented pumps, and be grounded and bonded.

Only a reasonable working supply of combustible building materials shall be located inside the building.

All oil-soaked rags, papers, and other similar combustible materials shall be removed from the building at the close of each day's work, or more often if necessary, and placed in metal containers, with self-closing lids.

Materials and equipment stored in cardboard cartons, wood crates or other combustible containers shall be stored in an orderly manner and accessibly located, fire-fighting equipment of approved types shall be placed in the immediate vicinity of any materials or equipment stored in this type of crate or carton.

No gasoline, benzene, or like flammable materials shall be poured into sewers, manholes, or traps.

All rubbish shall be removed from the site and legally disposed of. Burning of rubbish, waste materials or trash on the site shall not be permitted.

The contractor shall be responsible for the conduct of employees relative to smoking and all smoking shall be in the area designated by the Architect/Engineer.

B. GENERAL SAFETY AND BUILDING PRECAUTIONS

Provide and maintain in good repair barricades, railings, etc., as required by law for the protection of the Public. All exposed material shall be smoothly dressed.

At dangerous points throughout the work environment provide and maintain colored lights or flags in addition to above guardrails.

Isolate Owner's occupied areas from areas where demolition and alteration work will be done, with temporary, dustproof, weatherproof, and fireproof enclosures as conditions may require and as directed by the Architect/Engineer.

Cover and protect furniture, equipment and fixtures to remain from soiling, dust, dirt, or damage when demolition work is performed in rooms or areas from which such items have not been removed.

Protect openings made in the existing roofs, floors, and other construction with weatherproof coverings, barricades, and temporary fire rated partitions to prevent accidents.

Repair any damage done to existing work caused by the construction and removal of temporary partitions, coverings, and barricades.

The Contractor will be held responsible for all breakage or other damage to glass up to the time the work is completed.

Provide protection for existing buildings, interior and exterior, finishes, walls, drives, landscaping, lawns (see below), etc. All damages shall be restored to match existing conditions to the satisfaction of the Architect/Engineer.

The Contractor and Owner will define the anticipated area of lawn damage at the project Pre-Construction Meeting. Whether the lawn is sparse or fully developed, any lawn damaged due to the Contractor's work will be replaced with sod by the University. The University's unit cost of $10.00 per square yard and landscaping at a rate of 1.5
times the cost of the sod repairs, the full cost of which will be assessed against the Contractor. At the completion of the project, a deductive Change Order reflecting this cost will be issued. The Contractor is to include an allowance in his bid for this corrective work.

C. INTERFERENCE WITH OWNER’S OPERATIONS

The Owner will be utilizing the Building Facilities to carry on his normal business operation during construction. The Contractor shall schedule performance of the work necessary to complete the project in such a way as to interfere as little as possible with the operation during construction. The Contractor shall schedule performance of the work necessary to complete the project in such a way as to interfere as little as possible with the operation of the Owner.

Work which will interfere with the Owner's occupancy, including interruptions to the Owner's mechanical and electrical services, and essentially noisy operations (such as jackhammering) shall be scheduled in advance. The schedule of alterations shall be approved by the Architect/Engineer and the work shall be done in accordance with the approved schedule.

It is understood that the work is to be carried through to completion with the utmost speed consistent with good workmanship and to meet the construction schedule.

The Contractor shall begin work under the Contract without delay upon receipt of the fully-executed contract and shall substantially complete the project ready for unobstructed occupancy and use of the Owner for the purposes intended within the completion time stated in the contract.

The Contractor shall, immediately upon award of contract, schedule his work and expedite deliveries of materials and performance of subcontractors to maintain the necessary pace to meet the construction schedule.

CONTRACTOR’S REPRESENTATION AND COORDINATION

A. FIELD SUPERINTENDENT

Contractor shall assign a full time project manager/superintendent for the duration of the project. This person shall be experienced and qualified in all phases of the work and shall be present at the site during Contractor’s working hours. The project manager shall have Contractor’s full authority to represent Contractor in all routine operations including payment, changes to the work, and scheduling. Contractor shall not re-assign this individual without prior written permission of the Owner.

B. MEETINGS

When directed by the Architect/Engineer, meetings shall be held for the purpose of coordinating and expediting the work. The invited contractors or subcontractors will be required to have qualified representatives at these meetings, empowered to act in their behalf.

C. COORDINATION

The Contractor shall also provide a staff adequate to coordinate and expedite the work properly and shall at all times maintain competent supervision of its own work and that of its subcontractors to insure compliance with contract requirements.

The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the Contractor.

D. CONSTRUCTION SCHEDULE

The Construction Schedule shall be prepared after the award of contract. Soon after, a pre-construction meeting is held with the Owner and the Architect/Engineer to determine the areas to which the Contractor will be allowed access at any one time.
The Contractor is alerted to the fact that areas in which he will be working will be occupied by students and employees of the University as well as the general public. The Contractor's access, to and from the project site, will be confined to limited areas so as not to unduly disrupt the normal activities of the University.

TEMPORARY FACILITIES

A. GENERAL

The following temporary facilities descriptions represent standard conditions. Verify accuracy with Architect/Engineer at time of bids.

B. CONTRACTOR'S OFFICE

Provide field offices as required. Locate temporary field offices on site where directed by Architect/Engineer.

Appearance and location of field offices shall be approved by the Architect/Engineer.

Provide for all other administrative facilities and storage off the Owner's property.

C. STORAGE OF MATERIALS

All materials shall be stored in areas designated by the Architect/Engineer. All stored materials shall be arranged for the minimum disruption to occupants and to allow full access to and throughout the building. Materials stored outdoors shall be neat and orderly and covered to prevent damage or vandalism.

D. PARKING

1. GENERAL

University parking regulations will be strictly enforced.

Maintain Owner's parking areas free of dirt and debris resulting from operations under the contract.

2. STANDING AND UNLOADING/LOADING VEHICLES

All Contractors are to call Wayne State University Public Safety at 577-2222, and give at least 24 hours advance notice that they have vehicles that must be at the job site.

Vehicles will be permitted at the project site only as long as the vehicles are needed for loading/unloading, and must be immediately moved upon completion.

All unauthorized and/or unattended standing vehicles will be subject to ticketing and removal by University Police. Towed vehicles may be reclaimed by calling 577-2222, and paying any assessed charges.

3. COMPLIMENTARY PARKING

There is no complimentary parking for Contractor's employee vehicles.

4. WAYNE STATE UNIVERSITY PUBLIC/STUDENT PARKING AREAS

Public Parking, on a first-come first-served basis is available. Contact the office of the One Card System, at 313.577.9513 for information on availability of parking on a contractual basis.

E. TOILET FACILITIES

The Owner's designated existing toilet facilities may be used by workers on the project. Contractor shall maintain such facilities in a neat and sanitary condition.
F. **TELEPHONE USE**

If required, the Contractor shall provide and pay for a temporary telephone within the building for his use and that of his subcontractors.

No use of the Owner's telephone (except pay telephones) will be permitted.

G. **ACCESS DEVICES**

The Contractor shall furnish and maintain temporary hoists, ladders, railings, scaffolds, runways, and the like as required for safe, normal access to the permanent construction until the permanent facilities are complete. Each trade shall furnish such additional means of access as may be required for the progress and completion of the work. Such temporary access devices shall meet all applicable local, state, and federal codes and regulations.

H. **HEAT AND VENTILATION**

Provide cold weather protection and temporary heat and ventilation as required during construction to protect the work from freezing and frost damage.

Provide adequate ventilation as required to maintain reasonable interior building air conditions and temperatures, to prevent accumulation of excess moisture, and to remove construction fumes.

Tarpaulins and other materials used for temporary enclosures. Coverings and protection shall be flameproofed.

I. **WATER SERVICE**

Sources of water are available at the site. The Owner will pay for reasonable amounts of water used for construction purposes.

The Contractor shall provide, at the earliest possible date, temporary connections to the water supply sources and maintain adequate distribution for all construction requirements. The Contractor shall protect sources against damage.

Methods of conveying this water shall be approved by the Architect/Engineer and shall not interfere with the Owner's operations.

J. **ELECTRICAL SERVICES**

All charges for reasonable amounts of electrical power energy used for temporary lighting and power required for this work will be paid by the Owner.

The Contractor shall provide and maintain any temporary electrical lighting and power required for this work. At the completion of the work, all such temporary electrical facilities shall be removed and disposed of by the Contractor.

Temporary lighting and power shall comply with the regulations and requirements of the National Electrical Code.

**INSPECTIONS AND TESTS**

The Architect/Engineer shall at all times have access to the work wherever it is in preparation or in progress and the Contractor shall provide proper facilities for such access and for observation.

No failure of the Architect/Engineer, during the progress of the work, to discover or reject materials or work not in accordance with the Contract Specifications and Drawings shall be deemed an acceptance thereof nor a waiver of defects therein. Likewise, no acceptance or waiver shall be inferred or implied due to payments made to contractor or by partial or entire occupancy of the work, or installation of materials that are not strictly in accordance with the Contract Specifications and Drawings.

Where tests are specifically called for in the Specifications, the Owner shall pay all costs of such tests and engineering services unless otherwise stated in the contract.
Where tests are not specifically called for in the Specifications, but are required by the Architect/Engineer or Consultant, the Owner shall pay all costs of such tests and engineering services unless the tests reveal that the workmanship or materials used by the Contractor are not in conformity with the Drawings, Specifications, and/or approved shop drawings. In such event, the Contractor shall pay for the tests, shall remove all work and materials so failing to conform and replace with work and materials that are in full conformity.

CLEAN-UP

The Contractor shall at all times keep the Owner's premises and the adjoining premises, driveways and streets clean of rubbish caused by the Contractor's operations and at the completion of the work shall remove all the rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the contractor does not attend to such cleaning immediately upon request, the Architect/Engineer may cause such cleaning to be done by others and charge the cost of same to the Contractor.

The Contractor will be responsible for all damage from fire that originates in, or is propagated by, accumulations of rubbish or debris.

All rubbish and debris shall be disposed of off the Owner's property in an approved sanitary landfill site. No open burning of debris or rubbish will be permitted. Job site shall be left neat and clean at the completion of each day's operation.

PROJECT CLOSE-OUT

A. RECORD DRAWINGS

At beginning of job, provide one copy of Working Drawings, and record changes, between Working Drawings and "As Built", including changes made by Addenda, Change Orders, Shop Drawings, etc. These shall be kept up to date. Update to indicate make of all mechanical and electrical equipment and fixtures installed. Keep these Record Prints in good condition and available for inspection by the Architect/Engineer.

Upon completion of the job, turn over to the Architect/Engineer Record Prints of Working Drawings showing all job changes.

B. OPERATING AND MAINTENANCE DATA

Prepare and furnish to the Architect/Engineer three (3) bound copies of "Operating and Maintenance Manual" on all equipment installed under this Contract.

Manual shall include copies of all Manufacturers’ "Operating and Service Instructions", including Parts List, Control Diagrams, Description of Control Systems, Operating, Electrical Wiring, and any other information needed to understand, operate and maintain the equipment. The names and addresses of all subcontractors shall be included. These instructions shall be custom-prepared for this job -- catalog cuts will not be accepted. Equipment shall be cross-referenced to Section of Specifications and to location shown and scheduled on drawings.


C. FINAL INSPECTION

Secure final inspections from the State of Michigan as soon as the work is completed and immediately submit such Certificates to the Architect/Engineer.

D. GUARANTEES (See Sections 00510 and 01781)

 Guarantees on material and labor from the General Contractor and his subcontractors shall be as required in Sections 00510 and 01781.

E. SWORN STATEMENT AND WAIVER OF LIENS (revised 4-11-2012)
Prior to final payment, the General Contractor shall provide a Contractor's Sworn Statement and Full Unconditional Waivers of Liens from all subcontractors for material and labor and from all suppliers who provide materials exceeding $1,000. Sworn Statements and signed waivers from all Subcontractors must accompany Pay Applications or they will be returned for such documentation prior to approval.

**ASBESTOS HAZARD**

A. The contractor shall not start any work in any area that has not been inspected for asbestos by the Owner's Industrial Hygiene Department, or a qualified representative of the Owner and approval is given for work to be done. If asbestos is found, safety measures as recommended by the Owner's Industrial Hygiene Department, or a qualified representative of the Owner, shall be completed, or approval given for work to be done before work is started. The contractor shall not perform any asbestos removal or containment work under the contract.

**KEYS**

A. The Owner shall provide the contractor keys on loan to have access to the various spaces in order to complete the contract. Contractor will sign for and be responsible for each key on loan, returnable to Owner upon completion of the contract. In case of any lost keys, the Owner will backcharge the contract $250.00 for each core change. In the event that a Contractor wants access to a secured area, he shall give the Owner a minimum 48-hour notice.
SUMMARY OF WORK

PROJECT: Electrical Reliability Upgrades – Bid Package #2

WSU PROJECT NO.: 050-245285 (Shapero Hall)
629-245283 (Elliman Building)

PROJECT MANAGER: Bill McVea

1. EXAMINATION

The Contractor shall visit the site and become familiar with conditions under which he will be working. Also meet with the project manager and review site access, storage areas, etc.

2. DESCRIPTION OF WORK

Project includes the installation of a complete working system of generators, UPS System and fuel systems for the Elliman Building and Shapero Hall. Provide all electrical wiring and equipment, including transfer switches to integrate into the existing building services. Include all site work, fuel storage, pumps and piping, and all controls, including all power wiring for a complete functioning UPS and generator installation. (Note: No UPS at Shapero Hall.) Include field and internal control wiring required for Siemens BMS Generator monitoring work. (Note: Siemens to provide parts and pieces, programming, and interface to WSU BMS monitoring station.) Limited interior demolition and architectural work to support the additional equipment.

Allowances:

For Electrical Reliability Upgrades – Bid Package #2 project base bid shall include allowances to cover costs associated with premium time associated with overtime work per Specification Section 012100. The allowance expenditure must be accounted for and approved in advance by WSU during the construction phase of the project, unused allowances will be returned to the University.

Shutdowns:

All shut down work is to be coordinated so that it is scheduled for Sundays or holidays. The premium portion of the wage associated with shut down work is to be covered in the allowance that is to be included in the bid. It will be the contractors responsibility to determine how to sequence and the means and methods necessary for shut downs to complete the work, including providing any necessary equipment, (renting and running generators, etc.) to minimize impact on the building occupants, which must be approved by WSU. All costs to cover this effort must be included within the bid amount for respective buildings. Any temporary enclosures shall be installed as security measures around cable wireway between temporary generator and secure area at building. Contractors must provide at a minimum a seven (7) day advanced shut down notice for disruption of any utilities.

3. The building is located at

Wayne State University
- Shapero Hall 5501 Gullen Mall, Detroit, MI 48202
- Elliman Bldg. 421 E. Canfield, Detroit, MI 48201

In Detroit, Michigan 48202
2013 EPA Tier 2 Exhaust Emission Compliance Statement
1500DQGAF
Stationary Emergency
60 Hz Diesel Generator Set

Compliance Information:
The engine used in this generator set complies with Tier 2 emissions limit of U.S. EPA New Source Performance Standards for stationary emergency engines under the provisions of 40 CFR 60 Subpart III when tested per ISO8178 D2.

Engine Manufacturer: Cummins Inc
EPA Certificate Number: DCXLO50.AAD-025
Effective Date: 05/01/2012
Date Issued: 05/01/2012
EPA Engine Family (Cummins Emissions Family): DCXLO50.AAD (D283)

Engine Information:
Model: QSK50-G5 NR2
Engine Nameplate HP: 2220
Type: 4 Cycle, 60°V, 16 Cylinder Diesel
Aspiration: Turbocharged and CAC
Emission Control Device: Electronic Control
Bore: 6.25 in. (159 mm)
Stroke: 6.25 in. (159 mm)
Displacement: 3067cu. in. (50.2 liters)
Compression Ratio: 15:1

Diesel Fuel Emission Limits
D2 Cycle Exhaust Emissions

<table>
<thead>
<tr>
<th>Test Results - Diesel Fuel (300-4000 ppm Sulfur)</th>
<th>NOx + NMHC</th>
<th>CO</th>
<th>PM</th>
<th>NOx + NMHC</th>
<th>CO</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grams per BHP-hr</td>
<td>4.6</td>
<td>0.9</td>
<td>0.06</td>
<td>8.1</td>
<td>1.2</td>
<td>0.08</td>
</tr>
<tr>
<td>Grams per kWm-hr</td>
<td>4.8</td>
<td>2.6</td>
<td>0.15</td>
<td>6.4</td>
<td>3.5</td>
<td>0.20</td>
</tr>
</tbody>
</table>

The CARB emission values are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.

Test Methods: EPA/CARB Nonroad emissions recorded per 40CFR60 (ref. ISO8178-1) and weighted at load points prescribed in Subpart E, Appendix A for Constant Speed Engines (ref. ISO8178-4, D2)

Reference Conditions: Air Inlet Temperature: 26°C (77°F), Fuel Inlet Temperature: 40°C (104°F), Barometric Pressure: 100 kPa (29.53 in Hg), Humidity: 10.7 g/l (75 grams H2O/lb) of dry air, required for NOx correction. Restrictions: Intake Restriction set to a maximum allowable limit for clean filter. Exhaust Back Pressure set to maximum allowable limit.
Tests conducted using alternate test methods, instrumentation, fuel or reference conditions can yield different results.
Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Cummins Power Generation Data and Specifications Subject to Change Without Notice EPA-1157b
Pursuant to Section 111 and Section 213 of the Clean Air Act (42 U.S.C. sections 7411 and 7547) and 40 CFR Part 60, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following engines, by engine family, more fully described in the documentation required by 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new compression-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void ab initio for other reasons specified in 40 CFR Part 60.

This certificate does not cover engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

The actual engine power may lie outside the limits of the Emissions Power Category shown above. See the certificate application for details.
ELECTRICAL RELIABILITY UPGRADE

050 – Shapero Hall
5501 Gullen Mall, Detroit, Michigan 48201
WSU Project No. 050-245285

629 – Elliman Clinical Research Center
421 East Canfield Avenue, Detroit, Michigan 48201
WSU Project No. 629-245283

Issued for Bid
October 27, 2014

Shapero Hall
MEP Project No. 1415-3

Elliman Clinical Research Center
MEP Project No. 1415-4
<table>
<thead>
<tr>
<th>Division</th>
<th>Section Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIVISION 01 - GENERAL REQUIREMENTS</strong></td>
<td></td>
</tr>
<tr>
<td>01 1000</td>
<td>SPECIAL CONDITIONS</td>
</tr>
<tr>
<td>01 1010</td>
<td>SUMMARY OF WORK</td>
</tr>
<tr>
<td>01 1019</td>
<td>CONTRACT CONSIDERATIONS</td>
</tr>
<tr>
<td>01 1039</td>
<td>COORDINATION AND MEETINGS</td>
</tr>
<tr>
<td>01 1300</td>
<td>SUBMITTALS</td>
</tr>
<tr>
<td>01 1630</td>
<td>PRODUCT SUBSTITUTIONS</td>
</tr>
<tr>
<td>01 1650</td>
<td>STARTING OF SYSTEMS</td>
</tr>
<tr>
<td>01 1700</td>
<td>CONTRACT CLOSEOUT</td>
</tr>
<tr>
<td>01 2100</td>
<td>ALLOWANCES</td>
</tr>
<tr>
<td><strong>DIVISION 03 - CONCRETE</strong></td>
<td></td>
</tr>
<tr>
<td>03 3000</td>
<td>CAST-IN-PLACE CONCRETE</td>
</tr>
<tr>
<td><strong>DIVISION 07 - THERMAL AND MOISTURE PROTECTION</strong></td>
<td></td>
</tr>
<tr>
<td>07 8413</td>
<td>PENETRATION FIRESTopping</td>
</tr>
<tr>
<td><strong>DIVISION 26 - ELECTRICAL</strong></td>
<td></td>
</tr>
<tr>
<td>26 0010</td>
<td>ELECTRICAL GENERAL REQUIREMENTS</td>
</tr>
<tr>
<td>26 0100</td>
<td>ELECTRICAL TESTING</td>
</tr>
<tr>
<td>26 0513</td>
<td>MEDIUM-VOLTAGE CABLES</td>
</tr>
<tr>
<td>26 0519</td>
<td>LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES</td>
</tr>
<tr>
<td>26 0526</td>
<td>GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>26 0529</td>
<td>HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>26 0533</td>
<td>RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>26 0543</td>
<td>UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>26 0553</td>
<td>ELECTRICAL IDENTIFICATION</td>
</tr>
<tr>
<td>26 0573</td>
<td>OVERCURRENT DEVICE COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS</td>
</tr>
<tr>
<td>26 1316</td>
<td>MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHGEAR</td>
</tr>
<tr>
<td>26 2200</td>
<td>LOW-VOLTAGE TRANSFORMERS</td>
</tr>
<tr>
<td>26 2416</td>
<td>PANELBOARDS</td>
</tr>
<tr>
<td>26 2726</td>
<td>WIRING DEVICES</td>
</tr>
<tr>
<td>26 2813</td>
<td>FUSES</td>
</tr>
<tr>
<td>26 3213EL</td>
<td>DIESEL PACKAGED ENGINE GENERATORS - ELLIMAN</td>
</tr>
<tr>
<td>26 3213SH</td>
<td>NATURAL GAS PACKAGED ENGINE GENERATORS – SHAPERO HALL</td>
</tr>
<tr>
<td>26 3353</td>
<td>STATIC UNINTERRUPTIBLE POWER SUPPLY</td>
</tr>
<tr>
<td>26 3600EL</td>
<td>TRANSFER SWITCHES - ELLIMAN</td>
</tr>
<tr>
<td>26 3600SH</td>
<td>TRANSFER SWITCHES - SHAPERO HALL</td>
</tr>
<tr>
<td>26 5600</td>
<td>EXTERIOR LIGHTING</td>
</tr>
<tr>
<td><strong>DIVISION 31 - EARTHWORK</strong></td>
<td></td>
</tr>
<tr>
<td>31 1000</td>
<td>SITE CLEARING</td>
</tr>
<tr>
<td>31 2000</td>
<td>EARTH MOVING</td>
</tr>
<tr>
<td><strong>DIVISION 32 - EXTERIOR IMPROVEMENTS</strong></td>
<td></td>
</tr>
<tr>
<td>32 1313</td>
<td>CONCRETE PAVING</td>
</tr>
<tr>
<td>32 1373</td>
<td>CONCRETE PAVING JOINT SEALANTS</td>
</tr>
<tr>
<td>32 3119</td>
<td>ORNAMENTAL METAL FENCES</td>
</tr>
<tr>
<td><strong>DIVISION 33 - UTILITIES</strong></td>
<td></td>
</tr>
<tr>
<td>33 4000</td>
<td>STORM SEWER</td>
</tr>
<tr>
<td>33 5213</td>
<td>FUEL DISTRIBUTION AND STORAGE</td>
</tr>
</tbody>
</table>
SECTION 01 1000 - SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and Division-1 Specification sections, apply to work of this section.

B. These specifications are of abbreviated short form, or streamlined type, and include incomplete sentences. Omissions of words or phrases such as "the contractor shall," "in conformity therewith," "shall," "shall furnish (and/or install)," "as noted on the drawings," "according to the plans," "a," "an," "the," "is," "are," and "all" are intentional. Omitted words and phrases shall be supplied by inference in the same manner as they are when a note occurs on the drawings.

C. The words "shall," or "shall be" shall be supplied by inference where a colon (:) is used within a sentence. In general, phrases and clauses which follow a semi-colon (;) within a sentence shall refer to the subject of the preceding colon within the sentence.

D. Titles to divisions, sections of these specifications are introduced merely for convenience and are not necessarily correct segregation of labor or materials. Such separations shall not operate to make Engineer an arbiter to establish limits between contractor and subcontractors.

E. Contractor: clarify, allocate furnishing of materials, performance of work to various trades in accordance with local customs, jurisdictional awards, regulations, decisions insofar as they are applicable.

1.2 MANUFACTURERS SPECIFICATIONS

A. Latest edition of manufacturers recommendations, instructions, specifications for products, materials employed in work apply, unless specified otherwise herein.

1.3 STANDARDS, REFERENCES

A. Latest editions of specifications, instructions, recommendations of following organizations govern where applicable to work specified herein:

1. ACI - American Concrete Institute
2. AGA - American Gas Association
3. AISC - American Institute of Steel Construction
4. AISI - American Iron and Steel Institute
5. ASA - American Standards Association
6. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
7. ASTM - American Society for Testing Materials
8. AWS - American Welding Society
9. CRSI - Concrete Reinforcing Steel Institute
10. CSI - Construction Specifications Institute
11. NCMA - National Concrete Masonry Association
12. NEC - National Electrical Code
13. NFPA - National Fire Protection Association
14. UL - Underwriters Laboratory
15. WRI - Wire Reinforcement Institute

1.4 COOPERATION AND CO-RESPONSIBILITY

A. Each Subcontractor: cooperate with General Contractor and/or subcontractor for other trades in performance of their work and with men employed by Owner for purposes of installing equipment, furnishings, and like.

B. When material furnished by one Subcontractor, to be set by another, arrange mutually for time and place of its delivery. Subcontractor for setting: responsible for condition of material, after its acceptance, and replace without charge any such items lost, stolen, or damaged before completion of his work even though installed.

C. Each Subcontractor: make reasonable provision for protection of work; if damage occurs, restoration done only by installing subcontractor with costs borne by party causing damage.

1.5 CONTRACT LIMITS, OPERATIONAL REQUIREMENTS

A. Work at project: confined to areas within contract limits as indicated, unless otherwise defined.

B. Construction operations, delivery, storage of materials, movements of equipment: governed by applicable local building codes, by-laws, traffic regulations, safety, fire regulations of the municipality and Owner's requirements.

1.6 EXISTING PIPING, DRAINS, UTILITY LINES, ETC.

A. Piping, drains, utility lines, etc., shown on drawings or not encountered in excavating or other construction work, unless ordered removed: supported, braced, protected from damage. Notify Engineer if utility lines are encountered. Do not disturb any such work unless so directed. Any existing piping, drain, utility lines, etc., damaged during excavating or by other work under this contract: repaired and any damage related to same made good.

1.7 JOB SAFETY

A. Maintain proper standards of safety in accordance with federal, state, local rules, regulations for the construction industry.
1.8 PROTECTION OF WORK, PROPERTY

A. Contractor: Provide against damage from elements, undermining or displacement due to conditions of the site, methods of construction.

B. Work: carried on in manner which will cause as little inconvenience as possible to Owner in his use of property, existing facilities, and structures. Contractor: provide, maintain adequate protective coverings, barricades about work which might be injured during construction; keep same in repair throughout entire work; responsible for injury, damage resulting from his operations.

C. Protect existing sidewalks, pavements, curbs, lawns, adjacent property during construction. Restore to conditions existing prior to construction, any damaged parts, and areas.

D. No explosives will be permitted on the Owner's premises.

E. No smoking will be allowed on the Owner's premises.


1.9 BARRICADES

A. Contractor: provide, maintain barricades, enclosures, protection as necessary for safety of public and workmen; erect, maintain appropriate, required warning signs, lamps, flares, etc. All protective devices, etc.: constructed of non-combustible materials.

1.10 SITE MAINTENANCE AND CLEAN-UP

A. Provide all labor and equipment necessary to remove debris and scrap materials from the building on a daily basis.

B. Take all measures during construction to enforce the requirements outlined in the various sections of the specifications for protection of adjacent surfaces during application of finishes, etc.

C. Contractor: clean-up the site at the end of the day.

D. Leave premises in condition to allow Owner to use all entrances, walks and drives.

1.11 PARKING

A. Refer to the Wayne State University special conditions for parking requirements.

1.12 VANDALISM
A. Contractor: pay for, satisfactorily repair all damage done to site, equipment, and/or stored material of work under his contract due to acts of vandalism during construction and until final acceptance by Owner. See General Conditions for reimbursement.

B. Contractor may elect to hire a watchman and/or secure additional insurance coverage at his own expense. This option is not a demand to contract.

1.13 RETAINED PERCENTAGE

A. There shall be retained ten (10) percent of the estimated amounts until the final completion and acceptance of all work covered by the Contract.

B. The balance of the retained percentage shall be paid thirty (30) days after Owner's acceptance of project, provided that all requirements of the Contract are met.

1.14 GUARANTEE

A. Contractors: furnish, unless otherwise indicated in trade sections, written one year guarantee on form included under the Contract Conditions in accordance with the terms of the General Conditions and Supplementary General Conditions.

1.15 JOB RECORDS, AS-BUILT DRAWINGS

A. Contractor: keep available in field office accurate, up to date record of actual construction, whether or not covered by official revisions, drawings, specifications.

B. On completion of project, Contractor: furnish marked-up set of sepias of contract drawings showing changes, variations from contract documents, accurately dimensioned with sizes, depths, elevations properly noted.

1.16 CRITICAL PHASING AND CRITICAL STAGES OF CONSTRUCTION

A. Due to the necessity for certain areas and services to remain in operation up to a certain date or through the life of the project, critical phasing and critical stages of construction have been established herein for the project. It is extremely important that the "Critical Phasing and Critical Stages of Construction" requirements be understood and complied with. The Contractor shall coordinate detailed critical phasing and construction sequencing and scheduling with the Owner. The Contractor shall expedite the submittal of shop drawings, ordering and delivering of materials and equipment, etc., to meet these critical phasing and staging requirements and the established completion date for the project.

B. The requirements set forth by the "Time of Completion" section of the Proposal Form shall be strictly adhered to.
C. Include proposed sequencing and phasing of work and shutdowns in the “Schedule of Operations” which is required.

D. Submit a separate detailed schedule to the Owner and the Engineer prior to initiating critical phasing work. Include information such as: dates, times, shutdowns, interruptions, duration of same, connections, etc.

E. All costs for the critical phasing work shall be included in the Bid Proposal, including cost for any necessary overtime work.

F. Submit shop drawings immediately on equipment items required for the critical stages of construction.

G. Coordinate new work and modifications to existing work to hold the number of shutdowns to a minimum. Schedule all shutdowns in advance with the Owner's Representative.

H. Schedule and plan delivery, storage and erection of materials to avoid disruption of Owner's operations. Coordinate unavoidable disruptions with the Owner's Representative.

I. Perform work so as to maintain access to emergency exits at all times.

END OF SECTION 01 1000
SECTION 011010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division-1 Specification Sections, apply to work of this Section.

1.2 PROJECT DESCRIPTION

A. The Work includes, but is not limited to: refer to drawings.

1.3 CONTRACTOR USE OF PREMISES

A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public. Take care not to contaminate indoor air systems with smoke, fumes, or exhaust from construction activities.

B. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

C. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

D. Maintain the existing building in a weather-tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.4 OWNER OCCUPANCY

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations.

B. The Time of Completion requirements set forth in the Form of Proposal shall be complied with by the Contractor with regards to shutdown of the Owner's operation.

END OF SECTION 011010
SECTION 01 1019 - CONTRACT CONSIDERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division-1 Specification Sections, apply to work of this Section.

1.2 SECTION INCLUDES

A. Schedule of Values.
B. Application for Payment.
C. Change Procedures.

1.3 RELATED SECTIONS

A. Section 011300 - Submittals: Schedule of Values.
B. Section 011630 - Material and Equipment: Product substitutions.

1.4 SCHEDULE OF VALUES

A. Submit typed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.
B. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds and insurance, breakdown by major category of work, or as directed by Engineer.
D. Revise schedule to list approved Change Orders, with each Application For Payment.

1.5 APPLICATIONS FOR PAYMENT

A. Submit three copies of each application on AIA Form G702 - Application and Certificate for Payment.
B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
C. Payment Period: Refer to Agreement.

D. Waivers of LIEN shall accompany each application for payment.

1.6 CHANGE PROCEDURES

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, 1987 Edition, Article 7.4 by issuing supplemental instructions.

B. The Engineer may issue a Notice of Change, which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. Contractor will prepare and submit an estimate within ten (10) days.

C. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

END OF SECTION 01 1019
SECTION 01 1039 - COORDINATION AND MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division-1 Specification Sections, apply to work of this Section.

1.2 SECTION INCLUDES
   A. Coordination.
   B. Alteration project procedures.
   C. Cutting and patching.
   D. Preconstruction conference.
   E. Progress meetings.

1.3 COORDINATION
   A. Coordinate scheduling submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.
   B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
   C. Coordinate space requirements and installation of mechanical and electrical work, which are indicated diagrammatically on Drawings. Follow routing shown for conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
   D. In finished areas, conceal conduit and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
   E. Coordinate completion and cleanup of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owners occupancy.
   F. Coordinate work to minimize disruption of Owner's activities.

1.4 ALTERATION PROJECT PROCEDURES
A. Materials: As specified in product Sections; match existing products and work for patching and extending work, unless specified or indicated otherwise.

B. Remove, cut, and patch work in a manner to minimize damage and to provide a means of restoring products and finishes to original condition.

C. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

D. Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work to match existing adjacent work in texture and appearance.

E. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a natural line of division and make recommendation to Engineer. F. Finish surfaces as specified in individual product Sections.

1.5 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affects:

   1. Structural integrity of element.
   2. Integrity of weather exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.

C. Execute cutting, fitting, and patching, including excavation and fill, to complete Work, and to:

   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods, which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

E. Cut rigid materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Documents.

G. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

I. Identify any hazardous substance or condition exposed during the Work to the Engineer for decision or remedy.

1.6 PRECONSTRUCTION CONFERENCE

A. Owner will schedule a conference after Notice of Award.

B. Attendance Required: Owner, Engineer and Contractor.

C. Agenda:

1. Submission of executed bonds and insurance certificates.
3. Submission of list of Subcontractors, list of products, Schedule of Values, and progress schedule.
4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
5. Use of premises by Owner and Contractor.
6. Owner's requirements and occupancy.
7. Construction facilities and controls provided by Owner.
8. Temporary utilities provided by Owner.
10. Schedules.
11. Downtime of systems.
12. Requirements for start-up of equipment.
13. Record documents.
15. Owner training.

1.7 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at monthly intervals and prior to critical phases.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to Engineer, Owner, participants, and those affected by decisions made.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Engineer, as appropriate to agenda topics for each meeting.

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

END OF SECTION 01 1039
SECTION 01 1300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division-1 Specification Sections, apply to work of this Section.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer accepted form.

B. Identify Project, Contractor or supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.

C. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

D. Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.

E. Identify variations from Contract Documents and Product or system limitations, which may be detrimental to successful performance of the completed Work.

F. Provide space for Contractor and Engineer review stamps. Allow ten (10) working days for review by the Engineer.

G. Revise and resubmit submittals as required, identify all changes made since previous submittal.

H. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial progress schedule in duplicate within ten (10) days after date Notice to Proceed for Engineer review.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
D. Submit a computer generated or horizontal bar chart with separate line for each major section of work or operation, identifying first work day of each week.

E. Indicate estimated percentage of completion for each item of Work at each submission.

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.4 PROPOSED PRODUCTS LIST

A. Within ten (10) days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 SHOP DRAWINGS

A. Submit in the form of one (1) reproducible transparency and three (3) copies. After review, the Engineer will retain all three (3) copies of the shop drawings, and will return the reviewed and noted transparency to the Contractor. Any required re-submittal shall follow the same procedure.

1.6 PRODUCT DATA

A. Submit six (6) copies.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers standard data to provide information unique to this Project.

1.7 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data. B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.8 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturers' certificate to Engineer for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceed specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

END OF SECTION 01 1300
SECTION 01 1630 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and Division - 1 Specification Sections, apply to work of this Section.

1.2 SECTION INCLUDES
   A. Furnish and install Products specified, under options and conditions for substitutions stated in this section.

1.3 RELATED SECTIONS
   A. Section 01300 - Submittals.

1.4 BIDDER’S OPTIONS
   A. For products that are specified only by reference standard, select Product that is standard by any manufacturer.
   B. For Products specified by naming several Products or manufacturers, select any one of products and manufacturers named which complies with Specifications.
   C. For Products specified by naming several Products or manufacturers submit a request as for substitutions, for any Product or manufacturer that is not specifically named for review and approval by the Engineer.
   D. For Products specified by naming only one Product and manufacturer, there is no option and no substitution will be allowed.

1.5 SUBSTITUTIONS
   A. Base Bid shall be in accordance with the Contract Documents.
      1. Engineer will consider requests from the Bidder for substitution of products in place of those specified as set forth in this section. Upon receiving a substitution request substantiating product ten (10) days prior to Bid Date.
      2. Those submitted the specified calendar days prior to Bid Date will be included in an addendum if acceptable.
3. After the end of the bidding period, requests will be considered only in case of Product unavailability or other conditions beyond the control of Contractor.

4. Bids shall not be based on assumed acceptance of any item that has not been approved by addendum.

B. Submit separate request for each substitution. Support each request with:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents.
   a. Product identification, including manufacturer=s name and address.
   b. Manufacturer=s literature; identifying:
      1) Product description.
      2) Reference standards.
      3) Performance and test data.
   c. Samples, as applicable.
   d. Name and address of similar projects on which product has been used, and date of each installation.

2. Itemized comparison of the proposed substitution with product specified; list significant variations.

3. Data relating to changes in delivery or construction schedule.

4. All effects of substitution on separate contracts.

5. Accurate cost data comparing proposed substitution with product specified.
   a. Amount of any net change to Contract Sum.

6. Designation of required license fees or royalties.

7. Designation of availability of maintenance services, sources of replacement materials.

C. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals without a formal request from Bidder.

2. Acceptance will require substantial revision of Contract Documents.

3. In judgment of Engineer, do not include adequate information necessary for a complete evaluation.

4. Requested after Contract Award directly by a subcontractor or supplier.

D. Substitute products shall not be ordered or installed without written acceptance of Engineer.

E. Engineer will determine acceptability of proposed substitution.
1.6 BIDDERS REPRESENTATION

A. In making formal request for substitution the Bidder represents that:

1. They have investigated proposed product and determined it is equivalent to or superior in all respects to that specified.
2. They will provide same warranties or bonds for substitution as for product specified.
3. They will coordinate installation of accepted substitution into the Work, and will make such changes as may be required for the Work to be complete in all respects.
4. They waive claims for additional costs caused by substitution that may subsequently become apparent.
5. Cost data is complete and includes related costs under their Contract, but not:
   a. Costs under separate contracts.
   b. Engineer=s costs for redesign or revision of Contract Documents.

B. Any modifications necessary as a result of the use of an approved substitute shall be paid by the Contractor proposing the substitution.

C. Any additional engineering costs required to be performed by the Engineer to approve, implement or coordinate the substitution above reasonable review services, shall be paid by the Contractor proposing the substitution.

D. Under no circumstances will the Engineer be required to prove that a product proposed for substitution is or is not equal to the quality of the product specified.

1.7 ENGINEERS DUTIES

A. Review requests for substitutions with reasonable promptness.

B. Coordinate review/approval of "Engineer Approved" substitutions with the Owner.

C. Issue a written instruction of decision to accept the substitution.

D. Substitution requests that are not approved will be returned to the party submitting the request with an explanation for the rejection.

END OF SECTION 01 1630
SECTION 01 1650 – STARTING OF SYSTEMS

PART 1 - GENERAL

1.1  RELATED DOCUMENTS

   A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and Division - 1 Specification Sections, apply to work of this Section.

1.2  SECTION INCLUDES

   A. Starting systems.
   B. Demonstration and instructions.

1.3  RELATED SECTIONS

   A. Section 011300 - Submittals.
   B. Section 011700 - Contract Closeout: System operation and maintenance data and extra materials.

1.4  STARTING SYSTEMS

   A. Coordinate schedule for start-up of various equipment and systems.
   B. Notify Engineer seven (7) days prior to start-up of each item.
   C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions that may cause damage.
   D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
   E. Verify wiring and support components for equipment are complete and tested.
   F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.

1.5  DEMONSTRATION AND INSTRUCTIONS

   A. Demonstrate operation and maintenance of Products to Owner's personnel two (2) weeks prior to date of Substantial Completion and as described within the individual specification sections.

   B. Provide Owner training as described within the individual specification sections.

END OF SECTION 01 1650
SECTION 01 1700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and Division-1 Specification Sections, apply to work of this Section.

1.2 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Adjusting.
D. Project record documents.
E. Operation and maintenance data.
F. Warranties.
G. Spare parts and maintenance materials.

1.3 RELATED SECTIONS

A. Section 011650 - Starting of Systems: System start-up.
B. Section 260100 – Electrical Testing.

1.4 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection. B. Provide submittals to Owner that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will occupy all portions of the building as specified in Section 01010.

E. Submit appropriate permits.

1.5 FINAL CLEANING

A. Execute final cleaning prior to final inspection.
B. Clean interior and exterior surfaces exposed to view for new work or existing surfaces affected by the new work.
C. Clean equipment and fixtures to a sanitary condition.
D. Clean site.
E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.6 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on site, one (1) set of the following record documents; record actual revisions to the Work:
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.

E. Submit documents to Engineer with claim for final Application for Payment.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit three (3) sets prior to final inspection, bound in 8-1/2 x 11 inch or 11 x 17 inch text pages, three ring binders with durable plastic covers, as described below and as supplemented in the individual specification sections.

B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.

C. Contents: Prepare a Table of Contents with each Product or system description identified.

D. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
E. Part 2: Operation and maintenance instructions.

F. Part 3: Project documents and certificates, including the following:
   1. Shop drawings and product data.
   2. Balance reports.
   3. Certificates.
   4. Photocopies of warranties.

1.9 WARRANTIES

A. Submit warranties required in the General Conditions of the Contract and in the individual specification Sections.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed. Obtain receipt prior to final payment.

END OF SECTION 01 1700
SECTION 01 2100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Elliman Clinical Research Building $ 40,000.00
B. Shapero Hall $ 5,000.00

END OF SECTION 01 2100
SECTION 03 3000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1.4 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

C. Floor surface flatness and levelness measurements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Pre-installation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.


D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

   1. Portland Cement: ASTM C 150, Type I Type II, option to supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

   B. Normal-Weight Aggregates: ASTM C 33, graded.
1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

2.4 ADMIXTURES


B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.

B. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 3/4 to 2-1/4 inches long.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.
2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

   1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

   1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 RELATED MATERIALS


2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

   1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50
3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent. Provide 6% plus or minus 1% for any exterior or concrete exposed to weather.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.
3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

  1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

  1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

  1. Apply to concrete surfaces exposed to public view, to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 CONCRETE PROTECTING AND CURING
A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9 CONCRETE SURFACE REPAIRS

A. Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.10 FIELD QUALITY CONTROL

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

END OF SECTION 03 3000
SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
   a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
   b. Classification markings on penetration firestopping correspond to designations listed by the following:
      1) UL in its "Fire Resistance Directory."
      2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
      3) FM Global in its "Building Materials Approval Guide."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2. Grace Construction Products.
3. Hilti, Inc.
6. NUCO Inc.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

D. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Temporary forming materials.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting
performance of the Work. B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."
C. Firestopping for Metallic Pipes, Conduit, or Tubing

1. UL-Classified Systems: Match existing
2. F-Rating: 2 hours
3. T-Rating: 2 hours
4. W-Rating: No leakage of water at completion of water leakage testing.
5. Type of Fill Materials: As required to achieve rating

END OF SECTION 07 8413
SECTION 26 0010 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

1.3 REFERENCES

All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:

1. A.N.S.I. - American National Standards Institute
2. A.S.T.M. - American Society for Testing Materials
3. I.C.E.A. - Insulated Cable Engineers Association
4. I.E.E.E. - Institute of Electrical and Electronics Engineers
5. N.E.C. - National Electrical Code
6. N.E.C.A. -National Electrical Contractors Association
7. N.E.M.A. - National Electrical Manufacturer's Association
8. U.L. - Underwriters Laboratories, Inc.

1.4 QUALITY ASSURANCE

A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.

1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bid shall be based on the most expensive combination of quality and quantity of the work indicated.
2. The Contractor understands that the work herein described shall be complete in every detail.

B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.
1. Notify the Architect/Engineer before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.

C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.

D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.

E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.

F. Sequence and Schedule: Work so as to avoid interference with the work of other trades. Be responsible for removing and relocating any work which in the opinion of the Owner’s Representatives causes interference.

1.5 CODES, PERMITS, AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules and regulations.

B. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or Specifications shall govern.

1.6 DRAWINGS

A. The Drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.

C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

1.7 MATERIAL AND EQUIPMENT MANUFACTURERS

A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of electrical equipment and shall be of the manufacturer's latest design.

B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.

C. Where existing equipment is modified to include new switches, circuit breakers, metering or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

1.8 INSPECTION OF SITE

Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

1.9 ITEMS REQUIRING PRIOR APPROVAL

A. Bid shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.

B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

1.10 SHOP DRAWINGS/SUBMITTALS

A. Submit project-specific submittals for review in compliance with Division 1.

B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.

C. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

D. Submit for approval shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical Specifications for additional requirements.

1. Medium Voltage Cables
2. Wiring Devices
3. Packaged Engine Generators
4. Static Uninterruptible Power Supply
5. Medium Voltage Switchgear
6. Transfer Switches
7. Panelboards
8. Dry Type Transformers (600 V and Less)
9. Underground Duct and Utility Structures
10. Exterior Lighting Fixtures

1.11 COORDINATION DRAWINGS

A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.
1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 1 Specification Sections.

B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for Owner and shall be bound in ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:

1. Routine maintenance procedures.
2. Trouble-shooting procedures.
3. Contractor's telephone numbers for warranty repair service.
5. Recommended spare parts lists.
6. Names and telephone numbers of major material suppliers and subcontractors.
7. System schematic drawings on 8-1/2" x 11" sheets.

1.13 RECORD DRAWINGS

A. Submit record drawings in compliance with Division 1.

B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work.

C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

1.14 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.

D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

1.15 WARRANTY

A. Warranty: Comply with the requirements in Division 1 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner’s satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.

B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.

C. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

1.16 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

1.17 COORDINATION

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

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

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

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

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

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

3.2 DEMOLITION WORK

A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items such as, but not limited to, electrical equipment, devices, lighting fixtures, conduit, and wiring called out on the Drawings and as necessary whether such items are actually indicated on the Drawings or not in order to accomplish the installation of the specified new work.

B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.

C. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the
appropriate trade for reuse. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.

D. Where equipment or fixtures are removed, outlets shall be properly blanked off, and conduits capped. After alterations are done, the entire installation shall present a “finished” look, as approved by the Architect/Engineer. The original function of the present electrical work to be modified shall not be changed unless required by the specific revisions to the system as specified or as indicated.

E. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface raceway or exposed conduits will be permitted only where approved by the Architect/Engineer.

3.3 INSTALLATION OF EQUIPMENT

A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.

B. Device Location:
   1. Allow for relocation prior to installation of wiring devices and other control devices, for example, receptacles, switches, fire alarm devices, and access control devices, within a 10-foot radius of indicated location without additional cost.

3.4 WORK IN EXISTING BUILDINGS

A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.

B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.

C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative. Prior approval required from Owner; 7 days notice.

D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement of all
hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

3.5 CHASES AND RECESSES
A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

3.6 CUTTING, PATCHING AND DAMAGE TO OTHER WORK
A. Refer to General Conditions for requirements.
B. All cutting, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

3.7 EXCAVATION AND BACKFILLING
A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
B. Where conduit is installed less than 2'-6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
D. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
E. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling.

3.8 EQUIPMENT CONNECTIONS
A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the
manufacturers of the particular equipment furnished. All additional connections not shown on the Drawings, but called out by the equipment manufacturer's shop Drawings shall be provided.

3.9 CLEANING

A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.

B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

3.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Equipment and materials shall be protected from theft, injury or damage.

B. Protect conduit openings with temporary plugs or caps.

C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

3.11 EXTRA WORK

A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done. Prior to any extra work which may be proposed, the Electrical Contractor shall submit unit prices (same prices for increase/decrease of work) for the following items: 3/4", 1", 1-1/2" conduit; #12, #10, #8, #6, #2 wire; receptacle, or other devices which may be required for any proposed extra work.

3.12 DRAWINGS AND MEASUREMENTS

A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor’s responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION 26 0010
SECTION 26 0100 - ELECTRICAL TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Provide material, equipment, labor and technical supervision to perform and complete the electrical field acceptance tests for the electrical equipment and distribution systems specified.

B. Intent
   1. The purpose of the tests outlined is to insure the safety of persons and property before and after occupancy by the Owner. These tests are to insure that the methods and materials used in manufacture, installation and erection have provided equipment that is safe and in an operable condition.

1.2 DEFINITIONS

A. Acceptance Tests
   1. Defined as those tests and inspections required to determine that the equipment involved may be energized for operational tests.

B. Operational Tests
   1. Defined as those tests and inspections required to determine that equipment performance characteristics comply with the intended design.

1.3 QUALITY ASSURANCE

A. Testing Company Qualifications
   1. Independent testing laboratory regularly engaged in the business of electrical acceptance testing, similar to the inspections and tests specified, with a minimum of two years experience.
   2. Testing under this Section shall not be performed by the installing Contractor.
   3. Provide at least one on-site test leader who is a certified NETA (InterNational Electrical Testing Association) or NICET (National Institute of Certified Electrical Technicians) test technician. Provide other test personnel who have had a minimum two years of supervised field experience in acceptance testing.

B. Acceptable Testing Firms:
   1. Northern Electrical Testing; Phone (248) 689-8980.
   2. Utilities Instrumentation Services; Phone (734) 482-1450.
   3. Emerson/High Voltage Maintenance Corporation; Phone (248) 305-5596.
   4. Powertech Services, Inc.; Phone (810) 720-2280.
   5. Magna Electric (248) 486-7370.
C. Industry Standards
   1. Perform tests per the standards of the industry such as IEEE (Institute of Electrical and Electronics Engineers, Inc.), NEMA (National Electrical Manufacturers Association), ANSI (American National Standards Institute), NETA (InterNational Electrical Testing Association), and ICEA (Insulated Cable Engineers Association), and as specified.

1.4 EXAMINATION

A. Verification of Conditions
   1. Review Project electrical documents and ascertain the extent of the Project testing and the conditions and parameters involved in the work.
   2. Prior to testing, visually inspect equipment to determine that there is no physical damage, loose bolts or missing parts and the equipment is supplied in agreement with the Contract documents and properly installed and connected.
   3. At the option of the Architect, conduct testing in the presence of the Architect at the site. Do not ship equipment off-site for testing without the authorization of the Architect.
   4. Report immediately to the Architect any system, material, or workmanship which is found defective or not in compliance with the Specifications.

1.5 SUBMITTALS

A. Quality Control Submittals
   1. Submit proof of testing company qualifications including the following:
      a. Name of the test leader and proof of certification.
      b. Qualifications of testing company.
   2. Membership in NETA may be submitted in addition to the above list to substantiate qualifications of other test personnel.

B. Test Report Submittals
   1. Incorporate a record of inspections and tests into a test report.
   2. Bind and certify the test report by the testing laboratory.
   3. Furnish 2 copies of test reports in draft form for review and approval prior to submitting the final reports.
   4. Furnish 3 copies of the complete report to the Architect no later than thirty days after completion of Project. At the discretion of the Architect, due to installation scheduling of specific items of equipment or for other reasons, testing may be subdivided into several smaller packages. In that case, submit one copy of a test report no later than thirty days after completion of each test package and submit an inclusive test report containing the package reports in the quantity and the time specified above for the complete report.
   5. Include in the test report the following:
      a. Project name.
      b. Equipment tested.
      c. Tests performed.
      d. List of test equipment used and calibration dates.
      e. Test results.
      f. Conclusions and recommendations, if any.
   6. Where adjustments, modifications, or repairs are made to equipment in order to meet the equipment and/or system specifications, indicate the "as left" condition in the test report.
7. Report test results for each separate piece of equipment on test forms designed for the purpose. Include on the test forms the following:
   a. Nameplate catalog number, serial number, and rating.
   b. Desired performance or performance range.

C. Scheduling
1. Submit schedule of tests, prior to testing, including:
   a. Test equipment used,
   b. Test personnel and date,
   c. Any discrepancies or repairs made.
2. Obtain approval from the Architect for the use of test forms which are different than NETA-approved test report forms.

1.6 PROJECT CONDITIONS

A. Environmental Requirements
1. Correct test results to 20 degrees C (68 degrees F). Report both the actual ambient temperature test readings and the calculated, corrected to temperature, test values.
2. Do not test any equipment when the insulation temperature is below 0 degrees C (32 degrees F).
3. Do not test any equipment where the relative humidity is above 70 percent. Deviations to this requirement will only be approved by the Architect if the testing laboratory can demonstrate that the higher humidity will not affect the test or that the higher humidity can be accounted for adequately in interpreting the test results.

1.7 SEQUENCING AND SCHEDULING

A. General
1. Schedule tests in cooperation with other affected Contract work. Obtain approval from the Architect for the testing schedule. Give three days notice prior to testing, unless otherwise necessary or specified.
2. Advise manufacturer's representatives of tests to be performed on their equipment. Give minimum ten days time notification to permit the representative of the manufacturer to witness the equipment under test.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 ACCEPTANCE TESTING METHODS

A. General
1. Provide necessary test equipment and be responsible for setting-up test equipment, wire checks of factory wiring and any other preliminary work in preparation for the electrical acceptance tests.
2. The testing laboratory shall have a calibration program which maintains applicable test instrumentation within rated accuracy. Accuracy shall be traceable to the national bureau of standards. Calibration frequency shall be in accordance with the following schedule:
a. Field instruments - 6 months minimum,
b. Laboratory instruments - 12 months minimum.

3. Place dated calibration labels visibly on equipment.

4. Certain pieces of equipment have been provided with the services of a manufacturer's service engineer who will assist in performing the tests on the equipment. When this service is provided, the service engineer will also be required to verify and sign each report form.

5. Perform tests which do not exceed the manufacturer's recommended limit for the equipment being tested.

6. Where required for the validity of tests or safety of equipment and personnel, isolate equipment to be tested from the system.

7. Include the ambient temperature and relative humidity existing at the time when performing insulation resistance, dielectric absorption and high potential tests.

B. Visual Inspections

1. Prior to any testing, perform visual inspections to verify the following:
   a. The equipment is completely and properly installed.
   b. The equipment is free from damage and defects.
   c. Shipping blocks and restraints have been removed.
   d. Electrical terminations are properly tightened.
   e. The equipment is properly aligned.
   f. The equipment is properly lubricated.
   g. The ventilation louvers are open and unobstructed.
   h. The equipment is ready to be tested.

C. Manual Operation

1. Prior to any testing, operate mechanical devices to verify that they function properly and freely.

D. Insulation Resistance Test

1. Perform test with a voltage source capable of providing a constant direct voltage for the time intervals as specified below. Do not use hand cranked voltage sources for direct voltages greater than 2500 volts.

2. The magnitude of applied direct voltage depends upon the voltage system to which the equipment is connected, as follows:

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Test Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 and under</td>
<td>500</td>
</tr>
<tr>
<td>151 – 600</td>
<td>1000</td>
</tr>
</tbody>
</table>

3. Hold 1000-volt and 500-volt insulation resistance tests for a minimum of one minute or until the reading reaches a constant value for 15 seconds unless specified otherwise.

4. Apply tests from phase to ground with the other phases grounded. Test each phase in a similar manner.

5. Check phase matching and phase identification immediately prior to energizing equipment.
3.2 EQUIPMENT TO BE TESTED

A. General
1. Independent testing laboratory to provide field acceptance tests for the following equipment. Installing Contractor may provide field acceptance tests for equipment not listed below:
   a. Wire and Cable under 600 volts (feeders).
   b. Medium Voltage Cables
   c. Medium Voltage Switchgear
   d. Engine Generator Set
   e. Grounding Systems
   f. Automatic Transfer Switches
   g. Uninterruptable Power Supply

END OF SECTION
1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions
      and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage
      (2001 to 35,000 V) electrical distribution systems.

1.3 DEFINITIONS
   A. Jacket: A continuous nonmetallic outer covering for conductors or cables.
   C. Sheath: A continuous metallic covering for conductors or cables.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of cable. Include splices and terminations for cables and cable
      accessories.
   B. Samples: 16-inch (400-mm) lengths for each type of cable specified.

1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For testing agency.
   B. Material Certificates: For each type of cable and accessory.
   C. Source quality-control reports.
   D. Field quality-control reports.

1.6 QUALITY ASSURANCE
   A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install,
      splice, and terminate medium-voltage cable.
B. Testing Agency Qualifications: Member Company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 FIELD CONDITIONS

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

   1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

   1. Cables:
      a. Okonite Company (The).
      b. Pirelli Company.
      c. Rome.

   2. Cable Splicing and Terminating Products and Accessories:
      a. 3M; Electrical Markets Division.
      b. Tyco Electronics; Raychem Products.
      c. PLM.

B. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

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. B. Comply with IEEE C2 and NFPA 70.
2.3 CABLES

A. Cable Type: Type MV 105.
B. Comply with UL 1072, AEIC CS8, ANSI/ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.
C. Conductor: Copper.
D. Conductor Stranding: Compact round, concentric lay, Class B.
E. Strand Filling: Conductor interstices are filled with impermeable compound.
F. Conductor Insulation: Ethylene-propylene rubber (EPR).
   1. Voltage Rating: 15 kV.
   2. Insulation Thickness: 133 percent insulation level.
G. Shielding: Copper tape, helically applied over semiconducting insulation shield with a minimum of 20% overlap.

2.4 CONNECTORS

A. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.
B. Copper-Conductor Connectors: Copper barrel crimped connectors.

2.5 SOLID TERMINATIONS

A. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.
   1. Class 1 Terminations, Interior: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
   2. Class 1 Terminations, Exterior: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.

2.6 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

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

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

2.7 SPLICE KITS

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

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

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
4. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.
5. Separable multiway splice system with all components for the required splice configuration.

2.8 MEDIUM-VOLTAGE TAPES

A. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.

2.9 ARC-PROOFING MATERIALS

A. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture resistant, PVC pipe-wrapping tape.

2.10 FAULT INDICATORS

A. Indicators: Manually reset fault indicator, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.
B. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

2.11 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 before shipping.

B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.

2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

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

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.

2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.

4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

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

E. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
F. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

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

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

I. Install separable insulated-connector components as follows:
   1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
   2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
   3. Standoff Insulator: At each terminal junction, with one on each terminal.

J. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
   1. Clean cable sheath.
   2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
   3. Smooth surface contours with electrical insulation putty.
   4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
   5. Band arc-proofing tape with two layers of 1-inch- (25-mm-) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

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

L. Install fault indicators on each phase where indicated.

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

N. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.

O. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.

C. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 0513
SECTION 26 0519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer to Specification Section “Electrical Testing”.

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

C. Comply with NFPA 70.

1.5 COORDINATION

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

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Triangle.
   2. Rome.
   3. Cablec.
   4. Southwire.
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

B. Copper Conductors: Comply with NEMA WC 70, stranded.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, RHH/RHW-2, THWN or THHN.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ilsco.
   2. Burndy.
   4. 3M; Electrical Products Division.
   5. Ideal.
   6. Square D.
   7. Thomas & Betts.
   8. GB Electric.

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

C. Taps and splices in all feeder and branch circuit conductors larger than no. 8 AWG shall be made with approved solderless, pressure type bolted connectors. Splices in conductors no. 8 AWG and smaller may be made with preinsulated Scotchlock or Ideal Wing-Nut spring tension connectors.

D. Termination of motor leads to branch circuit conductors shall be made with Burndy Clear UNITAP inspectable insulated multiple tap connectors sized for the conductors being terminated.

PART 3 - EXECUTION

3.1 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Power Feeder and Branch Circuit Wiring
   1. Install no more than three ungrounded conductors, three grounded (neutral) conductors, and one equipment grounding conductor, in a single conduit or cable assembly, unless otherwise indicated.

B. All wiring shall be installed in rigid galvanized conduit, intermediate metal conduit (I.M.C.), flexible conduit, electrical metallic tubing (E.M.T.) or other approved raceway.

C. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
E. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.

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

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

I. Minimum wire size shall be no. 12 AWG, except 120 Volt control circuits may be no. 14 AWG.

J. Branch circuits 100 feet or longer shall be minimum size number 10 wire AWG.

K. Cable types MC, NM, NMC or NMS shall not be used unless specifically noted on the drawings or in the specifications.

L. Aluminum conductors shall not be used.

M. Power Feeder and Branch Circuit Wiring
   1. Install no more than three underground conductors, three grounded (neutral) conductors, and one equipment grounding conductor, in a single conduct or cable assembly, unless otherwise noted.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. 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.

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

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

D. Support according to Division 26 Section “Hangers and Supports for Electrical Systems”.

E. Identify and color-code conductors and cables according to Division 26 Section “Identification for Electrical Systems”. Identify cable phasing left to right or front to back, facing front of equipment.
3.3 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 and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.4 FIRESTOPPING

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

3.5 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control tests in accordance with Division 26 Section “Electrical Testing”.
   1. Description: Test all feeders rated 100 A and above.
   2. Visual and Mechanical Inspection
      a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
      b. Test cable mechanical connections with an infrared survey.
      c. Check cable color-coding against project Specifications and N.E.C. requirements.
   3. Electrical Tests
      a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
      b. Perform continuity test to insure proper cable connection.
   4. Test Values
      a. Minimum insulation resistance values shall be not less than fifty mehogms.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

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

END OF SECTION
SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes: Grounding systems and equipment.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
      1. Ground rods.
      2. Grounding arrangements and connections for separately derived systems.
   C. Qualification Data: For qualified testing agency and testing agency’s field supervisor.
   D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE
   A. Testing Agency Qualifications: Refer to Specification Section “Electrical Testing.”
   B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   C. Comply with UL 467 for grounding and bonding materials and equipment.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Grounding Conductors and Cables:
      a. Refer to Division 26 Section “Conductors and Cables”.
   2. Grounding Rods:
      b. Apache Grounding/Erico Inc.
      c. Chance/Hubbell.
   3. Mechanical Connectors:
      b. Burndy.
      c. Chance/Hubbell.
   4. Exothermic Connections:
      a. Cadweld.

2.2 CONDUCTORS

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

B. Bare Copper Conductors:
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Conductors used for grounding shall be stranded copper, THWN/THHN, the same as the feeder conductors and/or branch circuit conductors. Conductors buried in concrete shall have RHW or THW insulation.
2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

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

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

E. Irreversible Connectors
   1. Compression connectors of pure, wrought copper, per ASTM B187.
   2. Cast connectors of copper base alloy per ASTM B30.
   3. Clearly and permanently mark connectors with the following information:
      a. Catalog number.
      b. Conductors accommodated.
      c. Installation die index or die catalog number is required.
      d. Underwriters Laboratories “Listing Mark”.
      e. The words “Direct Burial” or “Burial” per UL 467.
   4. Pre-fill connectors with a corrosion inhibiting compound which is compatible with the conductors being joined.
   5. Provide connectors equivalent in current carrying capacity to the maximum size copper conductors being joined.
   6. Manufacturers
      a. Burndy.
      b. Erico.
      c. G&W.
      d. Cadweld.

2.4 GROUNDING ELECTRODES

A. Ground Rods: 3/4 inch by 10 feet (19 mm by 3 m) in diameter. Solid, 98% conductivity, electrical grade copper.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
3. Connections to Structural Steel: Welded connectors.

3.2 POWER SYSTEM GROUND

A. Separately ground the emergency generator neutral to grounding electrodes, per NFPA 70.

3.3 EQUIPMENT GROUNDING

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

3.4 INSTALLATION

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

B. Ground Rods: Drive rods until tops are 12 inches (50 mm) 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.

3.5 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural
drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

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

C. Prepare test and inspection reports.

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

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

END OF SECTION
SECTION  26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

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

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

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

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

A. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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

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

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Empire Tool and Manufacturing Co., Inc.
         3) Hilti Inc.
         4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         5) MKT Fastening, LLC.
   2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   5. Toggle Bolts: All-steel springhead type.

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 APPLICATION

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

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system.
   1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

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

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in 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 shall be weight of supported components plus 200 lb (90 kg).

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. To Steel: Spring-tension clamps.
   6. To Light Steel: Sheet metal screws.
   7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, disconnect switches, control enclosures, pull and junction boxes, and other devices on slotted-channel racks attached to substrate.
   8. Enclosures for enclosed controllers and transfer switches and other similar equipment shall be mounted on ½” spacers when mounted in a room on a below grade exterior wall.

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

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported units, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.
1. Place and secure anchorage devices. Use supported equipment manufacturer’s setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer’s written instructions.

3.4 PAINTING

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

   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

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

END OF SECTION
SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes raceways and fittings for electrical wiring.

1.3 DEFINITIONS
A. EMT: Electrical metallic tubing.
B. RNC: Rigid nonmetallic conduit.
C. RSC: Rigid steel conduit.

1.4 SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, boxes, hinged-cover enclosures, and cabinets.
B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
C. Source quality-control test reports.

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

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION
A. All boxes, brackets, bolts, clamps, etc., shall be galvanized, electro-galvanized, metalized, or sherardized.
B. All hardware used outdoors shall be hot dipped galvanized.
C. Pull boxes, junction boxes, and device boxes installed outdoors shall be heavy duty die cast aluminum construction power coat finished with gasketed cover plate.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Triangle PWC.
   2. Allied Steel Conduit.
   3. Wheatland Tube Company.

B. All rigid conduit, and E.M.T. shall be hot dipped galvanized, sherardized, metalized or electro-galvanized.

C. Rigid Steel Conduit: ANSI C80.1.

D. EMT: ANSI C80.3.

E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Fittings for EMT: Compressed type, galvanized steel only, insulated throat. Cast type are not acceptable.

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

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carlon.
   2. Endot Industries.
   3. CANTEX Inc.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

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

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hoffman.
   2. Square D; Schneider Electric.
B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

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

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer’s standard enamel finish.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mono-Systems.
   2. Thomas & Betts Corporation.

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

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

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

E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer’s standard enamel.

F. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer’s standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Metal barriers to separate wiring of different systems and voltage.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit.
   2. Concealed Conduit, Aboveground: Rigid steel conduit.
   3. Underground Conduit beyond ten feet from building: RNC, Type EPC-40-PVC, direct buried.
5. All large (3” or larger) buried conduits containing conductors from generator shall be PVC; elbows or sweeps shall be galvanized rigid steel. Conduits projecting through concrete slabs or extending above grade shall be galvanized rigid steel.

6. All exterior underground conduits shall incorporate a conductive warning tape buried above the conduit.

7. Any electrical conduit penetrating the building foundation wall below grade shall be made water tight at each opening to prevent the conduit’s ability to conduct water from rain or flooding into the building.

8. Boxes and Enclosures, Aboveground: NEMA 250, Type 4x, stainless steel.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
      a. All conduit mounted exposed within the substation room, mechanical rooms and fire pump room shall be rigid steel conduit.
      b. All conduits 2-1/2 inch and larger shall be rigid steel conduit.
   2. Boxes and Enclosures: NEMA 250, Type 1.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. In locations where rigid steel conduit cannot be turned and a fitting is required, a three piece malleable iron/steel rain-tight fitting shall be used.
   3. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. No EMT or aluminum conduit shall be used in concrete or direct burial.

3.2 INSTALLATION

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

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. All conduit run exposed shall be run parallel to the structural members of the building in a neat manner, securely fastened in place. Approved conduit type fittings or outlet boxes shall be used at all bends in a vertical plane or where breaking around beams or columns. Bends on ceilings in a horizontal plane shall be made with long sweep elbows.

E. All conduits penetrating underground walls into basements, vaults, etc. shall be sealed between the conduits and walls with Link-Seal Model “C” modular sealing system.
F. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

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

H. Install no more than the equivalent of three 90-degree bends in any conduit run.

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

J. Terminations: All conduits.
   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Provide plastic insulated bushings on all conduit terminations.
   3. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
   4. Threaded couplings, connectors, and conduit bodies shall be used on rigid galvanized conduit; set screw or threadless types are not acceptable.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

3.3 FIRESTOPPING

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

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 IDENTIFICATION

A. Identify Conduit and boxes per specification section 26 0553 “Identification for Electrical Systems”.

END OF SECTION
SECTION 26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Direct-buried conduit, ducts, and duct accessories.
   2. Concrete-encased conduit, ducts, and duct accessories.

1.3 ACTION SUBMITTALS
A. Product Data: For the following:
   1. Duct-bank materials, including separators and miscellaneous components.
   2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
   1. Duct entry provisions, including locations and duct sizes.
   2. Reinforcement details.
   3. Frame and cover design and manhole frame support rings.
   4. Ladder or step details.
   5. Grounding details.
   6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
   7. Joint details.

1.4 INFORMATIONAL SUBMITTALS
A. Source quality-control test reports.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE
A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 FIELD CONDITIONS

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 seven days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, manholes with final arrangement of other utilities, site grading, and surface features as determined in the field.

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

PART 2 - PRODUCTS

2.1 CONDUIT

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Triangle PWC.
      b. Allied Steel Conduit.
      c. Wheatland Tube Company.

B. Rigid Non-metallic (RNC): NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CANTEX Inc.
      b. Carlon.
      c. Endot Industries.

2.2 PRECAST MANHOLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Christy Concrete Products.
   2. Elmhurst-Chicago Stone Co.
   4. Rinker Group, Ltd.
   5. Riverton Concrete Products.
   6. Utility Concrete Products, LLC.

B. Comply with ASTM C 858, requirements in “Underground Enclosure Application” Article,

C. One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.
1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
   a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
   b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
   c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

D. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

E. Ground Rod Sleeve: Provide a 3-inch PVC conduit sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

F. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.3 MANHOLE ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bilco Company (The).
   2. Campbell Foundry Company.
   3. Elmhurst-Chicago Stone Co.
   5. Riverton Concrete Products.
   6. Underground Devices, Inc.
   7. Utility Concrete Products, LLC.
   8. Utility Vault Co.

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
   1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, as indicated on drawings.
      a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
      b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
   2. Cover Legend: Cast in. Selected to suit system.
      a. Legend: “ELECTRIC-HV” for duct systems with medium-voltage cables.
   3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
      a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.
      b. Seal joints watertight using preformed plastic or rubber conforming to ASTM C 990. Install sealing material according to the sealant manufacturers’ printed instructions.

C. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-diameter eye, and 1-by-
4-inch bolt.
   1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch-diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
   1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
   1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

H. Cable Rack Assembly: Steel, hot-rolled galvanized, except insulators.
   1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
   2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.

I. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
   1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.
   2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

J. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

K. Fixed Manhole Ladders: Arranged for attachment to roof or wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.

L. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.4 DUCT ACCESSORIES

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

B. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
2.5 **SOURCE QUALITY CONTROL**

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

**PART 3 - EXECUTION**

3.1 **PREPARATION**

A. Coordinate layout and installation of ducts, manholes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes with final locations and profiles of ducts 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 runs drain to manholes and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Division 31 Section “Site Clearing.” Remove and stockpile topsoil for reapplication according to Division 31 Section "Site Clearing."

3.2 **UNDERGROUND DUCT AND RACEWAY APPLICATION**

A. Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, direct-buried duct bank, unless otherwise indicated.

D. Manholes
   1. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 **EARTHWORK**

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish 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.
3.4 DUCT INSTALLATION

A. Install ducts according to NEMA TCB2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and away from buildings and equipment. Slopeducts from a high point in runs between two manholes to drain in both directions.

C. Curves and Bends: Use rigid steel conduit. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Duct Entrances to Manholes and Concrete: Use end bells, spaced approximately 8 inches o.c. for 4-inch ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

F. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.

G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

H. Pulling Cord: Install 100-lbf-test nylon cord in ducts, including spares.

I. Concrete-Encased Ducts
   1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
   2. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. 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.
   3. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
      a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
      b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
   4. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
5. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

6. 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.

7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 3 inches between ducts for like services, and 4 inches between power and signal ducts unless otherwise indicated.

8. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
   a. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.

9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

J. Direct-Buried Duct Banks:
1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.

2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

3. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.

4. After installing first tier of ducts, 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 inches over ducts 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. Comply with Division 31 Section "Earth Moving" for installation of backfill materials.
   a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.

5. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.

6. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

7. Set elevation of bottom of duct bank below the frost line.

8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

9. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an
additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES

A. Precast Concrete Manhole Installation:
   1. Comply with ASTM C 891, unless otherwise indicated.
   2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
   3. Unless otherwise indicated, support units on a 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.

B. Elevations:
   1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
   2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.

C. Manhole Access: Circular opening in manhole roof; sized to match cover size.
   1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
   2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

D. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

E. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

F. Field-Installed Bolting Anchors in Manholes: Do not drill deeper than 3-7/8 inches for manholes for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

G. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
   2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
   3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.
3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 0543
SECTION 26 0553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

   1. Identification for raceway and metal-clad cable.
   2. Identification for conductors and communication and control cable.
   4. Warning labels and signs.
   5. Instruction signs.
   7. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

B. Comply with NFPA 70.

1.4 COORDINATION


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

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

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

PART 2 - PRODUCTS
2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

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

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

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

2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

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

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

2.3 UNDERGROUND-LINE WARNING TAPE

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

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

2.4 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated. C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
2.5 INSTRUCTION SIGNS

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

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

2.6 EQUIPMENT IDENTIFICATION LABELS


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

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

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

2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

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

2.8 WIRING DEVICE IDENTIFICATION

A. Description: Self adhesive label with black upper case letters on clear polyester label, font size 7.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.
C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

1. Fire Alarm System: Red.
3. Telecommunication System: Green and yellow.
4. Control Wiring: Green and red.

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

E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.

F. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.

G. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.


1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

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

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

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

1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label mechanically secured.
   b. Outdoor Equipment: Stenciled.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled: If included on project. All items may not be on project.
   a. Panelboards, electrical cabinets, and enclosures.
   b. Electrical switchgear and switchboards.
   c. Transformers.
   d. Enclosed circuit breakers.
   e. Power-generating units.
   f. Uninterruptible power supply equipment.

M. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

3.2 INSTALLATION

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

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

2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.

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

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

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

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

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

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Colors for 480/277-V Circuits:
   b. Phase B: Orange.
   c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

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

I. Label information arrangement for 3 lines of text.
1. Line one shall describe the panel or equipment. Line one example: “DP-XX,” “RP-XX,” “T-XX,” “EFXX,” etc.
2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: “Fed from DP-XX,” “Fed from RP-XX,” etc.
3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: “First Floor Elect. Rm #XXX.”
4. Line four shall include “Via T-XX” when panel or equipment is fed from a transformer.

J. Examples:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RP-1A</td>
<td>EF-1</td>
<td>LP-1A</td>
</tr>
<tr>
<td>FED FROM DP-1A</td>
<td>FED FROM MCC-1A</td>
<td>LOCATED IN</td>
</tr>
<tr>
<td>ELECTRICAL ROOM A100 VIA T-1A</td>
<td>MECHANICAL ROOM F101</td>
<td>ELECTRICAL ROOM A100</td>
</tr>
</tbody>
</table>

K. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.

L. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

M. Degrease and clean surface to receive nameplates.

N. Install nameplate and labels parallel to equipment lines.

O. Secure nameplate to equipment front using screws.

P. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

Q. Identify conduit using field painting where required.

R. Paint red colored band on each fire alarm conduit and junction box.

S. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION 26 0553
THIS SECTION APPLIES TO ELLIMAN CLINICAL RESEARCH BUILDING
SECTION 26 0573 – OVERCURRENT DEVICE COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SCOPE
A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer.
B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D prepared by the electrical equipment manufacturer.
C. The scope of the studies shall include all new distribution equipment supplied by the equipment manufacturer under this contract as well as all directly affected existing distribution equipment at the customer facility.

1.3 REFERENCES
A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
1.6 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The equipment manufacturer shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

1.7 COMPUTER SOFTWARE PROGRAMS

A. Computer Software Programs: Subject to compliance with requirements, provide products by one of the following:

1. EDSA Micro Corporation.
2. SKM Systems Analysis, Inc.
3. ETAP.

PART 2 - PRODUCTS

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D prepared by the equipment manufacturer.

2.2 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.
C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY


B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:
   1. Calculation methods and assumptions
   2. Selected base per unit quantities
   3. One-line diagram of the system being evaluated
   4. Source impedance data, including electric utility system and motor fault contribution characteristics
   5. Tabulations of calculated quantities
   6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
   1. Electric utility’s supply termination point
   2. Incoming switchgear
   3. Unit substation primary and secondary terminals
   4. Low voltage switchgear
   5. Motor control centers
   6. Standby generators and automatic transfer switches
   7. Branch circuit panelboards
   8. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short circuit ratings
   2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
   3. Notify design engineer in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.
2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility’s overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Miss-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.6 REPORT SECTIONS
A. Input data shall include, but not be limited to the following:

1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
3. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance (X"d), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
4. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

B. Short-Circuit Output Data shall include, but not be limited to the following reports:

1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
   a. Voltage
   b. Calculated fault current magnitude and angle
   c. Fault point X/R ratio
   d. Equivalent impedance

2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
   a. Voltage
   b. Calculated symmetrical fault current magnitude and angle
   c. Fault point X/R ratio
   d. Calculated asymmetrical fault currents
      1) Based on fault point X/R ratio
      2) Based on calculated symmetrical value multiplied by 1.6
      3) Based on calculated symmetrical value multiplied by 2.7
   e. Equivalent impedance

3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
   a. Voltage
   b. Calculated symmetrical fault current magnitude and angle
   c. Fault point X/R ratio
   d. No AC Decrement (NACD) Ratio
   e. Equivalent impedance
   f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
   g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
C. Recommended Protective Device Settings:

1. Phase and Ground Relays:
   a. Current transformer ratio
   b. Current setting
   c. Time setting
   d. Instantaneous setting
   e. Recommendations on improved relaying systems, if applicable.

2. Circuit Breakers:
   a. Adjustable pickups and time delays (long time, short time, ground)
   b. Adjustable time-current characteristic
   c. Adjustable instantaneous pickup
   d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude
2. Protective device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

A. The contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify design engineer in writing of any required major equipment modifications.
3.2 ARC FLASH WARNING LABELS

A. The contractor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date.

D. Labels shall be machine printed, with no field markings.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 480 and applicable 208 volt panelboard, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.
4. For each switchgear, one flash label shall be provided.
5. For medium voltage switches one arc flash label shall be provided.

F. Labels shall be field installed by the contractor.

END OF SECTION 26 0573
SECTION 26 1316 – MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHGEAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. This Section specifies the medium voltage switchgear and fusing for buildings and structures.

2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.

3. Furnish, install, and connect complete for operation new metal-enclosed primary switch unit and make all necessary wiring connections to the primary feeders as required by the drawings and for a complete working job.

4. Medium-voltage switchgear shall include the following items at a minimum:

   a. Medium voltage interrupter switchgear
   b. Medium voltage fusible interrupter switchgear
   c. Medium voltage fuses

1.3 SUBMITTALS

A. Shop Drawings

1. Medium-voltage switchgear
2. Medium-voltage fuses

1.4 QUALITY ASSURANCE

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

B. Comply with NFPA 70, “National Electrical Code”
C. The switchgear shall conform to the following:

1. ANSI C37.20
2. IEEE Standard 27
3. NEMA SG-5
4. National Electrical Code Article 710-21(e)

D. Guarantee

1. Furnish full parts and labor warranty to cover the switchgear for two years from shipment

1.5 MATERIAL TURNED OVER TO OWNER

A. Products Supplied But Not Installed Under This Section

1. Provide 3 spare primary fuses for each size used in the primary interrupter switches.
2. Portable control station with 50 ft. cord.
3. Test accessory.
4. Maintenance cable (nine pin).
5. 8'-0" jumper cable, two complete sets of three.
6. Two jumper storage bags.
7. Shotgun stick.
8. Shotgun stick storage bag.
10. Pentahead socket.
11. Universal Pole 8'-0" long.
13. Large clamp.
14. Any other miscellaneous components and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS


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

2. Eaton Corporation; Cutler-Hammer Products.
3. Square D; Schneider Electric.
4. Powercon Corporation.
2.2 GENERAL

A. Medium voltage primary switch unit shall consist of two 15 KV fused primary selector switches with automatic throwover for the incoming feeders and 15 KV fused primary switch and shall be furnished complete with channels.

B. Medium voltage substation primary feeders switches unit shall consist of two 15 KV non-fused primary selector switches manually operated for the two feeders and 15 KV primary termination compartment, as indicated on drawings, and shall be furnished complete with channels.

C. The ratings for the integrated switchgear assembly shall be as follows:

1. kV, Nominal 13.2
2. kV, Maximum Design 17.0
3. kV, BIL 95
4. Main Bus Continuous, Amperes 600
5. Short-Circuit Ratings
   a. Amperes, RMS Symmetrical 25,000
   b. MVA Three-Phase Symmetrical at Rated Nominal Voltage 600
6. Duty-Cycle Fault-Closing Amperes, RMS Asymmetrical 40,000

D. The momentary and duty-cycle fault-closing ratings of switches, momentary rating of bus, and interrupting ratings of fuses shall equal or exceed the short-circuit ratings of the metal-enclosed switchgear.

E. The interrupter switches shall have two-time duty-cycle fault-closing integrated switchgear assembly. These ratings define the ability to close the interrupter switch, either alone (unfused) or in combination with the appropriate power fuse, against a three-phase fault with asymmetrical current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Tests substantiating these ratings shall be performed at maximum design voltage applied for at least ten cycles and certified copies of tests submitted for record information.

F. The switch unit shall be arranged to provide control of switches from the front as indicated on the drawing. Unit shall be free standing, consisting of cubicles arranged for bolting together on concrete pad. Cubicles shall be welded, reinforced sheet steel enclosures with hinged doors. Complete unit shall be rustproofed and painted two coats.

G. The dimensions of the unit as indicated on the drawing are approximate. These shall be varied to suit the particular equipment furnished and such that overall dimensions of the completely assembled unit shall suit the space, subject to the approval of the Engineers. Complete shop drawings shall be submitted to the Engineers before fabrication.

H. The main buss shall be non-insulated flat copper bar of a minimum 56%IACS conductivity, mounted on track resistant Cycloaliphatic bus supports. The ground bus shall consist of copper bar CA11-, square edge, hard temper per ASTM B187. The contact surface for each bus connection shall be silver plated and tightly bolted to insure maximum conductivity.
I. Primary switch unit shall have a ground bus extending through each compartment for its entire length. Provide connections to ground system as indicated on drawing.

J. The bracing supporting the switches in the enclosure shall be of sufficient strength to permit laying the unit on its side. Also, the crating shall be arranged to permit laying the unit on its side for shipping.

K. The primary switch unit shall be completely wired, assembled, and operationally checked at the factory.

2.3 SELECTOR SWITCHES

A. Primary selector switches shall be fused, heavy duty, quick-make quick-break, 15 KV, 600 ampere, 3 pole, 95 KV BIL, with a minimum load interrupting rating of 600 amperes.

B. Primary switch shall be provided with three 15 KV fuses sized to properly protect the unit substation transformer. Fuses shall be power type with condensers and minimum interrupting rating of 600 MVA. Fuses shall be S & C, General Electric, Bussmann, or Gould Shawmat.

C. Each primary selector switch shall have diamond mesh expanded metal inner door with an engraved plate reading - WARNING - OPEN SWITCH BLADES ARE ENERGIZED -.

D. Primary selector switch units shall each be provided with lugs inside enclosure for termination of 2/0 AWG or 350 KCMIL as necessary with outdoor type Class 1 terminations, 15 KV single conductor cable entering the compartment.

E. Primary switches shall have mechanically interlocked doors to prevent access to switches or fuses when the switch is closed.

2.4 COMMON BUS PRIMARY-SELECTIVE AUTOMATIC THROWOVER

A. The automatic throwover unit shall automatically close and open the primary selector switches by means of three 7.62KV-120 volt control transformers with primary fuses on each incoming line, and necessary motor drives, limit switches, relays, and accessories. The automatic throwover unit shall include the following features:

1. Provisions for disconnecting the motor operators from the primary selector switches for manual operation of the switches, and disconnecting mechanism to allow testing automatic transfer equipment without operating 600 amp, 15 KV selector switch.

2. Three phase sensing.

3. Interlock to prevent closing both primary selector switches simultaneously, except for manual operation.
4. Three current transformers and necessary relays shall be provided with necessary controls to prevent transfer in the event of a phase-to-phase bus fault.

5. Source selector to permit random selection of either incoming line as preferred or alternate source.

6. Field selection of Automatic Hold Return to select automatic return to a preferred source or holding on the alternate source after the initial automatic transfer operation.

7. Field selection of open transition or closed transition on automatic retransfer.


9. Source-voltage indicating lamps of the push-to-test type that shall indicate presence of correct voltage on each high-voltage source.

10. A field-adjustable time delay between loss of voltage and initiation of automatic switching to confirm that loss of voltage on either source is not transient. The timer range shall be from 1/4 to 10 seconds.

11. A field-adjustable time delay between return of voltage and initiation of retransfer switching to confirm that return of voltage on either source is not temporary. The timer range shall be from 1/2 to 15 minutes.

12. An indicating lamp of the push-to-test type which shall indicate that all switch operators are coupled to their respective interrupter switches and are in the correct positions; that all doors providing access to interrupter switches powered by stored-energy switch operators are closed and latched; that the source-transfer control is in the automatic mode; and that all control circuitry is properly connected for automatic transfer.

13. Pushbutton test switches shall be provided to simulate loss of voltage on either source and to allow convenient field testing of the entire source-transfer scheme.

14. Controls located in a removable drawer and a low voltage compartment completely isolated from high voltage circuits.

15. Switch operating mechanism shall be removable for repairs and capable of decoupling without access to high-voltage compartment. It shall be in a grounded compartment.

16. Current transformer and relays for ground fault blocking to prevent transfer if fault occurs in this unit.

B. Primary automatic throwover switch shall be S & C utilizing S & C Micro-AT Source-Transfer Control.
2.5 PRIMARY SWITCH – ATS - EM

A. Primary switch shall be fused, heavy duty, quick-make quick-break, 15 KV, 600 ampere, 3 pole, 95 KV BIL, with a minimum load interrupting rating of 600 amperes.

B. Primary switch shall be provided with three 15 KV fuses sized to properly protect the unit substation transformer. Fuses shall be power type with condensers and minimum interrupting rating of 600 MVA. Fuses shall be S & C, General Electric, Bussmann, or Gould Shawmut.

C. Switches shall be provided with lugs for No. 2/0 AWG, 15 KV cable connection and sufficient space for termination of cables and terminators.

D. Primary switches shall have mechanically interlocked doors to prevent access to switches or fuses when the switch is closed.

2.6 OUTDOOR SWITCHGEAR

A. Outdoor Finish

1. The enclosure finish shall conform to or exceed the applicable requirements of ANSI C57.12.28.

2. During fabrication, the areas of structural parts which may later become inaccessible, such as folded edges and overlapping members, shall be given an iron-oxide zinc-chromate anticorrosion primer to ensure that all surfaces are protected.

3. Full coverage at joints and blind areas shall be achieved by processing enclosures independently of components such as doors and roofs before assembly into the unitized structures.

4. To remove oils and dirt, to form a chemically and anodically neutral conversion corrosion, all surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, drying, and cooling before any protective coatings are applied. By utilizing an automated pretreatment process, the enclosure shall receive a highly consistent thorough treatment, eliminating fluctuations in reaction time, reaction temperature, and chemical concentrations.

5. After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the capability to resist corrosion and protect the enclosure, representative test specimens coated by the enclosure manufacturer’s finishing system shall satisfactorily pass the following tests:
   a. 4000 hours of exposure to salt-spray testing per ASTM B 117 with:
      i. Under-film corrosion not to extend more than 1/32 in. from the scribe, as evaluated per ASTM D 1654, Procedure A, Method 2 (scraping); and
      ii. Loss of adhesion from bare metal not to extend more than 1/8 in. from the scribe.
b. 1000 hours of humidity testing per ASTM D 4585, with no blistering as evaluated per ASTM D 714.

c. 500 hours of ultraviolet-accelerated weathering testing per ASTM G 53 using lamp UVB-313, with no chalking as evaluated per ASTM D 659, and no more than a 10% reduction of paint gloss as evaluated per ASTM D 523.

d. Crosshatch-adhesion testing per ASTM D 3359 Method B, with no loss of paint.

e. 160-inch-pound impact, followed by adhesion testing per ASTM D 2794, with no paint chipping or cracking.

f. 3000 cycles of abrasion testing per ASTM 4060, with no penetration to the substrate.

g. Certified test abstracts substantiating the above capabilities shall be furnished upon request.

6. A heavy coat of insulating “no-drip” compound shall be applied to the inside surface of the roof structure to prevent condensation of moisture thereon.

7. After the enclosures are completely assembled and the components (switches, fuses, bus, etc.) are installed, the finish shall be inspected for scuffs and scratches. Blemishes shall be touched up to restore the protective integrity of the finish.

8. Touch-up materials—with complete instructions—shall be included with each shipment of metal-enclosed switchgear, for touch-up in the field.

9. The finish shall be light gray, satisfying the requirements of ANSI Standard Z55.1 for No. 61. TGIC polyester powder applied electrostatically through air. Following paint application, parts shall be baked to produce a hard durable finish. The average thickness of the paint film shall be 2.0 mils. Paint film shall be uniform in color and free from blisters, sags, flaking and peeling.

10. Adequacy of paint finish to inhibit the buildup of rust on ferrous metal materials shall be tested and evaluated per paragraphs 5.2.8.1-7 of ANSI C37.20.2-1987. Salt spray withstand tests in accordance with ASTM #D-1654 and #B-117 shall be periodically performed on a sample to confirm conformance with the corrosion resistance standard of at least 2500 hours minimum (outdoor equipment).

B. Outdoor Features

1. Enclosure Ventilation
   a. Ventilation openings shall be provided at the top and bottom on the front and rear of each bay. Ventilation openings on the front of arc-resistant switchgear shall be provided at the top only.
   
   b. Vents shall be rain-resistant and corrosion-resistant.
   
   c. Each vent shall have an inside screen and baffle to exclude insects and to protect against insertion of foreign objects.
   
   d. In consideration of exceptionally high concentrations of airborne dust, externally accessible glass-fiber filters shall be provided.

2. Lifting eyes shall be removable. Sockets for lifting eyes shall be blind-tapped.
3. **Gasketing and Sealing**
   a. Door openings and openings for hinged bolted panels (and bolted panels providing access to low-voltage components) shall have resilient compression gasketing to prevent water from entering the enclosure.
   b. Gasket seals shall be provided at the top and side edges of adjoining bays to prevent water entry between the double walls.
   c. The top and both sides of bus openings between bays shall be covered with channel gaskets as an additional protection against entrance of water, or external labyrinthine metal rainshields shall be provided over enclosure roof flanges between adjacent bays.
   d. Roofs shall be weather-sealed in place with a suitable sealant.

4. **Space Heaters**
   a. Space heaters 120V AC with sheaths of high-temperature chrome steel shall be provided to maintain air circulation inside the enclosure.
   b. There shall be a space heater in each bay.
   c. Space heaters shall be wired to generator load center.
   d. A low-voltage circuit breaker shall be provided in the strip heater circuit.

### 2.7 METERING SECTION

A. Provide Metering Section with provisions for utility supplied PT’s and CT’s.

### 2.8 SUBSTATION PRIMARY FEEDERS SWITCHES

A. Primary feeder switches shall be non-fused, heavy duty, quick-make quick-break, 15 KV, 600 ampere, 3 pole, 95 KV BIL, with a minimum load interrupting rating of 600 amperes.

B. Each primary feeder switch shall have diamond mesh expanded metal inner door with an engraved plate reading - WARNING - OPEN SWITCH BLADES ARE ENERGIZED -.

C. Primary switch units shall each be provided with lugs inside enclosure for termination of 2/0 AWG or 350 KCMIL as necessary with outdoor type Class 1 terminations, 15 KV single conductor cable entering the compartment.

D. Incoming termination compartment shall be provided with lugs inside enclosure for termination of 2/0 AWG or 350 KCMIL as necessary with outdoor type Class 1 terminations, 15 KV single conductor cable entering the compartment.

### 2.9 SOURCE QUALITY CONTROL

A. Before shipment of equipment, perform the following tests and prepare test reports:
   1. Production tests on completed switchgear assembly according to IEEE C37.20.2.

B. Assemble switchgear and equipment in manufacturer's plant and perform the following:
1. Functional tests of all features and control devices.
2. Functional test of all trip mechanisms.

C. Prepare equipment for shipment.
   1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
   2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive switchgear for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Anchor switchgear assembly to 4-inch (100-mm), channel-iron sill embedded in concrete base and attach by bolting.
   1. Sills: Select to suit switchgear; level and grout flush into concrete base.
   2. Concrete Bases as indicated on drawings.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchgear units and components.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
   1. Provide engraved plastic-laminate signs, per Section 260553, “Identification for Electrical Systems”, located on the front of each component, indicating the lines of information as follows:
      a. Incoming line Section
         1) Designation (e.g., “Incoming line 1”).
         2) Incoming line electrical characteristics (e.g., 13.2kV, 3PH, 3W, grounded”).
      b. Feeder Section
         1) Designation (e.g., “ATS-EM”).
         2) Load served (e.g., “Load served: Substation A - LBS-1 ”).

B. Diagram and Instructions:
   1. Frame under clear acrylic plastic on front of switchgear.
3.4 CONNECTIONS

A. Cable terminations at switchgear are specified in Division 26 Section "Medium-Voltage Cables."

B. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Sections "Low-Voltage Electrical Power Conductors and Cables" and "Medium-Voltage Cables."

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
   1. Inspect switchgear, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
   2. Assist in field testing of equipment.

C. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

D. Perform the following field tests and inspections and prepare test reports:
   1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
a. Switchgear.
b. Source-Transfer Controls.
c. Instrument transformers.
d. Surge arresters.

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

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear.
SECTION 26 2200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes dry-type transformers rated 600 V and less, with capacities up to 1000 kVA.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Qualification Data: For testing agency.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

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

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

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

D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

E. Comply with NECA 409, “Standard for Installing and Maintaining Dry-Type Transformers.”

1.5 COORDINATION

A. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. General Electric Company.
   4. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.
   1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Transformer Enclosure Finish: Comply with NEMA 250.
   1. Finish Color: Gray.

E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

G. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with NEMA TP 1, Class 1 efficiency levels.
   2. Tested according to NEMA TP 2.

H. Wall Brackets: Manufacturer's standard brackets.

I. Fungus Proofing: Permanent fungicidal treatment for coil and core.

J. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

LOW-VOLTAGE TRANSFORMERS
2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each [distribution] [buck-boost] transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.
B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
   1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
C. Remove and replace units that do not pass tests or inspections and retest as specified above.
3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 2200
SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

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

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboard.

B. Handle and prepare panelboard for installation according to NECA 407 and NEMA PB 1.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
   5. Finishes:
      a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

B. Incoming Mains Location: Top.

C. Phase, Neutral, and Ground Buses:
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Same as phase buses.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
E. Panelboard Short-Circuit Current Rating: Fully rated with a minimum integrated rating of 10,000 amperes RMS symmetrical at 240 volts for 240V maximum panelboards, unless otherwise indicated.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As indicated.

D. Branch Overcurrent Protective Devices: Bolt-on thermal magnetic circuit breakers, replaceable without disturbing adjacent units.
   1. Multiple pole units enclosed in a single housing or approved handle-ties to operate as a single unit.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Same as panelboard manufacturer.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   2. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

B. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Mount top of trim 90 inches above finished floor unless otherwise indicated.
B. Mount panelboard cabinet plumb and rigid without distortion of box.

C. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Use a computer to create directory; handwritten directories are not acceptable. Panel directories shall be provided to the Owner at the project close out in as electronic file format, such as Microsoft Word or Excel. When circuits are added to an existing panel board, the directory shall be replaced in its entirety.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

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

END OF SECTION 26 2416
SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide wiring devices as specified and indicated.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

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

C. Comply with NFPA 70.

1.4 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers’ Names: Shortened versions (shown in parentheses) of the following manufacturers’ names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Heavy-duty Duplex Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following (The “X” in the following series numbers represents the amperage as specified):
      a. Bryant 5X62
      b. Cooper 5X62
      c. Hubbell HBL 5X62
      d. Leviton 5X62
      e. Pass & Seymour 5X62
2.3 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in “wet locations.”

2.4 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Electrical Reliability Upgrades: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Install devices surface mounted on wall, unless otherwise indicated.

C. Install devices and assemblies level, plumb, and square with building lines.

D. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

E. Device Installation:
   1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   3. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
   4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
   5. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
   6. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
   7. Tighten unused terminal screws on the device.
   8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

F. Device Orientation:
   1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."
   1. Wiring Devices (receptacles): Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Inspect each wiring device for defects.
   2. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. Using the test plug, verify that the device and its outlet box are securely mounted.
   5. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 2726
SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions and descriptions of individual components. Include the following for each fuse type indicated:
   1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   2. Current-limitation curves for fuses with current-limiting characteristics.
   3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
   4. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:
   1. Ambient temperature adjustment information.
   2. Current-limitation curves for fuses with current-limiting characteristics.
   3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
   4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

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

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.
1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.
2. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
1. Feeders: Class RK5, time delay.
2. Motor Branch Circuits: Class RK5, time delay.
3. Other Branch Circuits: Class RK5, time delay.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 2813
THIS SECTION APPLIES TO ELLIMAN CLINICAL RESEARCH BUILDING

SECTION 26 3213EL – DIESEL PACKAGED ENGINE GENERATORS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes packaged engine-generator set for emergency and standby power supply with the features as specified and indicated.

1.3 DEFINITIONS
A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SUBMITTALS
A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
   1. Thermal damage curve for generator.
   2. Time-current characteristic curves for generator protective device.
   3. EPA emission certificate for proposed generator(s) indicating manufactured size, family of engines, year of manufacture, and tier level.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
   2. Product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer and vibration isolators.
   3. Engine-generator set and foundation requirements.
   4. Auxiliary and remote equipment.

DIESEL ENGINE GENERATORS – ELLIMAN BUILDING 26 3213EL - 1
5. Make of engine, number of cylinders, compression ratio, bore and stroke, cylinder displacement, and speed.
6. Make of generator, electrical rating, number and type of bearings, and exciter type.
7. Installation instructions.
8. Name, location and phone number of nearest authorized distributor/service facility.
9. Sequence of Operation - Manufacturer shall prepare a detailed, typewritten sequence of operation and submit as part of the approval documents. Final approved sequence of operation shall be permanently encapsulated in plastic laminate and permanently attached to the equipment. Format shall be 8½" x 11" or 11" x 17" as appropriate. Include schematic one-line diagram with appropriate symbols and nomenclature properly referenced to text.
10. Nitrogen oxides (NOx) and Carbon monoxide (CO) in terms of pounds/MMbtu heat input.
11. Exhaust gas flow (cfm) and exhaust temperature at maximum capacity.

C. Qualification Data: For manufacturer.

D. Source quality-control test reports.
1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
1. Maintenance Proximity: Not more than 200 miles (321 km) from Installer's place of business to Project site.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
C. Testing Agency Qualifications: Refer to Electrical Specifications “Electrical Testing.”

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

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

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Submit certified performance test data for this or an exact duplicate prototype unit. Test shall include a full load test conducted at the specified ambient temperature for at least two (2) hours. The test shall be conducted with all components intended for this project including engine, generator fan and radiator. Single pass cooling systems shall NOT be used to replace the radiator for testing. Test shall include actual surge and steady state performance data for "0-to-50%", "0"-to-100%" and "50-to-100%" instantaneous load applications. Steady state performance shall be recorded at no greater than 15 minute intervals, application as well as 100% steady state performance. Test results shall include oil pressure, oil temperature, coolant temperature, fuel pressure, ambient temperature, load in kW, kVA, amperes and output voltage. Load characteristic shall be sinusoidal, 80% power factor and steady state performance testing shall also include at least two (2) hours at 100% rating, with load characteristic of 80% power factor and total harmonic distortion of 50%.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature: -20 to 104 deg F.
   2. Relative Humidity: 0 to 95 percent.
   3. Altitude: Sea level to 1000 feet (300 m).

1.7 COORDINATION

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

A. Special Warranty: Furnish full parts and labor warranty to cover the entire engine generator package including all accessories for two year from date of owner acceptance/start up.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: One for every 10 of each type and rating, but no less than one of each.
   2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
   3. Filters: Two sets each of lubricating oil, fuel, and combustion-air filters for each generator.
   4. Furnish one set of tools required for preventative maintenance of each engine generator system. Package tools in adequately sized metal tool box.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Caterpillar and Cummins.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Caterpillar; Engine Div.
   2. Kohler Co; Generator Division.
   4. Generac (Industrial)

2.2 GENERAL

A. Capacities and Characteristics:
   1. Power Output Ratings: Continuous electrical output power rating for standby operation of not less than KW as indicated, at 80 percent lagging power factor, 13,200 volts, three phase, 4-wire, 60 hertz. In addition, provide power required for generator accessories including battery charger and radiator.
   2. Provide alternator capable of accepting 5948KVA in a single step and capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set. In addition the alternator shall have a minimum of 5200kVA instantaneous lock rotor kVA with a maximum 30% instantaneous voltage dip.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

B. Generator-Set 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 bandwidth 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 bandwidth 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 bandwidth 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.

7. **Sustained Short-Circuit Current:** For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 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:** Comply with NFPA 110, Type 10, system requirements.

2.3 **ENGINE-GENERATOR SET**

A. **Furnish and install new diesel engine driven electric generating unit, factory assembled single unit generator set, with continuous output ratings as shown on the drawings at 0.8 power factor, 60 hertz, grounded neutral service, fully rated for operation at 1000 feet above sea level in an ambient temperature range of 104 deg. F. maximum to -20 deg.F. minimum, consisting of an engine, electric jacket heater, direct-connected generator, exciter, radiator and fan cooling system, exhaust system with muffler and weather cap, automatic battery starting equipment, battery rack with heater, batteries and charger, instrument panel, control panel, instruments and controls, all mounted on a common steel base suitable for mounting on a concrete foundation pad, remote mounted derangement panel and all accessories as specified and required for normal operation in standby service.

B. **Manual and Automatic Start - Unattended Operation**

1. Manual start shall be done by operating the “start” button on the generator or selecting “manual” on the manual-off-automatic selector switch on the automatic transfer switch.

2. Automatic start shall be done by the automatic transfer switch when the manual-off-automatic selector switch on the automatic transfer switch is in the “automatic” position.

C. **Voltage and frequency regulation**

1. **Engine/generator shall deliver rated output (kVA) at rated frequency and power factor, at not more than 2% above or below rated voltage.**

2. **Voltage regulation shall be plus or minus 2% for any constant load between no load and rated load. Random voltage variation shall not exceed .5% for any constant load. Voltage recovery to 100% normal output shall take no longer than two seconds after single step application of 100% rated load.**
3. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

4. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

D. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic.

E. Furnish all necessary electrical connections, transfer switch, control panel, relays, etc., for installation of new generator set.

F. Generator and engine shall be mounted on vibration isolating supports capable of 95% isolation to minimize vibration of the remainder of the skid-mounted equipment and transmission of vibration to the supporting pad.

G. Generator shall be fully enclosed or suitably guarded to prevent exposure to all parts which operate at extremely high temperatures, electrically energized, or rotating. All noncurrent carrying parts shall be grounded.

H. Thoroughly clean all equipment, and prime and finish paint with manufacturer's standard paint finish.

I. Factory-assembled and -tested, engine-generator set.

J. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

2.4 ENGINE

A. Fuel: Diesel, Grade DF-2 – Low Sulfur

B. Engine shall be standby power rated, multi-cylinder, spark ignited four stroke cycle, liquid cooled, internal combustion engine for use with diesel fuel, industrial type, designed for full rated power output at 1800 rpm, 60 hertz. Aspiration may include turbocharger with after-cooler system. Block and head shall be cast-iron with replaceable cylinder liners.

C. Governor shall be electronic isochronous type no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Random frequency variation shall not exceed ±0.25% of its mean value for constant loads from no load to full load. Governor shall be provided with means for manual operation and adjustment.
D. Lubrication system.
   1. Full pressure type with engine driven positive displacement sump pump.
   2. Full flow strainer.
   3. Full flow filter.
   4. Pressure relief and automatic bypass valves.
   5. Crankcase ventilator with filter and connection for outside venting.
   6. Drain connection.
   7. Oil cooler.
   8. Low oil pressure safety shutoff device.
   9. Provide water shutoff valves and drain on the oil cooler to facilitate draining water without draining the complete engine cooling system.
  10. Provide a radiator coolant level sight glass.

E. Cooling System
   1. Pressure type, with radiator, blower type fan.
   2. Engine driven circulating pump.
   3. Radiator cap incorporating a pressure-vacuum valve.
   4. Thermostat in conjunction with a radiator bypass.
   5. Drain connection.
   6. High coolant temperature safety device.
   7. Fan shall be sized to maintain safe engine temperature in ambient temperature of 104 degrees F.
   8. Provide gaskets and packing in the cooling system which are unaffected by ethylene glycol base coolant.
   9. Provide a 50% ethylene glycol antifreeze solution for the coolant.
  10. Radiator and Air Intake/Discharge System Flow Restriction requirement shall be no less than 0.5 inches of water.

F. Provide thermal circulation type engine jacket water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F.

G. Air intake system shall be complete with a dry type filter, and high frequency filter-type silencer for reducing the sound level at the intake to a point acceptable for residential use.

H. Engine exhaust system shall be complete silencer mounted inside the generator enclosure. Critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for orientation, sized in accordance with engine manufacturer's instructions.

I. Standard SAE nuts, bolts, and studs.

J. Standard NPT or SAE tubing and fittings.

2.5 ELECTRIC STARTING SYSTEM

A. Engine starting system shall be a 24 volt DC system depending on size of engine/generator, consisting of a heavy duty electric cranking motor(s) with drive mechanism, heavy duty
batteries with metal frame or box, engine driven alternator, battery charger, and transistorized voltage regulator.

B. Cranking motor shall be capable of starting the engine five times in rapid succession without overheating the motor and at sufficient speed for starting in ambient temperatures as low as -10 deg.F.

C. Storage batteries shall be lead acid type of voltage and capacity as determined by the engine manufacturer, with sufficient capacity to start the generator set five times consecutively in rapid succession.

D. Engine governor shall be a electronic, adjustable, isochronous type designed to maintain a constant engine speed from no load to full load. The frequency at any constant load, including no load, shall remain within a steady state bandwidth of plus or minus 0.25% of rated frequency. The governor shall not permit frequency modulation to exceed one cycle per second.

2.6 ENGINE-GENERATOR CONTROL PANEL

A. Control panel shall be engine generator frame mounted in NEMA 1 enclosure, totally front accessible. Control panel shall be completely factory pre-wired. All external connections shall be wired out to terminal blocks for field wiring. Control panel shall be complete with all engine and generator controls and indicators. Include front hinged double doors with latches and provision for padlock.

B. Control panel shall include the following fully identified by means of permanent nameplates:

1. Control
   a. Output voltage adjustment.
   b. Cranking limiter relay.
   c. Overspeed shutdown.
   d. Low oil pressure shutdown.
   e. High coolant temperature shutdown.
   f. Remote Alarm Contacts: Pre-wired SPST contacts to terminal strip for remote indication of all alarm functions.
   g. Battery operated service light to illuminate panel during power outage conditions.

2. Visual monitoring
   a. Frequency Meter: 45-65 Hz range, 3½ inch (89 mm) dial.
   b. AC Output Voltmeter: 3½ inch dial, 2 percent accuracy, with phase selector switch (phase-to-phase and phase-to-ground).
   c. AC Output Ammeter: 3½ inch dial, 2 percent accuracy, with phase selector switch and 3 current transformers.
   d. Push-to-test indicator lamps, one for each:
      1) Engine run
      2) Low oil pressure
      3) High water temperature
      4) Overspeed and overcrank
5) Overspeed shutdown
6) Failure to crank
7) Failure to establish voltage or frequency
8) Failure to reach rated voltage at transfer switch in ten seconds

   e. Engine running time meter.
   f. Electrical oil pressure gauge.
   g. Electrical water temperature gauge.
   h. Mechanical fuel pressure gauge.
   i. DC voltmeter and ammeter.

3. Audible monitoring
   a. Low oil pressure alarm condition.
   b. High coolant temperature alarm.
   c. Failure to crank.
   d. Failure to establish voltage or frequency.
   e. Failure to reach rated voltage at transfer switch in 10 seconds.

C. Battery charging system including alternator and solid state regulator.

D. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems.

E. Remote Alarm Annunciator: Comply with NFPA 99. An LED 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.

F. Generator control must have 12 dry contacts.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:

1. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.

2. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is in excess of 110% of rated current for more than 10 seconds.
3. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.

4. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.

5. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.

6. The protective system provided shall not include an instantaneous trip function.


C. Generator shall be provided with M51 relay and CT’s to coordinate with downstream medium voltage circuit breaker. CT’s provided to match medium voltage circuit breaker manufacturer.

D. Remote Emergency-Stop Switch: Weatherproof Surface mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.8 GENERATOR

A. Generator shall be alternating current, three phase, four pole, brushless revolving field synchronous type with brushless exciter directly connected to the generator field windings without slip rings or commutators.

B. Generator shall have a single prelubricated sealed bearing, direct connected to the engine, and air cooled by a direct drive centrifugal blower fan.

C. Insulation shall be Class H in a self-ventilated enclosure. Temperature rise shall be 105 deg C. max over ANSI 40 deg C. ambient for standby service without derating.

D. Bring out all leads from each winding to a generator main lead terminal box adequate in size for making up all connections and grounding the neutral to the generator set supporting frame.

E. Voltage regulation shall include 3 phase sensing, generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics. Include manual controls to adjust voltage output plus or minus 5% of nominal voltage level.

F. The generator shall have the necessary excitation control circuitry to prevent the loss of excitation on fault conditions allowing quick return to full voltage and power to normal and faulted circuits.

G. Furnish NEMA 1 output terminal and outgoing cable termination compartment integral with the engine-generator frame.
2.9 VOLTAGE REGULATION

A. Rotating/Dynamic type, three phase, mounted either on the generator control panel or combined with the exciter. Voltage shall have “manual-automatic” switch and be adjustable +/- 10% under all operating conditions.

2.10 ENCLOSURE

A. Outdoor Sound Attenuated Weather Protective Enclosure

B. The complete diesel engine generator set, including generator control panel, engine starting batteries, internally mounted muffler shall be enclosed in a sound attenuated enclosure, with the following features:
   1. 78 dba @ 23' (free field)
   2. Enclosure shall be Drop Over/Walk-In Style Modular Panel construction
   3. Enclosure shall have air intake and discharge plenums required to meet sound level
   4. Enclosure Roof Shall Be Modular Construction & have removable sections
   5. Enclosure Roof Designed for 200LBS SQ./FT. Loads
   7. Enclosure C-Channel Base Frame shall be 6”H Welded 7GA Steel Construction W/ Lifting Eyes
   8. Panel construction shall be 14GA 3” Galvanic (Minimum)
   9. 3” 6LB CU./FT. UL listed Rockwool acoustic / thermal insulation (Fire Resistant)
   10. 22GA Galvanized perforated interior liner
   11. Enclosure hardware shall be Zinc Plated or Stainless Steel
   12. (8) - Enclosure Access Doors W/ Key / Pad Locking Handles.
   13. Provide heavy duty HASP for owner provided padlock.
   14. (1) - Remote Mounted Control Panel Access Door W/ Window & Key / Pad Locking Handle
   15. Enclosure doors shall have interior Push Bar release handles for Walk-In Style Enclosure
   16. Enclosure door hinges shall be stainless steel & powder coated black
   17. Enclosure door hold backs shall be polished stainless steel W/ spring loaded returns
   18. Enclosure doorways shall have anti slip thresholds
   19. Exterior Aluminum Fixed Air Intake W/ Screen
   20. Interior 120V Motorized Air Intake louvers (Power Close / Spring Open) Wired to load center
   21. Exterior Aluminum Gravity Radiator Discharge louvers W/ Vertical Air Discharge Plenum
   22. Enclosure shall have (1) 100A, 120/208V, 3-phase, 4-wire, 24-circuit Load Center, with 100A main breaker, and 1P-20A, 2P-20A, and 2P-30A branch breakers, as required.
   23. Generator Block Heater & Battery Charger shall be wired to the load center
   24. (4) AC LED lighting fixtures & (2) Three way light switches wired to the load center (Located inside doorways)
25. (2) GFCI Receptacles wired to the load center (Located inside doorways)
26. 5KW Enclosure Space Heater W/ adjustable thermostat wired to the load center
27. Plumb Oil & Coolant drains to exterior of enclosure & provide internal ball valves for each
28. Extend Crankcase Breather Tubes into Radiator Discharge Plenum
29. Provide access platforms at service doors.
30. Extend exhaust piping above enclosure pointing west as indicated on drawings.

C. Enclosure Powder Coat Process:
   1. Run panels through 8 Stage wash line. Process removes laser scale then does an Alkaline Wash & Rinse then a NANO technology Phosphate free coating is applied for increased Powder adhesion.
   2. After wash parts shall be ran through dehydration over at 335 degrees
   3. After dehydration parts shall be run through dual action powder paint booth & sprayed with TGIC Ultra Durable Powder
   4. Parts shall be run through Curing Oven at 400-420 degrees for 25 Min.
   5. 2.5-3.5 Mil of powder on each panel
   6. 1200 Salt Spray Hours

D. Sub-base Fuel Supply Tank
   1. General: The fuel storage tank shall be a sub-base double wall type designed for installation as an operational foundation for the generator specified herein. The tank must be secondary containment double wall construction and listed EVFT under UL 142. Tank construction must be a true double wall construction whereas the secondary containment fully encloses the primary tank. Construction without a double top sheet will not be acceptable.

   2. Include additional requirements of local authority having jurisdiction for installations of this type. It shall be the responsibility of the installing contractor to apply for and obtain necessary permits. Contractor shall submit final approved shop drawing of generator and remote fill station to the MDEQ for plan review and permit application. Contractor shall contact MDEQ for all inspections as required by MDEQ and submit final MDEQ certificate to the owner and engineer. Include in bid price cost associated for MDEQ permit and inspections

   3. Sub base shall be marked with 3” tall letters per Michigan DEQ guidelines. Fuel piping including flexible line must be steel or fire rated with a UL listing.

   4. Capacity: The fuel storage tank shall have minimum useable capacity for 24 hours of continuous operation of the engine-generator at 100% rated capacity without refueling or minimum capacity of 3500 gallons, whichever is greater.

   5. Construction: The primary tank shall be of minimum 7 gauge type A36 welded construction with internal baffles. The fuel supply and return ports must have separation
baffle to insure there will be no recirculation of heated retuned fuel. Secondary containment basin is to be constructed of minimum 7 gauge outer rails, ends and bottom. The top plate will be minimum ¼” steel plate and capable of supporting up to 80,000 lbs. without additional support structure spanning from outer rail to outer rail. Basin top shall be void of visual structure as tank top serves a walking and mounting surface inside the enclosure without trip hazard. The outer rails must include 3/8” plate 4-point lifting provisions rated for 60,000lbs total lift or ¾” plate four point lifting provisions rated for 100,000lb total lift. The lift plates shall be UL listed.

6. Conduit entry: Include provisions for bottom entry conduits from the concrete mounting pad. The conduit entry location should allow direct access to the generator set’s output breaker(s). The tank manufacturer must provide a concrete pad layout drawing detailing the location of the conduit entry and overall size requirements. Include an access cover through the outer rail or end to perform connections. The access shall be supplied with a removable cover held in place with stainless steel fasteners. Tanks with type D stub areas requiring the fuel tank to totally surround the stub area will be exempt from this requirement.

7. Normal and Emergency Venting: Normal vent pipe shall be a minimum 2” pipe with approved screened cap. Vent outlet shall be located such that vapors are released at a safe point approved by the authority having jurisdiction. Include emergency vents on the primary tank and secondary double wall tank. The emergency vents are to be sized per UL 142 table 8.1 relative to the tanks wetted surface area. Include sealed emergency vent devices with flow ratings equal to the wetted surface area requirements. Normal vent shall be extended a minimum of 12’ above grade or 2’ above enclosure roof line, whichever is greater.

8. Fittings and Connections: All tank fittings are to be threaded NPT steel fittings welded to the primary tank and pass through the basin top without compromise to the tank or basin integrity. Include at a minimum: 2” supply with bushing and appropriately sized bottom siphon tube, 2” return with bushing and appropriately sized bottom siphon tube, 2” with Rochester magnetic dial level gauge, 2” normal vent, 2” with low level dry contact float switch set to actuate at 30% capacity remaining, 2” in the containment basin with dry contact float switch at the lowest point to actuate in the presence of any liquid and two 2” spare ports.

9. Remote Filling Station: A surface mount fill spill container having a capacity of not less than 5 gallons (18.9 L) shall be provided for each fill connection. Spill containers shall be noncombustible and equipped with a means to drain spillage. Provide a means to secure the fill against vandalism with a locking handle mounted in access door.

10. Fuel Status Alarm: Provide an alarm panel located in filling station. The panel is to include four pilot lights for leak alarm, low fuel, 90% capacity and 95% capacity with audible alarm and silence switch. The panel shall also include a momentary test button to test all functions. Panel construction to be rated NEMA 3R.
11. Overfill Prevention Valve: Provide a mechanically operated overfill prevention valve set to shutoff fuel delivery at 95% of total tank capacity. Valve shall have a maximum flow rate of 125 GPM at 100 PSI.

12. Provide interface/integration with Siemens Building Management System to monitor alarms, status, fuel tank for 50% and 80% fuel level, and analog fuel tank gauge.

13. A 50% and 80% fuel level intrinsically safe circuitry is to be provided and installed by generator manufacture. Siemens is responsible to connect into the protected side of circuit for dry contacts only.

2.11 VIBRATION ISOLATION DEVICES

A. Provide type as recommended by generator manufacture.

2.12 FINISHES

A. Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.13 SOURCE QUALITY CONTROL

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

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Full load run.
   3. Maximum power.
   4. Voltage regulation.
   5. Transient and steady-state governing.
   7. Safety shutdown.
   8. Report factory test results within 10 days of completion of test.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

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

3.2 INSTALLATION

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

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

C. Install packaged engine generator with vibration isolation devices as specified having a minimum deflection of 1 inch (25 mm) on 4-inch-(100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section “Hangers and Supports for Electrical Systems.”

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Piping shall be same diameter as muffler outlet.
   1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

B. Connect engine exhaust pipe to engine with flexible connector.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Furnish, as part of the base scope of work, a factory authorized field service engineer to inspect the equipment for proper installation and proper functioning, to direct (and/or perform) all electrical and mechanical adjustments which may be required, to supervise (and/or participate in) all testing and to certify that the installation and equipment is in accordance with Manufacturer's requirements, ready for energization and for being placed in operation.

B. The equipment shall be operated through all design functions. This shall include all remote control operation, actuation of all alarm and indication devices, mechanical and electrical operation from protective devices. In addition perform all specific inspections and tests as recommended by the manufacturer.

C. The engineering field service shall include, but not be limited to, the following:
   1. Examine for evidence of shipping, storage, and handling damage. Identify parts damaged and reorder as required. Expedite equipment as appropriate.
   2. Determine that shipping devices and tags have been removed. Direct the removal of such straps, blocks, braces that remain.
   3. Examine all interior wiring, breakers, fuses, etc., for any damage.
   4. Examine insulation and assembly of phase bus, ground bus, control, sensors, relaying and metering connections. Identify and direct all necessary changes.
   5. Check all accessible connections to manufacturer's tightening torque specifications.
   6. Verify phasing.
   7. Check circuitry for electrical continuity.
   8. Test for circuit integrity with a megohm meter.
   9. Check electrically operable devices by operating several times.
  10. Check that primary and control connections are made. Determine that control voltages are consistent with equipment furnished.
  11. Visually inspect main bus between the generator terminals and the outgoing feeder. Direct the disconnecting of the generator and check the bus with a megohm meter if conditions dictate. Values shall be in accordance with the manufacturer's recommendations.
  12. Megger insulation resistance levels phase-to-phase and phase-to-ground. Values shall be in accordance with the manufacturer's recommendations but no less than 6 megohms on 2500V megohm-meter.
  13. Verify that the equipment is clean and free of debris.
14. Assure that the equipment is level, properly secured to the floor, physically connected to the grounding system, and that doors swing properly and can be readily secured closed. Direct any adjustments or additional work required.
15. Review the field assembly work and, to the extent possible, determine that the work was completed in accordance with the manufacturer's instructions and drawings.
16. Test temperature relays, gages, switches, alarms, safety shut-down systems, and local and remote control meters and indicating lights for proper installation and operation.
17. Check operation of auxiliaries, interlocks, etc. Check contact wipe, gaps and clearances as described in the Manufacturer's instruction book.
18. Verify proper operation of starting battery and charger system.
19. Set governor, voltage regulator, etc. and verify proper operation under all load conditions.
20. Assist in energization.

D. Tests and Inspections:
1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
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 under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

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

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

G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

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

J. Remove and replace malfunctioning units and retest and reinspect as specified above.

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

L. 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.

M. Load Bank Test
   1. Furnish a continuous on site four (4) hour 100% full load "Load Bank" test.
   2. Generator supplier is to provide medium voltage transformer and/or medium voltage load banks for onsite testing.
   3. Test to be conducted during normal business hours, 0830 to 1700, Monday through Friday. WSU to be given 72 hour notice not including weekends. Test shall be witnessed by WSU or owner’s representative.

N. Adjusting and Cleaning
   1. Adjust operating mechanisms for free mechanical movement.
   2. Touch-up scratched or marred surfaces to match original finishes.
   3. Remove debris, tools, and foreign material from enclosures.

O. Inspection
   1. Manufacturer must examine areas and conditions under which the engine-generator and components are to be installed, and notify the Engineer and Owner's Representatives in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Engineer and Owner's Representative.

P. Generator Start-Up, Transfer, and Run
   1. Verify the proper functioning of all indicating devices.
   2. Verify proper phasing, proper frequency and isochronous operation no-load to full-load.

Q. A checklist with this information shall be prepared by the manufacturer and three copies signed and dated by the manufacturer's engineer verifying proper installation, energization, and operation of the equipment shall be submitted to the Owner’s Representative.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.
1. Provide minimum 16 hours demonstration, excluding travel time.

3.7 SERVICE AGREEMENT

A. The supplier shall include in the base price, a two-year service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine-generator set and the transfer switch(es). The work shall be performed annually and shall consist of a minimum of four hours on site. A representative of the Owner shall accompany the technician. This agreement shall include the following:

1. Generator supplier must have an in-house rental fleet with equipment sized to back up this project site.
2. All engine maintenance as recommended by the service manual.
3. All electrical controls maintenance and calibrations as recommended by the manufacturer.
4. All auxiliary equipment as a part of the emergency systems.
5. The supplier shall guarantee emergency service.
6. All expendable maintenance items are to be included in this agreement.
7. A copy of this agreement and a schedule shall be given to the Owner at the time of his acceptance, showing what work is to be accomplished and when.

END OF SECTION 26 3213EL
THIS SECTION APPLIES TO SHAPERO HALL

SECTION 26 3213SH – NATURAL GAS PACKAGED ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY
   A. This Section includes packaged engine-generator sets for emergency power supply with the features as specified and indicated.
   B. Related Sections include the following:
      1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS
   A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
   B. Natural Gas EPA SI NSPS Compliant Capable

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
      1. Thermal damage curve for generator.
      2. EPA emission certificate for proposed generator(s) indicating manufactured size, family of engines, year of manufacture, and tier level.
   B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Nitrogen oxides (NOx) and Carbon monoxide (CO) in terms of pounds/MMbtu heat input.
4. Exhaust gas flow (cfm) and exhaust temperature at maximum capacity.

C. Compliance Statement
1. Submit a document which states whether the proposed product(s) either comply or deviate from the Specification requirements. This includes all Part 1, Part 2, and Part 3 specification items. Specification requirements not noted as deviations will be assumed as complying.
2. Provide the statement in an itemized, columnar format as follows:
   Column 1 – Reference to the specification item, organized in the same sequential order as in the Specification.
   Column 2 – Explanation for noted deviations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Source quality-control test reports.
   1. Certified summary of prototype-unit test report.
   2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
   4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
   6. Report of exhaust emissions showing compliance with applicable regulations.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Include the following:
   1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.8 QUALITY ASSURANCE

A. Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

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

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

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

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level 2 emergency power supply system.

K. Engine Exhaust Emissions: Comply with applicable state and local government requirements. Engine to be EPS SI NSPS certified or compliant capable (site validation test required)
L. Noise Emission: maximum noise level of 69dB measured at 23 feet from engine-generator.

1.9 PROJECT CONDITIONS

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 seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

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

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m)

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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: two (2) years from date of Start-up/Owners Acceptance

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Caterpillar; Engine Div.
2. Onan/Cummins Power Generation
3. Kohler
2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:
   1. Power Output Ratings: Continuous electrical output power rating for standby operation of not less than 60 kW, at 80 percent lagging power factor, 277/480, three phase, 4-wire, 60 hertz. In addition, provide power required for generator accessories including battery charger and radiator.
   2. Alternator shall be capable of accepting maximum 272KVA in a single step and be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set. In addition the alternator shall have a minimum of 250kVA instantaneous lock rotor kVA with a maximum 30% instantaneous voltage dip.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set 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.
   7. Sustained Short-Circuit Current: For a 3-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: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: Natural gas

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines

D. Lubrication System: The following items are mounted on engine or skid:

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.

E. Engine Fuel System:

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

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Sizing recommended by manufacture. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

1. Suitable for operation on 120-volt, single phase, 60 hertz power.

G. Governor: Adjustable isochronous, with speed sensing, capable of maintaining frequency within 0.2 Hz of nominal.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set 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.

   a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements or noise requirements. Exhaust must be mounted inside sound attenuated housing.


K. Starting System: 12-V electric, with negative ground.
   1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" 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 adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
   5. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
   6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Include accessories required to support and fasten batteries in place.
   8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. 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 deg C to plus 60 deg C to prevent overheating 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.
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.

2.4 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 generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

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

C. 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 generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Indicating and Protective Devices and Controls:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
9. Generator-voltage adjusting rheostat.
10. Start-stop switch.
11. Over-speed shutdown device.
12. Coolant high-temperature shutdown device.
13. Coolant low-level shutdown device.
14. Oil low-pressure shutdown device.
15. Generator overload.
E. 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.

F. Remote Alarm Annunciator: Comply with NFPA 99. An LED 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 mounting type as indicated.

G. Provide interface/integration with Siemens Building Management System to monitor alarms, status, and battery/charger.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker as indicated on drawings: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.6 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 105C without derating

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

E. 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.

F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
   1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

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

K. Subtransient Reactance: 11 percent, maximum.

2.7 OUTDOOR SOUND ATTENUATED GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, Sound Attenuated housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments, control and battery system shall be mounted within enclosure.
   1. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
   3. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
   4. Locate muffler inside housing
   5. 78dba Measured at 23 feet or 7 Meters (free field)

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2.8 FINISHES

A. Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.9 SOURCE QUALITY CONTROL

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


B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
7. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

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

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

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

C. Install packaged engine generator with vibration isolation devices.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Piping shall be same diameter as muffler outlet.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

B. Connect fuel piping to engines with a gate valve and union and flexible connector.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing. A Knowledgeable Generator Manufactures representative must be present at time of start-up to accomplish a two party commissioning test on the following items to meet the sequence of operations:

B. Demonstrate the physical Generator points indicating Run and Alarm.

C. Demonstrate a physical ATS change of state.
D. Perform tests and inspections and prepare test reports.

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

E. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

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.

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

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

H. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

I. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

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

K. Remove and replace malfunctioning units and retest and reinspect as specified above.
L. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

M. 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.

3.6 DEMONSTRATION

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

3.7 SERVICE AGREEMENT:

A. The supplier shall include in the base price, a two-year service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine-generator set and the transfer switch. The work shall be performed annually and shall consist of a minimum of four hours on site. A representative of the Owner shall accompany the technician. This agreement shall include the following:

B. Generator supplier must have an in-house rental fleet with equipment sized to back up this project site.

C. All engine maintenance as recommended by the service manual.

D. All electrical controls maintenance and calibrations as recommended by the manufacturer.

E. All auxiliary equipment as a part of the emergency systems.

F. The supplier shall guarantee emergency service.

G. All expendable maintenance items are to be included in this agreement.

H. A copy of this agreement and a schedule shall be given to the Owner at the time of his acceptance, showing what work is to be accomplished and when.

END OF SECTION 26 3213SH
26 3353 STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes three-phase, on-line, double-conversion, static-type, UPS installations complete with transient voltage surge suppression, input harmonics reduction, rectifier-charger, battery, battery disconnect device, inverter, static bypass transfer switch, internal maintenance bypass/isolation switch, external maintenance bypass/isolation switch, output isolation transformer, remote UPS monitoring provisions, battery monitoring, remote battery monitoring.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. LCD: Liquid-crystal display.

C. LED: Light-emitting diode.

D. THD: Total harmonic distortion.

E. UPS: Uninterruptible power supply.

1.3 SUBMITTALS

A. Product Data: Include data on features, components, ratings, and performance for each UPS component indicated.

B. Shop Drawings: Detail assemblies of equipment indicating dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.


C. Manufacturer Seismic Qualification Certification: Submit certification that UPS equipment will withstand seismic forces in Seismic Zone 1.

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

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

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

D. Qualification Data: For Installer, power quality specialist, manufacturer, and testing agency.

E. Manufacturer Certificates: For each product, signed by manufacturers.

F. Factory Test Reports: Comply with specified requirements.

G. Field Quality-Control and Performance Test Reports: Indicate test results compared with specified performance requirements, and provide justification and resolution of differences if values do not agree.

H. Operation and Maintenance Data: For UPS units to include in emergency, operation, and maintenance manuals. Include the following:

1. Lists of spare parts and replacement components recommended being stored at Project site for ready access.
2. Detailed operating instructions covering operation under both normal and abnormal conditions.

I. Warranties: Special warranties specified in this Section.

J. Training onsite – four hours minimum.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within southeastern Michigan, a service center capable of providing training, parts, and emergency maintenance repairs with four hours maximum response time.

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

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

D. Source Limitations: Obtain the UPS and associated components specified in this Section from a single manufacturer with responsibility for entire UPS installation.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
F. UL Compliance: Listed and labeled under UL 1778.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.

B. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

1.6 WARRANTY

A. Special Battery Warranties: Specified form in which manufacturer and Installer agree to repair or replace UPS system storage batteries that fail in materials or workmanship within specified warranty period.

1. Warranted Cycle Life for Valve-Regulated, Lead-Acid or Flooded Cell Batteries: Equal to or greater than that represented in manufacturer's published table, including figures corresponding to the following, based on annual average battery temperature of 77 deg F (25 deg C):

<table>
<thead>
<tr>
<th>Discharge Rate</th>
<th>Discharge Duration</th>
<th>Discharge End Voltage</th>
<th>Cycle Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 hours</td>
<td>8 hours</td>
<td>1.67</td>
<td>6 cycles</td>
</tr>
<tr>
<td>30 minutes</td>
<td>30 minutes</td>
<td>1.67</td>
<td>20 cycles</td>
</tr>
<tr>
<td>15 minutes</td>
<td>45 seconds</td>
<td>1.67</td>
<td>120 cycles</td>
</tr>
</tbody>
</table>

B. Special UPS Warranties: Specified form in which manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within special warranty period.

1. Special Warranty Period: Two years from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

1. Fuses: One set of spare fuses.
2. Cabinet Ventilation Filters: One complete set.

PART 2 – PRODUCTS

A. Provide UPS system with KVA and input and output voltage ratings as indicted on drawings.
2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Manufacturers: Toshiba International Corporation through Ancona Controls (Beth Ancona 248-672-8002) Voluntary alternate UPS manufacturer’s will not be accepted.

2.2 PERFORMANCE DESCRIPTION

A. Automatic operation includes the following:

   1. Normal Conditions: Supply the load with ac power flowing from the normal ac power input terminals, through the rectifier-charger and inverter, with the battery connected in parallel with the rectifier-charger output.
   2. Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, the battery supplies energy to maintain constant, regulated inverter ac power output to the load without switching or disturbance.
   3. If normal power fails, energy supplied by the battery through the inverter continues supply-regulated ac power to the load without switching or disturbance.
   4. When power is restored at the normal supply terminals of the system, controls automatically synchronize the inverter with the external source before transferring the load. The rectifier-charger then supplies power to the load through the inverter and simultaneously recharges the battery.
   5. If the battery becomes discharged and normal supply is available, the rectifier-charger charges the battery. On reaching full charge, the rectifier-charger automatically shifts to float-charge mode.
   6. If any element of the UPS system fails and power is available at the normal supply terminals of the system, the static bypass transfer switch switches the load to the normal ac supply circuit without disturbance or interruption.
   7. If a fault occurs in the system supplied by the UPS, and current flows in excess of the overload rating of the UPS system, the static bypass transfer switch operates to bypass the fault current to the normal ac supply circuit for fault clearing.
   8. When the fault has cleared, the static bypass transfer switch returns the load to the UPS system.
   9. If the battery is disconnected, the UPS continues to supply power to the load with no degradation of its regulation of voltage and frequency of the output bus.

B. Manual operation includes the following:

   1. Turning the inverter off causes the static bypass transfer switch to transfer the load directly to the normal ac supply circuit without disturbance or interruption.

C. Maintenance Bypass/Isolation Switch Operation: Switch is interlocked so it cannot be operated unless the static bypass transfer switch is in the bypass mode. Device provides manual selection between the following three conditions without interrupting supply to the load during switching:
1. Full Isolation: Load is supplied, bypassing the UPS. Normal UPS ac input circuit, static bypass transfer switch, and UPS load terminals are completely disconnected from external circuits.
2. Maintenance Bypass: Load is supplied, bypassing the UPS. UPS ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
3. Normal: Normal UPS ac supply terminals are energized and the load is supplied through either the static bypass transfer switch and the UPS rectifier-charger and inverter, or the battery and the inverter.

2.3 SERVICE CONDITIONS

A. Environmental Conditions: The UPS shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.

1. Ambient Temperature for Electronic Components: 32 to 104 deg F (0 to 40 deg C).
2. Ambient Temperature for Battery: 41 to 95 deg F (5 to 35 deg C).
3. Relative Humidity: 0 to 95 percent, noncondensing.
4. Altitude: Sea level to 1000 feet (300 m).

2.4 PERFORMANCE REQUIREMENTS

A. The UPS shall perform as specified in this Article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:

1. Inverter is switched to battery source.
2. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.
3. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
4. THD of input voltage is 15 percent or more with a minimum crest factor of 3.0, and the largest single harmonic component is a minimum of 5 percent of the fundamental value.
5. Load is 50 percent unbalanced continuously.

B. Minimum Duration of Supply: If battery is sole energy source supplying rated full UPS load current at 80 percent power factor, duration of supply is as follows:

1. Building with a generator: 15 minutes minimum
2. Building without a generator: 20 minutes minimum

C. Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 15 percent from nominal voltage.
D. Overall UPS Efficiency: Equal to or greater than 97 percent at 100 percent load, 95 percent at 75 percent load, and 88 percent at 50 percent load.

E. Maximum Acoustical Noise: 60db, "A" weighting, emanating from any UPS component under any condition of normal operation, measured 39 inches (990 mm) from nearest surface of component enclosure.

F. Maximum Energizing Inrush Current: Six times the full-load current.

G. Maximum AC Output-Voltage Regulation for Loads up to 50 Percent Unbalanced: Plus or minus 2 percent over the full range of battery voltage.

H. Output Frequency: 60 Hz, plus or minus 0.5 percent over the full range of input voltage, load, and battery voltage.

I. Limitation of harmonic distortion of input current to the UPS shall be as follows:
   1. Description: Either a tuned harmonic filter or an arrangement of rectifier-charger circuits shall limit THD to 5 percent, maximum, at rated full UPS load current, for power sources with X/R ratio between 2 and 30.

J. Maximum Harmonic Content of Output-Voltage Waveform: 5 percent RMS total and 3 percent RMS for any single harmonic, for 100 percent rated nonlinear load current with a load crest factor of 3.0.

K. Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, and 150 percent for 30 seconds in all operating modes.

L. Maximum Output-Voltage Transient Excursions from Rated Value: For the following instantaneous load changes, stated as percentages of rated full UPS load, voltage shall remain within stated percentages of rated value and recover to, and remain within, plus or minus 2 percent of that value within 100 ms:
   1. 50 Percent: Plus or minus 5 percent.
   2. 100 Percent: Plus or minus 5 percent.
   3. Loss of AC Input Power: Plus or minus 1 percent.
   4. Restoration of AC Input Power: Plus or minus 1 percent.

M. Input Power Factor: A minimum of 0.85 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current.


2.5 UPS SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Toshiba International Corporation.

B. Electronic Equipment: Solid-state devices using hermetically sealed, semiconductor elements. Devices include rectifier-charger, inverter, static bypass transfer switch, and system controls.

C. Enclosures: Comply with NEMA 250, Type 1, unless otherwise indicated.

D. Control Assemblies: Mount on modular plug-ins, readily accessible for maintenance.

E. Surge Suppression: Protect internal UPS components from surges that enter at each ac power input connection including main disconnect switch, static bypass transfer switch, and maintenance bypass/isolation switch. Protect rectifier-charger, inverter, controls, and output components.

1. Use factory-installed surge suppressors tested according to IEEE C62.41, Category B.

F. Maintainability Features: Mount rectifier-charger and inverter sections and the static bypass transfer switch on modular plug-ins, readily accessible for maintenance.

G. UPS Cabinet Ventilation: Redundant fans or blowers draw in ambient air near the bottom of cabinet and discharge it near the top rear.

H. Output Circuit Neutral Bus, Conductor, and Terminal Ampacity: Rated phase current times a multiple of 1.73, minimum.

2.6 RECTIFIER-CHARGER

A. Capacity: Adequate to supply the inverter during rated full output load conditions and simultaneously recharge the battery from fully discharged condition to 95 percent of full charge within 10 times the rated discharge time for duration of supply under battery power at full load.

B. Output Ripple: Limited by output filtration to less than 0.5 percent of rated current, peak to peak.

C. Rectifier-Charger Control Circuits: Immune to frequency variations within rated frequency ranges of normal and emergency power sources.

1. Response Time: Field adjustable for maximum compatibility with local generator-set power source.

D. Battery Float-Charging Conditions: Comply with battery manufacturer's written instructions for battery terminal voltage and charging current required for maximum battery life.

2.7 INVERTER

A. Description: Pulse-width modulated, with sinusoidal output. Include a bypass phase synchronization window adjustment to optimize compatibility with local engine-generator-set
2.8 STATIC BYPASS TRANSFER SWITCH

A. Description: Solid-state switching device providing uninterrupted transfer. A contactor or electrically operated circuit breaker automatically provides electrical isolation for the switch.

B. Switch Rating: Continuous duty at the rated full UPS load current, minimum.

2.9 BATTERY

A. Description: Valve-regulated, premium, heavy-duty, recombinant, lead-calcium units, factory assembled in an isolated compartment or in a separate matching cabinet, complete with battery disconnect switch.

1. Arrange for drawout removal of battery assembly from cabinet, when used, for testing and inspecting.

B. Description: Flooded, lead-calcium, heavy-duty industrial units in styrene acrylonitrile or polypropylene containers mounted on, maximum three-tier, acid-resistant, painted steel racks with doors. Assembly includes battery disconnect switch, intercell connectors, hydrometer syringe, and thermometer with specific gravity-correction scales.

1. Suggested Manufacturers:
   b. EnerSys, Inc.
   c. HOPPECKE.
   d. Mitsubishi Electric Automation, Inc.
   e. Powerware; an Invensys Company.
   f. SAFT.
   g. Trojan
   h. DEKA

C. Seismic-Restraint Design: Battery racks, cabinets, assemblies, subassemblies, and components (and fastenings and supports, mounting, and anchorage devices for them), shall be designed and fabricated to withstand static and seismic forces.

2.10 CONTROLS AND INDICATIONS

A. Description: Group displays, indications, and basic system controls on a common control panel on front of UPS enclosure.

B. Minimum displays, indicating devices, and controls include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms include audible signals and visual displays.

C. Indications: Plain-language messages on a digital LCD or LED.

1. Quantitative indications shall include the following:
a. Input voltage, each phase, line to line.
b. Input current, each phase, line to line.
c. Bypass input voltage, each phase, line to line.
d. Bypass input frequency.
e. System output voltage, each phase, line to line.
f. System output current, each phase.
g. System output frequency.
h. DC bus voltage.
i. Battery current and direction (charge/discharge).
j. Elapsed time discharging battery.

2. Basic status condition indications shall include the following:

a. Normal operation.
b. Load-on bypass.
c. Load-on battery.
d. Inverter off.
e. Alarm condition.

3. Alarm indications shall include the following:

a. Bypass ac input overvoltage or undervoltage.
b. Bypass ac input overfrequency or underfrequency.
c. Bypass ac input and inverter out of synchronization.
d. Bypass ac input wrong-phase rotation.
e. Bypass ac input single-phase condition.
f. Bypass ac input filter fuse blown.
g. Internal frequency standard in use.
h. Battery system alarm.
i. Control power failure.
j. Fan failure.
k. UPS overload.
l. Battery-charging control faulty.
m. Input overvoltage or undervoltage.
n. Input transformer overtemperature.
o. Input circuit breaker tripped.
p. Input wrong-phase rotation.
q. Input single-phase condition.
r. Approaching end of battery operation.
s. Battery undervoltage shutdown.
t. Maximum battery voltage.
u. Inverter fuse blown.
v. Inverter transformer overtemperature.
w. Inverter overtemperature.
x. Static bypass transfer switch overtemperature.
y. Inverter power supply fault.
z. Inverter transistors out of saturation.
aa. Identification of faulty inverter section/leg.
4. Controls shall include the following:
   a. Inverter on-off.
   b. UPS start.
   c. Battery test.
   d. Alarm silence/reset.
   e. Output-voltage adjustment.

D. Dry-form "C" contacts shall be available for remote indication minimum of the following conditions:
   1. UPS on battery.
   2. UPS in alarm condition.

E. Emergency Power Off Switch: Capable of local operation and operation by means of activation by external dry contacts.

2.11 MAINTENANCE BYPASS/ISOLATION SWITCH

A. Description: Manually operated switch or arrangement of switching devices with mechanically actuated contact mechanism arranged to route the flow of power to the load around the rectifier-charger, inverter, and static bypass transfer switch.
   1. Switch shall be electrically and mechanically interlocked to prevent interrupting power to the load when switching to bypass mode.
   2. Switch shall electrically isolate other UPS components to permit safe servicing.

B. Comply with NEMA PB 2 and UL 891.

C. Switch Rating: Continuous duty at rated full UPS load current.

D. Mounting Provisions: Internal to system cabinet, Separate wall- or floor-mounted unit.

E. Key interlock requires unlocking maintenance bypass/isolation switch before switching from normal position with key that is released only when the UPS is bypassed by the static bypass transfer switch. Lock is designed specifically for mechanical and electrical component interlocking.

2.12 OUTPUT ISOLATION TRANSFORMER

A. Description: Shielded unit with low forward transfer impedance up to 3 kHz, minimum. Include the following features:
1. Comply with applicable portions of UL 1561, including requirements for nonlinear load current-handling capability for a K-factor of approximately 13.
2. Output Impedance at Fundamental Frequency: Between 3 and 4 percent.
3. Regulation: 5 percent, maximum, at rated nonlinear load current.
4. Full-Load Efficiency at Rated Nonlinear Load Current: 96 percent, minimum.
5. Electrostatic Shielding of Windings: Independent for each winding.
7. Shield Grounding Terminal: Separately mounted; labeled "Shield Ground."
8. Capacitive Coupling between Primary and Secondary: 33 picofarads, maximum, over a frequency range of 20 Hz to 1 MHz.

2.13 OUTPUT DISTRIBUTION SECTION

A. Panelboards: None, single output breaker.

2.14 MONITORING BY REMOTE STATUS AND ALARM PANEL

A. Description: Labeled LEDs on panel faceplate indicate manufacturer’s standard basic status conditions.

1. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.

2.15 MONITORING BY REMOTE COMPUTER

A. Description: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in "Controls and Indications" Article. The remote computer and the connecting signal wiring are not included in this Section. Include the following features:

1. Connectors and network interface units or modems for data transmission via RS-232 link. Supply necessary hardware for BACnet or Modbus integration into Building Management System.
2. Software designed for control and monitoring of UPS functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of meaningful reports. Permit storage and analysis of power-line transient records. Design for windows applications using a personal computer, which is not included in this Section.

2.16 BASIC BATTERY MONITORING

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

1. Albercorp; Hawker Siddeley.
2. BTECH Inc.
3. MetriXX USA, Inc.
4. Powerware; an Invensys Company.
B. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.

C. Battery compartment smoke/high-temperature detector initiates an alarm when smoke or a temperature greater than 75 deg C occurs within the compartment.

D. Annunciation of Alarms: At UPS control panel.

2.17 QUALITY CONTROL

A. Factory test complete and full UPS system before shipment.
   1. Test and demonstration of all functions, controls, indicators, sensors, and protective devices.
   2. Full-load test for full duration.
   4. Overload test.
   5. Power failure test.

B. Observation of Test: Give 14 days' advance notice of tests and provide opportunity for Owner's representative to observe tests at Owner's option.

C. Report test results. Include the following data:
   1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
   2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
   3. List of instruments and equipment used in factory tests.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install UPS system per N.E.C.A. 411-2006.

3.2 IDENTIFICATION

A. Identify each battery cell individually.

3.3 BATTERY EQUALIZATION

A. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

3.4 FIELD QUALITY CONTROL
A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation including connections, and to assist in field testing. Report results in writing.

B. Electrical Tests and Inspections: Perform tests and inspections:

1. Load the system using a variable-load bank to simulate kilovolt amperes, kilowatts, and power factor of loads for unit's rating. Use instruments calibrated, within the previous six months according to NIST standards, Including:

   a. Simulate malfunctions to verify protective device operation.
   b. Test duration of supply on emergency, low-battery voltage shutdown, and transfers and restoration due to normal source failure.
   c. Test harmonic content of input and output current less than 25, 50, and 100 percent of rated loads.
   d. Test output voltage under specified transient-load conditions.
   e. Test efficiency at 50, 75, and 100 percent of rated loads.
   f. Test remote status and alarm panel functions.
   g. Test battery-monitoring system functions.

C. Retest: Correct deficiencies and retest until specified requirements are met.

3.5 DEMONSTRATION

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

END OF SECTION 26 3353
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and higher, including the following:

1. Automatic transfer switches service entrance rated.
2. Automatic transfer switches shall be closed transition.
3. Automatic transfer switches with integral bypass isolation switch.
4. Remote annunciation system.
5. Furnish and install closed transition transfer switches (CTTS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each CTTS shall consist of Medium voltage (5 kV through 15 kV) freestanding metal-clad switchgear with vacuum circuit breakers and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.
6. The CTTS shall transfer the load without interruption (closed transition) by momentarily connecting both sources of power only when both sources are present and acceptable. The maximum interconnection time is 100 milliseconds. The CTTS shall operate as a conventional break-before make (open transition) switch when the power source serving the load fails.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Wiring Diagrams: Single-line diagram. Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

C. Field quality-control test reports.
D. Operation and Maintenance Data: Submit under provision of Section “Electrical General Requirements”. For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.
3. Include instructions for operating equipment under emergency conditions.
4. Document ratings of equipment and each major component.
5. Include routine preventive maintenance and lubrication schedule.
6. List special tools, maintenance materials, and replacement parts.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Testing Agency Qualifications: Refer to specification section “Electrical Testing”.

C. Source Limitations: Obtain automatic transfer switches, bypass/isolation switches, non-automatic transfer switches, remote annunciators and control panels through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

F. UL 1008 - Standard for Automatic Transfer Switches, unless requirements of those specifications are stricter.

G. NFPA 70 - National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700, 701 and 702

H. NFPA 99 - Essential Electrical Systems for Health Care Facilities

I. NFPA 110 - Standard for Emergency and Standby Power Systems


L. NEMA Standard ICS2-447 - AC Automatic Transfer Switches

M. IEC - Standard for Automatic Transfer Switches

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of the transfer switch and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.6 EXTRA MATERIALS/ACCESSORIES

A. Submit one racking handle(s)* per Medium Voltage CTTS line-up. Charging handle to be furnished on each breaker mechanism. * Any additional racking handles shall be specified.

B. Provide one circuit breaker lifting device.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide Emerson; ASCO Power Technologies, LP or a comparable product by one of the following:

1. Contactor Transfer Switches:
   a. Emerson; ASCO Power Technologies, LP
   b. Caterpillar; Engine Div.
   c. Generac Power Systems, Inc.
   d. Kohler Co.; Generator Division.
   e. Cummins Power Generation.
   f. Eaton Corporation; Cutler-Hammer Products.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS
A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

Minimum WCR with Switch Rating   "any breaker" rating

<table>
<thead>
<tr>
<th>Current Range</th>
<th>Minimum WCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-200</td>
<td>10,000</td>
</tr>
<tr>
<td>260-400</td>
<td>35,000</td>
</tr>
<tr>
<td>600-800</td>
<td>50,000</td>
</tr>
<tr>
<td>1000-1200</td>
<td>65,000</td>
</tr>
<tr>
<td>1600-4000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

1. Provide fault-current and withstand ratings in accordance with UL 1008 standard's 1½ and 3 cycle long-time ratings. Transfer switches which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

2. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels have communication capability matched with remote device.

D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor operated mechanism, mechanically and electrically interlocked in both directions.

G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit breaker components are not acceptable.

2. Switch Action: Double throw; mechanically held in both directions.

3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

H. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
I. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

J. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.

1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

L. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCH

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.


D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

E. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:

1. Fully automatic make-before-break operation.
2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
   a. Initiation occurs without active control of generator.
   b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
4. Failure of power source serving load initiates automatic break-before-make transfer.

F. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference
between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

G. AUTOMATIC TRANSFER-SWITCH FEATURES

1. Under-voltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained under-voltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulates normal-source failure.

6. Switch-Position Pilot Lights: Indicate source to which load is connected.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32V dc minimum.

10. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine generator controls after retransfer of load to normal source.

11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
b. Push-button programming control with digital display of settings.
c. Integral battery operation of time switch when normal control power is not available.

13. Provide selective load disconnect control circuit (24 VDC output) to operate 0 to 5 minutes (field adjustable) before transfer of the automatic transfer switch and to reset 0 to 5 minutes (field adjustable) after transfer, in either direction. The two time delays shall be independently adjustable. This circuit shall be supplied on all transfer switches. For switches that feed elevator loads, provide double-pole/double-throw output relay for interface purposes that is driven by above control circuitry.

14. Transfer inhibit: Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.

2.4 BYPASS/ISOLATION SWITCH

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:

1. Means to lock the bypass/isolation switch in the position that isolates the transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.

2. Separate bypass and isolation handles shall be utilized to provide clear distinction between the two functions. The bypass handle shall provide three operating modes: "Bypass to Normal", "Automatic" and "Bypass to Emergency." Bypass to the load-carrying source shall be affected without any interruption of power to the load (make-before-break contacts). Load break-type bypass for ATS test and isolation shall not be acceptable. The operating speed of the bypass contacts shall be the same as that of the associated automatic transfer switch and shall be independent of the speed at which the manual bypass handle is operated. In the "Automatic" mode, bypass contacts shall be all open so they will not be subjected to fault currents.

3. The isolation handle shall provide three operating modes: "Closed", "Test" and "Open". The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switch(es), without any interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

4. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch allowing transfer and retransfer of the load between the two available sources without the feedback of load-regenerated voltage to the transfer switch. This transfer/retransfer operation shall comply with Paragraph 42.7 of UL 1008.

5. Bypass Switch Ratings: Match automatic transfer switch for electrical ratings.
6. Drawout Arrangement Electrically Operated for Transfer Switch: Provides physical separation from live parts and accessibility for testing and maintenance operations.

7. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.

8. Contact temperatures of bypass/isolation switches do not exceed those of automatic transfer switch contacts when they are carrying rated load.

9. Operability: Constructed so load bypass and transfer switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.

10. Legend: Manufacturer's standard legend for control labels and instruction signs give detailed operating instructions.

11. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.

C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

2.5 METAL-CLAD SWITCHGEAR ASSEMBLY

A. The metal-clad switchgear shall consist of a Type 3R Outdoor Non-Walk-In enclosure containing circuit breakers and the necessary accessory components all factory assembled (except for necessary shipping splits) and operationally checked. The assembly shall be a self-supporting and floor mounted on a level concrete pad. The integrated switchgear assembly shall withstand the effects of closing, carrying and interrupting currents up to the assigned maximum short circuit rating.

B. System Voltage: 15 kV nominal, three-phase grounded, 60 Hz.

C. Maximum Design Voltage: 15 kV.

D. Impulse Withstand (Basic Impulse Level): 95 kV.

E. Power Frequency Withstand: 36 kV, 1 minute test.

F. Main Bus Ampacity: 1200 amps, continuous.

G. Momentary Current Ratings: Equal to the circuit breaker close and latch rating, 50 kAIC @ 15 kV.

2.6 COMPONENTS

A. Stationary Structure

1. The switchgear shall comprise a minimum of two (for 1200A) sections including one breaker compartment and one auxiliary compartment with potential assemblies for Normal and
Emergency sources assembled to form a rigid self-supporting completely enclosed structures providing steel barriers between sections.

2. The first (for 1200A) section(s) is/are divided by metal barriers into the following compartments:

a. Circuit breaker, main bus and cable. The section may have up to two circuit breaker compartments for a 1200 ampere rating

b. Circuit breaker, one set of transformer assembly, main bus and cable.

B. Circuit Breaker Compartment

1. Each circuit breaker compartment shall be designed to house a horizontal drawout metal-clad vacuum circuit breaker. The stationary primary disconnecting contacts are to be silver-plated copper and mounted within glass polyester support bushings. The movable contacts and springs shall be mounted on the circuit breaker element for ease of inspection/maintenance.

2. Entrance to the stationary primary disconnecting contacts shall be automatically covered by metal shutters when the circuit breaker is withdrawn from the connected position to the test or disconnected position or removed from the circuit breaker compartment. Extend a ground bus into the circuit breaker compartment to automatically ground the breaker frame with high-current spring type grounding contacts located on the breaker chassis when in the test and connected positions. Guide rails for positioning the circuit breaker and all other necessary hardware are to be an integral part of the circuit breaker compartment. Blocking devices shall interlock breaker frame sizes to prevent installation of a lower ampere rating or interrupting capacity element into a compartment designed for one of a higher rating. It shall be possible with indoor switchgear to install a circuit breaker into a bottom compartment without use of a transport truck or lift device.

C. Ground Bus

1. A ¼ inch x 2 inch copper ground bus shall extend through the entire length of the transfer switch.

D. Main Bus Compartment

1. The main bus is to be rated 1200 amps and be fully insulated for its entire length with an epoxy coating by the fluidized bed process. The conductors are to be silver-plated copper and be of a bolted not welded design. Access to this compartment is gained from the front or rear of the structure by removing a steel barrier. Provide standard provisions for future extension, as applicable.

E. Doors and Panels

1. Relays, control switches, etc., shall be mounted on a formed front-hinged panel for each circuit breaker compartment. Front doors shall include features to facilitate quick and complete removal or reinstallation of entire front door assembly. Door hinges shall have removable pins. Where allowable, all control circuits (except, for example, current transformers and grounding) shall be wired via plugs/receptacles prior to termination.
F. Circuit Breakers
   1. The circuit breakers shall be rated 15 kV nominal volts, 15000 maximum volts, 60 Hz, with a continuous current rating of 1200 amps and a maximum symmetrical interrupting rating* of 25kA/500MVA - 15 kV system. Furnish vacuum circuit breakers with one vacuum interrupter per phase. Breakers of same type and rating shall be completely interchangeable. The circuit breaker shall be operated by means of a stored energy mechanism which is normally charged by a universal motor but can also be charged by the manual handle supplied on each breaker for manual emergency closing or testing. The closing speed of the moving contacts is to be independent of both the control voltage and the operator. Provide a full front shield on the breaker. Secondary control circuits shall be connected automatically with a self-aligning, self-engaging plug and receptacle arrangement when the circuit breaker is racked into the connected position. Provision shall be made for secondary control plug to be manually connected in test position. A minimum of 4 auxiliary contacts (2a 2b), shall be provided for external use. 6 additional cell mounted auxiliary contacts MOC type for external use shall be provided. The racking mechanism to move the breaker between positions shall be operable with the front door closed and position indication shall be visible with door closed.

   * Maximum symmetrical kA interrupting ratings are based on Table 1 of C37.06-1997. MVA ratings are nominal reference values for comparison only.

   2. An interlocking system shall be provided to prevent racking a closed circuit breaker to or from any position. An additional interlock shall automatically discharge the stored-energy operating mechanism springs upon removal of the breaker out of the compartment.

   3. The circuit breaker control voltage shall be: 250 volts DC, 120 volts AC, one capacitor trip unit provided for each circuit breaker with AC control power.

G. Instrument Transformers
   1. Voltage transformers are drawout mounted with primary current-limiting fuses and shall have ratio as indicated. The transformers shall have mechanical rating equal to the momentary rating of the circuit breakers and shall have metering accuracy per ANSI Standards.

   2. Current transformers*: Each breaker compartment shall have provision for mounting of optional current transformers per phase* (ANSI standard relay accuracy). The current transformer assembly shall be insulated for the full voltage rating of the switchgear. The current transformers wiring shall be #12 AWG minimum.

*Relaying and metering accuracy shall conform to ANSI Standards.

H. Control Wiring
   1. The switchgear shall be wired with Type SIS #12 AWG minimum. The control wiring shall be UL listed and have VW-1 flame retardant rating. Wires shall terminate on terminal blocks with marker strips numbered in agreement with detailed connection diagrams.
be 11 gauge steel on all exterior surfaces. Adjacent bays shall be securely bolted together to form an integrated rigid structure. The rear covers shall be removable to assist installation and maintenance of bus and cables.

B. The metal-clad switchgear shall be fully assembled, inspected and tested at the factory prior to shipment. Large line-ups shall be split to permit normal shipping and handling as well as for ease of joining at the job site.

2.8 FACTORY FINISHING

A. All steel parts shall be cleaned and a zinc-phosphate (outdoor equipment) pre-treatment applied prior to paint application.

B. Paint color shall be light gray, satisfying the requirements of ANSI Standard Z55.1 for No.61. TGIC polyester powder applied electrostatically through air. Following paint application, parts shall be baked to produce a hard durable finish. The average thickness of the paint film shall be 2.0 mils. Paint film shall be uniform in color and free from blisters, sags, flaking and peeling.

C. Adequacy of paint finish to inhibit the buildup of rust on ferrous metal materials shall be tested and evaluated per paragraphs 5.2.8.1-7 of ANSI C37.20.2-1987. Salt spray withstand tests in accordance with ASTM #D-1654 and #B-117 shall be periodically performed on a sample to confirm conformance with the corrosion resistance standard of at least 2500 hours minimum (outdoor equipment).

2.9 MICROPROCESSOR CONTROLLER

A. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

B. 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. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.

C. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

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

EN 55011 Emission standard - Group 1, Class A
EN 50082-2 Generic immunity standard, from which:
EN 61000-4-2 Electrostatic discharge (ESD) immunity
ENV 50140 Radiated Electro-Magnetic field immunity
EN 61000-4-3 Radiated RF Electromagnetic Field Immunity
EN 61000-4-4 Electrical fast transient (EFT) immunity
EN 61000-4-5 Surge transient immunity
EN 61000-4-6 Conducted Radio-Frequency field immunity
EN 61000-4-11 Voltage Dips, Interruption and Variations Immunity

2.10 ENCLOSURE

A. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement.

2.11 CONTROLLER DISPLAY AND KEYPAD

A. A four line, 20 character 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 the serial communications input 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
3. Operating parameter protection
4. Transfer operating mode configuration
   (Open transition, Closed transition, or Delayed transition)
To appropriately trained operators, all instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

2.12 VOLTAGE, FREQUENCY AND PHASE ROTATION 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 setting capabilities (values shown as % of nominal unless otherwise specified):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sources</th>
<th>Dropout / Trip</th>
<th>Pickup / Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervoltage</td>
<td>N&amp;E, 3φ</td>
<td>70 to 98%</td>
<td>85 to 100%</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>N&amp;E, 3φ</td>
<td>102 to 115%</td>
<td>2% below trip</td>
</tr>
<tr>
<td>Underfrequency</td>
<td>N&amp;E</td>
<td>85 to 98%</td>
<td>90 to 100%</td>
</tr>
<tr>
<td>Overfrequency</td>
<td>N&amp;E</td>
<td>102 to 110%</td>
<td>2% below trip</td>
</tr>
<tr>
<td>Voltage unbalance</td>
<td>N&amp;E</td>
<td>5 to 20%</td>
<td>1% below dropout</td>
</tr>
</tbody>
</table>

B. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of minus 20°C to 60°C.
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 differential sensing shall be provided for the closed transition operating mode. The sensor shall enable transfer/re-transfer between live sources in the closed transition mode only when the two sources have a maximum voltage differential of 5%, frequency differential of 0.2 Hz and are within 5 electrical degrees.

E. Closed transition transfer shall be accomplished with no power interruption and without altering or actively controlling standby generator set.

F. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

G. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

2.13 AUTOMATIC AND USER SUPERVISED NON-AUTOMATIC CONTROL

A. Open, Closed, and Delayed Transition Switching Solutions provide complete automatic control of the transfer switch.

B. A Transfer Switch Automatic-Manual selector switch allows the user to place the transfer switch in a fully manual mode of operation. The Normal and Emergency Source Circuit Breakers may then be operated using the circuit breaker control switches on the front of each circuit breaker compartment. This provides electrically interlocked operation to ensure that both circuit breakers cannot be closed simultaneously. Additionally, the Normal or Emergency Source Circuit Breakers may be tripped open by the circuit breaker control switches at any time during Automatic or Manual operation.

C. Included Components:

   a. Trip, Close, and Pull to Lock
   b. Closed LED – Red
   c. Open LED – Green
   d. Tripped LED – Amber (When Optional Protective Relaying is provided)
3. Controls Not In Auto LED (Indicates Automatic Operating Mode Disabled).

2.14 TIME DELAYS
A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. An adjustable time delay of 0 to 6 seconds to override momentary emergency source outage to delay all retransfer signals during initial loading of engine generator set.

D. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 10 hours. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

E. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

F. 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 minute 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.

G. The controller shall also include the following user-adjustable time delays for optional Closed Transition and Delayed Transition operation:
   1. FailToSyncTD: failure to synchronize normal and emergency sources prior to closed transition transfer.
   2. XtdParallelTD: extended parallel condition of both power sources during closed transition operation.

H. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

I. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

2.15 ADDITIONAL FEATURES
A. A three position momentary-type test switch shall be provided for the test / automatic / reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A SPDT contact, rated 5 amps at 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 CTTS is connected to the normal source and one contact closed, when the CTTS is connected to the emergency source.

D. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the CTTS is connected to the normal source (green) and one to indicate when the CTTS is connected to the emergency source (red).

E. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

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

F. 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.

G. Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

1. Enable or disable the routine.
2. Enable or disable transfer of the load during routine.
3. Set the start time:
   - Time of day
   - Day of week
   - Week of month (1st, 2nd, 3rd, 4th, alternate or every)
   a. Set the duration of the run.
4. At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.
The following feature shall be built into the controller, but capable of being activated through keypad programming or the communications interface port.

H. Terminals shall be provided for a remote contact which opens to signal the CTTS to transfer to emergency.

I. 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 a maximum of two times. This screen shall display a clear description of the active operating sequence 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.

J. 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.

K. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. 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.

L. 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
   a. Data and time and reason for transfer normal to emergency.
   b. Data and time and reason for transfer emergency to normal.
   c. Data and time and reason for engine start.
   d. Data and time engine stopped.
   e. Data and time emergency source available.
   f. Data and time emergency source not available.

2. Statistical Data
   a. Total number of transfers.
   b. Total number of transfers due to source failure.
c. Total number of days controller is energized.

d. Total number of hours both normal and emergency sources are available.

M. Communications Module - A full duplex RS485 interface shall be installed in the CTTS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices. The serial communication interface shall be equal to ASCO Accessory 72A.

2.16 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel annunciates conditions for indicated transfer switches. Annunciation includes the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.17 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor-Mounted Switch: Anchor to floor by bolting.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 2 inches (50 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated. Cast anchor-bolt inserts into bases. Comply with Division 3 Section "Cast-in Place Concrete."
B. Annunciator and Control Panel Mounting: Surface wall mounted, unless otherwise indicated.

C. Identify components according to Division 26 Section “Electrical Identification”.

3.2 WIRING TO REMOTE COMPONENTS

A. Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section “Low Voltage Electrical Power Conductors and Cables.”

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

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing: Perform the following field quality control tests in accordance with Division 26 section “Electrical Testing.”

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.22.3. Certify compliance with test parameters.


   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
   a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
   f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   a. Verify grounding connections and locations and ratings of sensors.
   b. Observe reaction of circuit-interrupting devices when simulated fault current is applied at sensors.

C. Coordinate tests with tests of generator and run them concurrently.

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

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

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 1 Section "Closeout Procedures."

   1. Coordinate this training with that for generator equipment.

END OF SECTION 26 3600
THIS SECTION APPLIES TO SHAPERO HALL

SECTION 26 36 00SH - TRANSFER SWITCHES

PART 1 - This system will momentarily connect the emergency generator to the utility during transfer. This usually necessitates obtaining approval from the utility company. Coordinate with Owner.

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

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

2.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:
   1. Automatic transfer switches, as specified and indicated.

B. Furnish and install automatic closed transition transfer & bypass-isolation switch (CTTS/BPS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each CTTS/BPS system(s) shall consist of a closed transition transfer switch and a two-way bypass/isolation switch. All CTTS/BPSs and control modules shall be the product of the same manufacturer.

C. The CTTS/BPS shall transfer the load without interruption (closed transition) by momentarily connecting both sources of power only when both sources are present and acceptable. The maximum interconnection time is 100 milliseconds. The CTTS shall operate as a conventional break-before-make (open transition) switch when the power source serving the load fails.

2.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
   1. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
C. Field quality-control test reports.

2.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:
   1. Features and operating sequences, both automatic and manual.
   2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

2.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.


C. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

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

E. Comply with NEMA ICS 1 and ICS 2-447.

F. Comply with NFPA 70.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

2.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
PART 3 - PRODUCTS

3.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Contactor Transfer Switches:
      b. Emerson; ASCO Power Technologies
      c. Caterpillar; Engine Div.
      d. Generac Power Systems, Inc.
      e. Kohler Co.; Generator Division.

3.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.
B. Test Fault-Current Closing and Withstand Rating: Minimum 42,000 RMS symmetrical amperes withstand rating and an “any breaker” rating with a 3-cycle fault clearing time per UL 1008, unless greater rating is required per short circuit study.
C. The controller’s sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Switch Action: Double throw; mechanically held in both directions.
   2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
H. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations.
Color-coding, wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

I. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

3.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. The CTTS shall transfer the load without interruption (closed transition) by momentarily connecting both sources of power only when both sources are present and acceptable. The maximum interconnection time is 100 milliseconds. The CTTS shall operate as a conventional break-before-make (open transition) switch when the power source serving the load fails. Designs that transfer in a delayed transition manner (intentional delay in the neutral position) when closed transition transfer is bypassed are not acceptable. All contacts, coils, springs and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

D. Automatic transfer switches utilizing components of molded-case circuit breakers, contactors, or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.

E. The automatic transfer switch shall conform to the requirements of NEMA Standard ICS 2-447 and Underwriters’ Laboratories UL-1008.

F. Provide closed transition with maintenance bypass on full load as indicated on drawings.

G. Automatic Transfer-Switch Features:
   1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
   2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
   3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at
90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulate normal-source failure.

6. Switch-Position Pilot Lights: Indicate source to which load is connected.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.

10. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

11. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
   a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
   b. Push-button programming control with digital display of settings.
   c. Integral battery operation of time switch when normal control power is not available.

3.4 PERFORMANCE FEATURES

A. Provide a complete automatic engine starting control and automatic load transfer switch. The automatic equipment shall start the emergency generator and transfer load to the emergency source after a voltage drop in any one or more phases, and restore the load to the normal source, stop the generator set and reset itself for another complete cycle of operation within an adjustable time period after return of the normal service voltage.

B. The automatic engine starting control shall initiate the engine by an auxiliary contact in the transfer switch (provide one normally-closed and one normally-open contact). If the engine fails to start the particular “failure” shall be annunciated on the generator control panel and maintain the control in the “tripped-out” position until reset.
C. Provide a three position “manual-off-auto” selector switch that can reset the engine control, manually start and operate the engine without transferring the load, and prevent operation of the generator set.

D. For 3 phase switches all phases of the normal voltage shall be monitored line-to-line. Close differential voltage sensing shall be provided. The pickup voltage shall be adjustable from 85% to 100% of nominal and the dropout voltage shall be adjustable from 75% to 98% of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85% of nominal voltage and retransfer to normal shall occur when normal source restores to 95% of nominal.

E. Permit simulation of normal power failure without load transfer, by a maintained contact test switch.

F. A time delay to override momentary normal source outages to delay all transfer switch and engine starting signals. The time delay shall be field adjustable from 0.5 to 6 seconds.

G. A time delay on retransfer to normal source. The time delay shall be automatically bypassed if the emergency source fails and normal source is available. The time delay shall be field adjustable from 0.5 to 30 minutes.

H. An unloaded running time delay for generator cool-down. The time delay shall be field adjustable from 0 to 5 minute and factory set at 5 minutes.

I. A time delay on transfer to emergency. Initially set at zero but field adjustable up to 1 minute for controlled timing of load transfer to emergency, where indicated.

J. Independent single phase voltage and frequency sensing of the emergency source. The pickup voltage shall be adjustable from 85% to 100% of nominal. Pickup frequency shall be adjustable from 90% to 100% of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90% or more of nominal and frequency is 95% or more of nominal.

K. A contact that closes when normal source fails for initiating engine starting.

L. A contact that opens when normal source fails for initiating engine starting.

M. One auxiliary contact that is closed when automatic transfer switch is connected to normal and one auxiliary contact that is closed when automatic transfer switch is connected to emergency.

N. The controller shall also include the following built-in time delays for Closed Transition Transfer with Bypass-Isolation operation:

1. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.

2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
O. 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
2. Date and time and reason for transfer normal to emergency.
3. Date and time and reason for transfer emergency to normal.
4. Date and time and reason for engine start.
5. Date and time engine stopped.
6. Date and time emergency source available.
7. Date and time emergency source not available.
8. Statistical Data
9. Total number of transfers.
10. Total number of transfers due to source failure.
11. Total number of days controller is energized.
12. Total number of hours both normal and emergency sources are available.

3.5 Bypass-Isolation Switch

A. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

B. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.

C. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

D. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

E. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for
inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

F. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

G. Designs requiring operation of key interlocks for bypass isolation or ATSs which cannot be completely withdrawn when isolated are not acceptable.

3.6 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 4 - EXECUTION

4.1 INSTALLATION

A. Design each fastener and support to carry load indicated. See Division 26 Section "Hanger and Supports for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.
   1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Identify components according to Division 26 Section "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

4.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
4.3 FIELD QUALITY CONTROL

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

B. Testing Agency's Tests and Inspections:
   1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
      a. Check for electrical continuity of circuits and for short circuits.
      b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
      c. Verify that manual transfer warnings are properly placed.
      d. Perform manual transfer operation.
   4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
      a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
      b. Simulate loss of phase-to-ground voltage for each phase of normal source.
      c. Verify time-delay settings.
      d. Verify pickup and dropout voltages by data readout or inspection of control settings.
      e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
   5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
      a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

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

E. Remove and replace malfunctioning units and retest as specified above.
4.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
   1. Provide minimum 8 hours demonstration excluding travel time.

B. Coordinate this training with that for generator equipment.

END OF SECTION
SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.3 DEFINITIONS

A. CRI: Color-rendering index.
B. HID: High-intensity discharge.
C. Luminaire: Complete lighting fixture, including ballast housing if provided.
D. Pole: Luminaire support structure, including tower used for large area illumination.
E. Standard: Same definition as "Pole" above.

1.4 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
7. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
8. Anchor bolts for poles.

B. Shop Drawings:

1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

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


E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

D. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period.
1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
C. Metal Parts: Free of burrs and sharp corners and edges.
D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and
when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.


1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   a. Color: Dark bronze.

2.6 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.7 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; 1-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole and bracket, then bolted together with galvanized-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

F. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.


PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION


B. Install lamps in each luminaire.

C. Fasten luminaire to indicated structural supports.

   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

D. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION
A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
   1. Fire Hydrants and Storm Drainage Piping: 60 inches.
   3. Trees: 15 feet.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers, unless otherwise indicated.
   4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

3.3 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding."

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photoelectric controls.

END OF SECTION 26 5600
DIVISION 31 – EARTHWORK
SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and removing site utilities and/or abandoning site utilities in place.
6. Temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP
A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 QUALITY ASSURANCE
A. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS
A. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
B. Utility Locator Service: Notify “Call Before You Dig” for area where Project is located before site clearing.
C. Do not commence site clearing operations until required temporary erosion- and sedimentation-control and plant-protection measures are in place.
D. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
E. Do not direct vehicle or equipment exhaust towards protection zones.
F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

1. Use coating with a VOC content of 420 g/L (3.5 lb/gal or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide required temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Do not stockpile topsoil within protection zones.
2. Stockpile surplus topsoil to allow for resspreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 1000
SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, plants and other site amenities.
2. Drainage course for concrete slabs-on-grade.
3. Excavating and backfilling trenches for utilities and pits for buried utility structures.
4. Excavating and backfilling for sedimentation and erosion control.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698, ASTM D 1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS
A. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth moving operations.

B. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

C. Do not direct vehicle or equipment exhaust towards protection zones.

D. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups and Geotechnical Engineer.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course/Crushed Aggregate: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; screened to be free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

K. Sand: ASTM C 33; fine aggregate.

L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
   a. 24 inches outside of concrete forms other than at footings.
   b. 12 inches outside of concrete forms at footings.
   c. 6 inches outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches beneath bottom of concrete slabs-on-grade.
   f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
   a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
   a. 24 inches outside of concrete forms other than at footings.
   b. 12 inches outside of concrete forms at footings.
   c. 6 inches outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches beneath bottom of concrete slabs-on-grade.
3.4 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit or as indicated on drawings.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3.5 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.
B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete.
D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete.
E. Backfill voids with satisfactory soil while removing shoring and bracing.
F. Place and compact initial backfill of [subbase material] [satisfactory soil], free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
3.10  SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under walks and pavements, use satisfactory soil material.
   2. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11  SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12  COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698, ASTM D 1557:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13  GRADING

EARTH MOVING
A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.

3.14 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Place drainage course 6 inches or less in compacted thickness in a single layer.
   2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Construction Manager will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

F. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

G. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

H. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

I. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

J. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2000
SECTION 32 1313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Materials and installation requirements are generally indicated on the plans. Materials indicated in these specifications only apply if indicated on the plans and allowed by the regulating authority. Contractor is responsible for confirming allowable materials and installation requirements with the regulating authority and including these requirements in their bid.

C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Fence footings
   2. Concrete filled bollards
   3. Mechanical unit pads

B. All materials, equipment and construction for concrete pavements and seatwalls shall be in accordance with the current version of the Michigan department of Transportation Standard Specifications for Construction.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Bonding agent or adhesive.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

E. ACI Publications:

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

G. No substitutions will be permitted without written approval of the University Landscape architect. The Landscape contractor shall remove rejected materials from the site.

H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Concrete subcontractor.
PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curves of a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
   3. Fly Ash: ASTM C 618, Class F or C.

C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
   1. Aggregate under Pad: MDOT 21AA.
   2. Aggregate around Pad: MDOT 6AA, ASTM #57.

2.4 ADMIXTURES

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Water: Potable.

2.6 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Compressive Strength (28 Days):
   b. Footing: 3000 psi 470#/CY cement.

2. Slump: 4 inches.
   a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.

C. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

D. Proportion mixes to provide concrete with the following properties: 1. Compressive Strength (28 Days): 4000 psi for all work

1. Maximum Water-Cementitious Materials Ratio: 0.50.
2. Slump Limit: 4 inches max and 1.5 inches min. as determined by the slump cone test specified in ASTM C-143.
3. Air entrained with a total air content of not less than 4 percent but not more than 7 percent.
4. Cement content shall be a min. of 6 sacks per cubic yard.
E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals and as follows:

1. Fly Ash: 25 percent.

2.7 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

2.9 RELATED MATERIALS


C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subbase or base surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subbase or base is ready to receive pavement.

B. Remove loose material from compacted subbase or base surface immediately before placing concrete.

3.2 FORMWORK
A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete as indicated on drawings.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.
F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 301.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent (at no additional cost) if approved by Architect or Wayne State University.

I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
3.6 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish for flat concrete: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Flat concrete: Medium-to-Fine-Textured Broom Finish. Draw a soft bristle broom across floatfinished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: WAYNE STATE UNIVERSITY will engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing shall be performed according to the following requirements:

1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
4. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
5. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
6. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
7. When total quantity of a given class of concrete is less than 50 cu. yd., Wayne State University may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

C. Test results shall be reported in writing to Architect, Wayne State University, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project
identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Wayne State University but will not be used as the sole basis for approval or rejection.

E. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Wayne State University. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Wayne State University when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

3.11 CLEAN UP

A. Concrete work washout cannot be discharged into storm drains, catch basins or the sanitary sewer system

B. Contractor shall utilize proper disposal and washout practices in designated areas or off site.

END OF SECTION 32 1313
SECTION 32 1373 – CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion joints within concrete pavement.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.
C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.2 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

2.3 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance. B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373
SECTION 32 3119 – ORNAMENTAL METAL FENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

   A. This Section includes the following:

      1. Ornamental Metal Fences
      2. Ornamental Metal Pedestrian Gate
      3. Exit Devices

1.3 PERFORMANCE REQUIREMENTS FOR ORNAMENTAL METAL

   A. Structural Performance of Ornamental metal: Provide ornamental metal complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

   B. Thermal Movements: Provide ornamental metal that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

      1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

   C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

   D. Comply with Section concerning “Hot Dip Galvanizing”.

1.4 SUBMITTALS

   A. Product Data: For each product used in ornamental metal, including finishing materials and methods.

      1. Include Product Data for grout and anchoring cement.
B. Shop Drawings: Show fabrication and installation of ornamental metal. Include plans, elevations, component details, and attachments to other Work. Indicate materials and profiles of each ornamental metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1. Include setting drawings, templates, and directions for installing anchor bolts and other anchorages.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for installation of ornamental metal specified in this Section by the same firm that fabricated it.

B. Fabricator Qualifications: A firm experienced in producing ornamental metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. The manufacturer shall supply a total ornamental aluminum fencing system. The system shall include all components (i.e., pickets, posts, rails, gates and hardware) required.

D. Welding Standards: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store ornamental metal inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where ornamental metal is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers:

1. Ornamental metal:
   a. Known Source: Ameristar Echelon Plus ‘Classic’.
   b. Or approved substitute.

2.2 METALS

A. General: Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.

B. Steel and Iron: Provide steel and iron in form indicated to comply with the following requirements:

1. Tubing: Cold formed, ASTM A 500.
2. Steel Plate, Shapes, and Bars: ASTM A 36.
5. Malleable-Iron Castings: ASTM A 47, grade as recommended by fabricator for type of use indicated.

A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T5. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T5.

B. Pickets shall be 3/4" square x .045" thick. Horizontal rails shall be 1-1/4" x 1-7/16" Forerunner™ channel with .060" thick top & internal web wall, and .090" thick side walls and shall be punched to allow picket to pass through the top of the rail. The Forerunner™ rail shall be constructed with an internal web insert providing a raceway for the pickets to be retained with a 1/8" retaining rod. The number of rails shall vary with the style, height and strength as determined by manufacturer. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

C. Accessories: Aluminum castings shall be used for all post caps, scrolls, finials, and other miscellaneous hardware. Hinges and latches shall be fabricated from aluminum, stainless steel or composite materials.

D. Etching Cleaner for Galvanized Metal: Complying with MPI#25

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
F. Polyurethane Topcoat: Complying with MPI#72 and compatible with undercoat. Color gloss black.

2.3 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners: Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting ornamental metal components and for attaching them to other work unless exposed fasteners are unavoidable or are the standard fastening method.

2.4 FABRICATION, GENERAL

A. Form ornamental metal to required shapes and sizes, with true curves, lines, and angles. Provide components in sizes and profiles indicated, but not less than that needed to comply with requirements indicated for structural performance.

B. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated.

C. Comply with AWS for recommended practices in shop welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of all flux, and dress all exposed and contact surfaces.

D. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

E. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

F. Fabricate and assemble materials per manufacturer’s specifications.

2.5 FABRICATING FENCING

A. Nonwelded Connections: Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
B. Welded Connections: Fabricate ornamental metal for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
5. Provide welded connections for ferrous ornamental metal.

C. Form changes in direction of railing members as follows:

1. By changing direction at post.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of handrail and railing components.

E. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

1. Furnish inserts and other anchorage devices for connecting ornamental metal to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by ornamental metal. Coordinate anchorage devices with supporting structure.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 IRON AND STEEL FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123.

1. Hot-dip galvanize iron and steel hardware indicated to be galvanized to comply with ASTM A 153.
B. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Finishes shall be per manufacturer’s specifications.

2.8 EXIT DEVICES

A. Surface mount exit bar kit, suitable for exterior uses: reversible exit bar, 24” tall mounting plate, adjustable receiver bracket, lock box with keyed cylinder and two keys.

   1. Known Source: DAC Industries Model # D-6045-S48

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install fencing and gates per manufacturer’s specifications.

B. Provide anchorage devices and fasteners where necessary for securing ornamental metal to in-place construction.

C. Perform cutting, drilling, and fitting required to install ornamental metal. Set products accurately in location, alignment, and elevation; measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of ornamental metal, restore finishes to eliminate any evidence of such corrective work.

E. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

F. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

G. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

   1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
H. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

3.2 INSTALLING ORNAMENTAL FENCING

A. Adjust posts and railings before anchoring to ensure alignment at abutting joints.

B. Concrete anchored posts in concrete footings: set W6x15 posts true and level in concrete footing to match details on structural drawings.

C. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of ornamental metal.

D. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use fittings designed for this purpose.

3.3 CLEANING

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

3.4 PROTECTION

A. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 32 3119
SECTION 33 4000 – STORM SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Extent of storm sewers is shown on drawings.

1. Storm sewer system includes all piping and appurtenances from a point 5 feet outside of building to, and including tap-in to existing municipal system.

A. Comply with requirements of Section 31 0000 for excavation and backfill required for storm sewers.

B. Comply with requirements of Section 03 3000 for cast-in-place concrete required for storm sewers.

C. Related Work Specified Elsewhere:

1. Division 31 section, “Earth Moving”.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for storm sewer materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed storm sewer piping and products, in accordance with requirements of Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm with at least three years of successful installation experience on projects with storm sewer work similar to that required for project.

B. Codes and Standards:

1. Plumbing Code Compliance: Comply with all applicable portions of National Plumbing Standard Plumbing Code pertaining to selection and installation of storm sewer materials and products.

2. Comply with Detroit Water and Sewerage Department requirements and standards for Storm Sewers and Appurtenances. DWSD standard storm sewer details and specifications are referenced and included as part of the Contract Documents. If a discrepancy occurs between
these specifications and details and DWSD, DWSD shall govern. Notify Architect of all such conditions prior to commencing work or ordering materials.

C. Obtain and pay required fees, assessments, and other cost for permits, inspections, and testing required by authorities having jurisdiction

D. Reference Standards:

1. AASHTO - American Association of State Highway and Transportation Officials.
2. ACPA - American Concrete Pipe Association.
5. CISPI - Cast Iron Soil Pipe Institute.

PART 2 - PRODUCTS

2.1 SEWER PIPE AND FITTINGS

A. General: Provide pipe materials, weight/class and other characteristics indicated and compatible fittings and accessories of same material and weight/class as pipe, with joining method specified.

B. Reinforced Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, Wall B, for rubber gaskets.
   2. Sizes: 12 inches and larger.

C. Non-Reinforced Concrete Sewer Pipe and Fittings: ASTM C 14, Class 2, for rubber gasket joints.
   2. Sizes: 4 to 10 inches.

D PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 23.5, for solvent cement or elastomeric gasket joints.

E. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM F 679, T-1 wall thickness, bell and spigot, for elastomeric gasket joints.
   2. Sizes: 18 to 36 inches.

F. ABS (Acrylonitrile-Butadiene-Styrene) Sewer Pipe and Fittings: ASTM D 2751, for solvent cement or elastomeric gasket joints.
1. SDR 35 for 3 to 6 inches.
2. SDR 42 for 8 to 12 inches.
5. Sizes: 12 inches and smaller.

G. Composite (Truss) Sewer Pipe: Either PVC or ABS, ASTM D 2680 composite walls separated with spacers (truss) of same material as pipe. Voids between walls filled with insulating concrete. Joints solvent cement, Type SC, or mechanical seal, Type OR.

1. Sizes: 8 inches and larger.

H. Pipe End Sections: Provide flared end sections at outfalls.

I. Bar Screens: Circular steel plate frame of outside diameter to suit inside diameter of pipe, with 1/2 inch diameter bars at 6 inches O.C. each way.

2.2 UNDERDRAINAGE PIPE AND FITTINGS

A. General: Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars and joint materials.


D. Perforated, corrugated, single wall Polyethylene (PE) tubing and fittings: AASHTO M 252 or ASTM F 405, for coupled joints, complete with geotextile filters.

1. Provide with non-woven cloth filter fabric, Dupont, Inc. typar 3201, or Mirafi 140 N or approved substitute.
2. Couplings: Manufacturer's standard, band type.

2.3 MANHOLES

A. General: Provide precast reinforced concrete units of depth indicated, ASTM C 478, with provision for rubber gasket joints.

B. Base Section: 8 inch minimum thickness for floor slab and 5 inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
C. Riser Sections: 5 inch minimum thickness; diameter as indicated, and lengths to provide depth indicated.

D. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone to match grade rings.

E. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6 to 9 inches total thickness and match 24 inch diameter frame and cover.

F. Gaskets: ASTM C 443, rubber.

G. Steps: Cast into base, riser and top sections of side wall at 16 inch intervals and within 24 inches of floor.

1. Ductile iron, cast aluminum, or steel reinforced plastic as acceptable to the municipality having jurisdiction.

H. Pipe Connectors: ASTM C 923, resilient, of size required, for each ABS pipe connection.

I. Channel and Bench: Concrete.

J. Manhole Frames and Covers: Type scheduled on the drawings with the lettering “Storm Sewer” cast into cover.

2.4 CATCH BASINS, INLETS AND PLAZA DRAINS

A. General: Provide precast reinforced concrete units of depth indicated, ASTM C 478, with provision for rubber gasket joints. Note-Plaza Drain shall be 12-inches, as detailed on sheet C1.3 and installed at the location shown on the drawings.

B. Base Section: 8 inch minimum thickness for floor slab and 5 inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.

C. Riser Sections: 5 inch minimum thickness; diameter as indicated, and lengths to provide depth indicated.

D. Top Section: Flat slab type with opening to match grade rings.

E. Grade Rings: Provide 2 or 3 reinforced concrete rings, of 6 to 9 inches total thickness and match frame and cover.

F. Gaskets: ASTM C 443, rubber.

G. Steps: Cast into base, riser and top sections of side wall at 16 inch intervals and within 24 inches from floor.

1. Ductile iron, cast aluminum, or steel reinforced plastic as acceptable to the municipality having jurisdiction.
H. Pipe Connectors: ASTM C 923, resilient, of size required, for each ABS pipe connection.

I. Channel and Bench: Concrete.

J. Catch Basin and Inlet Frames and Grates: Type as scheduled on the drawings.

K. Plaza Drain Assembly: Zurn model ‘ZB505-6”-NH-DG-HP-VP’, Smith model ‘2141Y-06-M-U’ or approved equal. Plaza drain shall be equipped with a ‘P’ type trap.

2.5 CONCRETE MATERIALS

A. Concrete: Ready mixed, ASTM C 94, 3000 psi at 28 days.

   1. Cement: ASTM C 150, Type II.

B. Reinforcement:

   1. Bars: ASTM A 615, Grade 60.

2.6 IDENTIFICATION

A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letter "CAUTION - SEWER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer must examine areas and conditions under which storm sewers are to be installed. Notify Construction Manager in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

A. Grade trench bottom to provide a smooth, firm, stable and rock-free foundation, throughout the length of the pipe.
B. Remove unstable, soft and unsuitable materials at the surface upon which pipes are to be laid, and backfill with bedding material shown to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with compacted bedding material. Ensure continuous bearing of the pipe barrel on the foundation.

3.3 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings indicate the general location and arrangement of storm sewers. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Install gaskets, seals, sleeves and couplings in accordance with manufacturer's recommendations for use of lubricants and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use proper size increasers, reducers and couplings where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

D. Use manholes or catch basins to change directions, except where fittings are indicated. Use fittings for branch connections, unless direct tap is indicated.

E. Install piping pitched down in direction of flow, at minimum slope indicated.

F. Connect pipe to building system in locations indicated.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. Join concrete pipe and fittings with rubber gaskets in accordance with ASTM C 443, and install piping in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual".

B. Join and install PVC pipe as follows:

1. Elastomeric joints in accordance with ASTM D 3212.
2. Solvent cement in accordance with ASTM D 2855 and ASTM F 402.
3. Install in accordance with ASTM D 2321.

C. Join and install ABS pipe as follows:

1. Elastomeric joints in accordance with ASTM D 3212.
2. Solvent cement in accordance with ASTM D 2855 and ASTM F 402.
3. Install in accordance with ASTM D 2321.

D. Join and install Composite (Truss) pipe with elastomeric seals and install in accordance with ASTM D 2321 and manufacturer's recommendations.
E. Join different types of pipe with standard manufactured couplings and fittings.

3.5 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channels and benches between inlets and outlet. Set tops of frames and covers flush with finish surface where manholes occur in pavements. Elsewhere, set tops 3 inches above finish surface, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

C. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

3.6 CATCH BASINS AND INLETS

A. Construct inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 UNDERDRAINS

A. Install underdrain pipe centered in filter material in conformance with manufacturer’s recommendations. Coordinate with drainage structure construction.

3.8 TAP CONNECTIONS

A. Make connection to existing piping, so that finished work will conform as nearly as practicable to requirements specified for new work. Use connection as acceptable to agencies having jurisdiction.

B. Take care while making tap connections to prevent concrete or debris from entering existing piping. Remove debris, concrete or other extraneous material that may accumulate.

C. Do not disrupt service during tap; maintain continuous service so others served by system will be unaffected.

3.9 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back filling of trench for underground storm sewer piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.10 FIELD QUALITY CONTROL
A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
   1. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
   1. Make inspections after pipe between inlets and inlet locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
   2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects and re-inspect.
   3. Perform remote televised inspection if required for final acceptance.

3.11 FINAL ACCEPTANCE

A. Secure inspection of agency having jurisdiction, and make appropriate corrective measures as required to obtain final acceptance.

END OF SECTION 33 4000
SECTION 33 5213 - FUEL DISTRIBUTION AND STORAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. Fuel: Includes fuel oil.
B. Fuel Oil: Includes diesel fuel oil for diesel engines.
C. The following are industry abbreviations for storage tanks:
   1. AST: Aboveground storage tank.
   2. FRP: Glass-fiber-reinforced plastic.
   3. UST: Underground storage tank.
D. The following are industry abbreviations for plastic piping materials:
   1. PE: Polyethylene plastic.
   2. PTFE: Polytetrafluoroethylene plastic.
   5. TFE: Tetrafluoroethylene plastic.
E. STI: Steel Tank Institute.

1.3 PIPING SYSTEMS DESCRIPTION

A. Aboveground, Fuel Piping and Vent Piping: Use the following piping materials for each size range:
   1. NPS 2 and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
   2. NPS 2-1/2 and larger: Steel pipe, steel welding fittings, and welded joints.
B. Underground, Fuel Piping: Use the following piping materials. Size indicated is carrier-pipe size.
   1. NPS 1-1/2 and Smaller: Flexible double-contained piping.
   2. NPS 2 and Larger: Rigid double-contained piping.
C. Underground, Fuel Tank, Fill Piping: Use the following piping materials. Size indicated is carrier-pipe size.
   1. All Sizes: Rigid double-contained piping and bonded joints.
D. Underground Gage Piping: Use any of the following piping materials for each size range:
1. NPS 2 and Smaller: Copper tube, copper fittings, and brazed joints.
2. NPS 2-1/2 to NPS 4: Copper tube, copper fittings, and brazed joints.

E. Valve Applications: Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Fuel Oil Shutoff Duty: Use gate or ball valves.

1.4 PERFORMANCE REQUIREMENTS

A. General: Use flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system's pressure rating in aboveground and containment sump applications, unless otherwise indicated.

B. Minimum working-pressure ratings for piping are the following, unless otherwise indicated:

2. Double-Contained Piping:
   b. Secondary-Containment Conduit: 5 psig.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Piping.
   2. Valves.
   3. Fuel storage tank piping specialties.
   4. Leak-detection and -monitoring systems.

B. Brazing certificates.

C. Welding certificates.

D. Material Certificates: For each fuel storage tank, signed by manufacturers.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For fuel storage tank pumps and leak-detection and -monitoring systems to include in operation and maintenance manuals.

G. Warranties: Special warranties specified in this Section.
1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of fuel storage tanks and are based on specific units indicated. Refer to Division 01 Section "Product Requirements."

B. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use. E. Comply with ASME B31.3, "Process Piping," for fuel piping.

F. Comply with NFPA 30, "Flammable and Combustible Liquids Code," for design, construction, installation, testing, and inspection of fuel distribution systems.

G. Comply with requirements of the EPA and state and local environmental-protection authorities having jurisdiction. Include recording of fuel storage tanks and monitoring of tanks and piping.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Lift and support fuel storage tanks only at designated lifting or supporting points, as shown on Shop Drawings. Do not move or lift tanks unless empty.

B. Prepare fuel storage tanks and accessories for shipping as follows:
   1. Ensure that units are dry and internally protected against rust and corrosion.
   2. Protect fuel storage tank accessories and piping connections against damage.

C. Store plastic pipes protected from direct sunlight. Support pipes to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility locating service for area where Project is located.

B. Interruption of Existing Fuel Oil Service: Do not interrupt fuel oil service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fuel oil supply according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of fuel oil service.
2. Do not proceed with interruption of fuel oil service without Owner's written permission.

1.9 COORDINATION

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

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel storage tanks that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following when used for storage of fuel at temperatures not exceeding 150 deg F:
   a. Structural failure including cracking, breakup, and collapse.
   b. Corrosion failure including external and internal corrosion of steel tanks.

2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 1 "Piping Systems Description" Article for applications of pipes, tubes, fittings, valves, and joining materials.

2.3 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, black.
1. Steel Welding Fittings: ASTM A 234/A 234M, seamless or welded; ASME B16.9, butt-welding type or ASME B16.11, socket-welding type.
2. Steel Threaded Fittings: ASME B16.11, with threads according to ASME B1.20.1.

B. Rigid Nonmetallic Piping: Fiberglass piping for underground applications. Include transition, bulkhead, termination, or other end fittings as required.

1. Manufacturers:
   a. Ameron International; Fiberglass Pipe Group.
   b. Smith Fibercast; a Varco Company; Red Thread.

2. RTRP: ASTM D 2996 or ASTM D 2997, and complying with UL 971.
   a. RTRP NPS 2 and NPS 3: 150-psig minimum working-pressure rating.
   b. RTRP NPS 4 and NPS 6: 125-psig minimum working-pressure rating. UL requirement for NPS 6 is waived.
   c. RTRFs: ASTM D 2996 or ASTM D 2997, complying with UL 971, and made by RTRP manufacturer.
   d. Bonding Adhesive: Manufacturer's standard, suitable for fuel piping application.

C. Flexible Double-Contained Piping: UL 971, flexible, nonmetallic, carrier pipe with flexible, nonmetallic, secondary-containment pipe, for underground applications. Include bulkhead, termination, or other end fittings as required.

1. Manufacturers:
   a. Advanced Polymer Technology, Inc. (APT).
   b. Innovative Petroleum Products LLC (IPP).
   c. PetroTechnik Group; UPP Pipework.

D. Rigid Double-Contained Piping: Factory manufactured type. Field fabricated systems will not be allowed. System consisting of carrier pipe, containment pipe, carrier pipe supports, special fittings, and end seals. System prefabricated and supplied by single manufacturer.

1. Manufacturers:
   a. Insul-Tek Piping Systems, Inc.; ENVIRO-TEK.
   b. Ipex Inc.; Guardian CustomGuard.
c. Rovanco Piping Systems, Inc.

2. Carrier Pipe and Fittings: Steel pipe and welding fittings as specified in Paragraph “Steel Pipe.”
3. Isolation Valves: UL Valves as specified in Article “Valves.”
4. Inner Pipe Supports: Nonmetallic construction, designed to allow free air and fluid movement within containment pipe, and spaced to carry weight of carrier pipe full of fluid while allowing carrier pipe to expand and contract.
5. Containment Pipe: Filament-wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating with minimum wall thickness of 80 mils as specified in Paragraph “Rigid Nonmetallic Piping.”
6. Containment Pipe Fittings: Factory prefabricated of same materials as containment pipe, and capable of withstanding 75 psig pressure test. Refer to Paragraph “Rigid Nonmetallic Piping.”
7. End Seals: Equip terminal ends of system with end seals manufactured of same material and to same standards as containment pipe fittings.

E. Copper Tube: ASTM B 88, Type L; water tube; drawn temper.

2. Copper Unions: MSS SP-123, cast-copper alloy, hexagonal-body stock with ball-and-socket metal-to-metal seating surfaces and solder-joint or threaded ends.
3. Brazing Filler Metals: AWS A5.8, BAg-1 (silver classification).

F. Flexible Nonmetallic Piping: UL 971, plastic pipe and fittings for underground applications. Include bulkhead, termination, or other end fittings as required.

1. Manufacturers:
   a. Ameron International; Fiberglass Pipe Group.
   b. Containment Technologies Corp.
   c. Dayco Industrial Products, Inc.
   d. Environ Products Inc.
   e. OPW Fueling Components.
   f. S. Bravo Systems, Inc.
   g. Western Fiberglass, Inc.

G. Transition Couplings:

1. Aboveground, Fuel Piping: Manufactured coupling or fitting or companion flanges same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
2. Underground, Fuel Piping: Sleeve-type coupling or manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined. H. Flexible Connectors: UL-listed, flexible piping 96 inches or less in length.

1. Metallic Connectors: For connection to aboveground, fuel tanks.
   a. Manufacturers:
      1) FLEX-ING, Inc.
      2) Hose Master, Inc.
      3) Jackson Industries.
      4) Teleflex Fluid Systems, Inc.
      5) Titeflex Corporation.

2. Nonmetallic Connectors: For connection to underground piping or underground sumps.
   a. Manufacturers:
      1) Hose Master, Inc.
      2) Teleflex Fluid Systems, Inc.
      3) Titeflex Corporation.

I. Flexible Metal Hoses: UL 536, with 100-psig minimum pressure rating.
   1. Manufacturers:
      a. American Flexible Hose Co., Inc.

J. Flexible Pipe Connectors: Flexible metal hose.
   1. Manufacturers:
      a. Anamet Inc.
      b. Flex-Hose Co., Inc.
      c. Flexicraft Industries.
      d. Flex-Pression Ltd.
      e. Hyspan Precision Products, Inc.
      f. Mercer Rubber Company.
      g. Metraflex, Inc.
      h. Proco Products, Inc.
      i. Unaflex Inc.

2. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
2.4 VALVES

A. Bronze Gate Valves: MSS SP-80, Type 2, Class 200. Include ends threaded according to ASME B1.20.1. Valves with solder ends may be furnished for use with copper tube.

B. Bronze Ball Valves: MSS SP-110; 3-piece bolted-body; 400-psig minimum, WOG, nonshock, working pressure rating. Include full-port, cast-bronze, chrome-plated bronze ball; PTFE seats; lever handle; and threaded ends according to ASME B1.20.1. Valves with solder ends may be furnished for use with copper tube.

C. Bronze Check Valves: MSS SP-80, Type 3, Class 200. Include ends threaded according to ASME B1.20.1. Valves with solder ends may be furnished for use with copper tube.

D. Bronze Vertical Ball Check Valves: ASTM B 61 or ASTM B 62, 2-piece construction; and 400-psig WOG, nonshock, working pressure rating. Include integral bronze seats, replaceable stainless-steel ball, and threaded ends according to ASME B1.20.1.

E. Cast-Iron Gate Valves: MSS SP-70, Type I, Class 250. Include OT construction, all-bronze trim, and flanged ends.

F. Steel Ball Valves: MSS SP-72; full-port, chrome-plated steel ball; TFE seats; and flanged ends.

G. Cast-Iron Check Valves: MSS SP-71, Type I, Class 250. Include flanged ends.

H. UL Valves: UL 842, listed for fuel oil service.

I. Special-Purpose, General-Duty Valves: Valves made in shape or configuration for specific fuel oil service and complying with requirements of NFPA 30.
A. Manufacturers:

1. EBW, Inc.
2. EMCO Wheaton DTM, Inc.
3. Environ Products Inc.
6. OPW Fueling Components.
7. Petroleum Containment Composites.
8. Preferred Utilities Manufacturing Corp.
9. Smith Fibercast; a Varco Company.
10. Universal Valve Company.

B. Fitting Materials: Cast-iron, malleable-iron, brass, or corrosion-resistant metal; suitable for service.


C. Spill-Containment Remote Fill Boxes: Free standing, with lockable door, 10 gallon capacity and 1” drain with locking ball valve, quick disconnect, check and ball valve and hand pump. Provide box with 4 leg stand for free standing.

D. Pipe Adapters and Extensions: Compatible with piping and fittings.

E. Suction Strainers and Check Valves: Bronze or corrosion-resistant metal components.

2.6 LEAK-DETECTION AND MONITORING SYSTEMS

A. Manufacturers:

1. Amprodux, Inc.
2. Caldwell Systems.
3. Containment Solutions, Inc.
4. EBW, Inc.
5. Gems Sensors Inc.
7. In-Situ, Inc.
8. Intelligent Controls, Inc.
10. MSA International; Instrument Div.
11. Pneumercator Inc.
12. Raychem Corp.
13. Tuthill Corporation; Tuthill Transfer Systems; Emco Electronics Div.

B. Description: Calibrated, leak-detection and monitoring system complying with UL 1238 with probes and other sensors and remote alarm panel for fuel piping. Include fittings and devices required for testing.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Install piping free of sags and bends.

B. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

C. Install fittings for changes in direction and branch connections.

D. Install rigid, underground, double-contained fill and vent piping at uniform slope downward toward fuel storage tank sump.

E. Install flexible, double-contained, fuel pipe at minimum slope of 1 percent downward toward fuel storage tank sump.

F. Assemble and install bulkhead fittings for pipe penetrations through storage tank sump sidewalls. Follow fitting manufacturer's written instructions and use components required for liquid-tight joints.

G. Install reductions in pipe sizes using eccentric reducer fittings. Install fitting with level side down.

H. Install flexible connectors at piping connections to UST.

I. Install flexible pipe connectors at piping connections to ASTs and vibration-producing equipment. Use according to the following applications:

   2. Copper Tubing: Bronze-hose, flexible connectors.

J. Install double-contained piping according to manufacturer's written instructions for assembly, joining, trench preparation, and installation.
K. Install and terminate double-contained piping at fuel storage tank containment sumps and at building.

3.3 VALVE INSTALLATION

A. Install valves in accessible locations. Protect valves from physical damage, and install metal tag attached with metal chain indicating fuel piping systems.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

D. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

E. Ground equipment according to Division 26 Section "Grounding and Bonding."

F. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

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

3.6 CONCRETE BASES

A. Construct concrete equipment bases according to equipment manufacturer's setting templates for anchorbolt and tie locations. Use 3000 psi, 28-day, compressive-strength concrete.

B. Refer to Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.

3.7 LEAK-DETECTION AND MONITORING SYSTEM INSTALLATION

A. Install leak-detection and monitoring systems according to manufacturer's written instructions. Install alarm panel inside building where indicated.

3.8 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each AST and on equipment exposed in sumps and manholes.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

B. Warning Tapes: Arrange for installation of continuous underground detectable warning tape during backfilling of trenches.

1. Piping: Over underground, fuel distribution piping.
2. Fuel Storage Tanks: Over edges of each UST.

3.9 FIELD PAINTING OF ABOVEGROUND PIPING

A. Paint exposed metal piping, valves, and piping specialties except units with factory-applied paint or protective coating.

B. Steel Piping: Prepare surface of aboveground steel piping and apply painting semigloss finish for ferrous metal.

C. Copper Tubing: Prepare surface of aboveground copper tubing and apply painting semigloss finish for nonferrous metal.

3.10 FIELD QUALITY CONTROL

A. Perform field tests on underground piping and USTs before backfilling.

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

1. Test fuel piping according to NFPA 30, "Piping Systems" Chapter on testing or NFPA 31, "Piping, Pumps, and Valves" Chapter on tests of piping.

   a. Hydrostatically test carrier piping to 1-1/2 times system pressure.
   b. Pneumatically test containment jacket at maximum 5 psig (35 kPa).

2. Test leak-detection and monitoring systems for accuracy by manually operating sensors and checking against alarm panel indication.

C. Remove and replace units and retest as specified above.
3.11 ADJUSTING

A. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain leak-detection and monitoring systems.

END OF SECTION 33 5213