



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

**Division of Facilities Construction and Management**

**DFCM**

## **STANDARD LOW BID PROJECT**

**December 30, 2009**

# **CAMPUSWIDE ELECTRICAL METERING IMPROVEMENTS**

**UTAH VALLEY UNIVERSITY  
OREM, UTAH**

DFCM Project Number 09054790

Spectrum Engineers  
324 South State Street  
Salt Lake City, Utah 84111

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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/StdDocs/index.html> "Standard Documents" – "Reference Documents I" – "Item 6. Supplemental General Conditions" or are available upon request from DFCM:

**DFCM Supplemental General Conditions dated July 1, 2009 \***

DFCM Supplemental General Conditions dated July 15, 2008

DFCM General Conditions dated May 25, 2005

DFCM Application and Certification for Payment dated May 25, 2005.

**\* NOTE: THE NEW SUPPLEMENTAL GENERAL CONDITIONS EFFECTIVE JULY 1, 2009 ADDRESSING HEALTH INSURANCE AND IMMIGRATION ARE REFERENCED AT THE LINK ABOVE.**

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>

## NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

**CAMPUSWIDE ELECTRICAL METERING IMPROVEMENTS**  
**UTAH VALLEY UNIVERSITY - OREM , UTAH**  
**DFCM PROJECT NO: 09054790**

Bids will be in accordance with the Contract Documents that will be available at 3:00 PM on Wednesday, December 30, 2009 and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Brian Bales, DFCM, at 801-230-3129. No others are to be contacted regarding this bidding process. The construction estimate for the Base Bid and Additive Alternate #1 is \$106,000. The construction estimate for Additive Alternate #2 is \$40,000.

A **mandatory** pre-bid meeting will be held at 9:00 AM on Tuesday, January 5, 2010 at Utah Valley University, 800 West University Parkway, Orem Utah (reference attached map). All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Wednesday , January 20, 2010 at 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.

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 and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT  
Marla Workman, Contract Coordinator  
4110 State Office Building, Salt Lake City, Utah 84114

## PROJECT DESCRIPTION

A mandatory pre-bid meeting will take place as indicated in the project schedule. The meeting will begin promptly at the specified time. Late arrivals may miss important issues and will not be allowed to sign in or bid the project.

The project scope is to provide and install new electrical meters throughout the UVU campus. The meters will be owned and monitored by Utah Valley University for the purpose of energy management. The meters will be remote readable utilizing the UVU Ethernet communication system. The Ethernet metering network server and the Ethernet network cabling from the central hub to each meter location will be provided by the owner. Modbus cabling between meters within the same room will be the responsibility of the contractor.

It is the contractor's responsibility to visit the project location and observe the site conditions for each meter and CT requirement. By submitting a bid the contractor has acknowledged that they have observed the existing conditions of each meter and CT location. It is the contractor's responsibility to select a CT appropriate for each location and wiring configuration. Split CT's may be utilized provided they meet the project specifications. The window dimensions of each CT shall be sized as small as possible for the specific locations to insure accurate meter readings. Grossly oversized CTs for ease of installation are not acceptable. All power outages shall be accomplished during non standard UVU business hours.

The project has been designed with utilizing a basis of design metering product. Other manufacturers are acceptable provided they meet the specified requirements. (see specification 2.1 a,b and c ). It should be noted that alternate manufacturers are acceptable provided they are equal or better than the basis of design meter. Requests to be approved as an alternate manufacturer shall be submitted no later than the date established in the project schedule as last day for questions. The request should include a full submittal package for the engineers review in order to determine acceptability of the proposed alternate. The alternate meter submittal package shall also include a copy of the project meter specification which indicates per specification line item compliance or non compliance of the proposed alternate meter. A detailed explanation should be included for each non compliant feature.

Incomplete alternate submittal packages will not be considered.

It should be noted that Priority # 3 Meters (see sheetE604) are not part of this project or bid.



## PROJECT SCHEDULE

<b>PROJECT NAME:</b>		<b>CAMPUSWIDE ELECTRICAL METERING IMPROVEMENTS UTAH VALLEY UNIVERSITY - OREM , UTAH</b>		
<b>DFCM PROJECT NO:</b>		<b>09054790</b>		
<b>Event</b>	<b>Day</b>	<b>Date</b>	<b>Time</b>	<b>Place</b>
Bidding Documents Available	Wednesday	December 30, 2009	3:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
<b>Mandatory</b> Pre-bid Site Meeting	Tuesday	January 5, 2010	9:00 AM	UVU 800 West University Parkway Orem, UT **
Last Day to Submit Questions	Thursday	January 7, 2010	2:00 PM	Brian Bales – DFCM E-mail <a href="mailto:brbales@utah.gov">brbales@utah.gov</a> Fax 801-538-3267 <b>and</b> David Wesemann E-mail <a href="mailto:Dew@spectrum-engineers.com">Dew@spectrum-engineers.com</a>
Addendum Deadline (exception for bid delays)	Thursday	January 14, 2010	4:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Wednesday	January 20, 2010	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Thursday	January 21, 2010	3:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Wednesday	May 5, 2010	3:00 PM	

## NOTES:

- \* DFCM's web site address is <http://dfcm.utah.gov>
- \*\* Refer to UVU Campus PDF map on DFCM website project link



# 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 "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **CAMPUSWIDE ELECTRICAL METERING IMPROVEMENTS - UTAH VALLEY UNIVERSITY – OREM, UTAH – DFCM PROJECT NO. 09054790** 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 as listed on Plan Sheet E604 and described in the Specifications and Contract Documents to provide and install Priority #1 Meters M2, M3, M4, M5, M6, M7, M8, M11, M13, M15, M17, and M18, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_ )  
(In case of discrepancy, written amount shall govern)

**ADDITIVE ALTERNATE #1:** For all work as listed on Plan Sheet E604 and described in the Specifications and Contract Documents to provide and install Priority #1 Meters M20, M21, M22, M23, and M24, I/we agree to perform for the sum of:

\_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_ )  
(In case of discrepancy, written amount shall govern)

**ADDITIVE ALTERNATE #2:** For all work as listed on Plan Sheet E604 and described in the Specifications and Contract Documents to provide and install Priority #2 Meters M9, M10, M12, M14, M16, M19, and M25, 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 **May 5, 2010**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of \$ **150.00** 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 the 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 the 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

# INSTRUCTIONS TO BIDDERS

## 1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

## 2. Bids

Before submitting a bid, each contractor 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. 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 Representative and the necessary changes shall be accomplished by Addendum.

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 deadline for submission of bids.

A bid bond properly signed by a qualified surety, as indicated on the DFCM Bid Bond form provided along with this Instruction to Bidders, in the amount of 5% of the bid, shall accompany the bid submission to DFCM. **THIS BID BOND MUST BE ON THE DFCM BID BOND FORM PROVIDED WITH THIS INSTRUCTION TO BIDDERS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID** unless only one bid is received by DFCM, or the failure to comply with the bid bond requirements is determined by the Director of DFCM to be nonsubstantial based on the following:

- (a) the bid bond is submitted on a form other than DFCM's required Bid Bond form and the bid bond meets all other requirements including being issued by a surety firm authorized to do business in the State of Utah and be listed in the U.S. Department of the Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies for an amount not less than the amount of the bond to be issued. A co-surety may be utilized to satisfy this requirement; and
- (b) the contractor provides a bid bond properly signed by a qualified surety and on the required DFCM Bid Bond form by the close of business of the next succeeding business day after the DFCM notifies the bidder of the defective bid bond.

## 3. Contract and Bond

The Contractor's Agreement will be in the form found in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract 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.

**4. Listing of Subcontractors**

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these 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 is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

**5. Interpretation of Drawings and Specifications**

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

**6. Addenda**

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.

**7. 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 the State of Utah 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.

**8. DFCM Contractor Performance Rating**

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

**9. 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.

**10. 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.

**11. Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

**12. Time is of the Essence**

Time is of the essence in regard to all the requirements of the Contract Documents.

**13. Withdrawal of Bids**

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

**14. 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 A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. 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 A/E.

**15. 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.

**16. Debarment**

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

**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: \_\_\_\_\_

\_\_\_\_\_  
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**

**INSTRUCTIONS 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

**INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**  
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such 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:

<b>TYPE OF WORK</b>	<b>SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"</b>	<b>SUBCONTRACTOR BID AMOUNT</b>	<b>CONTRACTOR LICENSE #</b>
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 and July 1, 2009 ("also referred to as General Conditions") 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% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT  
PAGE NO. 2

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 Invitation to Bid, 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: \_\_\_\_\_

Attorney-in-Fact (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: \_\_\_\_\_

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

<b>Agency:</b> _____
<b>Agent:</b> _____
<b>Address:</b> _____
<b>Phone:</b> _____

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: \_\_\_\_\_ Attorney-in-Fact (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: \_\_\_\_\_

NOTARY PUBLIC

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

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



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:

- As-built 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. The amount withheld pending completion of the list of items noted and agreed to shall be: \$\_\_\_\_\_. 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.

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

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

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

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

**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>
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**Additional Comments:**

SECTION 260913 - ELECTRICAL POWER MONITORING AND CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following for monitoring of electrical power system:
  1. Remote metering devices.
  2. Communication network and interface modules for RS-485, Modbus TCP/IP and Ethernet data transmission protocols.
  3. Intercommunication wiring.
  4. Software.
  5. Factory field support for programming system.
  6. Wiring, cabling, raceways, boxes and supports required for the installation.

1.3 DEFINITIONS

- A. Ethernet: Local area network based on IEEE 802.3 standards.
- B. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.
- C. HTML: Hypertext markup language.
- D. I/O: Input/output.
- E. LAN: Local area network; sometimes plural as "LANs."
- F. LCD: Liquid crystal display.
- G. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or remote-control, signaling and power-limited circuits.
- H. Modbus TCP/IP: An open protocol for exchange of process data.
- I. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- J. PC: Personal computer; sometimes plural as "PCs."
- K. rms: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.
- L. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.
- M. RS-485: A TIA standard for multipoint communications using two twisted-pairs.

- N. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- O. THD: Total harmonic distortion.
- P. UPS: Uninterruptible power supply; used both in singular and plural context.
- Q. WAN: Wide area network.

#### 1.4 PRE-BID SUBMITTALS FOR ALTERNATE APPROVAL

- A. Where other than Basis of Design products and services are being proposed, provide a submittal no later than 10 days prior to bid date for evaluation. At a minimum, the pre-bid submittal shall include the following, but may include additional items that might assist in the evaluation of the system:
  - 1. Compliance Statement: Indicate if the products and services proposed meet the specifications. List all deviations of this specification by paragraph number with an explanation of how the proposed products or services differ from that specified.
  - 2. Product Data: For each type of product indicated. Catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements of each device.
  - 3. Software and Firmware Operational Documentation.
  - 4. Past Projects List: List five(5) projects where the proposed system has been installed and is in operation. For each project, list a contact reference name and phone number of an individual resident on the project who is familiar with and operates the system.
  - 5. Service and Technical Support: Provide description of technical support customer may receive after installation.

#### 1.5 SUBMITTALS (POST-BID / PRE-INSTALLATION)

- A. Product Data: For each type of product indicated. Catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements of each device
  - 1. Illustrate coordination among existing distribution equipment and power monitoring and control.
- B. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Outline Drawings: Indicate arrangement of components and clearance and access requirements.
  - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
  - 3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 4. Wiring Diagrams: For power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram. Clearly distinguish between factory wiring and field wiring.
- C. Software and Firmware Operational Documentation:
  - 1. Self-study guide describing the process for setting equipment's network address; setting Owner's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.

2. Software operating and upgrade manuals.
  3. Software Backup: On a magnetic media or compact disc, complete with Owner-selected options.
  4. Device address list and the set point of each device and operator option, as set in applications software.
  5. Graphic file and printout of graphic screens and related icons, with legend.
- D. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or power monitoring and control revisions.
- E. Software licenses and upgrades required by and installed for operating and programming digital and analog devices.
- F. Qualification Data: For qualified manufacturer.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For power monitoring and control units, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Operating and applications software documentation.
  2. Software licenses.
  3. Software service agreement.
  4. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
  5. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
- I. Other Informational Submittals:
1. Manufacturer's system installation and setup guides, with data forms to plan and record options and setup decisions.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing power monitoring and control equipment similar to that indicated for this Project and with a record of successful in-service performance.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. The system shall comply with the applicable portions of NEMA standards. In addition, the control unit shall comply with FCC Emission Standards specified in Part 15, Sub-part J for Class A application
- D. All Power Meters shall be UL 508 Listed, CSA approved, and have CE marking. They shall also have certified revenue accuracy as per ANSI C12.20 and IEC 60687 class 0.5S or better.

#### 1.7 COORDINATION

- A. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.
1. Match components and interconnections for optimum performance of specified functions.

- B. Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

#### 1.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include the operating systems. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

#### 1.9 DESIGN SERVICES

- A. The energy monitoring system (EMS) vendor shall make all alterations and changes needed to make the system perform as needed at each location. These changes may include:
  - 1. Custom enclosures and panels
  - 2. Modifications to existing switchgear and equipment, including installation
  - 3. Configuration of software, servers, and workstations
  - 4. Communication interface installation and configuration
  - 5. Communication network design
- B. The energy monitoring system vendor shall provide development, integration, and installation services required to complete and turn over a fully functional system. This shall include:
  - 1. Project management - A project manager shall be assigned to each plant EMS implementation. Typical responsibilities shall include coordination of personnel, information and on-site supervision for the various levels and functions of suppliers required for completion of the project. The Project Manager shall provide strategic direction for the entire team. Responsibilities include daily operational and tactical implementation of projects, provide logistics and ensure follow up and closure of site related issues.
  - 2. All technical coordination, installation, integration and testing of all components.
  - 3. Detailed system design.
  - 4. System drawings.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, the design is based on the following products:
  - 1. Power Meters:
    - a. Square D PowerLogic PM820 series meter
  - 2. Application Software:
    - a. Square D PowerLogic System Manager Software "Pro" version.
- B. Alternate Manufacturers: Subject to compliance with requirements, the following alternate manufacturers may submit proposals for this project, if the products and services offered are demonstrated in a pre-bid submittal to be equal to or better than the Basis-of-Design Products:
  - 1. Eaton Corporation; Cutler-Hammer products.
  - 2. General Electric Company; GE Consumer & Industrial.

3. Other manufacturers that meet the project requirements may submit prior to bid for pre-bid evaluation.

## 2.2 SYSTEM REQUIREMENTS

- A. Monitoring and Control System: Multiple PC-based workstations with graphics capability and Web access, with its operating system and application software, connected to data transmission network.
- B. Addressable Devices: All transmitters and receivers shall communicate unique device identification and status reports to monitoring and control clients.

## 2.3 OPERATING SYSTEM

- A. Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously. Software shall include interactive graphics client and shall be Web enabled. Workstations and portable computers shall not require any software except for an Internet browser to provide connectivity and full functionality. Include a firewall recommended by manufacturer. 100 Base-T Ethernet, Modbus TCP/IP RS-232, and RS-485 digital communications.
- B. Operating System Software: Based on 32-bit, Microsoft Windows workstation operating system. Software shall have the following features:
  1. Multiuser and multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
  2. Graphical user interface to show pull-down menus and a menu tree format.
  3. Capability for future additions within the indicated system size limits.
- C. Peer Computer Control Software: Shall detect a failure of workstation and associated server, and shall cause other workstation and associated server to assume control of all system functions without interruption of operation. Drivers shall be provided in both central computers to support this mode of operation.

## 2.4 APPLICATIONS SOFTWARE

- A. General:
  1. The Power Monitoring and Control System (PMCS) shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations by monitoring the devices in the system, recording events, indicating alarm conditions, logging and displaying system reports.
  2. The software shall be developed by the manufacturer of the monitoring devices, and shall be designed specifically for energy, power monitoring and control. Additional Utilities, i.e. WAGES (Water, Air, Gas, Electric, & Steam) shall also be easily integrated.
  3. The software shall be configured, not programmed. All software shall be configured by the vendor and delivered ready to use. This configuration shall include preparation of all graphics, displays, and interactive one-line diagrams required as a part of this project.
  4. Configuration shall be to the point that when additional monitoring devices are added, the user shall only need to convey to the software the communications address and type of the new device. The software shall then be able to display all data from that device in a format identical to that used for other devices of the same type.
  5. The software shall be a standard product offering with no customization required.
  6. Clients shall interface with the Server PC workstation (PCW) via Internet Explorer browser, no additional software application install shall be required for Client communication with Server PCW.

7. Browser based clients shall access server through standard ASP (active server page) interface that is capable of displaying:
    - a. Historical Reports that can be customized and saved to users PC
    - b. Graphical displays with real-time data updates
    - c. Real-time data and trend displays via TCP connection to monitoring devices
    - d. Electronic documentation (support of .pdf, .doc, .txt, .html, .htm, .xls, .ppt)
    - e. Setup of client based display preferences
  8. Access to online support and online product information via web pages and Internet hyperlinks.
  9. Web links shall be available in an HTML file.
  10. Directory located on Server PCW shall support the following files: .doc, .txt, .pdf, .HTML, .ASP, .xls, .ppt, .bmp, .jpeg, and flash.
  11. Web-enabled software shall support the viewing of interactive graphics in a browser client.
  12. Software shall contain context sensitive help files.
  13. The software shall be supported by the manufacturer through regular maintenance upgrades, which are available for download from the web via annual support agreements.
  14. The manufacturer shall make available regularly scheduled classes to provide instruction to the user on the operation of the software. Training will include but not be limited to: the addition of future devices to the system, proper use and setup of reports and alarming, and other operations associated with the operation of the PMCS.
  15. The software vendor shall offer a Technical Support program to offer technical assistance on using the software and associated monitoring devices to manage the PMCS. The vendor shall have the ability to connect remotely to the PMCS to troubleshoot and diagnose any problems.
- B. Basic Requirements:
1. Fully compatible with and based on the approved operating system.
  2. Software shall reside on the Server PC connected to a network able to poll and support over 1000 PMCS devices.
  3. Server Software shall support 10 licensed simultaneous remote viewing connections. It shall be possible to extend the number of licensed simultaneous connections via purchase at any time.
  4. Shall use the Microsoft SQL2005 database.
  5. Password-protected operator login and access; ten levels, with unlimited user accounts.
  6. Password-protected setup functions.
  7. Context-sensitive online help.
  8. Capability of creating, deleting, and copying files; and automatically maintaining a directory of all files, including size and location of each sequential and random-ordered record.
  9. Capability for importing custom icons into graphic views to represent alarms and I/O devices.
  10. Automatic and encrypted backups for database and history; automatically stored at central control PC or server and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
  11. Operator audit trail for recording and reporting all changes made to user-defined system options.
- C. Communications Protocols:
1. Modbus TCP/IP (Ethernet)
  2. Serial Modbus RTU
  3. Symax (RS485 and RS232 two wire or four wire).
  4. OPC Server.
- D. Workstation Server Functions:
1. Support other client PCs on the LAN and WAN.

2. Maintain recorded data in databases accessible from other PCs on the LAN and WAN.
- E. Data Storage: Shall log PMCS data to the PC hard disk on demand or at user specified intervals.
- F. Data Formats:
1. User-programmable export and import of data to and from commonly used Microsoft Windows spreadsheet, database, billing, and other applications; using dynamic data exchange technology.
  2. Option to convert reports and graphics to HTML format.
  3. Interactive graphics.
  4. Option to send preprogrammed or operator designed e-mail reports.
- G. Metered Data: Display metered values in real time.
- H. Reporting:
1. Standard report templates that include: History tables and trends, Power Factor, Harmonics, Cost Allocation, Energy Consumption and Alarm Analysis. Program shall also allow for custom report creation.
  2. Report creation tool shall be Wizard driven.
  3. Report presentation shall be available in a number of graphics formats such as: Trends, Tables, Histograms or Pareto Charts, Pie Charts. Graphics shall be customizable by changing colors, text, headings, size, graphic plot styles (bar graphs, line graphs, etc).
  4. Statistics on trending data for devices in the PMCS system which includes minimum and maximum values and their associated date and time stamps, average value, standard deviation and load factor.
  5. Shall be available in a customizable HTML format.
  6. Shall have the ability to Email reports.
  7. Be able to generate either on demand or as a scheduled task to run automatically at specified intervals.
  8. Shall have a quick reporting function to allow user to generate information quickly without having to define calculations, quantities and outputs.
  9. Shall have the ability to view data from different devices on the same trend plot simultaneously.
- I. Remote Control:
1. Display circuit-breaker status and allow breaker control.
  2. User defined with load-shedding automatically initiated and executed schemes responding to programmed time schedules, set points of metered demands, utility contracted load shedding, or combinations of these.
- J. Equipment Documentation: Database for recording of equipment ratings and characteristics; with capability for graphic display on monitors.
- K. Graphics: Web-enabled, interactive color-graphics platform with pull-down menus and mouse-driven generation of power system graphics, in formats widely used for such drafting; to include the following:
1. The Web-Enabled Interactive Graphics Client shall only reside on the Server PC, Client PC shall not require the installation of any application software other than Internet Explorer 6.0 SP1 or higher browser to become a fully functional system.
  2. Shall be a color graphics Web application that allows display of real-time information collected by the network server from the power monitoring devices on custom drawings including single line drawings, site plans or pictorial backgrounds.
  3. Software shall use the following objects to display defined functions:
    - a. Analog Function Block – displays the condition of a predefined analog function

- b. Bar Chart – allows the creation of custom bar charts for standard or custom quantities
  - c. Digital Function Block - displays the condition of a predefined digital function
  - d. Digital Function Switch – box that changes color to indicate the state of an associated digital function
  - e. Hyper Drawing Block – link to a defined Web page, drawing, report, or hyperlink
  - f. Meter – allows the creation of custom meters using a standard or custom quantity
  - g. Text – text object may be added to a diagram
  - h. Value Block – displays a single quantity, also may be used to open a summary page for the associated device in a new window.
4. Software shall include a graphics software package to assist with the creation of graphics pages. The Interactive Graphics software shall allow the user to zoom, scale, and scroll the drawings to the desired degree of magnification.
  5. From within any drawing the user shall have the ability to link and display drawings in a hierarchical fashion to allow quick access to related drawings.
  6. Custom graphic screens shall be supplied based on user drawings.
  7. The software shall be able to display various file types in the directory structure to permit the user to view relevant documentation from the interface(for example-Acrobat and Word files).
- L. Virtual Meter Display: Shall provide the capability to report sums, differences, and percentages of real-time readings for multiple devices . This data shall be available for real-time reporting, logging and trending, and alarm functions.
- M. User-Defined Monitoring and Control Events: Display and record with date and time stamps accurate to 0.1 second, and including the following:
1. Operator log on/off.
  2. Attempted operator log on/off.
  3. All alarms.
  4. Equipment operation counters.
  5. Out-of-limit, pickup, trip, and no-response events.
- N. Trending Reports: Display data acquired in real-time from different meters or devices, in historical format over user-defined time; unlimited as to interval, duration, or quantity of trends.
1. Spreadsheet functions of sum, delta, percent, average, mean, standard deviation, and related functions applied to recorded data.
  2. Charting, statistical, and display functions of standard Windows-based spreadsheet.
- O. Alarms: Display and record alarm messages from discrete input and controls outputs, according to user programmable protocol.
1. Functions requiring user acknowledgment shall run in background during computer use for other applications and override other presentations when they occur.
  2. Alarms/Events shall be recorded in both an Active Alarm and in Alarm Log view.
  3. Alarm Log shall be capable of holding at least 1000 events. The number of viewable events shall be user defined and only limited by size of storage drive.
  4. The Alarm Log shall record date/time of the event, event description, and user name (if applicable).
  5. The Alarm Log shall record occurrences that are related to the operation of the software such as breakers opening, or closing, loss of power, loss of device communications, user logon, changes to system setup, etc.
  6. Shall monitor for real-time alarm conditions detected by each device and indicate the alarm at the PC:
    - a. Alarms shall be user-defined pick-ups and dropouts and/or include pre-defined system alarms.

- b. Ten severity levels shall be supported for analog and digital alarm conditions, each level shall provide user audible, visible, and/or required acknowledgment. Severity levels can be customized changing color and/or sounds all password protected.
  - c. Alarms shall be reported by exception.
  - d. Alarms shall be on-board or PC-based and a summary of all active alarms may be viewed at any time.
- P. Waveform Data: Capability to display and record waveforms on demand or automatically on an alarm or programmed event, where remote meters are provided with this feature.
- Q. Data Sharing: Allow export of recorded displays and tabular data to third-party applications software.
- 1. Tabular data shall be in the comma-separated values.
- R. Activity Billing Software:
- 1. Automatically compute and prepare activity demand and energy-use statements based on metering of energy use and peak demand integrated over user-defined interval.
  - 2. Intervals shall be same as used by electric utilities, including current vendor.
  - 3. Import metered data from saved records that were generated by metering and monitoring software.
  - 4. Maintain separate directory for each activity's historical billing information.
  - 5. Prepare summary reports in user-defined formats and time intervals.
- S. Reporting: User commands initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
- 1. Print a record of user-defined alarm, supervisory, and trouble events on workstation printer.
  - 2. Sort and report by device name and by function.
  - 3. Report type of signal (alarm, supervisory, or trouble), description, date, and time of occurrence.
  - 4. Differentiate alarm signals from other indications.
  - 5. When system is reset, report reset event with same information concerning device, location, date, and time.

## 2.5 POWER MONITORS

- A. General: The Power Meter may be applied in three-phase, three- or four-wire systems, 60 Hz. at voltages ranging from 120V to 15,000 V.
- B. Separately mounted, permanently installed instrument for power monitoring and control, complying with UL 1244.
- C. Factory Enclosure: The power monitor shall be factory pre-wired in a listed enclosure with the following features and functions:
- 1. Meters and devices wired to terminal blocks.
  - 2. Fusible voltage disconnects for the potential transformers.
  - 3. Shorting blocks for the current transformers.
  - 4. Single or multiple meters per panel, depending on location and grouping of meters.
  - 5. Meter display on front of enclosure.
  - 6. Hinged, lockable wall-mountable.
  - 7. Carbon steel construction with ANSI 61 gray power-coat finish.
  - 8. Enclosure Type:
    - a. NEMA 250, Type 1 for indoor applications.
    - b. NEMA 250, Type 3R for outdoor applications.

- D. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
  - 1. Indoor installation in non-air-conditioned spaces that have environmental controls to maintain ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
- E. Nonvolatile Memory: All setup parameters required by the Power Meter shall be stored in nonvolatile memory and retained in the event of a control power interruption.
- F. True rms Real-Time Measurements:
  - 1. Current: Each phase, neutral, average of three phases, percent unbalance.
  - 2. Voltage: Line-to-line each phase, line-to-line average of three phases, line-to-neutral each phase, line-to-neutral average of three phases, line-to-neutral percent unbalance.
  - 3. Power: Per phase and three-phase total.
  - 4. Reactive Power: Per phase and three-phase total.
  - 5. Apparent Power: Per phase and three-phase total.
  - 6. Power Factor: Per phase and three-phase total.
  - 7. Displacement Power Factor: Per phase and three-phase total.
  - 8. Frequency.
  - 9. THD: Current and voltage.
  - 10. Accumulated Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
  - 11. Incremental Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
  - 12. Conditional Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
- G. Demand Current Calculations, per Phase, Three-Phase Average and Neutral:
  - 1. Present.
  - 2. Running average.
  - 3. Last completed interval.
  - 4. Peak.
- H. Demand Real Power Calculations, Three-Phase Total:
  - 1. Present.
  - 2. Running average.
  - 3. Last completed interval.
  - 4. Predicted.
  - 5. Peak.
  - 6. Coincident with peak kVA demand.
  - 7. Coincident with kVAR demand.
- I. Demand Reactive Power Calculations, Three-Phase Total:
  - 1. Present.
  - 2. Running average.
  - 3. Last completed interval.
  - 4. Predicted.
  - 5. Peak.
  - 6. Coincident with peak kVA demand.
  - 7. Coincident with kVAR demand.
- J. Demand Apparent Power Calculations, Three-Phase Total:
  - 1. Present.
  - 2. Running average.
  - 3. Last completed interval.
  - 4. Predicted.
  - 5. Peak.
  - 6. Coincident with peak kVA demand.

7. Coincident with kVAR demand.
- K. Average Power Factor Calculations, Demand Coincident, Three-Phase Total:
1. Last completed interval.
  2. Coincident with kW peak.
  3. Coincident with kVAR peak.
  4. Coincident with kVA peak.
- L. Power Analysis Values:
1. Voltage and Current: Per phase, three phase, and neutral.
  2. Displacement Power Factor: Per phase, three phase.
  3. Fundamental Voltage, Magnitude and Angle: Per phase.
  4. Fundamental Currents, Magnitude and Angle: Per phase.
  5. Fundamental Real Power: Per phase, three phase.
  6. Fundamental Reactive Power: Per phase.
  7. Harmonic Power: Per phase, three phase.
  8. Phase rotation.
  9. Unbalance: Current and voltage.
- M. Power Demand Calculations: According to one of the following calculation methods, selectable by the user:
1. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
  2. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:
    - a. Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
    - b. Fixed block that calculates demand at end of the interval.
    - c. Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.
  3. Demand Calculation Initiated by a Synchronization Signal:
    - a. Signal is a pulse from an external source. Demand period begins with every pulse. Calculation shall be configurable as either a block or rolling block calculation.
    - b. Signal is a communication signal. Calculation shall be configurable as either a block or rolling block calculation.
    - c. Demand can be synchronized with clock in the power meter.
- N. Sampling:
1. Current and voltage shall be digitally sampled at a rate high enough to provide accuracy to 63rd harmonic of 60-Hz fundamental.
  2. Power monitor shall provide continuous sampling at a rate of [128] <Insert number> samples per cycle on all voltage and current channels in the meter.
- O. Minimum and Maximum Values: Record monthly minimum and maximum values, including date and time of record. For three-phase measurements, identify phase of recorded value. Record the following parameters:
1. Line-to-line voltage.
  2. Line-to-neutral voltage.
  3. Current per phase.
  4. Line-to-line voltage unbalance.
  5. Line-to-neutral voltage unbalance.
  6. Power factor.
  7. Displacement power factor.
  8. Total power.
  9. Total reactive power.

10. Total apparent power.
  11. THD voltage L-L.
  12. THD voltage L-N.
  13. THD current.
  14. Frequency.
- P. Harmonic Calculation: Display and record the following:
1. Harmonic magnitudes and angles for each phase voltage and current through 31st harmonic. Calculate for all three phases, current and voltage, and residual current. Current and voltage information for all phases shall be obtained simultaneously from same cycle.
  2. Harmonic magnitude reported as a percentage of the fundamental or as a percentage of rms values, as selected by user.
- Q. Current and Voltage Ratings:
1. Designed for use with current inputs from standard instrument current transformers with 5-A secondary and shall have a metering range of 0-10 A.
  2. Withstand ratings shall not be less than 15 A, continuous; 50 A, lasting over 10 seconds, no more frequently than once per hour; 500 A, lasting 1 second, no more frequently than once per hour.
  3. Designed for use with voltage inputs from standard instrument potential transformers with a 120-V secondary.
- R. Current Transformers: Utility-grade, split-core type in compliance with ANSI Standard C57.13, rated to match system voltage and current.
1. Accuracy: 0.5% from 10% to 100% of rated current.
  2. Phase Shift: Less than 1-1/4.
  3. Leads: #18 AWG minimum, UL 1015 twisted pair, length as required for specific installation.
  4. Temperature Range: -15 deg C to 60 deg C.
  5. Humidity Range: 0-95% non-condensing.
  6. Max. Voltage: 600 VAC.
  7. Frequency Range: 50/60 Hz.
- S. Accuracy:
1. Comply with ANSI C12.20, Class 0.5; and IEC 60687, Class 0.5 for revenue meters. Accuracy from Light to Full Rating shall meet the following criteria:
    - a. Power: Accurate to 0.25 percent of reading, plus 0.025 percent of full scale.
    - b. Voltage and Current: Accurate to 0.075 percent of reading, plus 0.025 percent of full scale.
    - c. Power Factor: Plus or minus 0.002, from 0.5 leading to 0.5 lagging.
    - d. Frequency: Plus or minus 0.01 Hz at 45 to 67 Hz.
  2. For meters that are circuit-breaker accessories, metering accuracy at full-scale shall not be less than the following:
    - a. Current: Plus or minus 2.5 percent.
    - b. Voltage: Plus or minus 1.5 percent.
    - c. Energy, Demand, and Power: Plus or minus 4.0 percent.
    - d. Frequency: Plus or minus 1 Hz.
- T. Input: One digital input signal(s).
1. Normal mode for on/off signal.
  2. Demand interval synchronization pulse, accepting a demand synchronization pulse from a utility demand meter.
  3. Conditional energy signal to control conditional energy accumulation.

- U. Outputs:

1. Operated either by user command sent via communication link, or set to operate in response to user-defined alarm or event.
2. Closed in either a momentary or latched mode as defined by user.
3. Each output relay used in a momentary contact mode shall have an independent timer that can be set by user.
4. One digital KY pulse to a user-definable increment of energy measurement. Output ratings shall be up to 120-V ac, 300-V dc, 50 mA, and provide 3500-V rms isolation.
5. One relay output module(s), providing a load voltage range from 20- to 240-V ac or from 20- to 30-V dc, supporting a load current of 2 A.
6. Output Relay Control:
  - a. Relay outputs shall operate either by user command sent via communication link or in response to user-defined alarm or event.
  - b. Normally open and normally closed contacts, field configured to operate as follows:
    - 1) Normal contact closure where contacts change state for as long as signal exists.
    - 2) Latched mode when contacts change state on receipts of a pickup signal; changed state is held until a dropout signal is received.
    - 3) Timed mode when contacts change state on receipt of a pickup signal; changed state is held for a preprogrammed duration.
    - 4) End of power demand interval when relay operates as synchronization pulse for other devices.
    - 5) Energy Pulse Output: Relay pulses quantities used for absolute kWh, absolute kVARh, kVAh, kWh In, kVARh In, kWh Out, and kVARh Out.
    - 6) Output controlled by multiple alarms using Boolean-type logic.

V. Onboard Data Logging:

1. The Power Meter shall provide for onboard data logging. Each Power Meter shall be able to log data, alarms and events, and waveforms. The Meter shall offer 80kb of on-board nonvolatile memory. Logged information to be stored in each Power Meter include the following.
2. Stored Data:
  - a. Billing Log: User configurable; data shall be recorded every 15 minutes, identified by month, day, and 15-minute interval. Accumulate 24 months of monthly data, 32 days of daily data, and between 2 and 52 days of 15-minute interval data, depending on number of quantities selected.
  - b. Custom Data Logs: One user-defined log(s) holding up to 96 parameters. Date and time stamp each entry to the second and include the following user definitions:
    - 1) Schedule interval.
    - 2) Event definition.
    - 3) Configured as "fill-and-hold" or "circular, first-in first-out."
  - c. Alarm Log: Include time, date, event information, and coincident information for each defined alarm or event.
  - d. Waveform Log: Store captured waveforms configured as "fill-and-hold" or "circular, first-in first-out."
3. Default values for all logs shall be initially set at factory, with logging to begin on device power up.

W. Alarms.

1. User Options:
  - a. Define pickup, dropout, and delay.
  - b. Assign one of four severity levels to make it easier for user to respond to the most important events first.
  - c. Allow for combining up to four alarms using Boolean-type logic statements for outputting a single alarm.
2. Alarm Events:
  - a. Over/undercurrent.

- b. Over/undervoltage.
  - c. Current imbalance.
  - d. Phase loss, current.
  - e. Phase loss, voltage.
  - f. Voltage imbalance.
  - g. Over kW demand.
  - h. Phase reversal.
  - i. Digital input off/on.
  - j. End of incremental energy interval.
  - k. End of demand interval.
  - l. For each over/under metered value alarm, the user shall be able to define a pick-up, drop-out, and delay.
  - m. There shall be four alarm severity levels in order make it easier for the user to respond to the most important events first.
  - n. Indication of an alarm condition shall be given on the front panel.
- X. Control Power: 90- to 457-V ac or 100- to 300-V dc.
- Y. Communications:
- 1. Power monitor shall be permanently connected to communicate via Modbus TCP via a 100 Base-T Ethernet and RS-485 Modbus TCP/IP.
  - 2. Local plug-in connections shall be for RS-232 and 100 Base-T Ethernet.
- Z. Display Monitor:
- 1. Backlighted LCD to display metered data with touch-screen or touch-pad selecting device.
  - 2. Touch-screen display shall be a minimum 12-inch diagonal, resolution of 800 by 600 RGB pixels, 256 colors; NEMA 250, Type 1 display enclosure.
  - 3. Display four values on one screen at same time.
    - a. Current, per phase rms, three-phase average and neutral.
    - b. Voltage, phase to phase, phase to neutral, and three-phase averages of phase to phase and phase to neutral.
    - c. Real power, per phase and three-phase total.
    - d. Reactive power, per phase and three-phase total.
    - e. Apparent power, per phase and three-phase total.
    - f. Power factor, per phase and three-phase total.
    - g. Frequency.
    - h. Demand current, per phase and three-phase average.
    - i. Demand real power, three-phase total.
    - j. Demand apparent power, three-phase total.
    - k. Accumulated energy (MWh and MVARh).
    - l. THD, current and voltage, per phase.
  - 4. Reset: Allow reset of the following parameters at the display:
    - a. Peak demand current.
    - b. Peak demand power (kW) and peak demand apparent power (kVA).
    - c. Energy (MWh) and reactive energy (MVARh).
  - 5. Setup for system requirements shall be allowed from the Power Meter display. Setup provisions shall include:
    - a. CT Rating
    - b. PT Rating
    - c. System Type (3-phase/3-wire, 3-phase/4-wire, 1-phase/3-wire).

## 2.6 COMMUNICATION COMPONENTS AND NETWORKS

- A. Network Configuration: High-speed, multi-access, open nonproprietary, industry standard communication protocol; LANs complying with EIA 485, 100 Base-T Ethernet, and Modbus TCP/IP.
- B. Ethernet Solutions:
1. Basic (Ethernet Communications Card – PM8ECC)
    - a. The Ethernet communication card shall have an embedded web server inside the unit, capable of serving HTML pages with dynamic meter data displays.
    - b. The Ethernet communication card shall connect to the Ethernet backbone via standard RJ-45 port for connection of unshielded twisted pair cable (UTP) or LC fiber optic connection for multimode fiber (100BaseFX).
    - c. There shall be indicating LED's for the Ethernet connections to assist in troubleshooting. Indicators are required for TRANSMIT, RECIEVE, and LINK status for Ethernet, and TRANSMIT, RECEIVE for the RS-485 communications.
    - d. The Ethernet communication card shall support Power Meters, and other devices through one 2 wire or 4-wire RS-485 communication port via standard daisy-chain connections. The RS-485 serial port shall operate up to 38.4k baud.
    - e. The Ethernet communication card shall allow protocol conversion between standard Ethernet network protocols and SY/MAX and Modbus/Jbus devices on the same daisy chain.
    - f. fThe Ethernet communication card shall be fully TCP/IP compliant thereby allowing the power monitoring software access to power monitoring information from anywhere on the local area network (LAN) or via the Wide Area Network (WAN).
    - g. The protocol used over Ethernet by the Ethernet communication card shall be Modbus/TCP an international industry standard which is an open and well-defined protocol.
    - h. Setup of the Ethernet communication card shall be accomplished via the on-board Ethernet port and a web browser. It shall also be possible via the Ethernet port to upgrade the firmware of the Ethernet communication card in the field to accommodate new system features.
    - i. Web Pages shall be configurable to display data from all devices connected to the Ethernet Communication Card.
    - j. Data shall be displayed in tabular or trend chart format.
    - k. The Ethernet card shall be capable of initiating an e-mail based on alarms or custom user logic programming in the host Circuit Monitor.
    - l. A dedicated Ethernet communication card shall be used which requires no hardware adjustments or modifications. Standard personal computers (PCs) or programmable logic controllers (PLCs) are not acceptable as gateways to the power monitoring and control devices.
    - m. The Ethernet communication card shall derive control power directly from the Power Meter.
    - n. The Ethernet communication card shall be UL Listed, NOM and CE and CSA certified.
    - o. All Ethernet cabling shall be installed by a qualified data communications cable installer or the electrical contractor qualified to install data communications equipment. All communications cabling shall be Category 5 rated for 100baseT, or Fiber Optics rated for 100baseFX.
  2. Additional Network Media Options:
    - a. Fiber optics shall be installed where shown on the project drawings. Fiber optic modems and interface hardware shall be provided by the PMCS vendor as required. Use of fiber optics shall be transparent to PMCS software and monitoring devices.
    - b. Wireless Ethernet shall be installed where shown on the project drawings. Wireless Ethernet and interface hardware shall be provided by the PMCS vendor

as required. Use of wireless Ethernet shall be transparent to PMCS software and monitoring devices.

- c. Ethernet shall be used where shown on the project drawings. Ethernet Gateways shall be provided by the PMCS vendor and installed as necessary. Ethernet network connections shall be established using industry standard Ethernet protocols such TCP/IP. All components shall work with existing Ethernet Gateway, Router, and Hub technology. Use of Ethernet shall be transparent to PMCS software and monitoring devices

## 2.7 LAN CABLES

- A. RS-485 Cable:
  1. PVC-Jacketed, RS-485 Cable: Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.
  2. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket, and NFPA 70, Type CMP.
- B. Unshielded Twisted Pair Cables: Category 5e as specified for horizontal cable for data service in Division 27 Section "Communications Horizontal Cabling."

## 2.8 LOW-VOLTAGE WIRING

- A. Comply with Division 26 Section "Control-Voltage Electrical Power Cables."
- B. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
  1. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
  2. Ordinary Switching Circuits: Three conductors unless otherwise indicated.
  3. Switching Circuits with Pilot Lights or Locator Feature: Five conductors unless otherwise indicated.

## 2.9 RACEWAYS

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  2. Fittings for EMT: Steel, set-screw or compression type.
  3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

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

## 2.10 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R as required by location, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type; gasketed for damp or wet locations.
- E. Finish: Manufacturer's standard enamel finish.

## 2.11 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1; minimum 4" x 4" square, unless otherwise indicated.
- B. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- C. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- D. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## 2.12 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.

- e. Thomas & Betts Corporation.
  - f. Unistrut; Tyco International, Ltd.
  - g. Wesanco, Inc.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

### PART 3 - EXECUTION

#### 3.1 PRE-INSTALLATION SURVEY

- A. Prior to installation, examine each location in which a meter is to be installed. Review existing switchboards, panelboards, wiring, busways to verify equipment and requirements for installation.
  - 1. Remove covers of distribution gear and make measurements to verify the proposed current transformers will fit.
- B. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Provide digital image on CD of each site location for Owner prior to installation.
  - 1. Show meter and CT locations.
  - 2. Include with final record drawings.

#### 3.2 METERS

- A. Install meters according to NECA 1, NFPA 70, manufacturer's written instructions and industry standard practices.

#### 3.3 CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Wiring Method: Install wires and cables in raceways.
- C. Install LAN cables using techniques, practices, and methods that are consistent with specified category rating of components and that ensure specified category performance of completed and linked signal paths, end to end.
- D. Install cables without damaging conductors, shield, or jacket.

#### 3.4 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid steel conduit.
  - 2. Concealed Conduit, Aboveground: Rigid steel conduit.
  - 3. Underground Conduit: RNC, Type EPC-40-PVC.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed and Subject to Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.

- d. Stub-ups through floor.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: Rigid steel conduit.
  6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
  7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: **3/4-inch (21-mm)** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated
- 3.5 GROUNDING
- A. Comply with NFPA 70.
  - B. Ground meters and enclosures per NFPA 70 and manufacturer's written instructions.
  - C. Provide a green, insulated equipment grounding conductor with circuit conductors in all raceways.
  - D. Comply with IEEE 1100, "Recommended Practice for Powering and Grounding Electronic Equipment."
- 3.6 SUPPORT INSTALLATION
- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
  - B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force
  - D. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
  - E. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be **1/4 inch (6 mm)** in diameter.
    1. Secure raceways and cables to these supports with single-bolt conduit clamps.
  - F. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch (38-mm)** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports

- G. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus **200 lb (90 kg)**.
- H. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inches (100 mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches (100 mm)** thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- I. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.7 FIRE STOPPING

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

### 3.8 IDENTIFICATION

- A. Label each power monitoring and control module with a unique designation.

### 3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, start up, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Electrical Tests: Use caution when testing devices containing solid-state components.
  - 2. Continuity tests of circuits.
  - 3. Operational Tests: Set and operate controls at workstation and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by manufacturer. Submit sequences for approval. Note response to each test command

and operation. Note time intervals between initiation of alarm conditions and registration of alarms at central-processing workstation.

- a. Coordinate testing required by this Section with that required by Sections specifying equipment being monitored and controlled.
  - b. Test LANs according to requirements in Division 27 Section "Communications Horizontal Cabling."
  - c. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of calculated battery operating time.
  - d. Verify accuracy of graphic screens and icons.
  - e. Metering Test: Load feeders, measure loads on feeder conductor with an rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at central-processing workstation. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.
  - f. Record metered values, control settings, operations, cues, time intervals, and functional observations and submit test reports printed by workstation printer.
- D. Power monitoring and control equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
- I. Remove and replace malfunctioning devices and circuits and retest as specified above.

### 3.10 STARTUP, TRAINING AND DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to startup, program adjust, operate, and maintain systems.
1. On-site start-up and training of the PMCS shall be included in the project bid. The project bid shall include 6 days start-up assistance and 2 days training to include 2 trip(s).
  2. Start-up shall include a complete working demonstration of the PMCS with simulation of possible operating conditions that may be encountered.
  3. Program initial programming of interactive custom graphics including system one-line diagram, campus map, meter display windows, virtual meters, etc.
  4. Training shall include any documentation and hands-on exercises necessary to enable electrical operations personnel to assume full operating responsibility for the PMCS after completion of the training period.
  5. Train Owner's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Include troubleshooting, servicing, adjusting, and maintaining equipment.
  6. Training Aid: Use approved final versions of software and maintenance manuals as training aids.
  7. The power monitoring vendor shall offer regularly scheduled factory training for customers on all aspects of power monitoring and control, including:
    - a. Comprehensive software and hardware setup, configuration, and operation.
    - b. Advanced monitoring and data reporting.
    - c. Advanced power quality and disturbance monitoring.

3.11 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 260913