



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

**MULTI-STEP BIDDING PROCESS  
FOR  
CONTRACTORS**

**Request For Solicitation For  
Construction Services**

**Stage II – Electrical Contractors Bidders List FY09**

**January 29, 2009**

**GENERATOR UPGRADE  
LARRY H. MILLER CAMPUS**

**SALT LAKE COMMUNITY COLLEGE  
SANDY, UTAH**

**DFCM PROJECT # 08073660**

Thomas and Kolkman Engineering  
64 West 1700 South  
SLC, Utah 84115

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM:

DFCM Supplemental General Conditions dated July 15, 2008  
DFCM General Conditions dated May 25, 2005  
DFCM Application and Certificate for Payment dated May 25, 2005

Technical Specifications:  
Drawings:

**The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>**

## INVITATION TO BID

**ONLY FIRMS PRE-QUALIFIED DURING STAGE I OF THE RFS ARE ALLOWED TO BID ON THIS PROJECT**

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting bids for the construction of the following project:

**GENERATOR UPGRADE – LARRY H. MILLER CAMPUS**  
**SALT LAKE COMMUNITY COLLEGE - SANDY, UTAH**  
**DFCM PROJECT NO: 08073660**

Project Description: Installation of a new generator, concrete generator pad, generator distribution panel including feeders to multiple buildings, and various electrical modifications for the generator supported buildings.  
Construction Cost Estimate: \$125,000.

<b>Company</b>	<b>Contact</b>	<b>Fax</b>
Electro Specialist, Inc.	Jeff Davis	(801) 572-5658
Hidden Peak Electric Co., Inc.	Derek Lee	(801) 262-5689
Integrated Controls & Electric Inc	Rick Bowen	(801) 732-0452
KGM Electric L.L.C.	Kim Madsen	(435) 835-1790
Patriot Construction	Roan Poulter	(888) 867-1845
Positive Power, LLC	George Langlois	(801) 731-8908
Power Electric Company	Joseph Gormally	(801) 288-1065
Probst Electric	Mr. Riley Probst	(435) 657-1956
Taylor Electric and Engineering	Ryan J. Taylor	(801) 413-1361
Utah Controls, Inc.	Scott Porter	(801) 990-1955
Wade Electric	Shawn L. Wade	(801) 467-3944

The bid documents will be available on at 4:00 PM on Thursday, January 29, 2009 in electronic format only on CDs from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801)538-3018 and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Brian Bales, Project Manager, DFCM, at (801) 230-3129 No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 1:30 PM on Tuesday, February 3, 2009 at the Larry H. Miller Campus, Salt Lake Community College, 9750 South 300 West, Sandy, Utah. Meet at the location of the new generator on the north west corner of the campus as shown on the plans. All pre-qualified prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 3:00 PM on Wednesday, February 11, 2009 to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. Note: Bids must be received at 4110 State Office Building by the specified time. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction & Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the State.

**DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT**  
**MARLA WORKMAN, CONTRACT COORDINATOR**  
4110 State Office Bldg., Salt Lake City, Utah 84114

## **STAGE II - MULTI-STEP BIDDING PROCESS**

**ONLY FIRMS PRE-QUALIFIED DURING STAGE I OF THE RFS ARE ALLOWED TO BID ON THIS PROJECT**

### **1. Invitational Bid Procedures**

The following is an overview of the invitational bid process. More detailed information is contained throughout the document. Contractors are responsible for reading and complying with all information contained in this document.

Notification: DFCM will notify each registered pre-qualified firm (via fax or e-mail) when a project is ready for Construction Services and invite them to bid on the project.

Description of Work: A description of work or plans/specifications will be given to each contractor. If required, the plans and specifications will be available on the DFCM web page at <http://dfcm.utah.gov> and on CDs from DFCM, at 4110 State Office Building, Salt Lake City, Utah 84114.

Schedule: The Stage II Schedule shows critical dates including the mandatory pre-bid site meeting (if required), the question and answer period, the bid submittal deadline, the subcontractor list submittal deadline, etc. Contractors are responsible for meeting all deadlines shown on the schedule.

Mandatory Pre-Bid Site Meeting: If a firm fails to attend a pre-bid site meeting labeled “Mandatory” they will not be allowed to bid on the project. At the mandatory meeting, contractors may have an opportunity to inspect the site, receive additional instructions and ask questions about project. The schedule contains information on the date, time, and place of the mandatory pre-bid site meeting.

Written Questions: All questions must be in writing and directed to DFCM’s project manager assigned to this project. No others are to be contacted regarding this project. The schedule contains information on the deadline for submitting questions.

Addendum: All clarifications from DFCM will be in writing and issued as an addendum to the RFS. Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

Submitting Bids: Bids must be submitted to DFCM 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document.

Pre-qualified List of Contractors: Contractors shall remain on DFCM’s list of pre-qualified contractors provided: (a) they maintain a performance rating of 3.5 or greater on each project, (b) they are not suspended for failure to comply with requirements of their contract, (c) the firm has not undergone a significant reorganization involving the loss of key personnel (site superintendents, project managers, owners, etc.) to a degree such that the firm no longer meets the pre-qualification requirements outlined in Stage I, (d) the financial viability of the firm has not significantly changed, and (e) the firm is not otherwise disqualified by DFCM. Note: If a contractor fails to comply with items (a) through (e) above,

they may be removed from DFCM's list of pre-qualified contractors following an evaluation by a review committee. Contractors will be given the opportunity to address the review committee before a decision is made. Pre-qualified contractors are ONLY authorized to bid on projects within the discipline that they were originally pre-qualified under.

**2. Drawings and Specifications and Interpretations**

Drawings, specifications and other contract documents may be obtained as stated in the Invitation to Bid. If any firm is in doubt as to the meaning or interpretation of any part of the drawings, specifications, scope of work or contract documents, they shall submit, in writing, a request for interpretation to the authorized DFCM representative by the deadline identified in the schedule. Answers to questions and interpretations will be made via addenda issued by DFCM. Neither DFCM or the designer shall be responsible for incorrect information obtained by contractors from sources other than the official drawings/specifications and addenda issued by DFCM.

**3. Product Approvals**

Where reference is made to one or more proprietary products in the contract documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the contract documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the Designer. Such written approval must occur prior to the deadline established for the last scheduled addendum to be issued. The Designer's written approval will be included as part of the addendum issued by DFCM. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the Designer.

**4. Addenda**

All clarifications from DFCM will be in writing and issued as an addendum to the RFS. Addenda will be posted on DFCM's web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda shall result in disqualification from bidding. DFCM shall not be responsible for incorrect information obtained by contractors from sources other than official addenda issued by DFCM.

**5. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the Contractor, Subcontractor or Sub-subcontractor. Failure to respond may result in suspension from DFCM's list of pre-qualified contractors.

**6. Licensure**

The Contractor shall comply with and require all of its Subcontractors to comply with the license laws as required by the State of Utah.

**7. Permits**

In concurrence with the requirements for permitting in the general conditions, it is the responsibility of the contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

**8. Time is of the Essence**

Time is of the essence in regard to all the requirements of the contract documents.

**9. Bids**

Before submitting a bid, each bidder shall carefully examine the contract documents; shall visit the site of the work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the contract documents including those added via addenda. If the bidder observes that portions of the contract documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Project Manager prior to the bidding deadline. Changes necessary to correct these issues will be made via addenda issued by DFCM.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the published deadline for the submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **A cashier's check cannot be used as a substitute for a bid bond.**

**10. Listing of Subcontractors**

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", included as part of the contract documents. The subcontractors list shall be delivered to DFCM or faxed to DFCM at (801) 538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the contract documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements may be suspended from DFCM's list of pre-qualified contractors.

**11. Contract and Bond**

The Contractor's Agreement will be in the form provided in this document. The duration of the contract shall be for the time indicated by the project completion deadline shown on the schedule. The successful bidder, simultaneously with the execution of the Contractor's Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents.

The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

**12. Award of Contract**

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of DFCM to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc. Alternates will be selected in prioritized order up to the construction cost estimate.

**13. Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

**14. Withdrawal of Bids**

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.

**15. DFCM Contractor Performance Rating**

As a contractor completes each project, DFCM will evaluate project performance based on the enclosed "DFCM Contractor Performance Rating" form. The ratings issued on this project may affect the firm's "pre-qualified" status and their ability to obtain future work with DFCM.



## Stage II PROJECT SCHEDULE

<b>PROJECT NAME: GENERATOR UPGRADE – LARRY H. MILLER CAMPUS SALT LAKE COMMUNITY COLLEGE – SANDY, UTAH</b>				
<b>DFCM PROJECT #: 08073660</b>				
<b>Event</b>	<b>Day</b>	<b>Date</b>	<b>Time</b>	<b>Place</b>
Stage II Bidding Documents Available	Thursday	January 29, 2009	4:00 PM	DFCM 4110 State Office Building SLC, UT and the DFCM web site*
Mandatory Pre-bid Site Meeting	Tuesday	February 3, 2009	1:30 PM	Larry H. Miller Campus Salt Lake Community College 9750 South 300 West Sandy, UT **
Deadline for Submitting Questions	Thursday	February 5, 2009	12:00 NOON	Brian Bales – DFCM E-mail brbales@utah.gov Fax (801) 538-3267
Addendum Deadline (exception for bid delays)	Monday	February 9, 2009	4:00 PM	DFCM web site*
Prime Contractors Turn in Bid and Bid Bond	Wednesday	February 11, 2009	3:00 PM	DFCM 4110 State Office Building SLC, UT
Subcontractors List Due	Thursday	February 12, 2009	3:00 PM	DFCM 4110 State Office Building SLC, UT Fax (801) 538-3677
Substantial Completion Date	Thursday	June 18, 2009		

\* **NOTE: DFCM's web site address is <http://dfcm.utah.gov>**

\*\* Meet at the location of the new generator on the north west corner of the campus as shown on the plans.



## BID FORM

NAME OF BIDDER \_\_\_\_\_ DATE \_\_\_\_\_

To the Division of Facilities Construction and Management  
4110 State Office Building  
Salt Lake City, Utah 84114

The undersigned, responsive to the "Invitation to Bid" and in accordance with the Request for Bids for the **GENERATOR UPGRADE – LARRY H. MILLER CAMPUS – SALT LAKE COMMUNITY COLLEGE SANDY, UTAH - DFCM PROJECT NO. 08073660** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: \_\_\_\_\_

**BASE BID:** For all work shown as Base Bid on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

**ADDITIVE ALTERNATE #1:** For all work shown as Alternate #1 on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

**ADDITIVE ALTERNATE #2:** For all work shown as Alternate #2 on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_)

(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **June 18, 2009**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$300.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of \_\_\_\_\_

The undersigned Contractor's License Number for Utah is \_\_\_\_\_.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within time set forth.

Type of Organization: \_\_\_\_\_  
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:  
\_\_\_\_\_

Respectfully submitted,

\_\_\_\_\_  
Name of Bidder

ADDRESS:  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Authorized Signature

**BID BOND**

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

**KNOW ALL PERSONS BY THESE PRESENTS:**

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of \$ \_\_\_\_\_ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH** that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the \_\_\_\_\_ Project.

**NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH**, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

**DATED** this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

**Principal's name and address (if other than a corporation):**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

**Principal's name and address (if a corporation):**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Affix Corporate Seal)

**Surety's name and address:**

\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_  
Attorney-in-Fact (Affix Corporate Seal)

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.  
My Commission Expires: \_\_\_\_\_  
Resides at: \_\_\_\_\_

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

\_\_\_\_\_  
NOTARY PUBLIC

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

**Division of Facilities Construction and Management****INSTRUCTION AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, based on the following:

**DOLLAR AMOUNTS FOR LISTING**

**PROJECTS UNDER \$500,000: ALL FIRST-TIER SUBS \$20,000 OR OVER MUST BE LISTED**  
**PROJECTS \$500,000 OR MORE: ALL FIRST-TIER SUBS \$35,000 OR OVER MUST BE LISTED**

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

**LICENSURE:**

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

**'SPECIAL EXCEPTION':**

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

**GROUNDS FOR DISQUALIFICATION:**

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such

**INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**  
**Page No. 2**

other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

**CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:**

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

**EXAMPLE:**

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONTRACTOR LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self" *	\$300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	\$298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: \$350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

\* Bidders may list "self", but it is not required.

**PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.**



SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: \_\_\_\_\_

Caution: You must read and comply fully with instructions.

Table with 4 columns: TYPE OF WORK, SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION", SUBCONTRACTOR BID AMOUNT, CONT. LICENSE #

We certify that:

- 1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: \_\_\_\_\_

DATE: \_\_\_\_\_

SIGNED BY: \_\_\_\_\_

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

## CONTRACTOR'S AGREEMENT

FOR:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

THIS CONTRACTOR'S AGREEMENT, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and \_\_\_\_\_, incorporated in the State of \_\_\_\_\_ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is \_\_\_\_\_.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at \_\_\_\_\_  
\_\_\_\_\_.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

**ARTICLE 1. SCOPE OF WORK.** The Work to be performed shall be in accordance with the Contract Documents prepared by \_\_\_\_\_ and entitled "\_\_\_\_\_."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 and Supplemental General Conditions dated July 15, 2008 ("also referred to as General Conditions") and on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

**ARTICLE 2. CONTRACT SUM.** The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of \_\_\_\_\_  
\_\_\_\_\_ DOLLARS AND NO CENTS (\$\_\_\_\_\_.00), which is the base bid, and which sum also includes the cost of a 100%

CONTRACTOR'S AGREEMENT  
PAGE NO. 2

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

**ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY.** The Work shall be Substantially Complete by \_\_\_\_\_. Contractor agrees to pay liquidated damages in the amount of \$\_\_\_\_\_ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

**ARTICLE 4. CONTRACT DOCUMENTS.** The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

**ARTICLE 5. PAYMENT.** The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

**ARTICLE 6. INDEBTEDNESS.** Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

**ARTICLE 7. ADDITIONAL WORK.** It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

**ARTICLE 8. INSPECTIONS.** The Work shall be inspected for acceptance in accordance with the General Conditions.

**ARTICLE 9. DISPUTES.** Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

**ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT.** This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

**ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF.** The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

**ARTICLE 12. INDEMNIFICATION.** The Contractor shall comply with the indemnification provisions of the General Conditions.

**ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT.** The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

**ARTICLE 14. RELATIONSHIP OF THE PARTIES.** The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

**ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT.** Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

**ARTICLE 16. ATTORNEY FEES AND COSTS.** Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.



**PERFORMANCE BOND**

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That \_\_\_\_\_ hereinafter referred to as the "Principal" and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_, with its principal office in the City of \_\_\_\_\_ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ DOLLARS (\$) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_, for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which Contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**PRINCIPAL:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)  
Title: \_\_\_\_\_

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**SURETY:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)  
Attorney-in-Fact

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_  
Resides at: \_\_\_\_\_

\_\_\_\_\_  
NOTARY PUBLIC

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General

**PAYMENT BOND**

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

**KNOW ALL PERSONS BY THESE PRESENTS:**

That \_\_\_\_\_ hereinafter referred to as the "Principal," and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of \_\_\_\_\_, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has entered into a certain written Contract with the Obligee, dated the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, to construct \_\_\_\_\_ in the County of \_\_\_\_\_, State of Utah, Project No. \_\_\_\_\_ for the approximate sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), which contract is hereby incorporated by reference herein.

**NOW, THEREFORE**, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

**PROVIDED, HOWEVER**, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

**IN WITNESS WHEREOF**, the said Principal and Surety have signed and sealed this instrument this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**PRINCIPAL:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)  
Title: \_\_\_\_\_

**WITNESS OR ATTESTATION:**

\_\_\_\_\_

**SURETY:**

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)  
Attorney-in-Fact

STATE OF \_\_\_\_\_ )  
 ) ss.  
COUNTY OF \_\_\_\_\_ )

On this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, personally appeared before me \_\_\_\_\_, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

My commission expires: \_\_\_\_\_

Resides at: \_\_\_\_\_

\_\_\_\_\_  
NOTARY PUBLIC

**Agency:** \_\_\_\_\_  
**Agent:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_

Approved As To Form: May 25, 2005  
By Alan S. Bachman, Asst Attorney General



Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT \_\_\_\_\_ PROJECT NO: \_\_\_\_\_

AGENCY/INSTITUTION \_\_\_\_\_

AREA ACCEPTED \_\_\_\_\_

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at \_\_\_\_\_ (time) on \_\_\_\_\_ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

\_\_\_\_\_  
\_\_\_\_\_

The Owner acknowledges receipt of the following closeout and transition materials:

- Record Drawings
- O & M Manuals
- Warranty Documents
- Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of \_\_\_\_\_. (Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within \_\_\_\_\_ calendar days from the above date of issuance of this Certificate. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

\_\_\_\_\_  
CONTRACTOR (include name of firm) by: \_\_\_\_\_  
(Signature) DATE

\_\_\_\_\_  
A/E (include name of firm) by: \_\_\_\_\_  
(Signature) DATE

\_\_\_\_\_  
USING INSTITUTION OR AGENCY by: \_\_\_\_\_  
(Signature) DATE

\_\_\_\_\_  
DFCM (Owner) by: \_\_\_\_\_  
(Signature) DATE

4110 State Office Building, Salt Lake City, Utah 84114  
telephone 801-538-3018 • facsimile 801-538-3267 • <http://dfcm.utah.gov>

cc: Parties Noted  
DFCM, Director

**General Contractor Performance Rating Form**

Project Name:		DFCM Project#	
Contractor:  (ABC Construction, John Doe, 111-111-1111)	A/E:  (ABC Architects, Jane Doe, 222-222-2222)	Original Contract Amount:	Final Contract Amount:
DFCM Project Manager:		Contract Date:	
Completion Date:		Date of Rating:	

Rating Guideline	QUALITY OF PRODUCT OR SERVICES	COST CONTROL	TIMELINESS OF PERFORMANCE	BUSINESS RELATIONS
<b>5-Exceptional</b>	Contractor has demonstrated an exceptional performance level in any of the above four categories that justifies adding a point to the score. Contractor performance clearly exceeds the performance levels described as "Very Good"			
<b>4-Very Good</b>	Contractor is in compliance with contract requirements and/or delivers quality product/service.	Contractor is effective in managing costs and submits current, accurate, and complete billings	Contractor is effective in meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is effective
<b>3-Satisfactory</b>	Minor inefficiencies/errors have been identified	Contractor is usually effective in managing cost	Contractor is usually effective in meeting milestones and delivery schedules	Response to inquires technical/service/administrative issues is somewhat effective
<b>2-Marginal</b>	Major problems have been encountered	Contractor is having major difficulty managing cost effectively	Contractor is having major difficulty meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is marginally effective
<b>1-Unsatisfactory</b>	Contractor is not in compliance and is jeopardizing achievement of contract objectives	Contractor is unable to manage costs effectively	Contractor delays are jeopardizing performance of contract objectives	Response to inquiries, technical/service/administrative issues is not effective

<b>1. Rate Contractors quality of workmanship, management of sub contractor performance, project cleanliness, organization and safety requirement.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>2. Rate Contractor administration of project costs, change orders and financial management of the project budget.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>3. Rate Contractor's performance and adherence to Project Schedule, delay procedures and requirements of substantial completion, inspection and punch-list performance.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>4. Evaluate performance of contractor management team including project manager, engineer and superintendent also include in the rating team's ability to work well with owner, user agency and consultants.</b>	<b>Score</b>
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

5. Rate success of Contractor's management plan, completion of the plans mitigation of project risks and performance of value engineering concepts.	Score
<u>Agency Comments:</u>	
<u>A &amp; E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

<b>Signed by:</b>	<b>Date:</b>	<b>Mean Score</b>
-------------------	--------------	-------------------

**Additional Comments:**

# TECHNICAL SPECIFICATIONS

FOR



**Larry H. Miller Campus**  
**9750 South 300 West**  
Sandy, Utah

## **BUILDINGS 5-9**

### **EMERGENCY GENERATOR**

### **IMPROVEMENTS**



State of Utah—Department of Administrative Services

**DIVISION OF FACILITIES CONSTRUCTION**  
**AND MANAGEMENT**

4110 State Office Building / Salt Lake City, Utah 84114 / 538-3018

Prepared by

Thomas & Kolkman Engineering Company Inc.  
64 West 1700 South  
Salt Lake City, Utah 84115  
Tele: (801) 484-8161  
Fax: (801) 484-3538

January 15, 2009

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SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

- A. The Project consists of installation of new emergency generator for Buildings 5, 6, 7, 8, and 9 at the Larry Miller Campus of Salt Lake Community College Buildings as described by the Contract Documents prepared by Thomas & Kolkman Engineering Company Inc..
- B. The Work consists of providing new work and alterations to the existing building and building systems necessary for installation and proper operation of the new work including, but not limited to the following:
  - 1. New Emergency Power Systems including diesel engine-generator set in weather protective housing, sub-base dual wall fuel tank, automatic transfer switches, and electrical connections necessary for the proper operation of the emergency power systems.
  - 2. Connections to the existing Campus Automation System for monitoring of the new Emergency Power System.
  - 3. Demolition and repair of the existing buildings, limited to the extent required to install the above work.
  - 4. Incidental items required to complete the work even though not specifically indicated.

1.3 CONTRACTOR USE OF PREMISES

- A. The Contractor will have limited use of areas included in the scope of the work as required for storage and construction operations. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
  - 1. The Contractor may have limited use of the mechanical rooms, electrical room, or similar spaces in each building involved in the project, as approved by Salt Lake Community College, during the construction period for material storage not accommodated in the work areas. These areas are not secure and it will be the responsibility of the contractor to provide additional measures to secure stored materials, tools, and equipment. Material storage will not in any way interfere with the normal building operations or interfere with access or working clearance in the existing mechanical room and generator enclosure.
- B. Staging area will be made available to the contractor in each campus parking lot as indicated on the drawings. Maximum 4 parking spaces will be available. Coordinate exact location with SLCC Facilities Project Manager. Contractor to provide suitable barricades to protect staging area and passersby. Barricades will not impede traffic flow.
- C. Contractor will be allowed to use toilet rooms in the buildings in which work is be performed. The contractor will be required to keep the toilet rooms neat and clean or the contractor will not be allowed to use the building toilet rooms and will be required to provide portable toilet facilities.
- D. Contractor may use existing buildings utilities, including power and water, as required for construction purposes, to be used in a judicious manner.

- E. 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 except as specifically allowed by the Owner. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
- F. Maintain the existing building in a weathertight condition throughout the construction period. Repair all damage caused by construction operations.
- G. Take all precautions necessary to protect building occupants during the construction period. Provide temporary barricades, etc., as required to limit access of passersby to construction areas while maintaining access to building exits and occupied areas of the building.

#### 1.4 PARKING PERMITS

- A. Parking permits will be required for all contractor vehicles parked on the school campuses. Permits for general parking lots will be issued without cost to the contractor. This does not include parking at meters, in handicap spaces, or red curb parking.

#### 1.5 WORK SCHEDULING

- A. The Owner will occupy the existing buildings during the entire construction period. The Work will be scheduled with the least possible interference to the activities of the Owner's personnel and students.
- B. The contractor shall submit a complete construction schedule plan prior to beginning work. The plan shall include provision for dust control, pedestrian control including means to maintain access to all existing offices, classrooms, and building exits, and to protect the safety of all passersby.
- C. Excessively noisy construction operations such as hammer drilling shall be accomplished during times when the building is not normally occupied, such as weekends, holidays, etc.
- D. Cooperate with the Owner to minimize conflicts with Owner's usage.

#### 1.6 GUARANTEE/WARRANTY

- A. Notwithstanding other guarantees or warranties for specific components, The Contactor shall Warranty the entire work included in the Contract for a period of One (1) Year from the date of issuance of the Certificate of Substantial Completion against all defects in equipment, material and workmanship.
- B. Furnish and pay for all labor, equipment and material required to correct defects and deficiencies in the work without additional cost to the Owner and as approved by the Owner and Project Engineer.
- C. Provide all incidental product warranties which are available from manufacturers at no additional cost to the Owner.
- D. Submit all warranties in binders which are indexed, tabbed and labeled.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

\* END OF SECTION 01010 \*

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
  - 1. Pre-Construction Conference
  - 2. Coordination/Progress meetings

1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the Project Site or other convenient location prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Engineer, the Contractor and its superintendent, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
  - 1. Construction phasing and schedule.
  - 2. Critical Work sequencing.
  - 3. Designation of responsible personnel.
  - 4. Procedures for processing field decisions and Change Orders.
  - 5. Procedures for processing Applications for Payment.
  - 6. Distribution of Contract Documents.
  - 7. Submittal of Shop Drawings and Product Data.
  - 8. Preparation of Record Documents.
  - 9. Use of the premises.
  - 10. Parking.
  - 11. Work and Storage Areas.
  - 12. Equipment deliveries and priorities.
  - 13. Safety procedures.
  - 14. Security.
  - 15. Housekeeping.
  - 16. Working Hours.

1.4 COORDINATION/PROGRESS MEETINGS

- A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved.
  - 1. Meetings will be conducted weekly unless otherwise agreed upon by Owner, Project Engineer, and Contractor.
- B. The Owner, Project Engineer, the Contractor and/or its superintendent, and other parties currently involved in coordination or planning for the construction activities involved will be represented at each meeting.

- C. The Project Engineer will record meeting results and distribute copies to everyone in attendance and to others affected by decisions resulting from each meeting.
- D. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
  - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments for parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  - 2. Review the present and future needs of each entity present, including such items as:
    - a. Interface requirements.
    - b. Time.
    - c. Sequences.
    - d. Deliveries.
    - e. Off-Site fabrication problems.
    - f. Access.
    - g. Site utilization.
    - h. Temporary facilities and services.
    - i. Hours of work.
    - j. Hazards and risks.
    - k. Housekeeping.
    - l. Quality and Work standards.
    - m. Change Orders.
    - n. Documentation of information for Payment Requests.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

\* END OF SECTION 01200 \*

SECTION 01030 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Alternates.
- B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
- C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project. The cost of coordination of the alternate work shall be addressed in the alternate pricing.
- D. Notification: Immediately following award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.
- E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
  - 1. Include as part of each Alternate, miscellaneous devices, accessory objects, repairs and similar items incidental to or required for a complete installation whether or not specifically mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Additive Alternate No. 1: New Emergency Panels and Transformers.
  - 1. Provide new 120/208 Volt 3 Phase Panelboards, Step-Down Transformers, and connections to existing building emergency panels where indicated on the drawings.
  - 2. Connect existing systems such as building fire alarm systems to the new panelboards as indicated on the drawings.
  - 3. Provide new receptacles and connections to new panelboards as indicated on the drawings.
- B. Additive Alternate No. 2: Remove battery back-up emergency lighting.
  - 1. Replace battery backup exit lights with new AC only exit lights as indicated on the drawings.
  - 2. Remove existing battery operated emergency lighting units.

3. Remove existing emergency battery packs from existing fluorescent fixtures and provide closing plugs where necessary.

\* END OF SECTION 01030 \*

SECTION 01700 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Job Site Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operating and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final Cleaning.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date of Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
  - 3. Submit record drawings, maintenance manuals, damage or settlement survey, property survey, and similar final record information.
  - 4. Deliver tools, spare parts, and similar items.
  - 5. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
  - 6. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedure: On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
  - 1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.
  - 2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

- A. General: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
  2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected. The certified copy of the list shall state that each item has been completed, or otherwise resolved for acceptance and shall be endorsed and dated by the Engineer.
- B. Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Engineer.

#### 1.5 EXTRA STOCK SUBMITTALS

- A. Provide extra stock in original cartons, or packaged with protective coverings, for storage and identified with labels clearly describing contents.
- B. Turn over extra stock to Owner and place in storage prior to Substantial Completion. Exact location of storage to be determined by the Owner.
- C. Obtain signed receipt for extra stock materials from the SLCC Facilities Project Manager. Include copy of signed receipt in the Project Operation and Maintenance Manuals.
- D. Provide the following extra stock of materials to the Owner.
  1. Lamps, and exit lights: refer to Specification Section 16500 - Lighting for required quantities.

#### 1.6 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Engineer's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
  2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
  3. Mark all work and changes included in Addenda, Change Orders, Supplemental Instruction, or verbal instruction. Note related document numbers where applicable.
  4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

#### 1.7 OPERATION & MAINTENANCE MANUALS SUBMITTALS

- A. Provide 4 sets of Operation and Maintenance Manuals unless otherwise directed by the Owner and/or Project Engineer.
- B. Organize operation and maintenance data into suitable sets of manageable size. Bind properly

indexed data in individual, heavy-duty, 3-ring, vinyl-covered binders, with pockets folders for folded sheet information, and properly sized for the amount of materials.

1. Folding tab sheet folders are not acceptable.
- C. Include project identification on the front cover of each set to include, but not be limited to, the following information:
1. Project Name as it appears on the contract documents.
  2. Owner's Project Number.
  3. Contractor's name, address, telephone, fax, and other pertinent information.
  4. Project Engineer's name, address, telephone, fax, and other pertinent information.
- D. Include the Project Name as it appears on the contract documents and the Owner's Project Number on the back spine of each set.
- E. Include the following types of information:
1. Emergency instructions.
  2. Spare parts list.
  3. Copies of warranties.
  4. Wiring Diagrams.
  5. Recommended "turn around" cycles.
  6. Inspection Procedures.
  7. Shop Drawings and Product Data.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representative if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals.
  2. Record Documents.
  3. Spare Parts and materials.
  4. Tools.
  5. Lubricants.
  6. Identification systems.
  7. Control sequences.
  8. Hazards.
  9. Cleaning.
  10. Warranties and Bonds.
  11. Maintenance agreements and similar continuing commitments.

3.2 FINAL CLEANING

- A. The General Conditions require general cleaning during construction.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and

maintenance program. Comply with manufacturer's instructions.

1. Remove labels that are not permanent labels.
  2. Clean transparent materials, including mirrors and glass in doors and windows. Replace chipped or broken glass and other transparent materials damaged as a result of the work.
  3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.
  4. Leave concrete floors broom clean. Vacuum carpeted surfaces.
  5. Clean the site including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits.
- C. Removal of Protection: Remove temporary protection and facilities installed during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess material on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Place in storage or dispose of these materials as directed by the Owner.

\* END OF SECTION 01700 \*

SECTION 02100 - GENERAL SITE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for general site work including but not limited to:
  - 1. Examination.
  - 2. Preparation.
  - 3. Repair and Restoration.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

- A. 48 hours minimum prior to performing any work on site, contact Blue Stakes to arrange for utility location services.
- B. Prior to performing any excavation, obtain current utility plan indicating approximate location of known underground utilities from Salt Lake Community College (SLCC) Facilities Division.
- C. Contractor may pothole to verify location of existing underground utilities as deemed necessary by the contractor. No additional allowance will be made by the Owner to the contractor for potholing performed by the contractor.
- D. Upon discovery of conflicts or problems with existing facilities, notify the Project Engineer by telephone or fax within 24 hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.

3.2 PROTECTION

- A. Spillage -
  - 1. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
  - 2. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
- B. Dust Control -
  - 1. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
  - 2. Correct or repair damage caused by dust.
- C. Erosion Control -
  - 1. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.
  - 2. Develop, install, and maintain an erosion control plan if required by law.
  - 3. Repair and correct damage caused by erosion.

D. Existing Plants & Features -

1. Do not damage tops, trunks, and roots of existing trees and shrubs on site which are intended to remain. Do not use heavy equipment within branch spread. Interfering branches may be removed only with permission of Engineer and Owner.
2. Do not damage other plants and features which are to remain.

- E. If specified precautions are not taken or corrections and repairs are not made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of the Work.

3.3 REPAIR AND RESTORATION

- A. Adjust existing covers, boxes, and vaults to grade.
- B. Replace broken or damaged covers, boxes, and vaults.
- C. Independently confirm size, location, and number of covers, boxes, and vaults which require adjustment.

3.4 FIELD QUALITY CONTROL

- A. If work has been interrupted by weather, scheduling, or other reason, notify Engineer 24 hours minimum prior to intended resumption of grading or compacting.
- B. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils which have been exposed to adverse weather conditions.

\* END OF SECTION 02100 \*

SECTION 02170 - GRASS SOD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions and Division 1 Specification Sections apply to work of this section.
- B. Section 02200 - Earthwork applies to work of this section.

1.2 SCOPE OF WORK

- A. Provide all grass sod, labor, materials, and equipment necessary for replacement of existing grass sod removed, disturbed or damaged by construction activities including, but not limited to, the following:
  - 1. Installation of new underground utilities and structures.
  - 2. Damage caused by vehicular traffic on lawn areas.
    - a. Lawn areas will be considered as damaged where wheel tracks or other depressions are more than 1" below adjacent lawn areas or where lawn areas becomes muddy and unstable after normal watering.
    - b. Make repairs by removing the grass sod in the area of depressions with a sod cutter. Till the topsoil to minimum 6 inch depth and replace the grass sod.

1.3 QUALITY ASSURANCE

- A. All workers performing work of this section shall be thoroughly trained and experienced in the necessary crafts and be completely familiar with the specified requirements and the methods of the work of this section.

1.4 INSPECTIONS

- A. All new sod will be inspected upon delivery to site by Owner and/or Project Engineer. Any material that is not approved for use must be removed from site immediately and replaced with acceptable material.

1.5 JOB CONDITIONS

- A. Visit the site and be familiar with all existing conditions and extent of work performed by other contractors on the site.
- B. Obtain information and instructions from other trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them so that work can be made without delaying the project.
- C. Refer to drawings and compare locations of trees, shrubs, piping and existing utilities in order to avoid unnecessary damage to existing underground irrigation system and utilities.

PART 2 - PRODUCTS

## 2.1 GRASS SOD

- A. Grass sod removed from areas of excavation may be used for installation upon completion of backfilling only as follows:
  - 1. Carefully remove existing grass sod prior to excavation. Cut grass sod to a minimum depth of 1-1/2" or as required to obtain sufficient root structure for regrowth.
  - 2. Store removed grass at the project site in a location acceptable to the Owner.
  - 3. Maintain the stored grass sod in a healthy and live condition by regular watering and protection from construction activities.
  - 4. Grass sod that has been allowed to partially die or that is otherwise not equal to new grass sod shall be deemed unacceptable and be removed from the project site.
- B. Provide new grass sod for all lawn areas not covered by salvaged grass sod.
  - 1. New grass sod shall be two year old Kentucky Blue Grass that has been cut fresh not more than 24 hours prior to installation.
  - 2. Use only new grass sod that has been grown in a commercial sod farm. Do not use grass sod from any other source.
  - 3. New grass sod that has not been laid within 24 hours shall be deemed unacceptable and be removed from the site.

## 2.2 FERTILIZER

- A. Commercial fertilizer shall be a mixed commercial fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers.

## 2.3 TOPSOIL

- A. Excavated material free from subsoils, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris and any other undesirable material may be used for topsoil.
  - 1. Subsoils are expected to be gravelly and are not acceptable for topsoil. Contractor will be required to remove existing topsoil prior to excavation and stockpile the removed topsoil at the project site in a location acceptable to the Owner.
- B. Where existing topsoil is not stockpiled by the contractor or is otherwise not acceptable for topsoil, provide new imported topsoil as follows:
  - 1. Imported topsoil shall consist of natural sandy loam and be of uniform quality, free from subsoil, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris of any other undesirable material including plants, roots, or seeds that would be toxic or harmful to growth.
  - 2. Topsoil shall be obtained from naturally drained areas and shall contain at least 4 per cent organic material as determined by loss upon ignition of a moisture free sample that has been dried in accordance with current methods of the Association of Official Agricultural Chemists. Acidity range shall be 5.5 to 7.7 inclusive.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform all operations in connection with the installation of grass sod in strict accordance with this section of the specifications and the applicable drawings.
- B. Landscape work shall be suspended at any time when it may be subject to damage by climatic conditions. However, no substantial work suspension may be made without written permission of the Project Engineer.

3.2 PREPARATION OF SUBGRADE

- A. Inspect subgrade for any deleterious material including all rocks, clods and litter that is larger in diameter than specified.
- B. Correct any deficiencies in the subgrade including low spots, unevenness, and poor drainage areas due to improper grading or leveling prior to the installation of topsoil.
- C. Subgrade shall be 5-1/2" below finish grade in all cases to insure a uniform depth of 4" for topsoil and 1-1/2" for sod.

3.3 INSTALLATION

- A. When construction has been completed to a point where the areas will not be disturbed, subgrade shall be cleaned free of waste material of all kinds. Till and pulverize the subgrade to a depth of not less than 4 inches. Tilling shall be completed in all areas that are to receive plant materials whether it is to be grass sod or shrubs.
- B. Distribute topsoil to a depth of 4 inches over all sodded areas under the contract. Do not place topsoil over subgrade that is frozen or damp.
- C. The surface of the topsoil shall be fine graded. The surface shall be firm and free from footprints, depressions or undulations of any kind. The surface shall be free of all materials larger than 1/2" in diameter. Smooth shall be considered to be within 1/2 inch plus or minus of existing adjacent surfaces.
- D. The finish grade of the topsoil adjacent to all sidewalks, mowstrips, etc., and prior to the laying of the sod, shall be 1-1/2" below the top surface of the concrete or hard surface.
- E. Prior to laying of sod, the entire surface to receive sod shall be uniformly covered with the specified chemical fertilizer at the rate of 5 pounds per 1000 square feet.
- F. Upon completion of the laying operation, an inspection of the area shall be made. All voids and large cracks between individual pieces of sod shall be filled with topsoil, prior to watering.
- G. Watering of the sod shall be the complete responsibility of the contractor by whatever means necessary to establish the sod in an acceptable manner prior to acceptance by the owner. An existing irrigation system is in place on the site, but if for whatever reason, water is not available in the system, it is the full responsibility of the contractor to water the sod by other acceptable means, until the sod is accepted by the Owner.
- H. Upon completion of filling all voids in the newly laid sod areas, the sod is to be completely saturated with water.
- I. Protection of the newly laid sod shall be the complete responsibility of the contractor. Provide acceptable visual barriers by means of barricades set at appropriate distances and strings or

tapes between the barriers as an indication of new work. Restore any damaged areas caused by others, erosion or vehicular traffic until such a time as the lawn is accepted by the owner.

- J. The contractor shall keep the site free from accumulation of waste material. At the time of completion, all areas must be swept or washed clean and all rubbish removed to the satisfaction of the Project Engineer.

### 3.4 GUARANTEE

- A. The contractor shall be responsible for the protection, watering, weed control, and replacement of any damaged sod until acceptance by the Owner. This guarantee shall include the filling of any voids between sod pieces, removal and replacement of any deficient sod, repairing of any eroded or damaged areas and maintaining the sod by watering, mowing and controlling of insects and weeds, as well as advising the owner of any maintenance or watering procedures necessary to care for and promote plant life. All sod must be in satisfactory condition at the time of the final inspection.

\* END OF SECTION 02170 \*

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of earthwork is indicated on the drawings.
  - 1. Preparation of subgrade for equipment foundations, and pavements is included as part of this work.
  - 2. Drainage fill course for support of equipment foundations and walks is included as part of this work.
  - 3. Backfilling of utility trenches is included as part of this work.
- B. Excavation for Electrical Work: Refer to Division 16 sections for excavation and backfill required in conjunction with underground electrical utilities and buried electrical appurtenances.
- C. Definition: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal or redistribution of materials removed.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service: Owner may engage soil testing and inspection service as recommended by the Engineer for quality control testing during earthwork operations.

1.4 JOB CONDITIONS

- A. Locate existing underground utilities in areas of work. Provide adequate support and protection during earthwork operations for existing utilities to remain in place.
  - 1. Should uncharted or incorrectly charted piping or other utilities be encounter during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of the utility owner.
  - 2. The locations of existing underground utilities depicted on the drawings are shown in an approximate way only. Determine the exact location of all existing utilities, whether or not shown on the drawings before commencing work. Contractor will be responsible for any and all damages which might be occasioned by failure to exactly locate and preserve any and all underground utilities. If damaged or removed, the existing utility shall be restored or replaced by contractor in as nearly the original condition and location as is reasonably possible.
- B. Locate and protect survey reference lines, bench marks and monuments.
  - 1. If survey control lines or monuments are destroyed or altered as a consequence of construction, replace as directed, at no cost to the Owner.

- C. Barricade open excavations occurring as part of this work and post with warning lights as required for protection of persons and property.
  - 1. Operate warning lights as recommended by the authorities having jurisdiction.
  - 2. Protect structures, utilities, sidewalks, pavements and other facilities indicated to remain from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW and SP.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH and PT.
- C. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
- D. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 passing a 1-1/2" sieve and not more than 5% passing a No. 4 sieve.
- E. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.
- F. Structural Fill: Structural fill will be required as backfill over utilities and as structural site grading fill. All structural fill should be free of sod, rubbish, construction debris, frozen soil, and other deleterious materials.
- G. Granular subbase under pavements: See structural site grading fill above.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed the Engineer, shall be at Contractor's expense.
- C. Excavation for Pavements: Cut surface under pavement to comply with cross-sections, elevations and grades as shown.
- D. Excavation for Electrical Utility Trenches: dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room.
  - 1. Excavate trenches to depth indicated or required.
  - 2. Hand excavate bottom cut to accurate elevations to evenly support conduit on undisturbed soil. Over-excavate and fill bottom of trench with select backfill material where undisturbed soil is not suitable for conduit support.
  - 3. See Division 16 Specifications for additional requirements.

- E. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35° F (1° C).

### 3.2 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
- B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 1557; and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
  - 1. Structures, Equipment Foundations, and Pavements: Compact top 12" of subgrade and each layer of backfill or fill material at 95% maximum density for cohesive material or 95% relative density for cohesionless material.
  - 2. Unpaved Areas: Compact top 6" of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive materials and 90% relative density for cohesionless soils.
  - 3. Lawn Areas: Compact top 12" of subgrade backfill or fill material at 85% maximum density.
  - 4. Walkways: Compact top 6" of subgrade and each layer of backfill or fill material at 95% maximum density for cohesive materials and 95% relative density for cohesionless materials.
- C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
  - 1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
    - a. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

### 3.3 BACKFILL AND FILL

- A. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
  - 1. In excavations, use satisfactory excavated or borrow material.
  - 2. Under grassed areas, use satisfactory excavated or borrow material.
  - 3. Under walks and pavement, use subbase material, or satisfactory excavated or borrow material or combination of both.
  - 4. Under piping and conduit use subbase material where subbase is indicated under piping or conduit; shape to fit bottom 90° of cylinder.
- B. Cleanup: Remove all rocks, gravel, excess soil, and other deleterious matter from all lawn areas used for placement of borrow material or otherwise affected by excavation and backfill operations.

### 3.4 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grade.
- B. Finish surfaces free from irregular surface changes, and as follows:
  - 1. Lawn or Unpaved Areas: Finish areas including topsoil to within not more than 0.10' above or below required subgrade elevations.
  - 2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below required subgrade elevation.
- C. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum density for each area classification.

### 3.5 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded area from traffic and erosion. Keep free of trash and debris.
  - 1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape and compact to required density prior to further construction.
- C. Settling: Where settling is measurable or observable at excavated areas during general project period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

### 3.6 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it legally off Owner's property.

\* END OF SECTION 02200 \*

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions apply to work of this section.
- B. Section 16000 - General Provisions, Electrical

1.2 SCOPE

- A. Work Included: Cast-in-place concrete required for this work is indicated on the Drawings and includes, but not necessarily limited to:
  - 1. Exterior flat work, and electrical equipment foundations.

1.3 QUALIFICATIONS

- A. Provide at least one person who shall be present at all times during execution of this portion of the work, who shall be thoroughly trained and experienced in placing the type of concrete specified, and who shall direct all work performed under this Section. For finishing of exposed surfaces of the concrete, use only thoroughly trained and experienced journeymen concrete finishers.

1.4 CODES AND STANDARDS

- A. In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations of the following American Concrete Institute Publications: (unless higher standards are called for by these Specifications or applicable governing codes and regulations).
  - 1. ACI 347-78 Recommended Practice for Concrete Formwork.
  - 2. ACI 315-80 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
  - 3. ACI 318-86 Building Code Requirements for Reinforced Concrete.
  - 4. ACI 301-72 Structural Concrete for Buildings.
- B. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provision shall govern.

1.5 SUBMITTALS

- A. Transit-Mix Delivery Slips (Contract Delivery Tickets):
  - 1. The following information shall be furnished on each delivery ticket for each load of ready-mix concrete:
    - a. Number of cubic yards.
    - b. The exact amount of cement. (This can be indicated either by weight or quantity.)
    - c. The amount of mixing water, including moisture in the aggregate. (This can be indicated either by weight or quantity.)
    - d. If water is added at the job site (only when allowed by the Engineer), note the amount and time it was added.
    - e. Amount of slump in inches.

- f. Type of cement.
- g. Do the aggregates meet ASTM specified.....yes or no; indicate maximum size aggregate.
- h. All tickets shall be given to the Engineer, and if not on the job site, the superintendent or foreman shall obtain these tickets and see that they are held for the Engineer in a particular file so they are readily available upon request. Note the exact location of the concrete on the job. The Owner shall be allowed to review tickets at any time.
- i. Date of cast.
- j. Percent of air entrainment.

#### 1.6 PROJECT HANDLING

- A. Protection: Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to Owner.

#### 1.7 TESTING AND INSPECTION

- A. Testing and inspection of concrete and materials may be made under the direction of a Testing Agency, hired by the Owner, who shall have access to all places where concrete materials are stored, proportioned, mixed or placed.
- B. Tests of concrete and materials shall be made by an independent testing and inspection laboratory selected by the Contractor from the Owner's approved list.
- C. Unless otherwise directed by the Engineer, three test cylinder specimens per 10 cu. yards, or each day's pour, shall be made and cured for each test taken in accordance with current ASTM Specification C 31. Slump test shall be made on each batch tested in accordance with current ASTM Designation C 138. Copies of each test shall be mailed to the Engineer, Owner and Contractor.
- D. Test Report shall include the following:
  - 1. Age of test.
  - 2. Number of days cured in the field.
  - 3. Percentage of air entrainment.
  - 4. Location of pour from which test was taken.
  - 5. Concrete temperature.
  - 6. Date cylinder was cast.

#### 1.8 GUARANTEE

- A. The Contractor shall guarantee in writing, to the Owner, in a form approved by the Engineer, all materials and workmanship of concrete work to be free of defects for a period of five years from the Date of Substantial Completion as directed by the General Conditions. The Contractor shall promptly remove and/or repair defective concrete as directed by Owner and at the Contractor's expense. New replacement work shall also carry a similar five year written guarantee. Spalling, pitting and crazing of concrete shall be considered defective work.

#### PART 2 - PRODUCTS

2.1 CONCRETE

- A. General: All concrete, unless otherwise specifically permitted by the Engineer, shall be transit-mixed in accordance with ASTM C 94-84, except where a higher standard is called for.
- B. Mix Design: Prior to the placement of any concrete, the Contractor, at the Contractor's expense, shall provide the concrete mix and certification from an independent laboratory that the design is in accordance with ACI-613 and these Specifications with respect to workability, minimum strength and minimum segregation of materials.

C. Quality:

- 1. All concrete shall have the following minimum compressive strengths at 28 days and shall be proportioned within the following limits: CONCRETE DELIVERY SLIPS SHALL SHOW THESE MINIMUM CEMENT QUANTITIES:

Location concrete -----	Min. psi 28 days -----	Max. size aggregate -----	Min. sacks of cement/cu. yd -----	Max. slump in inches -----
Footing Found.	3000	3/4 inch	6	3
All other concrete	4000 *	3/4 inch	6-1/2	3

\* Air entrainment per C260

- 2. Concrete that is subject to freezing temperatures while wet shall have water-cement ratio not exceeding five gallons per sack and shall contain entrained air. (Moisture in aggregates considered as mix water.)
- D. Cement: All cement shall be Portland Cement, Type II, low alkali and shall be the product of one manufacturer; the temperature of cement delivered to plant shall not exceed 150 degrees F. The alkali content of the cement calculated as sodium oxide shall not exceed .75%.
- E. Aggregates: All aggregates shall conform to ASTM C-33-78, except as modified herein.
- F. Water: All water shall be clean and free from deleterious matter.
- G. Admixture: For all concrete exposed to weather, except floor slabs, use ASTM C-260 as follows:

Maximum Aggregate Size	Per cent Air
3/4 inch	6-1/2 +/- to 1-1/2%

(calcium chloride will not be allowed.)

2.2 FORM MATERIALS

- A. Form Lumber: All form lumber in contact with exposed concrete shall be new except all allowed for re-use for forms in PART 3.00 of these Specifications, and all form lumber shall be one of the following, a combination thereof, or an equal approved by Engineer.
  - 1. "Plyform" class I or II, bearing the label of the American Plywood Association. (APA)
  - 2. Douglas Fir-Larch, number two grade, seasoned, surface four sides.

B. Forms:

1. Metal forms may be used at the option of the Contractor.
2. Forms shall be the full depth of the concrete thickness when forming for slabs on grade. (See Drawings for the required thickness of slabs.)
3. Coating: All concrete forms shall be coated before erection with a compound which prevents a bond, leaving a flat finish on the concrete that will not affect the bonding properties of subsequent cement or paint coatings.

C. Ties and Spreaders:

1. Type: All form ties shall be of a type which does not leave an open hole through the concrete.
2. Design: When forms are removed all metal shall not be less than one inch from the surface.
3. Wire Ties and Wood Spreaders: Do not use wire or wood spreaders.

### 2.3 CONCRETE REINFORCEMENT

A. All concrete reinforcement materials shall be new, free from rust and complying with the following reference standards:

1. Bars for Reinforcement: "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement", ASTM A-615-82, all bars Grade 60.
2. Fiber Mesh Reinforcement: In addition to all other reinforcing shown or called for in these Specifications or noted on the Drawings, all exterior concrete slabs shall be reinforced as follows:
  - a. 100% virgin polypropylene fibrillated commercial fibers specifically manufactured for use as concrete reinforcement and so certified by the Manufacturer and containing no reprocessed olefin materials. Add to concrete materials at the time concrete is batched, at the rate of 1.5 lbs. per cubic yard.
    - (1) Material Characteristics:
      - (a) Specific Gravity = 0.91
      - (b) Mod. of Elast. =  $0.5 \times 10^6 - 0.7 \times 10^6$
      - (c) Tensile Strength = 70 to 110 ksi
      - (d) Fiber Lengths = 1-1/2 inch as per the Manufacturer.

### 2.4 CURING

A. All exterior concrete flatwork shall be treated with a clear resin compound containing a red fugitive dye.

1. The curing compound shall meet the following specifications: ASTM C-309, type Id, unless otherwise approved by the Engineer.
2. As soon as the water sheen is off of the concrete surface, spray the curing compound on at a minimum rate of 200 square feet per gallon.
3. Follow the Manufacturer's preparation and application instructions.

## 2.5 OTHER MATERIALS

- A. Expansion Joint Filler Materials: Flexible, self leveling, polyurethane sealant equal to Sikafelx 1C SL complete with suitable backer rod.
  - 1. Sealant shall conform to Federal Specification TT-S-00230C, Type I, Class A, and ASTM C-290, Type S, Grade P, Class 25.
  - 2. Sealant Manufacturer shall provide a written warranty against defects of the sealant materials for of period of five (5) years from the date of Substantial Completion.
  - 3. Install joint sealant in accordance with the manufacturer's written installation instructions.
- B. Air Entrainment: Air entrainment shall conform to ASTM C-260.
- C. Accessories: Spacers, chairs and all other material not specifically described but required for a complete and proper installation shall be as selected by the Contractor subject to the approval of the Engineer.
- D. Grout: All grout shall be non-shrink, non-metallic, prepackaged type per Clifford Hill, EMBECO or per Corps of Engineers CRD-C-588.
- E. Anchors: All anchors and anchor bolts shall be in accordance with A307 Grade A. Nuts shall conform with A563 Grade A - Heavy hex type.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to all work of this Section carefully inspect the installed work of other trades and verify that all such work is complete to the point where this installation may properly commence.
  - 2. Verify that all items to be embedded in concrete are in place.
  - 3. Verify that concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearances from reinforcement.
  - 4. Verify that concrete reinforcement may be installed in strict accordance with all pertinent codes and regulations, the approved Shop Drawings and the original design.
- B. Discrepancies:
  - 1. In the event of discrepancies, immediately notify the Engineer.
  - 2. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.

### 3.2 FORM WORK

- A. General: Construct all required forms to be substantial, sufficiently tight to prevent leakage of mortar and able to withstand excessive deflection when filled with wet concrete. Form work shall comply with ACI-347.

**B. Layout:**

1. Form for all required cast-in-place concrete to be shapes, sizes, lines and dimensions indicated on the Drawings.
2. Exercise particular care in the layout of forms to avoid necessity for cutting of concrete after it is in place.
3. Exposed external corners shall be bevelled or chamfered by placing molding in the forms, unless Drawings state that chamfering is to be omitted.
4. Perform all forming required for work of other trades and do all cutting and repairing of forms required to permit such installation.
5. Carefully examine the Drawings and Specifications and consult with other trades as required relative to provisions for openings, reglets, chases and other items in the forms.
6. See that all sleeves and/or conduits, pipes, etc., are placed prior to pour.

**C. Bracing:**

1. Properly brace and tie forms together so as to maintain position and shape and to ensure safety to personnel.
2. Construct all bracing, supporting members and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
3. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying accurate spreading. Ties that occur in exposed concrete shall have plugs and be of the type which breaks back 1 inch to leave face hole for grout.

**D. Tolerances:** Construct all forms straight, true, plumb and square.

**E. Wetting:** Keep forms sufficiently wetted to prevent joints opening up before concrete is placed.

**F. Re-use of Forms:**

1. Re-use of forms shall be subject to advance approval of the Engineer.
2. Except as specifically approved by the Engineer in advance, re-use of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
3. Except as specifically approved in advance by the Engineer, re-use of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to the finished concrete.
4. Use all means necessary to protect workmen, passersby, the installed work and materials of other trades, and the complete safety of the project and adjacent facilities.
5. Cut nails and form ties off flush and leave all surfaces smooth and clean. Exposed concrete shall have ties that when broken leave 1 inch deep hole to be grouted.
6. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing-up and rubbing the resulting pockets to match the surrounding areas.

### 3.3 REINFORCING

#### A. General:

1. Fabricate all reinforcement in strict accordance with the approved Shop Drawings.
2. Do not use bars with kinks or bends not shown on the Drawings or on the approved Shop Drawings.
3. Do not bend or straighten steel in a manner that will injure the material.
4. Steel reinforcement, at the time concrete is placed around it, shall be free from rust, scale, loose mill scale, oil, paint and other coatings which will destroy or reduce bond between steel and concrete.

#### B. Design:

1. Bend all bars cold.
2. Make bends for stirrups and ties around a pin having a diameter not less than two times the minimum thickness of the bar.
3. Make bends for other bars, including hooks around a pin having diameter not less than six times the minimum thickness of the bar for #9 and larger.

#### C. Placing:

1. Provide all accessories such as spacers, chairs, ties and devices necessary to properly assemble, space and support all reinforcement. Before the start of concrete placement, positively secure and support reinforcement by concrete blocks, metal chairs or spacers, or by metal hangers.

#### D. Clearance:

1. Preserve clear spaces between bars of not less than one times the normal diameter of round bars.
2. In no case let the clear distance be less than 3/4 inch, or less than 1-1/3 times the maximum size of the aggregate.
3. Provide minimum 3" concrete covering of reinforcement unless detailed differently.

#### E. Splicing:

1. Place bars in horizontal members with minimum laps of 36 bar diameters at splices with 1'-6" minimum length dimension. Tension splices shall be Class C, splice length where noted on the Drawings.
2. Bars may be wired together at laps but not separate more than 1/5 lap or 6".
3. Stagger the splices of adjacent bars.
4. Other Splices: Make only those splices that are indicated on the approved Shop Drawings or specifically approved by the Engineer.
5. Splices shall not be made at or near points of maximum stress.

- F. Dowels: Place all required steel dowels with paper sleeves and securely anchor them into position before the concrete is placed.
- G. Obstructions: In the event of conduits, piping, inserts, sleeves or any other items interfere with the placing of reinforcement as indicated on the Drawings or as otherwise required, immediately consults with the Engineer and obtain approval of new procedures before placing the concrete.

### 3.4 CONCRETE

#### A. General:

1. Remove all wood scrap and debris from the areas in which the concrete will be placed.
2. Thoroughly clean the areas to ensure proper placement and bonding of concrete.
3. Thoroughly wet the forms (except in freezing weather) or oil; remove all standing water.
4. Thoroughly clean all transporting and handling equipment.
5. Notify the Engineer at least 24 hours before placing concrete.

#### B. Method of Placing Concrete:

1. Convey concrete from the mixer to place of final deposit by methods that will prevent separation of material.
2. For chuting, pumping and pneumatically conveying concrete use only equipment of such size and design as to ensure a practical, continuous flow of concrete at the delivery end without loss or separation of material.
3. Deposit concrete as nearly as possible in its final position to avoid segregation due to rehandling and flowing. Do not drop concrete freely where reinforcements will cause separation. Do not drop concrete freely more than six feet.
4. Place concrete at such a rate that the concrete is at all times plastic and flows readily between the bars.
5. Place concrete as dry as possible consistent with good workmanship, never exceeding the maximum slump.
6. When placing is once started, carry on as continuous operations until placement of the panel or section is complete.
7. Do not pour a greater area at one time than can be properly finished without checking. This is particularly important during hot or dry weather.
8. Compaction:
  - a. Thoroughly consolidate all concrete by suitable means during placement, working it around all embedded fixtures and into corners of the forms.
  - b. During placement, thoroughly compact the concrete by tamping and by mechanical vibration. Do not allow vibrator to touch rebars which extend into concrete which has taken set.
9. Acceptability: Do not use retempered concrete or concrete that has been contaminated by

foreign materials.

10. Place all concrete within one (1) hour after water has been added to the mix.

C. Joints:

1. Location: Make and locate construction joints as shown on the Drawings. Reinforcement to be continuous through the joint.
2. Approval: Obtain the Engineer's approval of location of all construction joints and control joints in the work prior to start of concrete placement. Reinforcement shall be continuous through construction joints.
3. No reinforcement, corner protection angles or other fixed metal items shall be run continuous through joints containing expansion filler, through crack control joints in slab-on-grade and vertical surfaces. Reinforcement shall be interrupted, 2" clear on each side, at crack control joints. Exception: Where dowels are specifically shown on the Drawings.
4. Finishing Flatwork:
  - a. When bleed water has disappeared and concrete will sustain foot pressure with only about 1/4" depression, proceed with the finishing.
  - b. All slabwork shall have a light broom finish; Engineer shall be consulted for direction of the brooming.

D. Curing:

1. See 2.04 of these Specifications.

E. Weather Requirements:

1. Placement:
  - a. Do not use concrete with a placing temperature that will cause difficulty from loss of slump, flash set or cold joints.
  - b. Maintain a concrete temperature during placement of less than 80 degrees F.
  - c. Use all means necessary to avoid drying of concrete prior to finishing operations.
2. Protection: Provide and use all required windbreaks, sunshades, fog spays and other devices to protect the concrete.
3. Cold Weather: Comply with ACI Standard 306R-78 and as approved by the Engineer.
4. Hot Weather: Comply with ACI Standard 305R-77 (latest revision) and as approved by the Engineer.

F. Defective Work:

1. Minor Defective Areas:
  - a. Chip away to a depth of about 1 inch, leaving edges perpendicular to the surfaces: wet the areas to be patched and a space of at least 6 inches wide around it to prevent water being absorbed out of the mortar.

- b. Coat the area to be patched with a cement wash consisting of neat cement and a solution of one part "Konset", or equal approved by the Engineer, to four parts of water; apply the patching mortar immediately.
  - c. Patching mortar shall consist of one part cement to three parts water, to a consistency as dry as possible within the requirements of handling and placing; thoroughly compact the mortar by ramming it into place.
  - d. Screed off so as to leave the patch slightly higher than the surrounding surfaces; leave undisturbed for a period of one to two hours to permit initial shrinkage; and the perform final finishing.
  - e. Finish the patch to match adjacent surfaces and keep wet for at least seven days; provide and install all required protective coatings.
2. Major Defective Areas: (when allowed by the Engineer): If the defects are serious or affect the strength of the structure, or if patching does not satisfactorily restore the quality and appearance of the surface, the Engineer may require the concrete to be removed and replaced, complete, in accordance with the provisions of this Section, all at no additional cost to the Owner.
- G. Sacking: (Exposed Concrete) After removing forms and while concrete is still green, all exposed vertical surfaces of the concrete shall have burrs knocked off with stone; shall patch form tie holes and apply a "sacking" finish by coating the concrete with a mixture of one part fine sand to one part cement and enough water to provide a creamy consistency, using burlap sacking for application, and achieving a uniformly textured surface with color to match adjacent concrete. Remove all form marks and other defects.
- H. Cleaning: Clean all exposed concrete and all adjoining work stained by leakage or splashing of concrete.
- I. Sealing Treatment: All exterior flatwork shall be sealed with two applications of sprayed-on sealing treatment which is compatible with the previously applied curing compound. Sealing shall not be done in freezing weather and not before concrete is 28 days old. Concrete shall be clean and dry. All work shall be in strict accordance with the Manufacturer's latest technical data guide. Proposed products to be used must be approved by the Engineer prior to application.

\* END OF SECTION 03300 \*

SECTION 16000 - GENERAL PROVISIONS, ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions and Division 1 Specification Sections apply to work of this section and all other Division 16 specification sections.
- B. This section applies to all Division 16 specification sections.

1.2 SUMMARY

- A. This section includes general administrative and procedural requirements for electrical installations to expand the requirements of the General Conditions and Division 1 Specification Sections.

1.3 STANDARDS

- A. The following industry standards are considered minimum requirements for electrical work and are made a part of the contract documents:
  - 1. National Electrical Code, 2008 Edition (NEC)
  - 2. Electrical Ordinances of Local Governing Authority
  - 3. Utah State Fire Marshal's Rules and Regulations
  - 4. International Building Code
  - 5. International Fire Code
  - 6. Underwriters Laboratories (UL) Standards
  - 7. American National Standards Institute (ANSI)
  - 8. National Electrical Manufacturer's Association (NEMA)
  - 9. National Fire Protection Association (NFPA) Standards
  - 10. Regulations of American Standards Association
  - 11. Power Company rules governing installation of electrical service.
- B. If any conflict occurs between these rules and the contract documents or between the plans and specifications, notify the Engineer promptly in writing. Do not proceed with any work in conflict until a solution is approved in writing by the Engineer.

1.4 WORKMANSHIP

- A. All Electrical Work of any nature shall be performed by qualified electricians, experienced in the type of work to be performed and licensed with the State of Utah. Electricians shall show their license upon request of the Owner, Engineer and/or their representatives.

1.5 CODE INSPECTIONS

- A. Code inspections will be conducted by an inspection agency hired by the Owner.
- B. Contractor is responsible to schedule inspections with the inspection agency.

1.6 ELECTRICAL WORK INCLUDED

- A. The basic contract work includes all labor, material, tools, transportation, equipment, and superintendence specified, indicated on the drawings or necessary to make a complete installation of, but not limited to, the following:

1. Appliances, apparatus and materials not specifically noted on drawings or mentioned herein, but which are necessary to make a complete working installation of all electrical systems required for the project.
2. Hangers, anchors, sleeves, chases, supports and fittings as may be required and as indicated.
3. Emergency Power System complete with Engine-Generator Set, skid mounted fuel tank, Automatic Transfer Switches, electric service with conduits, conductors, distribution panels, distribution system, branch panels and branch circuits for power and lighting with raceway system and outlet boxes.
4. Reconnection of equipment, lighting, etc., as shown on drawings with all equipment in proper working order.
5. New fixtures, wall switches, receptacles, etc..
6. Removal of abandoned fixtures, switches, conduit, wiring, etc..
7. Addition and modification of existing Building Automation Control System for monitoring of the new emergency power system.

#### 1.7 SUBSTITUTIONS

- A. Material or products specified by name of manufacturer, brand or trade name or catalogue reference will be the basis of the bid and furnished under the contract unless changed in writing by the Engineer. Where two or more materials are named, the choice of these will be optional with the Contractor.
- B. Submit requests for substitution in writing to the Engineer not less than 5 working days prior to bid opening or as otherwise required by Division 1 Specifications and the General Conditions.

#### 1.8 ACCURACY OF DATA

- A. Data given herein and on the drawings are as exact as could be secured, but their absolute accuracy is not guaranteed. Specifications and drawings are for the assistance and guidance of the Contractor.
- B. Electrical drawings are diagrammatic, but will be followed as closely as building construction and work of other contractors will permit. All deviations from the drawings required to make the Electrical Work conform to the building as constructed and to the work of other contractors will be made by the Contractor as approved by the Engineer.

#### 1.9 VISIT THE SITE

- A. Contractors are assumed to have visited the site and thoroughly acquainted themselves with conditions affecting the proposed work. Verify existing conditions and measurements at the building before beginning work and immediately notify the Engineer of any discrepancies which may adversely affect completion of the work.

#### 1.10 TEMPORARY POWER

- A. Provide temporary power for reasonable convenience during construction in accordance with the General Conditions.
- B. Provide GFCI Protection for all temporary power outlets.

- C. Use temporary power for construction purposes only. Do not use temporary power for electric space heating, etc..

#### 1.11 SHOP DRAWING SUBMITTALS

- A. As soon as possible after contract award, submit shop drawings for review in accordance with the General Conditions and Division 1 Specifications.
- B. Submit shop drawings in three ring loose-leaf binder.
- C. Divide Electrical equipment into subsections of common equipment such as wiring devices, lighting fixtures, panelboards, etc.. Provide a complete equipment list at the beginning of each subsection.
- D. Provide manufacturers' catalogue and/or descriptive literature indicating specific model and/or catalog numbers, options, accessories and modifications for the following items:
  - 1. Wiring Devices
  - 2. Panelboards and Circuit Breakers
  - 3. Motor Starters and Motor Control Centers
  - 4. Emergency/Standby Power System
  - 5. Building Automation System
- E. Above list is considered minimum. Additional items may be required to be submitted for review.
- F. Refer to individual Specification Sections for additional Shop Drawing Submittal requirements.

#### 1.12 RECORD DRAWINGS

- A. Provide As-Built Record Drawings in accordance with the General Conditions and Division 1 Specifications.
- B. Indicate location and routing of all underground raceways on the As-Built Record Drawings by dimension to permanent structures such as buildings, sidewalks, curbs, etc.
- C. Indicate all changes made to the drawings such as changes in fixture and outlet location, changes in circuit routing and circuit numbering, etc. Include all changes by Addenda, Change Order, Supplemental Instruction or verbal instruction.
- D. Refer to individual Specification Sections for additional Record Drawing requirements.

#### 1.13 OPERATION AND MAINTENANCE MANUALS

- A. Provide Operation and Maintenance Manuals in accordance with the General Conditions and Division 1 Specifications.
- B. Include manufacturers' catalog and/or descriptive literature of equipment actually installed. Clearly indicate on literature the specific model and/or catalog numbers of equipment installed, including all options, accessories and/or modifications.
- C. All copies of literature will be new, clean and clearly legible. Sheets used for shop drawing submittals with review stamp, remarks, etc., will not be acceptable.
- D. Divide Electrical equipment into subsections of common equipment such as wiring devices, lighting fixtures, panelboards, etc.. Provide a complete equipment list and recommended maintenance schedule at the beginning of each subsection.

- E. Refer to individual Specification Sections for additional Operation and Maintenance Manual requirements.

#### 1.14 WARRANTY

- A. Provide Warranty for Electrical Work in accordance with the General Conditions and Division 1 Specifications.
- B. Provide manufacturer's warranty for all equipment which the manufacturer normally provides a warranty in excess of twelve months. Refer to individual Specification Sections for extended warranty requirements.

#### 1.15 EXTRA MATERIAL STOCK

- A. Provide extra stock in original cartons, or packaged with protective coverings, for storage and identified with labels clearly describing contents.
- B. Turn over extra stock to Owner and place in storage prior to Substantial Completion. Exact location of storage to be determined by the Owner.
- C. Obtain signed receipt for extra stock materials from the Owner's Project Manager. Include copy of signed receipt in the Project Operation and Maintenance Manuals.
  - 1. Receipt shall include description and quantity of all material.
- D. Provide the following extra stock of materials to the Owner.
  - 1. Fixture lenses, louvers, diffusers, lamps, and ballasts: refer to Specification Section 16500 - Lighting for required quantities.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. All materials and equipment for which U.L. Standards have been established, will be listed by and bear the label of Underwriters Laboratories, Inc..
- B. All materials will be new and bear the manufacturer's name, trade name and catalog or model numbers. Similar items will be of the same manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation of materials will comply with all codes and be accomplished with good workmanship in the judgement of the Engineer.

#### 3.2 COOPERATION WITH OTHER CONTRACTORS

- A. Cooperate with other contractors doing work on the building as may be necessary for the proper execution of the work of various trades employed in construction of the building.
- B. Refer to drawings, for construction details, and coordinate the electrical work with that of other contractors to the end that unnecessary delays and conflicts will be avoided.

#### 3.3 MATERIAL HANDLING

- A. Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

### 3.4 CUTTING AND REPAIRING

- A. Provide all required digging, cutting, etc. incidental to the Electrical Work. Make required repairs thereafter to the satisfaction of the Engineer.
- B. Do not cut into any major structural element, beam or column, without written approval of the Engineer.
- C. Install the Electrical Work to proceed with other trades in order to avoid unnecessary cutting of the construction.

### 3.5 CONSTRUCTION REVIEW

- A. The Owner and/or Engineer will perform construction review throughout the construction of the project. The construction review does not relieve the contractor from the responsibility of providing all materials and performing the work in accordance with the Contract Documents.
- B. Notify the Engineer in writing, giving ample notice, at the following stages of construction and allow the Owner and/or Engineer to review the installed work.
  - 1. When underground electrical work is complete, before backfilling, including work under floor slabs.
  - 2. When all electrical rough-in is complete, but not covered.
  - 3. Pre-Final, upon completion of all electrical work.
  - 4. Final, upon completion of all items noted in the Pre-Final Construction Review Report.
- C. Prerequisite for Final Electrical Construction Review:
  - 1. Engineer must be present.
  - 2. Electrical Contractor's job foreman must be present.
  - 3. Owner's Representative must be present.
  - 4. Panelboard Enclosures must be open.
  - 5. Clear access must be provided to all devices and equipment.
  - 6. All panels, disconnects, etc. must be labeled and typed panel index cards installed.
  - 7. All light fixtures, outlets, equipment, etc., must be energized and operable.
  - 8. Contractor must have pad and pencil to list all deficient items.
  - 9. Make all corrections and adjustments after the Final Construction Review, not during. Items requiring correction will appear on the Final Construction Field Report.
  - 10. Contractor must have all required keys to provide access to all panels and doors.
- D. Test all systems and equipment provided and/or connected under the Contract for short circuits, ground faults, proper neutral connections and proper operation in the presence of the Owner and/or Engineer.
- E. The entire construction will be installed in accordance with the contract documents and be free of mechanical and electrical defects prior to final acceptance of the work.

\* END OF SECTION 16000 \*

SECTION 16060 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Division 1 Demolition Sections.

1.2 SCOPE

- A. Remove electrical equipment and wiring systems and make required extensions and reconnections as shown on Drawings and specified herein.
- B. Repair all damage resulting from demolition and extension work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide new materials and equipment for patching and extending work as specified in the appropriate Specification Section for the materials and equipment involved.
- B. Where materials or methods not included in the Specifications are required, provide materials and methods in accordance with normal construction industry standards and as approved by the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field verify existing measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on field observation of existing surface conditions and available existing building electrical drawings. Report discrepancies to Engineer before disturbing existing installation.
- D. All demolition and extension work is not necessarily indicated on Drawings. Include all such work without additional cost to Owner.

3.2 PREPARATION

- A. Coordinate utility service outages with Owner's Facilities Project Manager.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use electricians experienced in such operations.
- C. Protect all existing electrical equipment to remain from damage during demolition and new construction. Survey all existing equipment prior to beginning work and document in writing any existing damage to existing equipment.

### 3.3 DEMOLITION

- A. Coordinate with Owner for equipment and materials to be removed by Owner or salvaged by the contractor for Owner. Place salvaged equipment and materials in storage at the project site as directed by the Owner.
- B. Legally dispose of all removed equipment and materials not salvaged for the Owner.
- C. Remove abandoned wiring to source of supply, i.e. panelboard, circuit breaker, etc..
- D. Remove accessible abandoned conduit, cables, junction boxes, etc., including above accessible ceilings. Cut conduit flush with walls and floors.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlet boxes and conduit servicing them where indicated on drawings. Provide blank cover for abandoned outlets which are not indicated to be removed.

### 3.4 EXTENSION OF EXISTING ELECTRICAL WORK

- A. Reconnect existing equipment where demolition interrupts existing branch circuits or feeders to the equipment.
- B. Repair adjacent construction and finishes damaged during demolition and extension work to match surrounding surfaces.
- C. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- D. Extend existing installations using materials and methods as specified for new work. Remove and replace existing installations which are not compatible with new work.

### 3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide new typed circuit directory showing revised circuiting arrangement.
- C. Luminaries: Remove existing luminaries for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps and broken electrical parts.

### 3.6 INSTALLATION

- A. Install relocated materials and equipment as required for new materials and equipment.

### 3.7 OUTAGES

- A. Maintain Existing Electrical Systems in service until new systems are complete and ready for service. Disable systems only to make switchovers and connections. Minimize outage duration.
- B. Obtain permission from Owner's Facility Project Manager before partially or completely disabling systems in accordance with Division 1 Specification Sections.

\* END OF SECTION 16060 \*

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide a complete raceway system for all wiring as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 WIRING METHODS

- A. Provide approved raceway systems for all wiring systems except that metal clad cable may be used for branch circuits where concealed within finished walls and ceilings and not subject to damage.
  - 1. Provide minimum 3/4" conduit for all branch circuit homeruns.
- B. Do not use aluminum conduit, intermediate steel conduit (IMC), BX cable, Flexible Non-metallic Tubing, NM cable, Direct Burial Cable or any other wiring methods not allowed by this specification unless approved in writing by the Engineer and/or Engineer.

2.2 ABOVEGROUND RACEWAYS

- A. Provide Electrical Metallic Tubing (EMT), galvanized inside and out, for raceways not subject to permanent moisture or damage.
- B. Provide Galvanized Rigid Steel Conduit (GRC) where raceways are subject to permanent moisture such as underground, or damage such as vehicular traffic, etc..

2.3 UNDERGROUND RACEWAYS

- A. Provide Schedule 40 PVC electrical conduit in earth or in concrete in contact with earth.
  - 1. Provide a separate ground wire in all PVC conduits, except main electrical service conduits.
  - 2. Provide Galvanized Rigid Steel Conduit (GRC) for all bends greater than 22 degrees in PVC conduits.
  - 3. Do not use PVC conduit above grade nor for penetrations through structural elements such as foundation walls, floor slabs, etc..
- B. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through floor slab or grade to extend minimum 12" above floor or grade.
- C. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through foundation walls to extend minimum 36" beyond the foundation wall.
- D. Corrosion protect all galvanized rigid steel conduit (GRC) installed in earth or in concrete in contact with earth with two (2) half-lapped layers of 0.010" thick approved waterproof PVC tape

equal to Scotch No. 50 or use factory PVC coated rigid steel conduit with all field joints coated after installation.

#### 2.4 FLEXIBLE RACEWAY CONNECTIONS

- A. Provide Flexible Steel Conduit for final connection to lay-in light fixtures, motors and other equipment subject to vibrations or movement, not to exceed 6 feet for fixture connections and 3 feet for motor and equipment connections.
- B. Provide liquid-tight flexible steel conduit outside and in wet, humid, corrosive and oily locations.
  - 1. Provide Sunlight Resistant liquid-tight flexible steel conduit outdoors.
- C. Provide a ground conductor in all flexible steel conduit.
- D. Flexible Steel Conduit may be used where misalignment or cramped quarters exist only with prior approval of the Engineer.
- E. Minimum 1/2" flexible steel conduit or 3/8" factory fabricated fixture whips may be used to make final connections to lay-in light fixtures.
- F. Flexible Steel Conduit may be used to fish through existing walls and ceilings only with prior approval of the Engineer.

#### 2.5 CONDUIT FITTINGS

- A. Provide steel compression type or steel set screw type fittings for Electrical Metallic Tubing.
- B. Provide malleable iron clamp type fittings for Flexible Steel Conduit.
- C. Provide steel compression type fittings for Liquid-Tight Flexible Steel Conduit.
- D. Provide threaded fittings for GRC conduit. Provide double locknuts and plastic bushing for GRC conduit terminations or provide boxes and enclosures with threaded hubs.
- E. Provide liquid-tight and gas-tight conduit fittings underground using fittings and PVC cement as recommended by the conduit manufacturer.
- F. Provide steel rain-tight, compression type fittings for all conduit installed outside and in wet, humid, corrosive and oily locations.
- G. Provide Insulated Throat Connectors for all conduit terminations 1" diameter and smaller. Provide insulating bushings for all conduit terminations 1-1/4" diameter and larger.
- H. Provide Grounding Bushings bonded to the electrical system ground:
  - 1. On each end of all service conduits.
  - 2. On each end of all feeder conduits in which a separate ground conductor is installed.
  - 3. On each end of all conduits used to protect ground conductors.
  - 4. On all conduit terminations installed in concentric or eccentric knockouts or where reducing washers have been installed.
- I. Do not use cast metal or indenter type fittings. Do not use screw-in type fittings for Flexible Steel Conduit. Do not use spray (aerosol) PVC cement.

## 2.6 RACEWAY SEALS

- A. Seal all conduit penetrations through fire rated walls, ceilings and floors with a UL classified fire barrier system as manufactured by Scotch 3M or Nelson Electric which will provide an immediate fire seal, require no curing time, and emit no hazardous or toxic fumes.
- B. Seal all conduit penetrations through airtight spaces and plenums with an approved mastic compound acceptable to the Engineer to prevent air leakage.

## 2.7 PULL BOXES

- A. Provide pull boxes or conduit bodies in accessible locations where required to reduce the number of bends in the conduit run to less than 360 degrees and at points not exceeding 100 feet in long branch circuit conduit runs.
  - 1. Indicate exact location of pull boxes and conduit bodies on the As-Built Record Drawings.

## 2.8 PULL STRING

- A. Provide a nylon or polypropylene pull string with not less than 200 lb tensile strength in all spare conduits and conduits installed for use by others. Provide a hard cardboard tag for each raceway to indicate location of the opposite end of the raceway.

## PART 3 - EXECUTION

### 3.1 SUPPORTS

- A. Securely support all raceways with full (2 hole) pipe straps, hangers, or ceiling trapeze directly from building structure such as roof trusses, beams, floor joists, etc., in accordance with Specification Section 16190 - Supporting Devices.
  - 1. Do not support raceways from other electrical systems or mechanical systems.
- B. Provide supports at 5'-0" on center with a minimum of two supports for each ten foot length of conduit or fraction thereof up to 6 feet.
- C. Provide a support within 12" of each coupling, fitting, box, enclosure and bend.
  - 1. Install supports at vertical to horizontal conduit bends on the upper side of the bend.

### 3.2 INSTALLATION

- A. Raceway layouts on the drawings are generally diagrammatic and the exact routing of raceways will be governed by structural conditions and the work of other contractors.
- B. Install raceways concealed within finished ceilings, walls and floors except where exposed raceways are specifically shown on the drawings or permitted by the Engineer.
- C. Install exposed raceways parallel with or perpendicular to walls and ceilings, with right angle turns consisting of symmetrical bends or conduit bodies equal to Crouse-Hinds "Condulet". Avoid all bends and offsets where possible.
  - 1. Paint exposed raceways to match surrounding surfaces.
- D. Install raceways minimum 12" from insulation of hot water piping, steam piping and other systems or equipment with temperatures in excess of 104° F (40° C).

- E. Make all field bends and offsets with a radius not less than allowed by the National Electrical Code for the type of raceway system.
  - 1. Do not install bends or offsets which are flattened, kinked, rippled or which destroy the smooth internal bore or surface of the conduit.
- F. Cap the open ends of raceways during construction to prevent the accumulation of water, dirt or concrete in the raceways. Thoroughly clean raceways in which water or other foreign matter has been permitted to accumulate or replace the raceway where such accumulation cannot be removed by a method approved by the Engineer.
- G. Do not install raceways which have been crushed or deformed in any manner.
- H. Do not install wiring until work which might cause damage to the wires or raceways has been completed.

### 3.3 UNDERGROUND RACEWAY INSTALLATION

- A. Install underground raceways within buildings minimum 4" below the bottom of the concrete floor slab to the top of the raceway.
- B. Install underground raceways outside of building minimum 24" below finished grade to the top of the raceway.
  - 1. Provide a plastic red magnetic warning ribbon stating "CAUTION - BURIED ELECTRICAL" 12" directly above the top of the raceway.
- C. Use select granular fill, free of rocks or hard clumps with sharp or angular edges, for the first 6" of backfill around underground raceways including raceways below concrete floor slabs. Provide imported sand backfill where required by Division 2 Specifications or where excavated materials are not suitable.
- D. Coordinate location of underground raceways with the General Contractor to avoid areas where raceways may be damaged by subsequent installation of trees, shrubbery or other landscape vegetation.
- E. Install underground raceways minimum 3'-0" from parallel runs, and minimum 1'-0" from perpendicular runs, of underground natural gas and propane lines.
- F. Do not use torches to heat PVC conduit for field bends. Do not install PVC conduit that has been scorched by heating for bends.

\* END OF SECTION 16110 \*

SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all conductors for power and lighting as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Provide Copper building wire, minimum #12 AWG, with type THHN/THWN or XHHW 600 volt insulation, except as otherwise noted on the drawings or required by NEC.
  - 1. Provide conductors in underground raceways with insulation approved for wet locations such as type THWN or XHHW.
- B. Provide stranded conductors for wires #8 AWG and larger and for terminal connections to all motors. Stranded or solid conductors may be used for sizes smaller than #8 AWG at the contractor's option.
- C. Provide conductors rated 90° C minimum in wiring channels of Fluorescent and High Intensity Discharge lighting fixtures.
- D. Provide conductors with surface printed identification showing conductor size and material, insulation type, voltage rating and approvals at regularly spaced intervals of 24".
- E. Do not use sizes smaller than #12 AWG in branch circuits carrying load. Circuits requiring larger sizes to meet voltage drop conditions, etc., are indicated on the drawings.
  - 1. Where branch circuit homeruns indicate conductor size, use that size conductor for the entire branch circuit, including switch legs, etc.
- F. Do not use aluminum conductors.

2.2 SPLICES

- A. Provide Ideal wirenuts or Scotchlock spring connectors for all conductor splices #8 AWG and smaller. Provide split-bolt or compression type connectors for all conductor splices larger than #8 AWG.
- B. Provide splices which are UL listed for the type, quantity and size of the conductors to be spliced.
- C. Provide all splices with insulation at least equal to that of the conductor.
- D. Provide watertight splices in junction or outlet boxes located outside and in wet locations. Provide heat shrink insulating kits or use connectors pre-potted with an approved waterproof compound.
- E. Splice conductors only in approved boxes.

- F. Do not splice conductors in conduit bodies, panelboard enclosures, switchboard enclosures, or similar locations.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install all conductors in approved raceway systems.
- B. Install branch circuit conductors continuous without splice from panelboards to fixture outlet boxes, device terminals, etc..
  - 1. Provide suitable pull boxes in readily accessible locations where necessary at intermediate points of branch circuits. Indicate exact location of all boxes on the As-Built Record Drawings.
- C. Do not install wiring until work which might cause damage to the wires has been completed.

#### 3.2 COLOR CODING AND IDENTIFICATION

- A. Color code all wiring at each enclosure and box where conductors are accessible and at each splice, tap or termination by means of colored conductor insulation.
  - 1. For conductors #6 AWG and larger, colored self-adhesive tape with the appropriate color designations may be used.
- B. Color code each conductor of each circuit as follows.
  - 1. Ground: Green or Bare Copper
  - 2. 120/208 Volt, 3 Phase, 4 Wire System
    - a. Phase A - Black
    - b. Phase B - Red
    - c. Phase C - Blue
    - d. Neutral - White
  - 3. 277/480 Volt, 3 Phase, 4 Wire System
    - a. Phase A - Brown
    - b. Phase B - Yellow
    - c. Phase C - Violet
    - d. Neutral - Gray
  - 4. Match existing conductor color coding if different than above.
- C. Color code switch legs and travelers according to phase with colors other than used for phase conductors, to be consistent throughout the project.

#### 3.3 IDENTIFICATION

- A. Provide conductor identification in accordance with Specification Section 16195 - Electrical Identification.

#### 3.4 MULTI-WIRE BRANCH CIRCUITS

- A. Where a common neutral is run for multi-wire branch circuits, connect phase conductors to separate phases such that the neutral conductor will carry only the unbalanced current. Use neutral conductors of the same size as the phase conductors unless specifically noted otherwise.

1. Multi-wire circuits will not be allowed for receptacles circuits serving electronic equipment.

B. Do not install more than three phase conductors in any raceway except where specifically shown on the drawings or approved by the Engineer.

### 3.5 PHASE ROTATION

A. Phase rotation for Three Phase System will be A leads B Leads C from front to back, from left to right or from top to bottom as viewed from the front of the enclosure.

\* END OF SECTION 16120 \*

SECTION 16130 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide junction boxes and outlet boxes at each outlet, fixture and other device location as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 OUTLET AND DEVICE BOXES

- A. Provide galvanized or cadmium plated sheet steel electrical boxes in indoor dry locations, of the most suitable size and shape for the conditions encountered and in accordance with NEC requirements for the number of conductors allowed.
- B. Provide Type FD cast metal boxes outside, in wet, humid or corrosive locations and where exposed to damage such as vehicular traffic.
- C. Confer with the various equipment suppliers and either use or properly provide for boxes which are furnished with the equipment, such as speakers, horns, bells, etc..
- D. Do not use "THRU-THE-WALL" boxes, sectional (gangable) boxes or non-metallic boxes.

2.2 JUNCTION BOXES

- A. Provide junction boxes as specified for outlet and device boxes except that boxes 6" square and larger may be painted sheet steel.

2.3 BOX ACCESSORIES

- A. Provide fittings, plaster rings, cover plates and other accessories suitable for the purpose and location of each box.
- B. Provide plaster rings which are minimum 1/8" deeper than wall covering for flush mounted boxes (i.e. use 3/4" plaster ring for 5/8" gypsum board wall covering) such that plaster ring will be flush with finished face of wall.
- C. Provide industrial raised covers for surface mounted outlet and device boxes.
- D. Provide masonry rings for boxes installed in brick walls, concrete block walls and in walls with tile finish.
- E. Provide ceiling outlet boxes with standard 3/8" fixture stud where required for fixture to be installed.

PART 3 - EXECUTION

3.1 SUPPORTS

- A. Support each box from the building structure independent of the raceway system.
- B. Support flush mounted wall boxes with metal bar hangers or metal stud backing behind the box secured to wall studs.
- C. Support flush mounted ceiling boxes with metal bar hangers secured to ceiling support system or threaded rod hangers secured to structure.
  - 1. Secure boxes for box supported fixtures to the building structure with suitable anchors capable of supporting not less than 200 lbs or 4 times the fixture weight, whichever is greater.
- D. Secure surface mounted boxes to building structure with minimum of 2 screws or bolts as required.
- E. Secure boxes in concrete block walls in place prior to pouring grout such that installation of grout will not displace the box and the box will be flush with the finished face of the wall.
- F. Do not use side mounted boxes or brackets.

### 3.2 INSTALLATION

- A. Install flush mounted boxes, after being equipped with extensions, accessories, etc., flush with finished face of wall, ceiling or floor.
  - 1. Replace or repair all boxes not installed flush with finished surfaces to the satisfaction of the Engineer.
  - 2. In order to meet this requirement, it is recommended that the Electrical Contractor be present during installation of gypsum board, tile or other wall coverings and during installation of outlet boxes in masonry walls.
  - 3. Coordinate depth of wall coverings to be installed on all walls with the General Contractor prior to installing plaster rings.
- B. Install boxes in opposite sides of common room walls in adjacent stud spaces where possible and with minimum 6" separation between the boxes. Provide minimum 10" of conduit between boxes which are connected by conduit.
- C. Install outlet boxes for light switches on the strike side of door openings. Coordinate door swings with the General Contractor prior to roughing in switch boxes.
- D. Install boxes in masonry walls in the cell of the block or behind brick with deep masonry ring to extend flush with the finished wall surface.
- E. Seal around the surface of all switch and outlet boxes with plaster or grout to close any opening between the outlet box and the wall finish.
- F. Install boxes level and plumb.

### 3.3 LOCATIONS

- A. The wiring system layouts on the drawings are generally diagrammatic and the location of outlets and equipment are approximate.
- B. Study all available drawing details, shop drawings, equipment drawings, building conditions and materials surrounding each outlet and device box prior to installing the box to ascertain the exact

location required for each box.

- C. Rough in the electrical work such that electrical outlets, fixtures and other fittings are properly fitted to the work of other trades.
- D. Do not install boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.
- E. The right is reserved to make any reasonable change in the location of the outlets before roughing in, without involving additional expense.

### 3.4 MOUNTING HEIGHT

- A. Install outlet and device boxes at the heights shown on the drawings or as directed by the Engineer. In general, mount outlets as follows.
  - 1. Convenience Outlet                      18"
  - 2. Wall Switch                                46"
- B. All mounting heights, including mounting heights indicated on drawings, are to the center of the outlet box above finished floor or grade unless noted otherwise.
- C. Install outlets above counters 4" above the top of the counter backsplash to the center of the outlet. Coordinate mounting heights with the cabinet installer prior to roughing in the outlets.
- D. Refer to applicable Specification Sections for mounting heights of devices and equipment not included above or install at heights as directed by the Engineer.

\* END OF SECTION 16130 \*

SECTION 16140 - OUTLETS AND WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all wiring devices complete with coverplates and necessary accessories as shown on the drawings and as specified herein.

1.3 SUBMITTALS

- A. Provide submittals for each type of wiring device to be used on the project in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the contract documents.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Provide wiring devices rated 20 amps minimum, as specified below, or equivalent of Eagle, General Electric, Hubbell, Leviton or Pass & Seymour.
  - 1. Switch, Single Pole Bryant 4901
  - 2. Switch, 3 - Way Bryant 4903
  - 3. Receptacle, duplex convenience, 3-wire Bryant 5352
  - 4. Receptacle, duplex, GFCI protected Bryant GFR53FT
- B. Color of devices in finished areas will be as selected by the Engineer from the manufacturer's standard colors to compliment the color of architectural finishes.
- C. Provide Gray devices in unfinished spaces such as mechanical and electrical rooms.
- D. Provide Red devices for all receptacles and switches connected to emergency power systems.
- E. Provide convenience outlets with GFCI protection in accordance with NEC requirements, where installed outside or within 6 feet of any sink and as indicated on the drawings.
  - 1. Provide a self-adhesive printed label stating "GFCI PROTECTED" for each outlet protected by feed-through GFCI receptacles or GFCI circuit breakers.
  - 2. Use feed-through GFCI outlets only to protect other outlets within sight of the GFCI protected outlet.

2.2 COVERPLATES

- A. Provide a cover plate for each outlet and box suitable for the location and function of the outlet and box.
- B. Provide blank cover plates for junction boxes and outlet boxes not used.
- C. Provide nylon or impact resistant thermoplastic coverplates for outlets and boxes installed in

finished areas, of the same manufacturer and color as the wiring devices.

- D. Provide Stainless Steel coverplates for outlets and boxes installed in unfinished areas such as mechanical and electrical rooms.
- E. Provide UV Stabilized Polycarbonate, "Raintight While In Use" coverplates with spring return lids and suitable gasket as manufactured by Eagle or Taymac for all devices installed outside or in wet locations.

### 2.3 ACCESSORIES

- A. Equip each outlet with devices suitable for the purpose of the outlet and with means of properly connecting the equipment served, whether or not such devices are specifically mentioned.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Properly locate each outlet to fulfill its particular purpose. Do not install receptacles or boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.
- B. Install all outlets and wiring devices flush with face of coverplate, with the coverplate in contact with the finished face of the wall and with mounting strap of device in contact with the outlet box.

\* END OF SECTION 16140 \*

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide suitable supporting devices for all electrical equipment, raceways and components as specified herein and as shown on the drawings.
- B. Refer to individual specification sections for additional supporting requirements.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Provide support anchors which will support in tension a minimum of 4 times the weight of the equipment to be supported but not less than 100 lbs.
- B. Provide wood screws in wood; toggle bolts in hollow masonry units; expansion bolts with lead shield or shot anchors in concrete and brick; and machine screws, threaded 'C' clamps or spring-tension clamps on steel work.
- C. Do not use tie wire for support unless specifically called for in individual specification sections.
- D. Do not use threaded C Clamps on tapered steel sections.
- E. Do not weld supports, equipment, boxes, raceways, etc., to steel structures.
- F. Do not use wooden plugs or plastic inserts as a base for supports.
- G. Do not use shot anchors or drilled anchors of any kind in prestressed or post-tensioned concrete slabs and beams except as approved in writing by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Secure supporting devices to building structure.
- B. Do not install supporting devices with sheetrock or plaster as the sole means of support. Provide proper blocking behind the sheetrock or plaster as required to support equipment.

\* END OF SECTION 16190 \*

## SECTION 16195 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

#### 1.2 SCOPE

- A. Provide identification of all electrical equipment, devices, enclosures, conductors, cables, etc., as shown on the drawings and as specified herein.
- B. Refer to individual specification sections for additional identification requirements.

### PART 2 - PRODUCTS

#### 2.1 NAMEPLATES

- A. Provide engraved laminated micarta or plastic nameplates to identify each panelboard, cabinet, motor starter, disconnect, etc., with the following minimum lettering heights:
  - 1. Switchboards, panelboards, etc. - 3/8"
- B. Provide Black Nameplates with White Lettering unless noted otherwise, or required to contrast with equipment enclosures.
  - 1. Provide Red nameplates with White lettering for equipment served by the Emergency Power System.
- C. Do not use Dynamo Labels, printed labels, etc., unless specifically called for in other specification sections or approved by the Engineer.

#### 2.2 PANELBOARD IDENTIFICATION

- A. Provide one engraved nameplate on the exterior trim of each Panelboard, visible without opening the door, to include the Panel Designation and the System Voltage.
  - 1. Example:      PANEL 'A'  
                      120/208 V, 3Ø

#### 2.3 TRANSFORMER IDENTIFICATION

- A. Provide an engraved nameplate on the exterior of each Transformer to include the Transformer Designation, and the Distribution Panel serving the Transformer.
  - 1. Example:      TRANSFORMER 'T1'  
                      MAIN IN 'LDP1'

#### 2.4 CONDUCTOR IDENTIFICATION

- A. Identify each branch circuit and each feeder conductor at each outlet box, pull box, or other accessible location with hand lettering in black India ink in the enclosure to indicate panel and circuit numbers of all conductors in the enclosure.

- B. Identify individual conductors with self adhesive printed markers equal to Thomas & Betts "E-Z Code" markers in outlet boxes, pull boxes, or other accessible location according to the circuit number in outlet boxes, pull boxes, etc., at the following locations:
  - 1. Where circuit number of individual conductors cannot be determined by color coding, such as two or more conductors on the same phase.
  - 2. Where more than one neutral conductor occurs, or where the neutral conductor is not common to all phase conductors, identify the neutral conductor according the associated phase conductor(s) circuit number(s).

## 2.5 PANELBOARD CIRCUIT INDEX

- A. Provide a neatly typed index, to include type of load served and the specific location of the load for each branch circuit of each panelboard.
  - 1. Provide a new typed index for each existing panelboard in which branch circuits are added, removed, or modified to reflect all changes in circuiting.
- B. Examples
  - 1. Lighting, Southwest Conference Room
  - 2. Lighting, 2nd Floor Conf. Rm and Office 208
  - 3. Receptacles, SW Conf. Rm, west and north walls
- C. Do not use room numbers shown on plans, use room numbers or nomenclature assigned to rooms by the Owner. Do not use remarks from panel schedules on drawing, the remarks are for the Contractor's reference only.
- D. Include the panel designation and location of feeder breaker serving the panelboard at the top of the circuit index.
  - 1. Example:       PANEL 'A'  
                      MAIN IN PANEL 'LDP1'

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install nameplates to be visible from normal viewing angles.
- B. Attach nameplates to equipment enclosures with stainless steel screws or rivets. Adhesives are not acceptable.
- C. Install panel index behind protective plastic covering.

\* END OF SECTION 16195 \*

SECTION 16400 - SECONDARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16110 - Raceways
- C. Section 16120 - Conductors

1.2 SCOPE

- A. Provide complete electrical service as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. The Existing Secondary Electrical Distribution System is 277/480 Volt, Three Phase, Four Wire, 60 Cycle for HID Lighting, Fluorescent Lighting, and Equipment; and 120/208 Volt, Three Phase, Four Wire, 60 Cycle for Incandescent Lighting, Appliances and Outlets.

2.2 FEEDERS

- A. Sizes and connection of feeders are shown on the Power Riser Diagram. Feeders are sized to handle rated loads and to meet voltage drop conditions.
- B. Do not install conductors of different sizes or types in the same conduits.

PART 3 - EXECUTION

3.1 FEEDERS

- A. Before or during final job site observation, check each panel feeder and main feeder for balance of load on each phase, and make necessary adjustments to insure acceptable balance.

3.2 POWER OUTAGES

- A. Power outages to any portion of the existing building will not be allowed except on weekends, holidays and/or as directed by the Owner.
  - 1. Submit written requests for power outages to the Owner not less than Seven (7) working days prior to all proposed outages.
  - 2. Do not take any power outages without the Owners permission.

\* END OF SECTION 16400 \*

SECTION 16450 - SECONDARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Ground all non-current carrying metallic parts of electrical equipment, raceway systems and the neutral conductor of the wiring system as shown on the drawings and specified herein.

PART 2 - PRODUCTS

2.1 GROUND CONDUCTORS

- A. Provide copper ground electrode conductors, minimum No. 8 AWG solid. Stranded conductors may be used for sizes No. 2 AWG and larger.
- B. Provide an insulated equipment ground conductor in all raceways on the load side of the service disconnect.

2.2 GROUND CONNECTIONS

- A. Make ground connections to the existing building ground system and extend to new electrical equipment, raceways, outlets, lighting, etc..
- B. Bond the neutral conductor to electrical service ground system at the main transformer and the main service equipment only.
- C. Bond all interior metallic piping systems to the electrical service ground system.
- D. Make above ground connections by means of pressure connectors, compression connectors, clamps or other means which are UL Listed and classified as suitable for purpose.
- E. Make all underground connections by means of an exothermic welding process equal to Cadweld or Thermoweld, in strict accordance with manufacturer's written instructions and recommendations.

2.3 GROUND RODS

- A. Provide copper ground rods, minimum 3/4" diameter and 10'-0" long, which conform to UL 467, Grounding and Bonding Equipment where indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Leave ground connections accessible for inspection.
- B. Install ground rods minimum 8 feet into earth. Space adjacent ground rods minimum 6 feet apart.
- C. Provide a separate ground terminal for each ground conductor in each panelboard, switchboard, and similar electrical equipment enclosures.

- D. Install all grounding in accordance with the latest edition of the National Electrical Code.

### 3.2 GROUND RESISTANCE MEASUREMENTS

- A. Measure the resistance to ground using the fall-of-potential method described in IEEE No. 81. The resistance values, soil conditions at the time of measurement and the location of each ground rod shall be recorded and forwarded to the Engineer.
- B. If a ground resistance of 25 Ohms or less cannot be obtained with the indicated ground electrodes, provide a supplementary ground electrode consisting of 3/4" x 10'-0" copper ground rods or deep driven sectional ground rods until a resistance of 25 Ohms or less is obtained. Total length of additional ground rods will not be required to exceed 30 feet. Space additional ground rods as evenly as possible and at least 6 feet from any other ground rods.

\* END OF SECTION 16450 \*

## SECTION 16460 - DRY TYPE TRANSFORMERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install dry type distribution transformers as shown on drawings and as described herein.

#### 1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Transformer in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each transformer. Clearly indicate all ratings, voltages, options, accessories, finishes, etc., to be provided with each transformer.

### PART 2 - PRODUCTS

#### 2.1 DRY TYPE TRANSFORMERS

- A. Furnish quiet type dry type utilization transformers with sound level meeting the standards of NEMA ST-20. Mount transformers with sound levels greater than 50 dBs on rubber vibration isolators to prevent amplification of sound.
- B. Transformer insulation will be rated 150 degrees celsius temperature rise above 40 degrees celsius ambient. All insulating materials to be in accordance with NEMA ST-20 standards for a 220 degrees celsius UL component recognized insulation system.
- C. Primary voltage will be rated 480 volt, three phase, three wire, 60 cycle, delta with two (2) 2-1/2 percent taps above and two (2) 2-1/2 percent taps below rated primary voltage.
- D. Secondary voltage will be rated 120/208 volt, three phase, four wire, 60 cycle, wye.
- E. Transformers will contain not less than two full windings per phase.
- F. Acceptable Manufacturers
  - 1. Cutler Hammer
  - 2. General Electric
  - 3. Siemens
  - 4. Square 'D'

### PART 3 - EXECUTION

#### 3.1 SUPPORTS

- A. Furnish and install a minimum of four supports for each transformer located at each corner of the transformer enclosure.

3.2 INSTALLATION

- A. Install transformers in accordance with the manufacturer's written installation instruction. Provide clearances for ventilation as recommended by the manufacturer.

\* END OF SECTION 16460 \*

SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide new panelboards complete with all necessary accessories as shown on drawings and as specified herein.
- B. Provide new branch circuit breakers in existing panelboards to serve new branch circuits as shown on drawings.

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Panelboard in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include dimensioned construction drawings for each Panelboard. Clearly indicate voltage, ampacities, breaker types, conduit entrance areas, materials, options, accessories, finishes, etc., to be provided with each Panelboard. Include Series-Rated verification where required.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Provide dead front safety type panelboards, constructed in accordance with NEMA and UL standards, with plated aluminum or copper bus bars.
- B. Provide each panelboard with main circuit breaker, single lugs or double lugs for attaching feeder conductors and/or sub-feeder conductors as shown on the drawings.
- C. All panelboards to be 20" wide minimum.
- D. Provide panelboards with NEMA 1 enclosures unless indicated otherwise on the drawings.
- E. Arrange circuit breakers in double vertical row configuration with bolted bus connections.
- F. Provide lighting and appliance panelboard fronts with concealed steel door hinges and a flush mounted combination latch and lock. Cover shall be full length hinged (door-in-door construction) Key all locks alike for all panelboards furnished for the project.
- G. Provide each panelboard with an approved circuit index holder with transparent protective cover on the inside of panelboard door.
- H. Provide a ground bus in each panelboard with a separate terminal for connection of each feeder and each branch circuit ground conductor.
- I. Panelboard schedules as shown on drawings.

## 2.2 CIRCUIT BREAKERS

- A. Provide thermal-magnetic type circuit breakers unless noted otherwise.
- B. Provide multi-pole breakers with trip elements in each pole and common trip handle.
- C. Provide "HACR" rated circuit breakers to serve heating, ventilating and air conditioning equipment branch circuits.
- D. Provide "SWD" rated circuit breakers to serve all lighting and outlet branch circuits.
- E. Provide new circuit breakers in existing panelboards of the same type and interrupting ratings as the existing circuit breakers. Provide new mounting hardware, connectors, dead front covers, etc., as required to install the new circuit breakers.
- F. Plug-in breakers are not acceptable for use in panelboards.

## 2.3 INTERRUPTING RATING

- A. Provide panelboards with minimum short circuit current interrupting ratings as shown on the drawings.
- B. The interrupting rating of circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short circuit current rating specified for the panelboards.
- C. The minimum interrupting ratings of circuit breakers used as feeders and branches may be in accordance with UL 489 tested and certified series-connected circuit breaker combinations. All electrical equipment using the Series Rated circuit breaker combinations shall be clearly marked on the panel nameplate and feeder breaker indicating the same.

## 2.4 ACCEPTABLE MANUFACTURERS

- A. Acceptable panelboard manufacturers, subject to compliance with the contract documents, are Cutler Hammer, General Electric, Siemens, and Square 'D'.

## PART 3 - EXECUTION

### 3.1 SUPPORTS

- A. Provide a minimum of four supports, located at each corner of each panelboard. Where the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

### 3.2 MOUNTING HEIGHT

- A. In general, mount panelboards 6 feet above finished floor or grade to top of panel.
- B. Where panelboard exceeds 6 feet in height, arrange the panelboard so that the top operating handle does not exceed 6'-6" above finished floor or grade.

### 3.3 IDENTIFICATION

- A. Provide nameplates and neatly typed circuit index for each panelboard in accordance with Section 16195 - Electrical Identification.

\* END OF SECTION 16470 \*

SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

- A. Provide all lighting fixtures, as shown on drawings and as described herein, complete with all necessary wiring, sockets, lamps, auxiliaries, supports, etc..

1.3 SUBMITTALS

- A. Provide shop drawing submittals for each Fixture and Ballast type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.
- B. Include Manufacturer's standard published literature for each fixture type. Clearly indicate all options, accessories, finishes, etc., to be provided with each fixture type.
- C. Provide construction drawings for custom fixtures and/or accessories to include mounting details, manufacturing methods, wiring methods, finishes, materials, etc., as required.
- D. Include Manufacturer's standard published literature for each ballast type to be used on the project. Provide literature for each ballast manufacturer which the fixture manufacturer may use depending upon availability at the time the fixtures are manufactured.

PART 2 - PRODUCTS

2.1 FIXTURES

- A. Provide fixtures which comply with the appropriate Underwriters Laboratories (UL) Standards for the fixture type and which are UL Listed and UL Labeled.
- B. Acceptable fixture manufacturers and types are indicated on the Fixture Schedule included with the Drawings.
  - 1. Listing of the manufacturer's catalog numbers on the Fixture Schedule is intended to establish the general fixture type required and does not relieve the contractor and/or supplier from the responsibility to provide all accessories and options included in the fixture description nor from meeting the requirements of this specification.
- C. Provide all recessed light fixtures with thermal protection in compliance with NEC Article 410-65 (c) and UL Test Standard 1571.
- D. Provide individual fixtures with multiple ballasts as required to meet lamp switching requirements shown on the drawings.

2.2 FLUORESCENT BALLASTS

- A. Provide UL Listed, CBM-Certified by ETL, Premium Class 'P', Solid State Electronic, fluorescent ballasts with Class 'A' sound rating which meet the energy efficient requirements of Public Law 100-357 (National Appliance Energy Conservation Amendment of 1988 to the Energy Policy and

Conservation Act of 1987) for the lamp types to be served by the ballast.

- B. Electronic Ballasts shall operate lamps at a frequency of 20 to 35 KHz with no detectable lamp flicker, shall comply with FCC and NEMA limits governing EMI and RFI, and shall not interfere with the operation of other normal electric and electronic equipment.
- C. Ballasts shall be potted, in a steel case and contain no PCBs. Operating temperature of the ballasts shall not exceed 60° C at any point on the case during normal operation.
- D. Provide fluorescent ballasts with the proper lamp circuit voltage and rating for the lamp types to be served by the ballast and with the following operating characteristics:
  - 1. Minimum Ballast Factor 0.88
  - 2. Minimum Power Factor 95%
  - 3. Maximum Total Harmonic Distortion (THD) 10%
- E. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type, UL listing, CBM Certification and Date of Manufacture Code.
- F. Electronic Ballast Warranty shall be 5 Years from the "Date of Manufacture" Code on the ballast.
- G. Fluorescent Ballasts shall be of U.S. Manufacture. Acceptable Manufacturers, subject to compliance with Contract Documents, are Advance, Magnetek and Sylvania.

### 2.3 HIGH INTENSITY DISCHARGE (HID) BALLASTS

- A. Provide UL Listed, High Power Factor, High Intensity Discharge (HID) Ballasts which conform to the applicable ANSI Designation for the wattage and type of lamp served.
- B. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type, UL listing and Date of Manufacture Code.
- C. HID Ballasts shall contain no PCB's.
- D. HID Ballast Warranty shall be 2 Years from the "Date of Manufacture" Code on the ballast.

### 2.4 LAMPS

- A. Provide lamps of the Wattages, Types, and with color characteristics as indicated on the Fixture Schedule included with the Drawings.
- B. Provide incandescent lamps rated for 120 volt unless otherwise specified.
- C. Provide fluorescent lamps which conform to the Energy Policy Act of 1992 and the applicable ANSI Designations for the lamp wattage and type.
  - 1. Fluorescent Lamps shall be compatible with supplied ballasts to meet the energy conservation requirements of Public Law 100-357.
- D. Provide new fluorescent lamps with reduced mercury content, such as Phillips "Alto" Series Fluorescent Lamps, to meet the requirements of the EPA Resource Conservation Recovery Act for Toxic Characteristic Leaching Procedure.
  - 1. Reduced mercury content lamps will not be required for lamp types which are not available from any of the acceptable lamp manufacturers with reduced mercury content.

- E. Provide High Intensity Discharge (HID) lamps suitable for the installed burning position which conform to the applicable ANSI designations for the wattage and type of lamps specified on the drawings.
- F. Acceptable Lamp Manufacturers, subject to compliance with the Contract Documents are General Electric, Phillips, Sylvania and Venture.

## 2.5 EXTRA STOCK

- A. Provide the following extra stock of materials to the Owner.
  - 1. Lamps: 10% , but not less than 2 of each type used on the project.
  - 2. Fixtures lenses and louvers: 10%, but not less than 1 of each type used on the project.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Properly center fixtures in each room. Where multiple fixtures occur, space them uniformly and in straight lines with each other.
- B. Locate recessed ceiling light fixtures to center on a single tile or at the intersection of four tiles.
- C. Carefully lay out all openings required for recessed lighting units. Cooperate with other contractors and make provisions for openings of exact dimensions required and provide all required plaster rings and ground frames to be inserted in openings.
- D. Where lighting fixtures are shown to conflict with locations of structural members and mechanical or other equipment, provide adequate supports and wiring to clear same.

### 3.2 SUPPORTS

- A. Provide all necessary connectors, straps, etc., for secure mounting of all fixtures.
- B. Secure fixtures in suspended grid type ceilings to the grid members using a device capable of holding 100% of the fixture weight acting in any direction. Provide 12 gauge galvanized steel ceiling support wires attached to grid members within 3" of each corner of the fixture. Tandem fixtures may utilize common grid member support wires.
  - 1. Fixtures weighing less than 56 pounds in suspended grid type ceilings shall also be secured to building structure independent of the ceiling support system with a 12 gauge galvanized steel wire or #10 jack chain located at diagonally opposite corners of the fixture. These wires or chains may be slack.
    - a. Provide recessed can type fixtures with metal bar hangers attached to the ceiling grid system. Secure fixtures to the building structure as specified above.
    - b. Support surface mounted fluorescent fixtures installed on suspended grid type ceilings from the building structure by means of independent support clips equal to Caddy No. IDS with proper stud length for fixture installed, and minimum of two 12 gauge galvanized steel support wires.
  - 2. Fixture weighing 56 pounds or more in suspended grid type ceilings shall be supported directly from the structure above by approved hangers.
- C. Support recessed fixtures installed in gypsum board ceilings to the ceiling support system with

metal bar hangers or suitable brackets.

- D. Support surface mounted fluorescent fixtures installed on gypsum board or concrete ceilings from the ceiling with proper anchors at each corner of the fixture.
- E. Fixtures designed to be supported from the outlet box will not require any additional support. Provide proper outlet box with fixture stud or plaster ring suitable to support the fixture. Secure the outlet box to the building structure with suitable anchors capable of supporting not less than 200 lbs or 4 times the fixture weight, whichever is greater.
- F. Provide suspended fixtures with swivel hangers to insure plumb installation. Secure hangers to the building structure with suitable anchors capable of supporting not less than 200 lbs or 4 times the fixture weight, whichever is greater. Install hangers such that the motion of swivels or hinged joints will not cause sharp bends in conductors or damage to insulation.

### 3.3 LAMP BURN-IN

- A. Burn-in all fluorescent and HID lamps for a minimum of 100 hours prior to completion of the project and replace all defective lamps.

### 3.4 COORDINATION

- A. Coordinate ceiling types with General Contractor and verify compatibility with fixture mounting provisions prior to ordering fixtures. Immediately notify the Engineer in writing of any discrepancies between ceiling types and specified fixture types.
- B. Verify available voltages and coordinate fixture voltage with the fixture supplier prior to ordering fixtures. Immediately notify the Engineer in writing of any discrepancies between available voltages and the specified fixture voltages.
- C. Coordinate fixture locations with other contractors to provide adequate clearance between fixtures and ductwork, piping, structural members, etc., for proper installation of fixtures and provide access for maintenance or replacement of the fixtures.

\* END OF SECTION 16500 \*

SECTION 16620 - EMERGENCY/STANDBY POWER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16910 - Automation System Controls

1.2 SCOPE

- A. Provide, install and acceptance test a complete and operable Emergency/Standby electric generating system, including all devices and equipment specified herein, as shown on the drawings, or required for the service. Equipment shall be new, factory tested, and delivered ready for installation.

1.3 ACCEPTABLE MANUFACTURERS

- A. Acceptable Emergency/Standby Power System Manufacturers, subject to compliance with the Contract Documents, are:
  - 1. Caterpillar - Olympian
  - 2. Cummins Power Generation
  - 3. Generac Power Systems
  - 4. Kohler Power Systems
- B. All Suppliers submitting quotes shall note all deviations from this specification on their bid proposals and the contractor shall notify the Project Engineer of all deviations within 24 hours of Bid Opening.

1.4 SUBSTITUTIONS

- A. Submit requests for substitutions in writing to the Project Engineer, in accordance with the General Conditions and Section 16000 - General Provision, Electrical.
- B. Requests for substitutions shall include complete submittal data, as specified Paragraph "Submittals", clearly denoting any and all deviations and/or exceptions to the equipment specified.
- C. The Contractor will be responsible for the cost of all necessary revisions and or modifications required for installation of substitute equipment.

1.5 SUBMITTALS

- A. Provide shop drawing submittals in accordance with the General Conditions and Section 16000, General Provisions - Electrical, to verify compliance with the Contract Documents. Include the following minimum information:
  - 1. Complete equipment list to include all accessories and options.
  - 2. Ratings at site conditions.
  - 3. Calculations based on information in paragraph "Load Profile" to verify compliance with specified voltage and frequency dip values.
  - 4. Specification and data sheets for all equipment and accessories.
  - 5. Manufacturer's certification of prototype testing.
  - 6. Manufacturer's published warranty documents.

7. Shop drawings showing plan and elevation views with certified overall dimensions and interconnection point dimensions.
8. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
9. Manufacturer's installation instructions.
10. Location of field service office including address and telephone numbers and emergency service telephone numbers.

#### 1.6 WARRANTY

- A. Provide a no deductible warranty for the complete electrical power system, including engine-generator set, controls, transfer switch and accessories, against defects in material and workmanship for a Five Year period or 1500 Hours of operation, whichever occurs first, from the start-up date. Warranty shall cover cost of replacement parts for the entire coverage period as well as labor and travel expenses through the second year of coverage per the manufacturer's standard published limited warranty.

#### 1.7 SINGLE SUPPLIER

- A. The Emergency/Standby Power System supplier shall be the manufacturer's factory authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service.
- B. The supplier shall have 24-hour, 365 days per year, service availability and factory-trained and certified service technicians authorized to do warranty service on all warrantable products.
- C. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles.

### PART 2 - PRODUCTS

#### 2.1 DIESEL ENGINE-GENERATOR SET

- A. Provide a 4-cycle, 1800 rpm, diesel engine-generator set with low reactance brushless generator, torque-matched excitation, automatic voltage regulator, set-mounted control panel, and high ambient cooling system (50 degree C).
- B. Ratings:
  1. Minimum Generator Set Nameplate Standby Rating: As indicated on the drawings.
  2. System voltage: 277/480 WYE Volts AC, 3 Phase, 4 Wire, 60 Hertz.
  3. Altitude: 4800 Feet above Mean Sea Level
  4. Temperature Range: -20 degrees F to 120 degrees F.
- C. Prototype Tests and Evaluation shall have been done on a complete and functional unit, component level type tests will not substitute for this requirement.
- D. Voltage regulation shall be +/- 1 percent for any constant load between no load and rated load.
- E. Frequency regulation shall be within 5% 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  $\pm$  0.5%.
- F. The diesel 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.

- G. Motor starting capability shall be nominal 500 KVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage with the specified KVA load at near zero power factor applied to the generator set.
- H. Maximum transient voltage dip shall not exceed 25 percent below rated voltage on application of the single largest surge load step.

## 2.2 ENGINE

- A. The engine shall be diesel, 4 cycle, radiator and fan cooled. The horsepower rating of the engine at it's minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
  - 1. Two cycle engines are not acceptable.
- B. A mechanical governing system shall provide automatic frequency regulation as described herein.
- C. The engine shall be cooled by a unit-mounted closed loop radiator system rated for full rated load operation in 122 degrees F (50 degrees C) ambient condition with the ambient temperature as measured at the generator air inlet. Radiators shall be provided with a duct adaptor flange. The cooling system shall be filled with 50/50 ethylene glycol/water mixture by the equipment supplier. Rotating parts shall be guarded against accidental contact.
- D. Engine Accessory Equipment: The engine-generator set shall include the engine accessories as follows:
  - 1. An electric starter capable of three complete cranking attempts without overheating.
  - 2. Positive displacement, mechanical, full pressure, lubrication oil pump. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator. Lubrication oil to be provided by the equipment supplier.
  - 3. An engine driven, mechanical, positive displacement fuel pump. Fuel/water separator.
  - 4. Fuel filter with replaceable spin-on canister element.
  - 5. Replaceable dry element air cleaner with restriction indicator.
  - 6. Flexible supply and return fuel lines.
  - 7. Engine mounted battery charging alternator, 45 ampere, and solid-state voltage regulator.

## 2.3 AC GENERATOR

- A. The AC generator shall be; synchronous, 4 pole, 2/3 pitch, revolving field, dripproof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc(s).
- B. All insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.
- C. The generator shall be broad range, 12 lead reconnectable, connected and tested at the factory

for specified system voltage. The generator shall be capable of delivering rated output (KVA) at rated frequency and power factor, at any voltage within the broad range.

- D. A permanent magnet generator (PMG) shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non-linear loads. The PMG shall sustain excitation power for optimum motor starting and to sustain short circuit current at approximately 300% of rated current for not more than 10 seconds. The automatic voltage regulator shall be temperature compensated, solid-state design with three-phase RMS sensing. The regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The regulator shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 HZ. The torque-matching characteristic shall include differential rate of frequency change compensation to use maximum available engine torque and provide optimal transient load response. Regulators which use a straight-line fixed volts per hertz characteristic are not acceptable.

## 2.4 GENERATOR SET CONTROL

- A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.
- B. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
- C. The generator set mounted control shall include the following features and functions:
- D. Control Switches
1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
  2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
  3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
  4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
- E. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:
1. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
  2. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter.

Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.

3. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
4. The control system shall log total number of operating hours, total kWh, and total control on hours, as well as total values since reset.

F. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
  - a. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
  - b. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
  - c. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
  - d. The control shall include an amber common warning indication lamp.
2. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:
  - a. low oil pressure (warning)
  - b. low oil pressure (shutdown)
  - c. oil pressure sender failure (warning)
  - d. low coolant temperature (warning)
  - e. high coolant temperature (warning)
  - f. high coolant temperature (shutdown)
  - g. high oil temperature (warning)
  - h. engine temperature sender failure (warning)
  - i. low coolant level (warning)
  - j. fail to crank (shutdown)
  - k. fail to start/overcrank (shutdown)
  - l. overspeed (shutdown)
  - m. low DC voltage (warning)
  - n. high DC voltage (warning)
  - o. weak battery (warning)
  - p. high AC voltage (shutdown)
  - q. low AC voltage (shutdown)
  - r. under frequency (shutdown)

- s. over current (warning)
  - t. over current (shutdown)
  - u. short circuit (shutdown)
  - v. over load (warning)
  - w. emergency stop (shutdown)
  - x. low fuel level (warning)
  - y. fuel tank leak (warning)
  - z. (3) configurable conditions
3. Provisions shall be made for indication of three customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

G. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control :
  - a. engine oil pressure (psi or kPA)
  - b. engine coolant temperature (degrees F or C)
  - c. engine oil temperature (degrees F or C)
  - d. engine speed (rpm)
  - e. number of hours of operation (hours)
  - f. number of start attempts
  - g. battery voltage (DC volts)
2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

H. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

I. Alternator Control Functions:

1. The generator set shall include an automatic digital voltage regulation system that is

matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

2. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds.
    - a. The controls shall open the Standby Power Automatic Transfer Switch 'ATS2' when output current level approaches the thermal damage point of the alternator.
    - b. Emergency Automatic Transfer Switch 'ATS1' shall remain closed to provide power to the emergency loads.
    - c. The protective functions provided shall be in compliance to the requirements of NFPA 70 Article 445.
  3. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 Article 445.
  4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
  5. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
  6. The generator set control shall include a 120VAC-control heater when required by the manufacturer for the site conditions.
- J. Other Control Functions
1. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.
  2. A battery monitoring system shall be provided which initiates alarms when the DC control

and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

**K. Control Interfaces for Remote Monitoring:**

1. The control system shall provide four programmable output relays with form C dry contacts. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control.
2. The relays shall be configured to indicate:
  - a. Generator set operating at rated voltage and frequency
  - b. Common warning
  - c. Common shutdown
  - d. One user programmable
3. Relays will be monitored the Johnson Controls Metasys System as specified in Section 16910 - Automation System Controls.

**2.5 GENERATOR SET BASE**

- A. The engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. The base shall incorporate a battery tray with battery holddown clamps within the rails. Provisions for stub up of electrical conduits shall be within the footprint of the set. Vibration isolators, standard quantity and type of the manufacturer, shall be integral between generator set and base.

**2.6 GENERATOR SET AUXILIARY EQUIPMENT AND ACCESSORIES**

- A. Provide a generator main circuit breaker, set-mounted and wired, UL listed, molded case thermal-magnetic type, ratings as shown on the drawings.
- B. Provide an engine mounted, thermostatically controlled, water jacket heater for the engine. The heater shall be sized as recommended by the equipment supplier. Heater voltage shall be 120 Single Phase, and clearly indicated on the shop drawing submittals.
- C. Provide Starting and Control Batteries, lead acid type, 24 volt DC, sized as recommended by the generator set manufacturer, for each generator set complete with battery cables and connectors.
- D. Provide thermostatically controlled Battery Heater, sized as recommended by the equipment supplier. Heater shall be 120 Volt, Single Phase and provided with NEMA 5-15P attachment plug and cord.
- E. Engine Exhaust Muffler of size and type as recommended by the generator set manufacturer. Muffler shall be Critical Grade. Exhaust system shall be installed according to the generator set manufacturer's recommendations and applicable codes and standards.
- F. Sub-Base Fuel Storage Tank: Provide a double wall sub-base fuel storage tank sized to operate the engine-generator set for approximately 16 hours at full load. The tank shall be made of corrosion resistant steel.
1. Tank shall not exceed 24" in height.
  2. The fuel tank shall meet all current EPA, NFPA, IFC and UL standards for non-containment areas.

3. The fuel tank shall not interfere with access to items requiring maintenance on the engine-generator such as drains, filters, etc., and shall provide visual tank-to-foundation clearance.
  4. The fuel tank shall include provisions for installing underground conduits to the engine-generator set within the footprint of the fuel tank coordinated to the engine-generator set conduit stub-up space.
  5. The fuel tank fill neck and cap shall be readily accessible within the weather protective enclosure and located away from the batteries. Over-fill protection shall be provided.
  6. Provide an automatic leak detection system in the space between the walls with alarm indicators on the Generator Control Panel.
  7. Provide the fuel tank with fuel level gauge which is visible from the fill neck location.
  8. Provide an electrical low fuel supply sensing device on the fuel tank with alarm indicators on the Generator Control Panel. The sensing device shall be adjusted to signal low fuel level when the tank contains less than 30% of tank capacity.
- G. Provide outdoor weather-protective housing, factory-assembled to engine-generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable and removable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color.

## 2.7 FUEL

- A. Fuel shall be No. 2 Diesel with additives to prevent gelling of the fuel in cold weather.
- B. Provide fuel to fill fuel storage tank and top off tank after all field testing is complete.

## 2.8 AUTOMATIC LOAD TRANSFER SWITCHES

### A. Ratings:

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 Volts AC minimum.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings and at the specified voltage. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

### B. Construction:

1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.

2. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
5. Power transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
6. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
7. Circuit breaker type transfer switches are not acceptable.

C. Connections:

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

## 2.9 TRANSFER SWITCH CONTROL

- A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.
1. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
  2. High intensity LED lamps to indicate that the transfer switch is "not in auto" (due to control being disabled or due to bypass switch (when used) enabled or in operation) and "Test/Exercise Active" to indicate that the control system is testing or exercising the generator set.
  3. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
  4. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

5. "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
6. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool and an operator display panel.
7. Analog AC meter display panel, to display 3-phase AC Amps, 3-phase AC Volts, Hz, KW load level, and load power factor. The display shall be color-coded, with green scale indicating normal or acceptable operating level, yellow indicating conditions nearing a fault, and red indicating operation in excess of rated conditions for the transfer switch.
8. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:
  - a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
  - b. Display source status, to indicate source is connected or not connected.
  - c. Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.
  - d. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
    - (1) Set nominal voltage and frequency for the transfer switch.
    - (2) Adjust voltage and frequency sensor operation set points.
    - (3) Set up time clock functions.
    - (4) Set up load sequence functions.
    - (5) Enable or disable control functions in the transfer switch, including program transition.
    - (6) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.
  - e. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.
  - f. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.
  - g. Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.
  - h. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to

close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

B. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site.
2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:
  - a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).
  - b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).
  - c. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.
  - d. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.
  - e. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).
  - f. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.
3. All transfer switch sensing shall be configurable from a Windows 95, 98, or NT PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. The transfer control shall incorporate a series of diagnostic LED lamps.
4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device for this feature is subject to approval of the Project Engineer.
5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).
6. Transfer switch 'ATS2' shall accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to source 2 or connect to source 1 if available.
7. The transfer switch shall be configurable to accept a relay contact signal and a network

signal from an external device to prevent transfer to the generator service.

8. Transfer switch shall provide a relay contact signal prior to transfer or retransfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
9. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
10. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
11. Transfer Switch ATS2 shall be provided with a battery charger for the generator set starting batteries. The battery charger shall be a float type charger rated 10 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs. The charger shall also include fault indications for high and low dc voltage, and supply power failed, and dry contacts for external indication of these fault conditions. Supply power failed indication shall be displayed on the ATS control panel.
  - a. Battery charger may be located in the engine-generator set housing at the option of the supplier.

#### C. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.
2. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
3. The transfer switch shall be provided with a network communication card, and configured to allow LonMark compliant communication with the transfer switch and other network system components. The network shall provide a redundant start signal to the generator set(s) in the system.

### 2.10 TRANSFER SWITCH ENCLOSURE

- A. Enclosures shall be UL listed. The enclosure shall provide wire bend space in compliance to the latest version of NFPA 70. The cabinet door shall include permanently mounted key type latches.
- B. Transfer switch equipment shall be provided in a NEMA 1 or better enclosure.
- C. Enclosures shall be the NEMA type specified. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

### 2.11 TRANSFER SWITCH OPERATION

- A. Open Transition Sequence of Operation:
  1. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the

transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

2. Generator Set Exercise (Test). The control system shall be configurable to test the generator set with or without load.

### PART 3 - EXECUTION

#### 3.1 SUPPORTS

- A. The engine-generator set shall be mounted on vibration isolator pads and securely fastened in place in accordance with manufacturer's recommendations.
- B. Provide a minimum of four supports, located at each corner of the Transfer switch enclosure for each enclosure. Where enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum. In general, mount Transfer Switches 6 feet above finished floor or grade to top of enclosure.
- C. The main fuel storage tank shall be mounted on seismic restraints and securely fastened in place in accordance with the manufacturer's recommendations.

#### 3.2 INSTALLATION

- A. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

#### 3.3 FACTORY TESTS

- A. Generator set factory tests on the equipment to be shipped, shall be performed at rated load and 0.8 PF. Generator sets that have not been factory tested at 0.8 PF will not be acceptable. Tests shall include: 2 Hour run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and safety shutdowns.
- B. Each transfer switch supplied shall be factory tested before shipment. Tests shall include a complete functional test of the transfer switch controls, including calibration of the voltage sensors.
- C. Provide a factory certified record of the production testing. Submit to Project Engineer upon receipt of test reports and include copies in the Operation and Maintenance Manuals.

#### 3.4 ON-SITE ACCEPTANCE TEST

- A. The completed installation shall be tested for compliance with the Contract Documents. Testing shall be conducted by a factory trained and authorized representatives of the manufacturer.
- B. The Owner and Project Engineer shall witness the tests at a date and time acceptable to all parties involved.
- C. Acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test.
- D. Demonstrate proper operation of all control functions including, but not limited to, load shedding, automatic shutdowns, transfer delays, etc..

### 3.5 OPERATION AND MAINTENANCE MANUALS

- A. Provide Operation and Maintenance Manuals in a hardback three-ring loose leaf binder with the project name, number, engineer, etc., on the front cover and project name and number on the back spline.
  - 1. Refer to General Conditions and Section 16000 - General Provisions, Electrical for additional requirements.
- B. Include complete parts lists for all items supplied in the Manuals.
- C. Include operation and maintenance instructions including tune-up, diagrams, dimensional drawings, installation instructions and ratings.
- D. Include full size drawings of the Engine Generator Control and Wiring Schematic; of the Control and Transfer Panel Schematic and Wiring; and of printed Circuit boards used in control or transfer panels.
  - 1. Drawings shall include all wiring, accessories and components which are actually installed for this project. The manufacturer's standard drawings which include accessories and components which are not installed as part of this project are not acceptable unless suitably modified and approved prior to acceptance of the drawings.
  - 2. All drawings shall be full drafted size. Any reduced drawings shall be legibly reproducible on standard office copy machines. A submittal of all proposed reduced size drawings must be approved prior to acceptance of reduced drawings.
- E. Include copies of all software utilized by the emergency/standby power system.
- F. Include complete warranty information including beginning date of warranty and serial numbers of warranted equipment.

### 3.6 TRAINING

- A. After emergency/standby power system installation and acceptance testing, but prior to substantial completion, the supplier shall conduct a complete operation, basic maintenance, and emergency service seminar for up to 10 persons employed by the owner. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be maximum 8 hours in length, and include practical operation with the installed equipment.
- B. The manufacturer shall supply to the facility owner a complete set of service and maintenance software required for use in properly supporting the emergency/standby power system. The software shall be provided at a training seminar attended by the user, to qualify the user in proper use of the software.

\* END OF SECTION 16620 \*

SECTION 16910 - BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.
- B. Section 16110 - Raceways
- C. Section 16115 - Outlet Boxes

1.2 SCOPE

- A. Furnish and install raceway system, junction boxes, wiring, control devices, etc., for monitoring the new Standby Power System, and control the Heat Plant mechanical systems, from the existing Johnson Controls Inc. Campus Automation System as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 EXISTING BUILDING AUTOMATION SYSTEM

- A. The existing building automation system is a Johnson Controls Inc. Metasys system.
- B. Provide all new work, equipment, programming, etc., to be compatible with the existing Johnson Controls Inc. Metasys Building Automation System.
- C. New automation system work shall not void warranties which the Owner may have in place with Johnson Controls Inc. for the existing building automation system.

2.2 SYSTEM TIE-IN

- A. The Automation System Contractor will furnish and install all necessary hardware required for separate Digital Inputs from the existing Johnson Control Metasys Digital Control Panels to the new Engine-Generator Set, Fuel Tank, and Automatic Transfer Switches. Existing inputs shall be used for control of the Heat Plant mechanical Systems.

2.3 AUTOMATION SYSTEM MODIFICATIONS

- A. The Automation System Contractor will furnish and install all hardware, software modifications, and programming at the existing Johnson Control Panels and at the existing Johnson Control Metasys Operator Workstation, to allow the local operator to monitor the following functions and initiate corrective actions as necessary:
  - 1. Monitor Engine-Generator Set
    - a. Generator Running
    - b. Generator Abnormal (warnings)
    - c. Generator Shutdown (alarms)
    - d. Fuel Tank Low
    - e. Fuel Tank Leak

2. Monitor each Automatic Transfer Switch
  - a. ATS on Normal Power
  - b. ATS on Emergency Power
  - c. ATS Battery Charger Failure

#### 2.4 RELATED WORK BY ELECTRICAL CONTRACTOR

- A. The Electrical Contractor will furnish and install all dry relay contacts in the engine-generator set control panel and in the Automatic Transfer Switch cabinets as specified in Section 16620 - Emergency/Standby Power System.
- B. The Electrical Contractor will furnish and install all conduit from the Engine Generator Set and Automatic Transfer Switches to the existing Johnson Control Digital Control Panels as shown on the drawings. Conductors will be by the Automation System Contractor.
  1. Verify all wiring requirements with the Automation System Contractor prior to roughing in raceways for new control wiring.

#### PART 3 - EXECUTION

##### 3.1 WIRING

- A. Provide 3 conductor, #18 AWG, shielded cable for all new Automation System control wiring.
- B. Install all Automation System Control wiring in approved raceway systems as specified for power wiring except that minimum 1/2" trade diameter conduit may be used.

##### 3.2 COORDINATION

- A. The Electrical Contractor and Automation System Contractor shall coordinate with each other to ensure that all Automation System Control work is properly installed and properly interfaces with the electrical and mechanical systems work.

\* END OF SECTION 16910 \*