INVITATION TO BID TRUCKEE MEADOWS WATER AUTHORITY NRS 332 IN EXCESS OF \$50,000 Glendale WTF 1.5 MW Diesel Generator Purchase TMWA BID NO.: 2017-005 TMWA CAPITAL PROJECT NO.: 11-0013

RANGE FOR ENGINEER'S ESTIMATE: \$450,000.00 - \$550,000.00

PROJECT SCOPE: Truckee Meadows Water Authority (TMWA) is accepting sealed bids for all labor, materials, equipment, and incidentals required for supplying a 1,500 kW, 2,000 kVA at 4,160V 3-phase diesel medium voltage backup power generator set ("Generator"). Delivery of Generator must be on or before June 1, 2017, or as otherwise agreed upon. Delivery of the Generator shall be to TMWA's Glendale Water Treatment Facility located at 1205 S. 21st Street, Sparks, Nevada.

MANDATORY PRE-BID CONFERENCE: NOT REQUIRED FOR THIS PROJECT

<u>BID DOCUMENTS</u>: All bid documents may be downloaded from TMWA's website at <u>http://tmwa.com/about_us/doingbusinesswithtmwa</u>

<u>BID SUBMITTAL</u>: Sealed bids must be submitted to TMWA by mail to P.O. Box 30013, Reno, Nevada 89520-3013 or in person to 1355 Capital Boulevard, Reno, NV 89502, and must be **RECEIVED BY TMWA NOT LATER THAN 2:00 P.M. on January 26, 2017**. Bids received after the date and time set for receipt will be **REJECTED**.

<u>BID OPENING</u>: January 26, 2017, at 2:05 P.M. at the TMWA Conference Room, 1355 Capital Blvd., Reno, NV 89502. TMWA reserves the right to reject any or all bids, including without limitation the right to reject any or all nonconforming, non-responsive, unbalanced, or conditional bids, and to reject the bid of any bidder if TMWA believes that it would not be in the best interest of TMWA to make an award to that bidder. TMWA also reserves the right to waive informalities. Bids will be evaluated as prescribed in Nevada Revised Statute 332.

AWARD DATE: On or before February 8, 2017.

DELIVERY DATE: One Hundred Thirteen (113) calendar days following Notice to Proceed.

SHIPPING AND DELIVERY: Total bid price shall include shipping, and delivery to TMWA's Glendale Water Treatment Plant located at 1205 S. 21st Street, Sparks, Nevada.

PLANS AND SPECIFICATIONS: Specifications included in bid package.

Bidders are to complete all Bid Submittal Forms, contained on pages 2-9 in the Bid Proposal Form Section of the Bid Documents. The complete Contract Documents must be submitted to comprise a responsive and responsible bid. **A bid bond will not be required for this project**. Addenda, if any, shall be posted on the TMWA web-site at http://www.tmwa.com/about_us/doingbusinesswithtmwa/ It is each bidder's sole responsibility to ensure that they have received all addenda prior to submission of their bid.

<u>QUESTIONS</u>: Questions may be submitted in writing to the Contract Administrator up to three (3) business days before Bid Opening.

Maria I. Dufur, Contract Administrator Truckee Meadows Water Authority 1355 Capital Boulevard Reno, NV 89502 (775) 834-8056 Fax (775) 834-8153: e-mail: <u>mdufur@tmwa.com</u>

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I. BIDDING PROCEDURES

A. Pre-bid Conference – NOT REQUIRED FOR THIS PROJECT

A Pre-bid Conference will be held at the time and place indicated on the Invitation to Bid. The purpose of this conference is to discuss the Project, prospective Bidder concerns, and key issues of the Project. Attendance is mandatory unless otherwise indicated.

B. Designated Contacts

The designated contact for questions pertaining to the Contract Documents, Specifications and/or Drawings is the designated Contract Administrator. All questions should be submitted in writing, and will receive a written response from the Contract Administrator.

Maria I. Dufur Truckee Meadows Water Authority P.O. Box 30013 Reno, NV 89502 775-834-8056 FAX No. 775-834-8153 E-mail: mdufur@tmwa.com

C. Interpretations and Addenda

Bidders shall take no advantage of any apparent error or omission in the Bidding Documents. In the event a Bidder discovers such an error or omission, it shall immediately notify the Contract Administrator in writing. Truckee Meadows Water Authority will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the Bidding Documents. Any Addendum or written clarification supplementing the Plans, Specifications, and Contract Documents issued prior to the time set for the submittal of Bid Proposal shall be made part of the Contract.

If it becomes necessary to issue a written addendum, a copy will be provided on Truckee Meadows Water Authority Web Site for free download at<u>http://tmwa.com/about_us/doingbusinesswithtmwa</u>. Truckee Meadows Water Authority is not bound by any oral representations, clarifications, or changes made by employees, or representatives, unless such clarification or change is provided to all Bidders in written form. No significant Addendum shall be issued by Truckee Meadows Water Authority less than one (1) working day prior to the advertised date and time for Bid submittal unless the bid date is extended.

Prior to submission of the Bid, each Bidder shall ascertain that it has received all Addenda issued. The Bidder shall acknowledge receipt of all Addenda by completing the acknowledgment space provided on the Bid Schedule.

D. Bid Preparation and Submission

1. Bid proposals are to be submitted on the Bid Schedule provided and must be manually signed by pen by an officer or authorized agent (with attached power of attorney) of the Bidder. All figures must be written in ink or typewritten. Figures written in pencil or erasures are not acceptable. Any interlineation or alteration must be initialed in ink by a person authorized to bind the Bidder to a Contract. If the person making said interlineation or alteration is not the same person who signs the Bid Proposal, such person must write his/her signature and print his/her name and title on each page of the Bid Proposal where initials appear. Written delegation of signature authority to an agent acting on behalf of the Bidder must accompany the sealed Bid and cannot contain any language which states the Bidder retains final approval of acceptance of any of the terms conditions, specifications and/or finalized Contract.

2. Each Bid shall be submitted in a sealed envelope and the envelope must be prominently marked on the lower left corner as follows:

TMWA BID NO.:2017-005OPENING:January 26, 2017COMPANY NAME:

Truckee Meadows Water Authority will not consider a Bid that fails to comply with the above stated requirements. Truckee Meadows Water Authority will not be responsible for the premature opening of a Bid not properly addressed or identified. All Bids must be received prior to the time and date specified in the Invitation to Bid at the following address:

Truckee Meadows Water Authority P.O. Box 30013, Reno, NV 89520-3013 or 1355 Capital Boulevard, Reno, NV 89502

3. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed as specified. Mailed Bids must be received by Truckee Meadows Water Authority prior to the closing time for receipt of Bids to receive consideration. Email or Facsimile Bids will not be accepted or considered.

E. Documents Necessary For Submittal - BID BOND NOT REQUIRED FOR THIS PROJECT

The Bid Bond and Bid Schedule Form comprise the Bid Proposal and all shall be included in the sealed envelope. Truckee Meadows Water Authority will not consider a Bid received if there is an omission of or failure to complete any portion of the required documents prior to the time of Bid Opening. Do not submit the entire bid book. A separate (loose) Bid bond and Bid Schedule Form are provided in the bid document for bid submission.

F. Bid Security

- 1. Each Bidder's Proposal must be accompanied by a Cashier's check, Certified Check, or Bid Bond acceptable to Truckee Meadows Water Authority in an amount equal to at least five percent (5%) of the Bidder's "Base Bid" Proposal. Bid Security shall be payable without condition to Truckee Meadows Water Authority as a guarantee that the Bidder, if awarded the Contract, will promptly execute the Contract in accordance with the Bid Proposal and in the manner and form required by the Contract Documents, and will furnish the required Performance and Payment bonds. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, the amount of the Bid security may be forfeited to Truckee Meadows Water Authority as liquidated damages, not as penalty. All checks must indicate the Payee as "Truckee Meadows Water Authority" and reflect the Bid number. Failure to enclose Bid security with the sealed Bid will cause the Bid to be rejected and not considered.
- 2. Surety companies issuing bid bonds must be licensed to issue surety by the State of Nevada Insurance Division. Bonds issued by an individual surety are not acceptable to Truckee Meadows Water Authority.
- 3. Truckee Meadows Water Authority will have the right to hold the Bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

G. Quantities

The quantities given in the Contract Documents or indicated by the unit Bid items are approximate quantities and are intended to illustrate Scope of Work. The Contractor shall be responsible for verifying the exact quantities involved each month through the measurement and payment provisions of the Contract Documents.

H. Compensation

The Total Bid Price shall cover all Work required by the Contract Documents and necessary or reasonably inferable to achieve completion of the Work. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment, tools and temporary utilities; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices Bid. All Work not specifically identified as a pay item in the Bid Schedule shall be considered a non-compensatory obligation of the Contractor, and all costs in connection therewith shall be deemed included in the prices otherwise Bid.

I. Schedule of Values

The purpose of the Schedule of Values shall serve Truckee Meadows Water Authority in two (2) distinct areas:

- 1. <u>PRIOR TO AWARD OF BIDS</u> Truckee Meadows Water Authority may request a Schedule of Values for any or all item(s) included in the Bid schedule for the purpose of determining an unbalanced Bid. The analysis shall be conducted by Truckee Meadows Water Authority. All prospective Bidders may be required to prepare a Schedule of Values, and it shall be the Bidder's responsibility to verify the quantities as shown on the Drawings before preparing his Bid. The schedule as shown in the Bid Schedule does not constitute a complete outline of the Work to be performed by the Contractor in accordance with the Contract Drawings and Specifications. This list is intended to include all major items, and the Bid computed there from will be the maximum compensation for all work and materials furnished by the Contractor in order to comply with the Contract Drawings and Specifications, whether or not indicated in the approximate quantities or pertaining to the items of Work listed therein
- 2. <u>AFTER AWARD OF BID</u> Truckee Meadows Water Authority will request a Schedule of Values for any or all item(s) included in the Bid schedule for the purpose of making partial payments to the Contractor.

Under no circumstances may any Bid item reflected as LUMP SUM or otherwise be increased or decreased as a result of the Lump Sum Bid breakdown analysis.

J. Validity of Bid

Truckee Meadows Water Authority reserves the right to withhold award of this Contract for a period of thirty (30) days from the date of the Bid opening. The Bidder acknowledges in submitting his/her Bid that all prices listed in the Bid Proposal are valid for a period of not less than thirty (30) days from the date of the Bid Opening.

K. Bidders Representation

Each Bidder by submitting its Bid represents and warrants that:

1. The Bidder, by submission of his Bid, confirms it has familiarized itself with the Invitation to Bid, Plans, Specifications, and Contract Documents and has found them fit and sufficient for the purpose of preparing his Bid. Bidder agrees to all the terms and conditions of the Contract and further agrees that no claim will be made against Truckee Meadows Water Authority, the Project Representative, or the Design Consultant for any damage that he or his subcontractors may have suffered due to the inadequacy of his Bid on account of any alleged errors, omissions, or other deficiencies in the Notice To Contractors, Plans, Specifications, or Contract Documents supplied to him by Truckee Meadows Water Authority.

2. The submission of a Bid shall constitute an acknowledgment upon which Truckee Meadows Water Authority may rely that the Bidder has thoroughly examined and is familiar with the Contract Documents. The Bidder shall in no way be relieved from any obligation with respect to its proposal or to the Contract. *No claim for additional compensation will be allowed which is based upon a lack of knowledge of the Contract Documents*.

3. The Bidder has inspected the site(s) of the Work and is fully satisfied, by personal examination or by other means, of the locations of the proposed Work, of the actual conditions, including subsurface conditions, of and at the site(s) of the Work. If, during the course of its examinations, a Bidder finds facts or conditions which appear to be in conflict with the letter or spirit of the Bidding documents before submitting his/her bid, the Bidder shall request Truckee Meadows Water Authority, in writing, to provide additional information and explanation.

4. Submission of a Bid by a Bidder shall constitute conclusive evidence that the Bidder has relied solely and exclusively on its own examination of (1) the site of the Work, (2) access to the site, (3) all other data and matters requisite to the fulfillment of the Work and on its own knowledge of existing facilities on and in the vicinity of the site of the Work to be constructed under the Contract, (4) the conditions to be encountered, (5) the character, quality and scope of the proposed Work, (6) the quality and quantity of the materials to be furnished, and (7) the requirements of the Bid, the Drawings and Specifications. The Bidder is aware that soil classifications do not represent any particular stability or drainability characteristics, and are aware that water table levels can vary. *No claim for additional compensation will be allowed which arises because of Bidder's failure to examine or become fully aware of the items in this paragraph.*

5. The information provided by Truckee Meadows Water Authority is provided for informational purposes only, without representation or warranty of any kind with respect to its accuracy or completeness, and is not intended to and shall not be relied upon as a substitute for, or a supplement to, the independent investigation by the Bidder of site conditions.

6. The Bidder, by signing the Bid Schedule, agrees that all material and workmanship on this Project shall meet or exceed OSHA standards and NOSHA standards.

7. The Bidder is qualified and possesses, at the time of the Bid submittal, a valid contractor's license for this particular Work (both as to type and available dollar limit) issued by the Nevada State Contractor's Board. Nevada Contractor's License type, number, expiration date and dollar limit must be indicated on the Bid Schedule. The Bidder and their subcontractors shall comply with all provisions of NRS Chapter 624 and Nevada Administrative Code, Chapter 624, to the extent applicable. Truckee Meadows Water Authority will not consider any Bid that fails to comply with these requirements.

8. The Bidder has a valid Business License and shall submit a copy with the bonds and Contract after award of contract.

9. The Bidder has appropriate work experience to be qualified to construct the Work. Bidder has successfully constructed at least three similar projects of equal or greater size, scope, type, cost, and complexity within the previous seven years. A similar project is one of the same category as this Project, defined for purposes of this paragraph as a Diesel Generator Purchase. Bidders must have such prior work experience in order to be deemed responsive or responsible for purposes of bid evaluations. TMWA considers it critical to public health and safety and in the best interests of TMWA that this work only be performed by contractors holding such prior experience.

a. Evidence of the Contractor's required project experience shall be provided in the reference section of the Proposal Summary section (additional sheets may be attached as necessary).

b. The requirements for submittal of required project experience also apply to proposed Subcontractors performing specialty work, including piping, control valve, electrical, power, telemetry, and equipment control work. Subcontractor experience shall be provided with submission of the final subcontractor list.

TMWA will determine in its sole and absolute discretion whether a Contractor is responsible, properly licensed, and has the requisite work experience required above to be eligible to perform this Project. Bids by Contractors that lack the proper license or requisite work experience set forth above will be rejected as non-responsible, non-responsive, and/or not in the best interests of TMWA

II. OPENING OF BIDS

A. Opening of Bids.

All Bids received on time and that comply with these requirements will be opened and publicly read aloud at the time and place set forth in the Invitation to Bid. Bidders, their representatives, and all other interested persons may be present at the opening and reading of Bids. Any Bids received after the time for receiving and opening Bids, as set forth in the Notice To Bidders and any Addendum, will not be considered. Any such Bids will be returned unopened to the Bidder.

B. Mistake In Bid

A request for withdrawal of a Bid due to a purported error shall not be considered unless it is given in writing to the Contract Administrator by the Bidder within forty-eight (48) hours after opening of the bid. Any such request shall contain a full explanation of any purported error and shall be supported by the original calculations on which the Bid was computed, together with a certification and notarization thereon that such calculation is the original as prepared by the Bidder or his agent.

In the case of a difference between written words and figures, the amount stated in written words shall govern for a Lump Sum Bid.

In the case of a difference between Unit Price and the extended price, the Unit Price shall govern.

C. Withdrawal of Bid

<u>Before Bid Opening</u> - A Bidder may request withdrawal of his/her posted, sealed Bid prior to the scheduled Bid opening time provided the request is submitted to the Contract Administrator's Office in writing or an authorized representative must present himself with proper identification to the Contract Administrator's office and verbally request that the Bid be withdrawn.

<u>After Bid Opening</u> - No Bids may be withdrawn for a period of thirty (30) calendar days after the date of Bid opening, except as set forth in A above. All responsive and responsible Bids received are considered firm offers for the time period specified above and may be considered for award. The Bidder's offer will expire at the time specified above or upon acceptance by Truckee Meadows Water Authority, which occurs when the successful Bidder provides the bonds, insurance, and submits the signed Contract to Truckee Meadows Water Authority for execution and Truckee Meadows Water Authority executes the Contract.

III. AWARD OF CONTRACT/REJECTION OF BIDS/DISQUALIFICATION OF BIDDERS

A. Award of Contract

Truckee Meadows Water Authority will award the Contract pursuant to the provisions of State law including but not limited to:

- (a) Chapter 332 (Purchasing: Local Governments)
- (b) Chapter 339 (Contractor's Bonds)
- (c) Chapter 624 (Contractors).

B. Rejection of Bids

Truckee Meadows Water Authority reserves the right to waive any informality or irregularity in any Bid received, and to reject any or all Bids. In the case of rejection of all Bids, Truckee Meadows Water Authority reserves the right to advertise for new Bids or to proceed to do the Work otherwise if it is in the best interest of Truckee Meadows Water Authority.

C. Irregular Bid

A Bid shall be considered irregular for the following reasons, any one or more of which may be cause for rejection:

- 1. If the Bid Schedule furnished by Truckee Meadows Water Authority is not used or is altered.
- 2. If there are unauthorized additions, conditional or alternate Bids, or omissions or irregularities of any kind which may tend to make the Bid incomplete, indefinite or ambiguous as to its meaning, or give the Bidder submitting the same an unfair competitive advantage over other Bidders.
- 3. If the Bid submitted contains any erasure, interlineations, or other corrections unless each such correction is prepared and authenticated in acceptance with the provisions of Paragraph IB.1.E (1).

D. Unbalanced Bid

If the Unit Bid Item prices and/or schedule of values of a prospective Bidder's Bid are obviously unbalanced, either in excess or below the reasonable cost analysis values, the Bid may be rejected. All Bids with separately priced line items shall be analyzed to determine if the prices are unbalanced. A bid may be rejected if Truckee Meadows Water Authority determines that the lack of balance poses an unacceptable risk to Truckee Meadows Water Authority.

A Bid with unbalanced pricing may increase performance risk and could result in payment of unreasonably high prices. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more bid items is significantly over or understated as indicated by the application of cost or price analysis techniques. The greatest risks associated with unbalanced pricing occur when:

- 1. Over pricing of startup work, mobilization, or early items of work (front end loading) would cause a bidder to receive substantial up-front payment;
- 2. Base quantities and option quantities are separate line items;
- 3. The quantities as bid are incorrect and the contract cost will be increased when quantities are corrected; or
- 4. On items where the quantities may vary, if the anticipated variation in quantity would result in the lower Bidder not remaining as the low Bidder.

E. Disqualification of Bidders

Any one or more of the following may be considered as sufficient for the disqualification of a prospective Bidder and the rejection of the Bid:

- 1. The Bidder is not responsive or responsible;
- 2. The quality of the services, materials, equipment or labor offered does not conform to the approved Contract plans and specifications;
- 3. Evidence of collusion among prospective Bidders; (Participants in such collusion will receive no recognition as Bidders)
- 4. Lack of contractor's license classification required by Truckee Meadows Water Authority for this Work;
- 5. More than one Bid for the same work from an individual, firm, or corporation under the same or different name;
- 6. Lack of competency, understanding of the scope of the Work, adequate machinery, plant and/or equipment as revealed by the requested experience or subcontractor information;
- 7. Unsatisfactory performance record as shown by past work for Truckee Meadows Water Authority, judged from the standpoint of workmanship, progress, and quality of services/goods provided;
- 8. Uncompleted work which, in the judgment of Truckee Meadows Water Authority, might hinder or prevent the prompt completion of additional work, if awarded;
- 9. Failure to pay or satisfactorily settle all bills due for labor and material on any contract(s);
- 10. Failure to comply with any requirements of Truckee Meadows Water Authority;
- 11. Failure to list, as required, all subcontractors who will be employed by the Bidder;
- 12. Negative actions against the Contractor's license by the Nevada State Contractor's Board; or
- 13. Any other reason determined, in good faith, to be in the best interest of Truckee Meadows Water Authority.

IV. BID PROTESTS

The Truckee Meadows Water Authority Contracts Division will post the recommendation for award of this Contract on the website: http://www.tmh2o.com/about_us/doingbusinesswithtmwa/. Any Bidder which submitted a bid to TMWA may protest the recommendation for award in accordance with the procedures set forth in NRS 338.142 as if such procedures applied to a contract awarded under NRS 332. The protest must be submitted in writing to TMWA's Purchasing and Contracts Administrator. In addition to any other information required by law, the protest shall include the following information:

- 1. The alleged violations(s) of: (a) Contract Documents referencing page number, item, and paragraph; (b) Nevada Revised Statutes referencing the specific chapter, section, and subsection; or (c) Local codes or ordinances referencing section number; and
- 2. Supporting documentation such as Nevada State Contractors Board licensing information or other detailed proof to substantiate the protest.

The Bidder filing the protest shall, at the time the protest is filed, post a bond with a good and solvent surety authorized to do business in the state of Nevada, or submit a cashier's check, money order, or certified check, to TMWA who will hold the bond or other security until a determination is made on the protest. The bond or other security submitted with the protest shall be in an amount equal to the lesser of 25 percent of the total Base Bid submitted by the Bidder filing the protest, or \$250,000.00.

If the protest is upheld, the bond or other security will be returned to the Bidder who submitted the protest. If the protest is rejected, a claim may be made by TMWA against the bond or other security in an amount equal to the expenses incurred by TMWA because of the unsuccessful protest. Any money remaining after the claim has been satisfied will be returned to the Bidder who posted the bond or submitted the security.

The protest filed in accordance with these provisions operates as a stay of action in relation to award of the Contract until a determination is made by TMWA on the protest.

An unsuccessful Bidder may not seek any type of judicial intervention until TMWA has made a determination on the protest and awarded the Contract.

TMWA will not be liable for any costs, expenses, attorney's fees, loss of income, or other damages sustained by a Bidder, whether or not the Bidder files the protest.

TMWA's Administrator of Purchasing and Contracts will promptly issue a decision in writing to the protester and any other party intervening. If the protester or any other intervening party wishes to appeal the decision rendered by TMWA's Administrator of Purchasing and Contracts to the TMWA Board, such appeal shall be made within 48 hours from receipt of the decision by submitting a notice of appeal in writing to TMWA's Administrator of Purchasing and Contracts.

An award recommendation will be made and presented to the Truckee Meadows Water Authority for a final decision. TMWA will not consider protests unless the procedures specified in this Section are followed.

V. BID PREPARATION EXPENSES

By accepting the Bid Proposal of the Bidder, Truckee Meadows Water Authority assumes no obligation to reimburse the Bidder for Bid preparation expenses. No Bidder shall have any right or claim against Truckee Meadows Water Authority for reimbursement of Bid preparation expenses.

VI. COLLUSION, DISCRIMINATION, AND/OR PRICE FIXING

The Bidder certifies that any and all prices which he may charge under the terms of the Contract do not, and will not, violate any existing federal, state or municipal laws or regulations concerning discrimination and/or price fixing. The Bidder agrees to indemnify, exonerate and hold Truckee Meadows Water Authority harmless from liability for any such violation now and throughout the term of the Contract.

VII. CONTRACT AWARD

A. Method of Award. The Bid, if awarded, will be awarded to the lowest responsive and responsible Bidder. Bidder must bid all items to be responsive and considered for award.

B. Time of Award. The award, if made, will be within thirty (30) calendar days after the opening of Bids. Truckee Meadows Water Authority reserves the right to accept or reject any or all Bids received.

C. Bonds. NOT REQUIRED FOR THIS PROJECT

The successful contractor will be required to provide the Bonds as indicated in Article 5 of the General Conditions.

D. Insurance. REFER TO THE PURCHASE AGREEMENT

Insurance as described in the General Conditions shall be required of the Contractor not later than ten (10) calendar days after receipt of the Notice of Award. The Contractor shall procure and maintain, at its own expense, all the insurance required as stated herein, and shall submit coverage verification (certificates) for review and approval by Truckee Meadows Water Authority. A Notice to Proceed may be issued prior to receipt of the required insurance, bonds, and signed contracts starting the time for contract performance on the project, however, the Contractor will not be permitted to work prior to Truckee Meadows Water Authority's receipt and approval of the insurance, bonds and signed contract. Said certificates shall be specific to the project and all notices regarding insurances shall be delivered to:

Truckee Meadows Water Authority Attn: Maria Dufur, New Business Project Coordinator P. O. Box 30013 Reno, NV 89520

The Notice to Proceed shall not be issued and Contractor shall not commence work, until such insurance has been approved by Truckee Meadows Water Authority. The Contractor shall not allow any subcontractors to commence work on its subcontract until all similar insurance required of the subcontractor has been obtained and verified by Contractor. Such insurance shall remain in full force and effect at all times during the execution of the Work and until the final completion and acceptance thereof and at all times thereafter as dictated in this Contract and the General Conditions.

If the Contractor fails to maintain any of the insurance coverage required herein, Truckee Meadows Water Authority will have the option to declare the Contractor in breach, or may purchase replacement insurance or pay the premiums that are due on existing policies in order that the required coverage may be maintained. The Contractor is responsible for any expenses paid by Truckee Meadows Water Authority to maintain such insurance and Truckee Meadows Water Authority may collect the same from the Contractor or deduct the amount paid from any sums due the Contractor under the Contract.

The insurance requirements specified herein do not relieve the Contractor of responsibility or limit the amount of liability to Truckee Meadows Water Authority or other persons, and the Contractor is encouraged to purchase such additional insurance as he deems necessary.

E. Penalty for Collusion. If, at any time, it is found that the Contractor has, in presenting any bid or bids, colluded with any other party or parties, then the Contract shall be null and void, and the Contractor and its sureties shall be liable for loss or damage which Truckee Meadows Water Authority may suffer thereby, and Truckee Meadows Water Authority may advertise for new bids for said Work. The Contractor further certifies that any and all prices which he may charge under the terms of the Contract do not, and will not, violate any existing Federal, State or Municipal laws or regulations concerning discrimination and/or price fixing.

F. Copeland Anti-Kickback Law. The Contractor shall comply with the Copeland Anti-Kickback Act (19 U.S.C. 874) as supplemented in the Department of Labor Regulations (29 CFR Part 3). This act provides that each Contractor or subcontractor shall be prohibited from inducing by any means, any person employed in the construction, completion or repair of public facilities, to give up any part of the compensation to which he is otherwise entitled.

G. Media Contact. The Contractor shall immediately contact the TMWA Project Manager assigned to them, if they are approached by the media while working on any TNWA project.

END OF INSTRUCTIONS TO BIDDERS

BID PROPOSAL FORMS

BID BOND – NOT REQUIRED FOR THIS PROJECT

KNOW ALL MEN BY THESE PRESENTS, that I/We

as Principal, hereinafter called Contractor, and

a corporation duly organized or authorized	ted to do business under the laws of the State of Nevada, as Surety, hereinafter called the
Surety, are held and firmly bound unto	Truckee Meadows Water Authority, a joint powers authority created pursuant to NRS
Chapter 277, for the sum of	
\$	Dollars
(state sum in words)	

for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. This bond shall be governed by the laws of the State of Nevada.

WHEREAS, the Principal has submitted a bid, identified as TMWA Bid #2017-005 and titled "Glendale WTF 1.5 MW Diesel Generator Purchase."

NOW, THEREFORE if Truckee Meadows Water Authority shall accept the bid of the Principal and the Principal shall enter into a contract with Truckee Meadows Water Authority in Accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to Truckee Meadows Water Authority the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which Truckee Meadows Water Authority may in good faith contract with another party to perform work covered by said bid or an appropriate liquidated amount as specified in the Invitation for Bids then this obligation shall be null and void, otherwise to remain in full force and effect.

Executed on this

dourof

	Executed on unis uay of , 20
(Signature of Principal)	Name:
	Title:
(Seal)	Firm:
	Address:
	City/ State / Zip Code:
	Written Name of Principal:
(Signature of Notary)	ATTEST NAME:
Subscribed and sworn before me this day of	, 20
(printed name of notary)	Notary Public for the State of
Claims Under This Bond May Be Addressed To:	
Name of Surety	
Address	
City	
State/Zip Code	
Name	
Title	
Phone	
Surety's Acknowledgment	

NOTICE: No substitution or revision to this bond form will be accepted. Sureties must be authorized to do business in and have an agent for service of process in the State of Nevada. Certified copy of Power of Attorney must be attached.

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BID SCHEDULES

TMWA BID NO.: 2017-005

BID TITLE: Glendale WTF 1.5 MW Diesel Generator Purchase

NOTICE: No substitution or revision to this Bid Schedule form will be accepted. Truckee Meadows Water Authority will reject any Bid that is received that has changes or alterations to this document. Although the Prevailing Wages are provided in this bid document, the bidder is responsible to verify with the Labor Commissioner if any addendums have been issued. If different, the successful bidder will be required to provide the current Prevailing Wages used in preparation of their bid within 24 hours of bid submission.

PRICES must be valid for 30 calendar days after the bid opening.

<u>COMPLETION</u> of this project is expected **PURSUANT TO CONTRACT DOCUMENTS**.

BIDDER acknowledges receipt of _____ Addendums.

Item pricing on this schedule is for use in preparing the schedule of values that will be used as a basis for partial payment during construction and for internal TMWA use. Item descriptions are not intended to be all inclusive. Bidders shall include costs for work not specifically mentioned in the most appropriate item.

Refer to Article 7 of the General Conditions for a list of items that may be included in the mobilization bid item. TMWA reserves the right to perform extra work using time and expense or negotiated lump sum procedures.

The Contract Sum will be adjusted (increased or decreased) for actual quantities per unit price items. Lump sum items will not be adjusted.

Compliance with all permit and environmental requirements is incidental to the Work. No separate bid item, or additional payment provisions, shall be made for operational constraints or conditions placed on the Work by permitting agency requirements.

(signature)

SUMMARY				
Description	Scheduled		Unit	Total
	Value	Unit	Price	Price
1. Supply 1,500 kW, 2,000 kVA at 4,160V 3-phase	1	LS		
diesel medium voltage backup power generator set				
per Technical Specification Section 263213 Diesel				
Medium Voltage Generator Set. Bid price shall				
EXCLUDE sales tax.				
TOTAL BID PRICE				
			1	

Total Bid Price Written in Words: _____

Notes to Bid Schedule:

1. Bid Price shall include delivery to the Glendale Water Treatment Facility, 1205 S. 21st Street, Sparks, NV 89431.

BIDDER INFORMATION:

Company Name:
Address:
City:
State / Zip Code:
Telephone Number including area code:
Fax Number including area code:
E-mail:

LICENSING INFORMATION:

 NSING INFORMATION:

 Nevada State Contractor's License Number: - NOT REQUIRED FOR THIS PROJECT

 License Classification(s):

 Limitation(s) of License:

 Date Issued:

 Date of Expiration:

 Name of Licensee:

 City, State, Zip Code of Licensee:

 Telephone Number of Licensee:

 Business License Number:

 Date Issued:

 Date of Expiration:

 Name of Licensee:

 City, State, Zip Code of Licensee:

 Telephone Number of Licensee:

Taxpayer Identification Number:

DISCLOSURE OF PRINCIPALS:

1. Individual and/or Partnership:
Owner 1) Name:
Address:
City, State, Zip Code:
Telephone Number:
Owner 2) Name:
Address:
City, State, Zip Code:
Telephone Number:
Other 1) Title:
Name
Other 2) Title:
Name:
2. Corporation:
State in which Company is Incorporated:
Date Incorporated:
Name of Corporation:
Address
City, State, Zip Code:
Telephone Number:
President's Name:
Vice-President's Name:
Other 1) Name:
Title:
Other 2) Name:

Title

MANAGEMENT AND SUPERVISORY PERSONNEL:

Persons and Positions	Years With Firm
Name	
Title	
Name	
Title	
Name	
Title	

(If additional space is needed, attach a separate page)

REFERENCES:

1. Instructions:

List at least three (3) contracts of a similar nature performed by your firm in the last three (3) years. If **NONE**, use your Company's letterhead (and submit with your bid proposal) a list what your qualifications are for this contract. Truckee Meadows Water Authority reserves the right to contact and verify, with any and all references listed, the quality of and the degree of satisfaction for such performance. See the Supplemental Conditions for the TMWA Project Category required for this project.

2. <u>**Clients:**</u> (if additional space is needed attach a separate page)

Owner's Representative :	Telephone #	
Address (inc. City, State & Zip):		
Owner's Representative's E-mail:		
Superintendent:		
Amount of Contract:	Date Completed:	
Project Title:		
TMWA Project Category:		
Owner's Representative :	Telephone #	
Owner's Representative : Address (inc. City, State & Zip):	Telephone #	
Owner's Representative : Address (inc. City, State & Zip): Owner's Representative's E-mail:	Telephone #	
Owner's Representative : Address (inc. City, State & Zip): Owner's Representative's E-mail: Superintendent:	Telephone #	
Owner's Representative : Address (inc. City, State & Zip): Owner's Representative's E-mail: Superintendent: Amount of Contract:	Telephone # Date Completed:	
Owner's Representative : Address (inc. City, State & Zip): Owner's Representative's E-mail: Superintendent: Amount of Contract: Project Title:	Telephone # Date Completed:	

Oran ar's Damagentation :	Talanhana #
Owner's Representative :	l elephone #
Address (inc. City, State & Zip):	
Owner's Representative's E-mail:	
Superintendent:	
Amount of Contract:	Date Completed:
Project Title:	
TMWA Project Category:	
Project Name:	
Owner's Representative :	Telephone #
Address (inc. City, State & Zip):	
Owner's Representative's E-mail:	
Superintendent:	
Amount of Contract:	Date Completed:
Project Title:	
TMWA Project Category:	
Project Name:	
Owner's Representative :	Telephone #
Address (inc. City, State & Zip):	
Owner's Representative's E-mail:	
Superintendent:	
Amount of Contract:	Date Completed:
Project Title:	
TMWA Project Category:	

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS PRIMARY COVERED TRANSACTIONS

- 1. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal, State or Local department or agency.
 - b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.
 - c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or Local) terminated for cause or default.
- 2. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Signature of Authorized Certifying Official

Bidder's Safety Factors:

Printed Name

I am unable to certify to the above statement. My explanation is attached.

Signature

BIDDER'S SAFETY INFORMATION – NOT REQUIRED FOR THIS PROJECT

y ear	"E-NIOd" Factor	USHA Incident Rate		
2014				
2015				
¹ E-Mod (E	xperience Modification) Factors	s are issued by the National		
Council on Compensation Insurance (NCCI).				
² OSHA Incident Rate is the number of OSHA Recordable Accidents				
multiplied by 200,000 and then dividing that result by the total number of				
annual man-hours. Please refer to the U.S. Department of Labor				
Occupational Safety and Health Administration's website for calculating				
worksheets and current requirements.				

Page 8

Date

Date

Title

ACKNOWLEDGMENT AND EXECUTION

STATE OF)
) SS
County of)

(Name of Principal)

Hereby deposes and says under the penalty of perjury:

That he/she is the Contractor, or authorized agent of the Contractor for whom the aforesaid described work is to be performed by; that he/she has read the Plans, Specifications, and related documents including but not limited to, any addendums issued and understands the terms, conditions, and requirements thereof; that if his/her bid is accepted that he/she agrees to furnish and deliver all materials except those specified to be furnished by Truckee Meadows Water Authority (Owner) and to do and perform all work for the "Glendale WTF 1.5 MW Diesel Generator Purchase," TMWA Bid No.: 2017-005, together with incidental items necessary to complete the work to be constructed in accordance with the Specifications, Plans, and Contract Documents annexed hereto.

TO THE GENERAL MANAGER OF TRUCKEE MEADOWS WATER AUTHORITY, NEVADA:

The undersigned, as bidder, declares that the only persons or parties interested in this proposal, as principals, are those named herein, the bidder is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid: that this proposal is made without collusion with any other person, firm or corporation; that he/she has carefully examined the location of the proposed work; the annexed proposed form of Contract, the Contract Provisions, Plans, Specifications and Contract Documents incorporated therein referred to and made part thereof; that he/she proposes and agrees if this proposal is accepted, that he/she will contract with Truckee Meadows Water Authority in the form of the Contract prescribed, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the Contract and annexed Contract Provisions, Plans and Specifications, in the manner and time prescribed and according to the requirements of the Project Representative as therein set forth, it being understood and agreed that the quantities shown herein are approximate only and are subject to increase or decrease, and that he/she will accept, in full, payment therefore the indicated prices.

		Contractor/Bidder:		
(Printed Name of Contractor/Bidder))	BY:		
		Firm:		
		Address:		
L.S.		City:		
		State / Zip Code:		
		Telephone Number:		
		Fax Number:		
		E-mail Address:		
(Signature of Principal)		Signature:		
		DATED this	day of	, 20
State of Nevada)			
County of) S.S.)			
On this day of		, in the year 20, befor	re me,	
/Notary Public, personally appeared				Personally known to me (or proved
to me on the basis of satisfactory evi executed it. WITNESS my hand and	dence) to be the official seal.	person whose name is subs	cribed to this instrument	t, and acknowledged that he (she)
Notary's Signature:			commission Expires:	Му

("SAMPLE) PURCHASE AGREEMENT (NRS 332)

GLENDALE WTF 1.5 MW DIESEL GENERATOR PURCHASE TMWA Bid No.: 2017-005 TMWA Capital Project No.: 11-0013

THIS EQUIPMENT/PRODUCT PURCHASE AGREEMENT (also herein referred to as "<u>Contract</u>"), made and entered into this ______ day of _____, 20___, by and between the Truckee Meadows Water Authority hereinafter called "<u>TMWA</u>" and hereinafter called the "<u>Supplier</u>".

WITNESSETH, that TMWA and the Supplier, for the consideration hereinafter named, agree as follows:

Article 1 Scope of Work

The Supplier shall provide equipment/product for the 1,500 kW, 2,000 kVA at 4,160V 3phase diesel medium voltage backup power generator set ("Generator") as provided in the specifications and provide all of the equipment and services described in the specification prepared by TMWA (Exhibit "A" attached hereto) and as amended by specific addenda, and shall do everything required by this Agreement in furnishing the Generator.

Delivery of the Generator shall be to TMWA's Glendale Water Treatment Facility located at 1205 S. 21st Street, Sparks, Nevada.

Article 2 Contract Time, Guaranteed Delivery Date, and Liquidated Damages

Supplier agrees to deliver the Generator, in a good and satisfactory condition, pursuant to the Specification to the TMWA Glendale Water Treatment Facility located at 1205 S. 21st Street, Sparks, Nevada, no later than **One Hundred Thirteen (113) calendar days** following the issuance of the Notice to Proceed, unless otherwise agreed to between the parties, which is the Guaranteed Delivery Time as defined in the Bid Package.

TMWA and Supplier recognize that time is of the essence of this Agreement.

Article 3 The Contract Sum

TMWA shall pay Supplier, as full compensation for furnishing the Generator, services, and other specified items in accordance with the Contract Documents and to the satisfaction of TMWA, the lump sum amount of: ______ (\$____) Dollars.

Article 4 Payment

Payment for the Generator item described on the Bid Schedule will be made within 30 days of the later of: i) inspection by TMWA and acceptance of delivery of such Generator; or ii) receipt of an invoice for the Generator item.

Article 5 Acceptance and Final Payment

Testing and acceptance of the Generator shall be as specified in the Specifications, Bid and Contract Documents. Acceptance of final payment by the Supplier shall constitute a full waiver and release by the Supplier of all claims against TMWA arising out of or relating to this Agreement.

Article 6 The Contract Documents

The following is an enumeration of the Contract Documents that are fully a part of the Contract as if herein repeated:

- 1. Bid Documents and Bid Form
- 2. Agreement
- 3. Specifications
- 4. Addenda

Article 7 Warranty

Supplier warrants that the Generator furnished under the Contract will be of good quality and new and that the Generator will be free from defects and will conform with the requirements of the Specifications, Bid and Contract Documents.

Article 8 Indemnification/Hold Harmless

Notwithstanding any provision to the contrary in the Contract Documents, TMWA waives any requirement that the Supplier on this bid provide insurance (other than property insurance insuring risk of loss until delivery and acceptance by TMWA) in connection with the delivery of the Generator.

Article 9 Performance Bond – NOT REQUIRED FOR THIS PROJECT

Article 10 Termination

In addition to other provisions of this Agreement, TMWA may terminate the Agreement in accordance with the procedures specified in the Bid Documents, Bid Form, Specifications and Contract upon giving Supplier seven (7) day notice in writing.

Article 11 Governing Law

This Agreement shall be governed by, interpreted under and construed and enforced in accordance with the laws of the State of Nevada, with venue in the County of Washoe. Each of the parties hereto acknowledge and agree that the laws of the State of Nevada and the selection of venue in the County of Washoe were freely chosen by the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first above written.

TRUCKEE MEADOWS WATER AUTHORITY

Dated:,	20	By: General Manager
		ATTEST: TMWA Clerk
Dated:,	20	Supplier:
		By:
		Name:
		Title:
STATE OF NEVADA)	
COUNTY OF WASHOE) 88.	
On this day of _ Public, the foregoing Agreement Supplier.	for Equi	, 20, personally appeared before me, a Notary, who acknowledged to me that he/she executed pment/Product as the authorized representative of the

Notary Public

ATTACHMENT "A"

TECHNICAL SPECIFICATIONS

SECTION 263213

DIESEL MEDIUM VOLTAGE GENERATOR SET

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes details to cover work required to furnish, install, start-up, test, and document the packaged medium-voltage standby-power diesel engine generator set to include the following features:
 - 1. Diesel engine.
 - 2. Starting system.
 - 3. Cooling system.
 - 4. Diesel fuel-oil system with sub-base tank.
 - 5. Engine exhaust & silencer.
 - 6. Control and monitoring.
 - 7. Battery and charger.
 - 8. Generator over-current and fault protection.
 - 9. Generator, exciter, and voltage regulator.
 - 10. Vibration isolation devices.
 - 11. Load bank and controller.

1.2 REFERENCES

- A. In all cases, referenced specifications, codes and standards shall be the most recently published editions or the version currently adopted by the authority having jurisdiction.
- B. National Electrical Manufacturers Association (NEMA)
 1. NEMA MG 1 Motors and Generators
- C. International Electrical Testing Association (NETA):
 - 1. NETA ATS Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 30 Flammable and Combustible Liquids Code
 - 2. NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
 - 3. NFPA 70 National Electrical Code (NEC)
 - 4. NFPA 110 Standard for Emergency and Standby Power Systems

1.3 SYSTEM DESCRIPTION

- A. General: Standby engine generator set rated to serve continuously during interruption of prime electrical power and required auxiliaries, accessories, and controls to provide source of power, as specified herein, according to NFPA 110.
- B. Capacity: Approximately <u>1500</u> kW, <u>2000</u> kVA at 4,160V 3-Phase. See performance and sizing calculation submittal requirements as well as electrical drawings for details.

1.4 ACTION SUBMITTALS

- A. Bill of Materials: A listing shall include all of the panels, racks, instruments, components, and devices provided under this section.
- B. Equipment tabulating all components furnished, followed by the manufacturer's name, manufacturer's model number, and a cross-reference to its location on the shop drawings.
- C. Product Data: For each type of product. Drawings and descriptive (catalog) data and brochures of each item of equipment including technical data sheets for the engine and generator.
 - 1. Diesel engine data.
 - a. Manufacturer
 - b. Model
 - c. Revolutions per minute (rpm)
 - d. Rated capacity brake horsepower (bhp)
 - e. Make and model of governor
 - f. Piston displacement (cubic inches)
 - g. Guaranteed fuel consumption rate in gallons per hour at:
 - 1) Full Load
 - 2) 3/4 Load
 - 3) 1/2 Load
 - Generator Data
 - a. Manufacturer
 - b. Model

2.

- c. Rated kVA
- d. Rated kW
- e. Voltage
- f. Temperature rise above 40°C ambient at rated output with 80% power factor
- g. Generator efficiency including excitation losses at
 - 1) Full Load
 - 2) 3/4 Load
 - 3) 1/2 Load
- h. Voltage dip calculations with specified loading (see electrical drawings).
- 3. Engine-generator unit and accessories to include:
 - a. Enclosure
 - b. Accessory sub-panel & transformer
 - c. Control panels
 - d. Voltage Regulator
 - e. Fuel System
 - f. Exhaust System
 - g. Batteries

- h. Battery Charger
- i. Water Jacket Heater
- j. Load Bank Unit
- k. Load Bank Controller
- l. other accessories not listed here
- m. Manufacturer
- n. Model
- o. Catalog data/cutsheets
- p. Weight of skid-mounted unit
- q. Overall length
- r. Overall width
- s. Overall height
- t. Exhaust pipe size
- u. Cubic feet per minute (cfm) of air required for combustion and also for ventilation.
- v. Heat rejected to enclosure by engine and generator in Btu/hr.
- w. Cooling air volume required
- x. Total efficiency of the unit
- y. Emissions certification
- z. Sound data (enclosure performance data)
- 4. Generator Circuit Breaker
 - a. Catalog data
 - b. Recommended trip settings for all adjustable settings
 - c. Short-circuit interrupting ratings
- D. Shop Drawings:
 - 1. Identify electrical connection requirements and characteristics.
 - 2. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Identify fluid drain ports and clearance requirements for proper fluid drain.
 - 5. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and supported equipment. Include base weights.
 - 7. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for equipment and functional relationship between all electrical components. Generator winding data and connection diagrams. Include battery charger and water jacket power requirements.
- E. Certified foundation and anchor bolt plans for all floor/concrete-mounted equipment. Include sizing and structural calculations for required anchoring and seismic bracing equipment for seismic considerations stamped by a Professional Engineer licensed in the State of Nevada.
- F. Departure from Drawings: Submit to the Engineer, in writing for review, details of any necessary proposed departures from these contract documents, and the reasons therefore, as soon as practicable and within 30-days after the award of the contract. Make no such departures without the prior written approval of the engineer.
- G. Description of operation.

H. Test procedures, syllabus of training and a schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Sizing Calculation: Generator supplier to submit a project specific sizing calculation for engineering review and approval. Loading as shown on the electrical drawings. Submitted generator set equipment shall not to exceed 80% of de-rated capacity. De-rated capacity shall take into consideration project elevation and temperature at the proposed installation site.
- B. Seismic Qualification Data: Certificates for engine generator, accessories, and components, from manufacturer.
- C. Source quality-control reports.
- D. Certified test reports: Indicate results of performance testing.
- E. Field quality-control reports: Inspections, findings, and recommendations.
- F. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data: Include six (6) copies of the instructions and service manuals for normal operation, routine maintenance, oil sampling, analysis for engine wear, and emergency maintenance procedures. The manual shall be bound in a 9-inch by 12-inch size binder. Include a table of contents with all pages neatly assembled and fit within the manual cover.
- B. For each section provide the following information as applicable:
 - 1. Itemized list for all data provided.
 - 2. Name and location of the manufacturer and the manufacturer's local representative, nearest suppliers, and spare parts warehouse.
 - 3. Recommended installation, adjustment, start-up, calibration, and trouble-shooting procedures.
 - 4. Recommended lubrication, lubrication intervals, and estimate of yearly quantity needed.
 - 5. Recommended step-by-step procedures for all modes of operation.
 - 6. Complete internal and connection wiring diagrams.
 - 7. Recommended preventative maintenance procedures for all modes of operation.
 - 8. Complete parts lists, by generic title and identification number.
 - 9. Recommended spare parts and special tools.
 - 10. Disassembly, overhaul, and reassembly instructions.
 - 11. All approved shop drawing information pertinent to facility operation and maintenance.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, with service facilities within 50 miles of this project. Manufacturer shall be ISO 9001 or 9002 certified. The generator set shall be certified

by the engine manufacturer to be suitable for use at the installed location and rating and shall meet all applicable exhaust emission requirements at the time of commissioning at the location installed for standby power. Provide certification that the engine-generator complies with the requirements of Federal, State, and Local Agencies.

- B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience. Supplier shall take unit responsibility for the entire medium voltage standby diesel engine generator system, to provide a complete and operable system that meets all the requirements of these contract documents. The medium voltage standby diesel engine generator supplier shall be responsible for the selection, design, manufacture, installation, and testing of the equipment specified herein to ensure complete compatibility of the elements of the standby generator system with other equipment installed, new and existing, at the facility. The generator-set supplier shall coordinate with all associated system suppliers and installers to ensure the installation dimensions, connections, and requirements are compatible.
- C. Installer: An authorized representative who is trained and approved by manufacturer.
- D. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA for on-site testing.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at the time of shipment.
- B. Equipment shall withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses, which occur during operation of the system. Protect radiator core with wood sheet.
- C. Store in a location as agreeable with the engineer, secure from weather or accidental damage. If stored outdoors, indoor gear shall be covered and heated, and outdoor gear shall be heated.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Furnish written manufacturer warranty for on-site parts and labor.
 - 2. Warranty Period: 2 years from date of successful generator startup, not to exceed 90-days from date of delivery.

1.10 MAINTENANCE SERVICE

1. Furnish service and maintenance of engine generator for one year from date of successful generator startup, not to exceed 90-days from date of delivery.

1.11 MAINTENANCE MATERIALS

1. Furnish two of each: fuel, oil, and air filter elements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide first-quality new materials, free from defects and suitable for the intended use and the space provided. Provide equipment compliant with requirements set forth in the contact documents and standards which have been locally established. As a minimum, provide equipment which meets the requirements of:
 - 1. UL 508 (Electric Industrial Controls)
 - 2. UL 142 (Sub Base Fuel Tanks)
 - 3. UL 1236 (Battery Chargers)
 - 4. UL 2200 (Generator Sets)
 - 5. UL 499 (Heaters)
- B. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide the complete system specified herein.

2.2 MANUFACTURERS

- A. Cummins/ONAN
- B. Caterpillar Inc.
- C. MTU Onsite Energy
- D. Generac Power Systems
- E. Kohler Industrial Power
- F. Katolight
- G. Taylor Power Systems
- H. Gillette Manufacturing
- I. Substitutions: TMWA approved alternate only.
- J. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. As a minimum, the standby generator shall have a continuous rating for stepped loads as specified on the electrical drawings. The contractor is responsible for coordinating functional

requirements with various equipment suppliers to furnish a complete, fully-integrated and operational system.

- B. Seismic Performance: Engine generator housing, day tank, engine generator, batteries, battery racks, silencers, sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels. Water shall be substituted for diesel fuel in fuel tank during test
 - 3. Component Importance Factor: 1.5.
- C. B11 Compliance: Comply with B11.19.
- D. NFPA Compliance:
 - 1. Comply with NFPA 37.
 - 2. Comply with NFPA 70.
 - 3. Comply with NFPA 110 requirements for Level 1 EPSS.
- E. UL Compliance: Comply with UL 2200.
- F. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.
- G. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator, including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- H. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: -20 to 115 deg F (-29 to 46 deg C).
 - 2. Relative Humidity: Zero to 95 percent.
 - 3. Altitude: Sea level to 4500 feet (1372 m).
- I. The generator set shall be provided with a sound-absorbing housing with interior lighting. It shall have sufficient clearances for routine maintenance and shall have code required clearances.
- J. Sufficient capacity to operate under 110% of nameplate rating for one hour in specified ambient environmental conditions.

2.4 ENGINE GENERATOR ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled, four-stroke cycle, compression ignition diesel internal combustion engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. EPSS Class: Engine generator shall be classified as a Class 2 according to NFPA 110.
- D. Service Load: shown on Electrical Sheets.
- E. Power Factor: 0.8, lagging.
- F. Frequency: 60 Hz.
- G. Voltage: 4160 Vac.
- H. Phase: Three-phase, four-wire wye.
- I. Induction Method: Turbocharged.
- J. Governor: Electronic, adjustable isochronous, with speed sensing. Shall maintain engine speed at precise rated frequency with operation within 0.25 percent steady-state, 5 percent no-load to full-load, and recovery to steady-state within 2 seconds following load changes. Governor shall not permit frequency modulation to exceed ¹/₄ cycle per second. Governor shall be a standalone unit and not integrated into the generator control panel.
- K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.
- L. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
 - 2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- M. Engine Generator Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage, from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent stepload increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

- 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency, from no load to full load.
- 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
- 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
- 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
- 8. Start Time: Comply with NFPA 110, Type 10 system requirements.

2.5 DIESEL ENGINE

- A. Fuel: ASTM D 975 diesel fuel oil, Grade 2-D S15.
- B. Rated Engine Speed: 1800 rpm (maximum nominal).
- C. The complete engine block shall be machined from one casting. Designs incorporating multiple blocks bolted together are not acceptable.
- D. The engine shall receive a prime coat, and two coats of industrial paint suitable for the intended use. Contractor to supply owner a selection of finish coat color from manufacturer's standard colors.
- E. All exposed rotating parts of the engine shall be provided with guards for protection of personnel per OSHA requirements.
- F. Lubrication System: Engine or skid mounted.
 - 1. Shall incorporate a gear type lube oil pump to furnish oil pressure to moving parts.
 - 2. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow. Shall incorporate a bypass valve that will allow circulation in case of filtration system failure.
 - 3. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe and shall incorporate a oil cooler system.
 - 4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
 - 5. Lubrication oil as recommended by the engine manufacturer for job conditions.
- G. Batteries: Four 8D heavy-duty 24VDC, diesel starting type lead-acid storage batteries mounted on a acid resistant material battery rack. Furnish battery cables of adequate size and length, minimum #4/0 AWG DLO.

- H. Engine Jacket Heater: Two 240V thermal-circulation, electric-immersion type heaters, factory installed in coolant jacket system with integral thermostatic control, sized to maintain engine jacket coolant between 120°F and 140°F in an ambient temperature of -20°F. Heater mechanical connections shall have isolation valves. Heaters shall be hard-wired, no plugs.
- I. Muffler/Silencer: Heavy-duty, welded construction, critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1. Minimum sound attenuation of 25 dB at 500 Hz.
 - 2. Include a seamless stainless-steel flexible exhaust connector.
 - 3. Shall be supported independently to prevent transmission of vibration and allow for expansion. Use long radius, low restriction fittings.
- J. Sound-attenuated, weather-proof enclosure: baffled, sound-attenuating insulation.
 - 1. Sound level measured at a distance of 23 feet (7 m) from exhaust discharge after installation is complete shall be 85 dBA or less.
 - 2. Be vandal resistant and lockable with three point handle operated latches. It shall not be possible to access or operate equipment without a key.
 - 3. The roof shall have a positive camber for water runoff. The exhaust outlet(s) shall be supplied with rain guard(s) at least 1-inch above the enclosure to prevent moisture from entering the enclosure.
 - 4. The base of the enclosure shall be designed for skid base installation and shall include a means for fastening to the concrete slab. Anchor points, isolators and anchors shall be designed for the site specific seismic zone.
 - 5. Air openings shall include fixed louvers sized to allow proper air flow. Frames shall be manufactured from 14-gauge steel. The blades and the fronts shall be covered with 14-guage expanded screen.
 - 6. Single doors shall be a minimum of 30-inches wide. Double doors shall be 60-inches wide. All doors shall have stainless steel hinges and be fully weather stripped. Doors shall be removable.
 - 7. Doors and walls shall be insulated with sound attenuating material.
 - 8. Mufflers and silencers shall be furnished for roof mounting to the enclosure. Fully insulated mufflers and silencers may be internally mounted if thermal performance is not compromised.
 - 9. All seams shall be caulked with body sealer. The enclosure shall be prepped, primed with self-etching primer suitable for the material used in the construction of the enclosure. Final coating shall be powder coat. Supply the owner with a color selection fan-deck (180 colors, minimum) that shall include standard and premium industrial colors. Include color sample chips for final selection as requested by owner. Final enclosure exterior color selection shall be by owner.
 - 10. A 100A 1-phase 240S/120V 12-circuit sub-panel with 100A main circuit breaker, 20amp branch breakers, and an associated approximate 30kVA 480x240S/120V transformer.
 - 11. A 120V LED lighting system shall be incorporated into the enclosure which will produce 40-50 foot-candles on the floor as well as associated 3-way switches at each door.
 - 12. Four GFCI receptacles shall be located within the enclosure where likely to be needed during maintenance.
- K. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
2.6 STARTING SYSTEM

- A. Starting shall be initiated by a 24VDC electric system with negative ground.
- B. Components: Sized so they are not damaged during a full engine-cranking cycle, with ambient temperature at maximum specified in "Performance Requirements" Article.
- C. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
- D. Cranking Cycle: As required by NFPA 110 for system level specified.
- E. Cranking Duration: Sufficient capacity to crank the engine at starting speed for one minute without overheating.
- F. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
- G. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
- H. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
- I. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
- J. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
 - 1. Operation: Automatic, two-rate, equalizing-charger with maximum rate of 10A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - 2. Construction: An SCR-controlled, replaceable printed circuit board installed in an enclosure with high/low rate potentiometers, ammeter, and charger status (power) light. Include a status control relay to allow three function options:
 - a. Disconnect during cranking only.
 - b. Disconnect during generator set operation.
 - c. Continuous battery monitoring.
 - 3. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
 - 4. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - 5. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - 6. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage

and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

- 7. Protection: Fused input and output suitable for installation.
- 8. Enclosure and Mounting: NEMA-12 wall-mounted cabinet within generator enclosure.
- K. NFPA 110 requirements for Level 1 equipment for heater capacity and with UL 499.

2.7 COOLING SYSTEM

- A. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction. The cooling system shall be sized to maintain safe operation at 50°C maximum ambient temperature at 5,000ft above sea level.
- B. Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine/gear-driven coolant pump with blower type fan and a radiator duct adapter to allow for direct exhausting of used cooling air.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Size of Radiator: Adequate to contain expansion of total system coolant, from cold start to 110 percent load condition.
- E. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant-system pressure for engine used. Equip with gauge glass and petcock.
- F. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- G. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.
 - 1. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- H. Radiator system shall be capable of maintaining a safe engine temperature in ambient temperature of 115°F.
- I. Radiator air-flow restriction of 0.5 inches of water maximum.

2.8 DIESEL FUEL-OIL SYSTEM

A. UL approved and comply with NFPA 30.

- B. Piping: Fuel-oil piping shall be Schedule 40 black steel. Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.
- C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.
- D. Shall include a fuel priming pump.
- E. Fuel Filtering: Remove water and contaminants larger than 1 micron.
- F. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- G. Sub-base Fuel Tank: Factory-fabricated fuel tank assembly of a 12-gauge steel construction complete with baffles, drain, fuel inlet, vent, fill cap fuel level gauge, fuel level light, and the following features:
 - 1. Containment: Double-wall.
 - a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of tank leak. Shall be wired into the common alarm signal.
 - 2. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of twenty-four hours' operation at 100 percent of rated power output of engine generator system without being refilled.
 - 3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel-supply pump at 110 percent of rated capacity, including fuel returned from engine.
 - 4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
 - 5. Piping Connections: Factory-installed fuel-supply and return lines, from tank to engine; local fuel fill; vent line; overflow line; and tank drain line with shutoff valve.
 - 6. Shall incorporate conduit entry openings.

2.9 CONTROL AND MONITORING

- A. Functional Requirement: The generator is to operate in a close-transition fashion. The generator set shall include control equipment and programming, as well as voltage matching and breaker operation components, to incorporate the functional requirements listed herein. Generator breakers shall rest in the open position until closed by command. Utility breakers will rest in the closed position until actuated by the control system.
- B. Comply with UL 508A.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.
- D. Control and Monitoring Panel:

- 1. Generator-mounted, NEMA-12 enclosure on vibration isolators, completely wired with a provision for padlocking.
- 2. Digital controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
- 3. Instruments: Located on the control and monitoring panel, digital sensors with inputs to a digital control panel, and viewable during operation:
 - a. Engine lubricating-oil temperature gauge.
 - b. Engine lubricating-oil pressure gauge.
 - c. Engine-coolant temperature gauge.
 - d. DC voltmeter (alternator battery charging).
 - e. Battery charging indicator.
 - f. Engine running-time meter (hours).
 - g. Phase selector switch.
 - h. AC voltmeter, for each phase.
 - i. AC ammeter, for each phase.
 - j. AC frequency meter.
 - k. Generator-voltage-adjusting rheostat.
 - 1. Oil Pressure Engine Fault Indicator.
 - m. Coolant Temperature Engine Fault Indicator.
 - n. Overspeed Engine Fault Indicator.
 - o. Run indication light.
 - p. Not in Auto indication.
- 4. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
 - a. Cranking control equipment.
 - b. Three-position Run-Off-Auto switch.
 - c. Alarm Reset pushbutton.
 - d. Control switch not in automatic position alarm.
 - e. Adjustable reset timers.
 - f. Overcrank alarm.
 - g. Overcrank shutdown device.
 - h. Low water temperature alarm.
 - i. High engine temperature pre-alarm.
 - j. High engine temperature.
 - k. High engine temperature shutdown device.
 - 1. Overspeed alarm.
 - m. Overspeed shutdown device.
 - n. Low-fuel main tank.
 - 1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for the duration required for the indicated EPSS class.
 - o. Coolant low-level alarm.
 - p. Coolant high-temperature prealarm.
 - q. Coolant high-temperature alarm.
 - r. Coolant low-temperature alarm.
 - s. Coolant high-temperature shutdown device.
 - t. EPS load indicator.

- u. Battery high-voltage alarm.
- v. Low-cranking voltage alarm.
- w. Battery-charger malfunction alarm.
- x. Battery low-voltage alarm.
- y. Lamp test.
- z. Contacts for local and remote common alarm.
- aa. Low-starting air pressure alarm.
- bb. Low-starting hydraulic pressure alarm.
- cc. Remote manual-stop shutdown device.
- dd. Air shutdown damper alarm when used.
- ee. Air shutdown damper shutdown device when used.
- ff. Alarm horn and silence switch.
- gg. Panel illumination lights ON/OFF switch.
- hh. Lamp push to test switch.
- ii. Auxiliary Run relays.
- E. Contactor based alarm terminal board for signals shall include:
 - 1. Engine failure. (common alarm)
 - 2. Low fuel level.
 - 3. Switch not-in-auto.
 - 4. Low battery voltage. (common alarm)
 - 5. Generator run.
 - 6. Transfer-switch indication.
 - 7. Generator breaker open/tripped. (common alarm)
 - 8. Auto hand switch.
- F. Control Interface Terminal board shall include:
 - 1. Start/Stop Control
 - 2. Generator Run-Off-Auto (dry-contacts)
 - 3. Common Alarm (dry-contacts)
 - 4. Low Fuel Alarm (dry-contacts)
 - 5. Generator Running (dry-contacts)
- G. All alarm and status contacts shall be brought out to terminal strips and numbered and identified.
- H. All engine contacts shall be capable of 10A, 120VAC Form-C type.
- I. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.
- J. All relays shall be of the plug-in enclosed type.
- K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.
- L. Provide connection terminals for a series switch to be connected to the Emergency Stop Switch for Fire Department use. This shall be a normally closed switch. The terminals shall be jumpered if not required for this purpose. Opening this circuit shall halt and prevent generator operation.

- M. Adjustable overall cranking cycle of 60 to 120 seconds with reset periods adjustable from 10 to 30 seconds. The control system shall provide for three cranking cycles of approximately 20 seconds duration each. The starting circuit shall be automatically disconnected when the engine starts. If the engine fails to start, a cranking limiter shall disconnect the starting circuit and shall lock out the control, and the FAIL TO START alarm shall be initiated.
- N. Generator mode of operation shall be determined by a 4-position selector switch with functions labeled as HAND-OFF-AUTOMATIC-TEST (HOAT).
- O. When the generator HOAT switch is in HAND position, generator and transfer control shall be as follows:
 - 1. The call to start the MV generator will be initiated.
 - 2. Transfer control shall ensure the utility breaker is closed.
 - 3. Transfer control shall ensure the generator breaker is open.
 - 4. Generator shall run until there is a change in mode of operation by the selector switch.
- P. When the HOAT switch is in the OFF position:
 - 1. It shall not be possible to start the generator set.
 - 2. If the generator set is running, it shall immediately shut-down with no cool-down sequence.
 - 3. In either case, the generator breaker shall be reset to the open position.
- Q. When the generator HOAT switch is in AUTOMATIC position, generator and transfer control shall be as follows:
 - 1. Upon loss of utility (normal) voltage, the transfer control program, after an adjustable delay, shall start the MV generator. Upon generator power quality being acceptable, the transfer control shall open the utility breaker and then shall close the generator breaker to power the MV bus.
 - 2. Upon return of power, the generator control system shall initiate a voltage magnitude, phase angle, and frequency synchronizing algorithm with the incoming utility voltage signal. Once the generator has achieved a matching voltage signal, the utility breaker shall be closed, with electrical power and operation uninterrupted for a complete closed-transition. After a programmable delay, the generator breaker will be opened and after an adjustable cooling delay, the generator will turn off.
 - 3. The utility and generator breaker controls shall be electrically coordinated, utilizing mechanically actuated auxiliary contacts, to allow for open-transition from utility to generator and closed-transition from generator to utility. Transfer controls shall incorporate fail-safe mechanisms which will account for normal or abnormal conditions including component failures and operator errors.
 - 4. Cooling cycle: When the generator is released, begin the cool-down period, adjustable from 0 to 30 minutes. This time delay shall be set in accordance with the recommendations of the standby generator supplier.
- R. When the generator HOAT switch is in TEST position, generator and transfer control shall be as follows:
 - 1. The call to start the MV generator will be initiated.
 - 2. The generator control system shall initiate a voltage magnitude, phase angle, and frequency synchronizing algorithm with the incoming utility voltage signal. Once the generator has achieved a matching voltage signal, the generator breaker shall be closed, with electrical power and operation uninterrupted for a complete closed-transition. After a programmable delay, the utility breaker will be opened.

- 3. Switching the HOAT switch to the AUTOMATIC position shall terminate the TEST mode. Upon switching the HOAT switch to the AUTOMATIC position, the generator control system shall initiate a voltage magnitude, phase angle, and frequency synchronizing algorithm with the incoming utility voltage signal. Once the generator has achieved a matching voltage signal, the utility breaker shall be closed, with electrical power and operation uninterrupted for a complete closed-transition. After a programmable delay, the generator breaker will be opened and the cooling cycle shall commence.
- 4. Cooling cycle: When the generator is released, begin the cool-down period, adjustable from 0 to 30 minutes. This time delay shall be set in accordance with the recommendations of the standby generator supplier.
- S. Generator unit shall incorporate a lockable DC-switch which shall remove the battery connections to the run circuit.
- T. The control system shall include a programmable delay of 0-30 seconds delay between any HOAT switch position changes.
- U. The protective functions shall be active, regardless of the position of the HAND-OFF-AUTO-TEST switch or other selector switches.

2.10 GENERATOR OVER-CURRENT AND FAULT PROTECTION

- A. Over-current protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
 - 1. Over-current protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Protective Relay: GE489, Beckwith M-3410A, Beckwith M-3425A (or pre-approved equal).
- C. Generator Main Line Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
 - 1. Type: 400A frame, 350A trip LSIG
 - 2. Tripping Characteristics: Adjustable long-time and short-time delay, instantaneous, and ground-fault sensing.
 - 3. Trip Settings: Selected to coordinate with generator thermal damage curve.
 - 4. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices through generator set 24VDC battery supply.
 - 5. Mounting: On generator output, adjacent to or integrated with control and monitoring panel, within NEMA-12 enclosure.
 - 6. Generator Main Line Circuit Breaker shall include lockout capability.
- D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open

the switch to disconnect the generator from load circuits. Protector performs the following functions:

- 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
- 2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
- 3. As over-current heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
- 4. Senses clearing of a fault by other over-current devices and controls recovery of rated voltage to avoid overshoot.
- E. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.
 - 1. Trip generator protective device on ground fault.

2.11 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- B. Shall be of a salient pole synchronous type generator with a temperature rise not to exceed 130° C.
- C. Single bearing flange mounted design. Bearing to be laminated, steel, semi-flexible, piloting device. The couplings shall be properly guarded to prevent injury to personnel.
- D. Excitation through a permanent magnet generator (PMG)
- E. Comply with NEMA MG 1.
- F. Electrical Insulation: Class H.
- G. Range: Provide limited range of output voltage by adjusting the excitation level.
- H. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- I. Enclosure: Drip-proof.
- J. Instrument Transformers: Mounted within generator enclosure.
- K. Voltage Regulator: Solid-state, volts-per-hertz type, separate from exciter, providing performance as specified and as required by NFPA 110. Voltage Regulation shall be a standalone unit and not integrated into the generator control panel.

- 1. Adjusting Rheostats on Control and Monitoring Panel: Provide manual control for plus or minus 5 percent adjustment of output-voltage operating band, voltage-drop, and voltage-gain.
- 2. Maintain voltage within 30 percent on one step, full load.
- 3. Provide anti-hunt provision to stabilize voltage.
- 4. Maintain frequency within 15 percent and stabilize at rated frequency within five seconds.
- 5. Printed circuit board and power control diodes shall be hermetically sealed for moisture protection.
- L. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- M. Subtransient Reactance: 12 percent, maximum.
- N. Skid-mounted design.
- O. Incorporate a power terminal cabinet with adequate size for connection of load conductors.

2.12 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Standard neoprene separated by steel shims.
 - 2. Shore A Scale Durometer Rating: 50.
 - 3. Number of Layers: Two.
 - 4. Minimum Deflection: 1 inch (25 mm).
- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint mounted to structure steel base tank.
 - 1. Housing: Steel with resilient, vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Minimum Deflection: 1 inch (25 mm).
- C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.13 LOAD BANK AND CONTROLLER

A. Radiator-mounted, manually-controlled load bank installed within the generator enclosure. Load bank to be 50% generator capacity in two equal steps. Include all accessories such as cables, connections, control power transformers, and disconnect circuit breaker, ventilation fans, enclosure, and indication/control panel.

2.14 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than two working days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Comply with NECA 1 and NECA 404.
- C. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.
- D. Equipment Mounting:
 - 1. Install packaged engine generators with sub-base fuel tanks on cast-in-place concrete equipment bases.
 - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- E. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- F. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.
- G. Fuel Piping:
 - 1. Copper and galvanized steel shall not be used in the fuel-oil piping system.

H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.2 CONNECTIONS

- A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.
- B. Connect cooling-system water piping to engine generator and heat exchanger with flexible connectors.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
- E. Ground equipment according to "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to applicable electrical power conductor and cable sections of this specification. Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.
- G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.3 IDENTIFICATION

A. Identify system components as necessary for HVAC piping and equipment and according to "Identification for Electrical Systems."

3.4 FACTORY TEST WITNESS PROVISION

- A. Generator supplier shall provide the owner with a full-load test to witness at the factory.
- B. Factory tests shall be made in a testing cell designed for full-load testing.
- C. Factory tests shall require owner approval prior to shipping the final product for installation at the project site.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a NETA certified, qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:

- 1. Perform tests recommended by manufacturer and in "Visual and Mechanical Inspection" and "Electrical and Mechanical Tests" subparagraphs below, as specified in the NETA ATS. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection:
 - 1) Compare equipment nameplate data with Drawings and the Specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify that the unit is clean.
 - b. Electrical and Mechanical Tests:
 - 1) Perform insulation-resistance tests according to IEEE 43.
 - a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, over-temperature, over-speed, and other protection features as applicable.
 - 5) Conduct performance test according to NFPA 110.
 - 6) Verify correct functioning of the governor and regulator.
- 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
- 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
- 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and floatcharging conditions.
- 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- 6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
- 7. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

- D. Coordinate tests with tests for transfer switches, and run them concurrently.
- E. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.
- K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component, indicating satisfactory completion of tests.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative for 2-hours of two persons each to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators, at the project site.
- B. Simulate power outage by interrupting normal source; demonstrate that the system operates to provide standby power.

END OF SECTION 263213

SECTION 263213

DIESEL MEDIUM VOLTAGE GENERATOR SET

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes details to cover work required to furnish, install, start-up, test, and document the packaged medium-voltage standby-power diesel engine generator set to include the following features:
 - 1. Diesel engine.
 - 2. Starting system.
 - 3. Cooling system.
 - 4. Diesel fuel-oil system with sub-base tank.
 - 5. Engine exhaust & silencer.
 - 6. Control and monitoring.
 - 7. Battery and charger.
 - 8. Generator over-current and fault protection.
 - 9. Generator, exciter, and voltage regulator.
 - 10. Vibration isolation devices.
 - 11. Load bank and controller.

1.2 REFERENCES

- A. In all cases, referenced specifications, codes and standards shall be the most recently published editions or the version currently adopted by the authority having jurisdiction.
- B. National Electrical Manufacturers Association (NEMA)
 1. NEMA MG 1 Motors and Generators
- C. International Electrical Testing Association (NETA):
 - 1. NETA ATS Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 30 Flammable and Combustible Liquids Code
 - 2. NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
 - 3. NFPA 70 National Electrical Code (NEC)
 - 4. NFPA 110 Standard for Emergency and Standby Power Systems

1.3 SYSTEM DESCRIPTION

- A. General: Standby engine generator set rated to serve continuously during interruption of prime electrical power and required auxiliaries, accessories, and controls to provide source of power, as specified herein, according to NFPA 110.
- B. Capacity: Approximately <u>1500</u> kW, <u>2000</u> kVA at 4,160V 3-Phase. See performance and sizing calculation submittal requirements as well as electrical drawings for details.

1.4 ACTION SUBMITTALS

- A. Bill of Materials: A listing shall include all of the panels, racks, instruments, components, and devices provided under this section.
- B. Equipment tabulating all components furnished, followed by the manufacturer's name, manufacturer's model number, and a cross-reference to its location on the shop drawings.
- C. Product Data: For each type of product. Drawings and descriptive (catalog) data and brochures of each item of equipment including technical data sheets for the engine and generator.
 - 1. Diesel engine data.
 - a. Manufacturer
 - b. Model
 - c. Revolutions per minute (rpm)
 - d. Rated capacity brake horsepower (bhp)
 - e. Make and model of governor
 - f. Piston displacement (cubic inches)
 - g. Guaranteed fuel consumption rate in gallons per hour at:
 - 1) Full Load
 - 2) 3/4 Load
 - 3) 1/2 Load
 - Generator Data
 - a. Manufacturer
 - b. Model

2.

- c. Rated kVA
- d. Rated kW
- e. Voltage
- f. Temperature rise above 40°C ambient at rated output with 80% power factor
- g. Generator efficiency including excitation losses at
 - 1) Full Load
 - 2) 3/4 Load
 - 3) 1/2 Load
- h. Voltage dip calculations with specified loading (see electrical drawings).
- 3. Engine-generator unit and accessories to include:
 - a. Enclosure
 - b. Accessory sub-panel & transformer
 - c. Control panels
 - d. Voltage Regulator
 - e. Fuel System
 - f. Exhaust System
 - g. Batteries

- h. Battery Charger
- i. Water Jacket Heater
- j. Load Bank Unit
- k. Load Bank Controller
- l. other accessories not listed here
- m. Manufacturer
- n. Model
- o. Catalog data/cutsheets
- p. Weight of skid-mounted unit
- q. Overall length
- r. Overall width
- s. Overall height
- t. Exhaust pipe size
- u. Cubic feet per minute (cfm) of air required for combustion and also for ventilation.
- v. Heat rejected to enclosure by engine and generator in Btu/hr.
- w. Cooling air volume required
- x. Total efficiency of the unit
- y. Emissions certification
- z. Sound data (enclosure performance data)
- 4. Generator Circuit Breaker
 - a. Catalog data
 - b. Recommended trip settings for all adjustable settings
 - c. Short-circuit interrupting ratings
- D. Shop Drawings:
 - 1. Identify electrical connection requirements and characteristics.
 - 2. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Identify fluid drain ports and clearance requirements for proper fluid drain.
 - 5. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and supported equipment. Include base weights.
 - 7. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for equipment and functional relationship between all electrical components. Generator winding data and connection diagrams. Include battery charger and water jacket power requirements.
- E. Certified foundation and anchor bolt plans for all floor/concrete-mounted equipment. Include sizing and structural calculations for required anchoring and seismic bracing equipment for seismic considerations stamped by a Professional Engineer licensed in the State of Nevada.
- F. Departure from Drawings: Submit to the Engineer, in writing for review, details of any necessary proposed departures from these contract documents, and the reasons therefore, as soon as practicable and within 30-days after the award of the contract. Make no such departures without the prior written approval of the engineer.
- G. Description of operation.

H. Test procedures, syllabus of training and a schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Sizing Calculation: Generator supplier to submit a project specific sizing calculation for engineering review and approval. Loading as shown on the electrical drawings. Submitted generator set equipment shall not to exceed 80% of de-rated capacity. De-rated capacity shall take into consideration project elevation and temperature at the proposed installation site.
- B. Seismic Qualification Data: Certificates for engine generator, accessories, and components, from manufacturer.
- C. Source quality-control reports.
- D. Certified test reports: Indicate results of performance testing.
- E. Field quality-control reports: Inspections, findings, and recommendations.
- F. Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data: Include six (6) copies of the instructions and service manuals for normal operation, routine maintenance, oil sampling, analysis for engine wear, and emergency maintenance procedures. The manual shall be bound in a 9-inch by 12-inch size binder. Include a table of contents with all pages neatly assembled and fit within the manual cover.
- B. For each section provide the following information as applicable:
 - 1. Itemized list for all data provided.
 - 2. Name and location of the manufacturer and the manufacturer's local representative, nearest suppliers, and spare parts warehouse.
 - 3. Recommended installation, adjustment, start-up, calibration, and trouble-shooting procedures.
 - 4. Recommended lubrication, lubrication intervals, and estimate of yearly quantity needed.
 - 5. Recommended step-by-step procedures for all modes of operation.
 - 6. Complete internal and connection wiring diagrams.
 - 7. Recommended preventative maintenance procedures for all modes of operation.
 - 8. Complete parts lists, by generic title and identification number.
 - 9. Recommended spare parts and special tools.
 - 10. Disassembly, overhaul, and reassembly instructions.
 - 11. All approved shop drawing information pertinent to facility operation and maintenance.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, with service facilities within 50 miles of this project. Manufacturer shall be ISO 9001 or 9002 certified. The generator set shall be certified

by the engine manufacturer to be suitable for use at the installed location and rating and shall meet all applicable exhaust emission requirements at the time of commissioning at the location installed for standby power. Provide certification that the engine-generator complies with the requirements of Federal, State, and Local Agencies.

- B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience. Supplier shall take unit responsibility for the entire medium voltage standby diesel engine generator system, to provide a complete and operable system that meets all the requirements of these contract documents. The medium voltage standby diesel engine generator supplier shall be responsible for the selection, design, manufacture, installation, and testing of the equipment specified herein to ensure complete compatibility of the elements of the standby generator system with other equipment installed, new and existing, at the facility. The generator-set supplier shall coordinate with all associated system suppliers and installers to ensure the installation dimensions, connections, and requirements are compatible.
- C. Installer: An authorized representative who is trained and approved by manufacturer.
- D. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA for on-site testing.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at the time of shipment.
- B. Equipment shall withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses, which occur during operation of the system. Protect radiator core with wood sheet.
- C. Store in a location as agreeable with the engineer, secure from weather or accidental damage. If stored outdoors, indoor gear shall be covered and heated, and outdoor gear shall be heated.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Furnish written manufacturer warranty for on-site parts and labor.
 - 2. Warranty Period: 2 years from date of successful generator startup, not to exceed 90-days from date of delivery.

1.10 MAINTENANCE SERVICE

1. Furnish service and maintenance of engine generator for one year from date of successful generator startup, not to exceed 90-days from date of delivery.

1.11 MAINTENANCE MATERIALS

1. Furnish two of each: fuel, oil, and air filter elements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide first-quality new materials, free from defects and suitable for the intended use and the space provided. Provide equipment compliant with requirements set forth in the contact documents and standards which have been locally established. As a minimum, provide equipment which meets the requirements of:
 - 1. UL 508 (Electric Industrial Controls)
 - 2. UL 142 (Sub Base Fuel Tanks)
 - 3. UL 1236 (Battery Chargers)
 - 4. UL 2200 (Generator Sets)
 - 5. UL 499 (Heaters)
- B. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide the complete system specified herein.

2.2 MANUFACTURERS

- A. Cummins/ONAN
- B. Caterpillar Inc.
- C. MTU Onsite Energy
- D. Generac Power Systems
- E. Kohler Industrial Power
- F. Katolight
- G. Taylor Power Systems
- H. Gillette Manufacturing
- I. Substitutions: TMWA approved alternate only.
- J. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. As a minimum, the standby generator shall have a continuous rating for stepped loads as specified on the electrical drawings. The contractor is responsible for coordinating functional

requirements with various equipment suppliers to furnish a complete, fully-integrated and operational system.

- B. Seismic Performance: Engine generator housing, day tank, engine generator, batteries, battery racks, silencers, sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels. Water shall be substituted for diesel fuel in fuel tank during test
 - 3. Component Importance Factor: 1.5.
- C. B11 Compliance: Comply with B11.19.
- D. NFPA Compliance:
 - 1. Comply with NFPA 37.
 - 2. Comply with NFPA 70.
 - 3. Comply with NFPA 110 requirements for Level 1 EPSS.
- E. UL Compliance: Comply with UL 2200.
- F. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.
- G. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator, including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- H. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: -20 to 115 deg F (-29 to 46 deg C).
 - 2. Relative Humidity: Zero to 95 percent.
 - 3. Altitude: Sea level to 4500 feet (1372 m).
- I. The generator set shall be provided with a sound-absorbing housing with interior lighting. It shall have sufficient clearances for routine maintenance and shall have code required clearances.
- J. Sufficient capacity to operate under 110% of nameplate rating for one hour in specified ambient environmental conditions.

2.4 ENGINE GENERATOR ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled, four-stroke cycle, compression ignition diesel internal combustion engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. EPSS Class: Engine generator shall be classified as a Class 2 according to NFPA 110.
- D. Service Load: shown on Electrical Sheets.
- E. Power Factor: 0.8, lagging.
- F. Frequency: 60 Hz.
- G. Voltage: 4160 Vac.
- H. Phase: Three-phase, four-wire wye.
- I. Induction Method: Turbocharged.
- J. Governor: Electronic, adjustable isochronous, with speed sensing. Shall maintain engine speed at precise rated frequency with operation within 0.25 percent steady-state, 5 percent no-load to full-load, and recovery to steady-state within 2 seconds following load changes. Governor shall not permit frequency modulation to exceed ¹/₄ cycle per second. Governor shall be a standalone unit and not integrated into the generator control panel.
- K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.
- L. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
 - 2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- M. Engine Generator Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage, from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent stepload increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

- 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency, from no load to full load.
- 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
- 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
- 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
- 8. Start Time: Comply with NFPA 110, Type 10 system requirements.

2.5 DIESEL ENGINE

- A. Fuel: ASTM D 975 diesel fuel oil, Grade 2-D S15.
- B. Rated Engine Speed: 1800 rpm (maximum nominal).
- C. The complete engine block shall be machined from one casting. Designs incorporating multiple blocks bolted together are not acceptable.
- D. The engine shall receive a prime coat, and two coats of industrial paint suitable for the intended use. Contractor to supply owner a selection of finish coat color from manufacturer's standard colors.
- E. All exposed rotating parts of the engine shall be provided with guards for protection of personnel per OSHA requirements.
- F. Lubrication System: Engine or skid mounted.
 - 1. Shall incorporate a gear type lube oil pump to furnish oil pressure to moving parts.
 - 2. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow. Shall incorporate a bypass valve that will allow circulation in case of filtration system failure.
 - 3. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe and shall incorporate a oil cooler system.
 - 4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
 - 5. Lubrication oil as recommended by the engine manufacturer for job conditions.
- G. Batteries: Four 8D heavy-duty 24VDC, diesel starting type lead-acid storage batteries mounted on a acid resistant material battery rack. Furnish battery cables of adequate size and length, minimum #4/0 AWG DLO.

- H. Engine Jacket Heater: Two 240V thermal-circulation, electric-immersion type heaters, factory installed in coolant jacket system with integral thermostatic control, sized to maintain engine jacket coolant between 120°F and 140°F in an ambient temperature of -20°F. Heater mechanical connections shall have isolation valves. Heaters shall be hard-wired, no plugs.
- I. Muffler/Silencer: Heavy-duty, welded construction, critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1. Minimum sound attenuation of 25 dB at 500 Hz.
 - 2. Include a seamless stainless-steel flexible exhaust connector.
 - 3. Shall be supported independently to prevent transmission of vibration and allow for expansion. Use long radius, low restriction fittings.
- J. Sound-attenuated, weather-proof enclosure: baffled, sound-attenuating insulation.
 - 1. Sound level measured at a distance of 23 feet (7 m) from exhaust discharge after installation is complete shall be 85 dBA or less.
 - 2. Be vandal resistant and lockable with three point handle operated latches. It shall not be possible to access or operate equipment without a key.
 - 3. The roof shall have a positive camber for water runoff. The exhaust outlet(s) shall be supplied with rain guard(s) at least 1-inch above the enclosure to prevent moisture from entering the enclosure.
 - 4. The base of the enclosure shall be designed for skid base installation and shall include a means for fastening to the concrete slab. Anchor points, isolators and anchors shall be designed for the site specific seismic zone.
 - 5. Air openings shall include fixed louvers sized to allow proper air flow. Frames shall be manufactured from 14-gauge steel. The blades and the fronts shall be covered with 14-guage expanded screen.
 - 6. Single doors shall be a minimum of 30-inches wide. Double doors shall be 60-inches wide. All doors shall have stainless steel hinges and be fully weather stripped. Doors shall be removable.
 - 7. Doors and walls shall be insulated with sound attenuating material.
 - 8. Mufflers and silencers shall be furnished for roof mounting to the enclosure. Fully insulated mufflers and silencers may be internally mounted if thermal performance is not compromised.
 - 9. All seams shall be caulked with body sealer. The enclosure shall be prepped, primed with self-etching primer suitable for the material used in the construction of the enclosure. Final coating shall be powder coat. Supply the owner with a color selection fan-deck (180 colors, minimum) that shall include standard and premium industrial colors. Include color sample chips for final selection as requested by owner. Final enclosure exterior color selection shall be by owner.
 - 10. A 100A 1-phase 240S/120V 12-circuit sub-panel with 100A main circuit breaker, 20amp branch breakers, and an associated approximate 30kVA 480x240S/120V transformer.
 - 11. A 120V LED lighting system shall be incorporated into the enclosure which will produce 40-50 foot-candles on the floor as well as associated 3-way switches at each door.
 - 12. Four GFCI receptacles shall be located within the enclosure where likely to be needed during maintenance.
- K. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

2.6 STARTING SYSTEM

- A. Starting shall be initiated by a 24VDC electric system with negative ground.
- B. Components: Sized so they are not damaged during a full engine-cranking cycle, with ambient temperature at maximum specified in "Performance Requirements" Article.
- C. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
- D. Cranking Cycle: As required by NFPA 110 for system level specified.
- E. Cranking Duration: Sufficient capacity to crank the engine at starting speed for one minute without overheating.
- F. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
- G. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
- H. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
- I. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
- J. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
 - 1. Operation: Automatic, two-rate, equalizing-charger with maximum rate of 10A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - 2. Construction: An SCR-controlled, replaceable printed circuit board installed in an enclosure with high/low rate potentiometers, ammeter, and charger status (power) light. Include a status control relay to allow three function options:
 - a. Disconnect during cranking only.
 - b. Disconnect during generator set operation.
 - c. Continuous battery monitoring.
 - 3. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
 - 4. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - 5. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - 6. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage

and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

- 7. Protection: Fused input and output suitable for installation.
- 8. Enclosure and Mounting: NEMA-12 wall-mounted cabinet within generator enclosure.
- K. NFPA 110 requirements for Level 1 equipment for heater capacity and with UL 499.

2.7 COOLING SYSTEM

- A. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction. The cooling system shall be sized to maintain safe operation at 50°C maximum ambient temperature at 5,000ft above sea level.
- B. Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine/gear-driven coolant pump with blower type fan and a radiator duct adapter to allow for direct exhausting of used cooling air.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Size of Radiator: Adequate to contain expansion of total system coolant, from cold start to 110 percent load condition.
- E. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant-system pressure for engine used. Equip with gauge glass and petcock.
- F. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- G. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.
 - 1. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- H. Radiator system shall be capable of maintaining a safe engine temperature in ambient temperature of 115°F.
- I. Radiator air-flow restriction of 0.5 inches of water maximum.

2.8 DIESEL FUEL-OIL SYSTEM

A. UL approved and comply with NFPA 30.

- B. Piping: Fuel-oil piping shall be Schedule 40 black steel. Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.
- C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.
- D. Shall include a fuel priming pump.
- E. Fuel Filtering: Remove water and contaminants larger than 1 micron.
- F. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- G. Sub-base Fuel Tank: Factory-fabricated fuel tank assembly of a 12-gauge steel construction complete with baffles, drain, fuel inlet, vent, fill cap fuel level gauge, fuel level light, and the following features:
 - 1. Containment: Double-wall.
 - a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of tank leak. Shall be wired into the common alarm signal.
 - 2. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of twenty-four hours' operation at 100 percent of rated power output of engine generator system without being refilled.
 - 3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel-supply pump at 110 percent of rated capacity, including fuel returned from engine.
 - 4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
 - 5. Piping Connections: Factory-installed fuel-supply and return lines, from tank to engine; local fuel fill; vent line; overflow line; and tank drain line with shutoff valve.
 - 6. Shall incorporate conduit entry openings.

2.9 CONTROL AND MONITORING

- A. Functional Requirement: The generator is to operate in a close-transition fashion. The generator set shall include control equipment and programming, as well as voltage matching and breaker operation components, to incorporate the functional requirements listed herein. Generator breakers shall rest in the open position until closed by command. Utility breakers will rest in the closed position until actuated by the control system.
- B. Comply with UL 508A.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.
- D. Control and Monitoring Panel:

- 1. Generator-mounted, NEMA-12 enclosure on vibration isolators, completely wired with a provision for padlocking.
- 2. Digital controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
- 3. Instruments: Located on the control and monitoring panel, digital sensors with inputs to a digital control panel, and viewable during operation:
 - a. Engine lubricating-oil temperature gauge.
 - b. Engine lubricating-oil pressure gauge.
 - c. Engine-coolant temperature gauge.
 - d. DC voltmeter (alternator battery charging).
 - e. Battery charging indicator.
 - f. Engine running-time meter (hours).
 - g. Phase selector switch.
 - h. AC voltmeter, for each phase.
 - i. AC ammeter, for each phase.
 - j. AC frequency meter.
 - k. Generator-voltage-adjusting rheostat.
 - 1. Oil Pressure Engine Fault Indicator.
 - m. Coolant Temperature Engine Fault Indicator.
 - n. Overspeed Engine Fault Indicator.
 - o. Run indication light.
 - p. Not in Auto indication.
- 4. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
 - a. Cranking control equipment.
 - b. Three-position Run-Off-Auto switch.
 - c. Alarm Reset pushbutton.
 - d. Control switch not in automatic position alarm.
 - e. Adjustable reset timers.
 - f. Overcrank alarm.
 - g. Overcrank shutdown device.
 - h. Low water temperature alarm.
 - i. High engine temperature pre-alarm.
 - j. High engine temperature.
 - k. High engine temperature shutdown device.
 - 1. Overspeed alarm.
 - m. Overspeed shutdown device.
 - n. Low-fuel main tank.
 - 1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for the duration required for the indicated EPSS class.
 - o. Coolant low-level alarm.
 - p. Coolant high-temperature prealarm.
 - q. Coolant high-temperature alarm.
 - r. Coolant low-temperature alarm.
 - s. Coolant high-temperature shutdown device.
 - t. EPS load indicator.

- u. Battery high-voltage alarm.
- v. Low-cranking voltage alarm.
- w. Battery-charger malfunction alarm.
- x. Battery low-voltage alarm.
- y. Lamp test.
- z. Contacts for local and remote common alarm.
- aa. Low-starting air pressure alarm.
- bb. Low-starting hydraulic pressure alarm.
- cc. Remote manual-stop shutdown device.
- dd. Air shutdown damper alarm when used.
- ee. Air shutdown damper shutdown device when used.
- ff. Alarm horn and silence switch.
- gg. Panel illumination lights ON/OFF switch.
- hh. Lamp push to test switch.
- ii. Auxiliary Run relays.
- E. Contactor based alarm terminal board for signals shall include:
 - 1. Engine failure. (common alarm)
 - 2. Low fuel level.
 - 3. Switch not-in-auto.
 - 4. Low battery voltage. (common alarm)
 - 5. Generator run.
 - 6. Transfer-switch indication.
 - 7. Generator breaker open/tripped. (common alarm)
 - 8. Auto hand switch.
- F. Control Interface Terminal board shall include:
 - 1. Start/Stop Control
 - 2. Generator Run-Off-Auto (dry-contacts)
 - 3. Common Alarm (dry-contacts)
 - 4. Low Fuel Alarm (dry-contacts)
 - 5. Generator Running (dry-contacts)
- G. All alarm and status contacts shall be brought out to terminal strips and numbered and identified.
- H. All engine contacts shall be capable of 10A, 120VAC Form-C type.
- I. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.
- J. All relays shall be of the plug-in enclosed type.
- K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.
- L. Provide connection terminals for a series switch to be connected to the Emergency Stop Switch for Fire Department use. This shall be a normally closed switch. The terminals shall be jumpered if not required for this purpose. Opening this circuit shall halt and prevent generator operation.

- M. Adjustable overall cranking cycle of 60 to 120 seconds with reset periods adjustable from 10 to 30 seconds. The control system shall provide for three cranking cycles of approximately 20 seconds duration each. The starting circuit shall be automatically disconnected when the engine starts. If the engine fails to start, a cranking limiter shall disconnect the starting circuit and shall lock out the control, and the FAIL TO START alarm shall be initiated.
- N. Generator mode of operation shall be determined by a 4-position selector switch with functions labeled as HAND-OFF-AUTOMATIC-TEST (HOAT).
- O. When the generator HOAT switch is in HAND position, generator and transfer control shall be as follows:
 - 1. The call to start the MV generator will be initiated.
 - 2. Transfer control shall ensure the utility breaker is closed.
 - 3. Transfer control shall ensure the generator breaker is open.
 - 4. Generator shall run until there is a change in mode of operation by the selector switch.
- P. When the HOAT switch is in the OFF position:
 - 1. It shall not be possible to start the generator set.
 - 2. If the generator set is running, it shall immediately shut-down with no cool-down sequence.
 - 3. In either case, the generator breaker shall be reset to the open position.
- Q. When the generator HOAT switch is in AUTOMATIC position, generator and transfer control shall be as follows:
 - 1. Upon loss of utility (normal) voltage, the transfer control program, after an adjustable delay, shall start the MV generator. Upon generator power quality being acceptable, the transfer control shall open the utility breaker and then shall close the generator breaker to power the MV bus.
 - 2. Upon return of power, the generator control system shall initiate a voltage magnitude, phase angle, and frequency synchronizing algorithm with the incoming utility voltage signal. Once the generator has achieved a matching voltage signal, the utility breaker shall be closed, with electrical power and operation uninterrupted for a complete closed-transition. After a programmable delay, the generator breaker will be opened and after an adjustable cooling delay, the generator will turn off.
 - 3. The utility and generator breaker controls shall be electrically coordinated, utilizing mechanically actuated auxiliary contacts, to allow for open-transition from utility to generator and closed-transition from generator to utility. Transfer controls shall incorporate fail-safe mechanisms which will account for normal or abnormal conditions including component failures and operator errors.
 - 4. Cooling cycle: When the generator is released, begin the cool-down period, adjustable from 0 to 30 minutes. This time delay shall be set in accordance with the recommendations of the standby generator supplier.
- R. When the generator HOAT switch is in TEST position, generator and transfer control shall be as follows:
 - 1. The call to start the MV generator will be initiated.
 - 2. The generator control system shall initiate a voltage magnitude, phase angle, and frequency synchronizing algorithm with the incoming utility voltage signal. Once the generator has achieved a matching voltage signal, the generator breaker shall be closed, with electrical power and operation uninterrupted for a complete closed-transition. After a programmable delay, the utility breaker will be opened.

- 3. Switching the HOAT switch to the AUTOMATIC position shall terminate the TEST mode. Upon switching the HOAT switch to the AUTOMATIC position, the generator control system shall initiate a voltage magnitude, phase angle, and frequency synchronizing algorithm with the incoming utility voltage signal. Once the generator has achieved a matching voltage signal, the utility breaker shall be closed, with electrical power and operation uninterrupted for a complete closed-transition. After a programmable delay, the generator breaker will be opened and the cooling cycle shall commence.
- 4. Cooling cycle: When the generator is released, begin the cool-down period, adjustable from 0 to 30 minutes. This time delay shall be set in accordance with the recommendations of the standby generator supplier.
- S. Generator unit shall incorporate a lockable DC-switch which shall remove the battery connections to the run circuit.
- T. The control system shall include a programmable delay of 0-30 seconds delay between any HOAT switch position changes.
- U. The protective functions shall be active, regardless of the position of the HAND-OFF-AUTO-TEST switch or other selector switches.

2.10 GENERATOR OVER-CURRENT AND FAULT PROTECTION

- A. Over-current protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
 - 1. Over-current protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Protective Relay: GE489, Beckwith M-3410A, Beckwith M-3425A (or pre-approved equal).
- C. Generator Main Line Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
 - 1. Type: 400A frame, 350A trip LSIG
 - 2. Tripping Characteristics: Adjustable long-time and short-time delay, instantaneous, and ground-fault sensing.
 - 3. Trip Settings: Selected to coordinate with generator thermal damage curve.
 - 4. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices through generator set 24VDC battery supply.
 - 5. Mounting: On generator output, adjacent to or integrated with control and monitoring panel, within NEMA-12 enclosure.
 - 6. Generator Main Line Circuit Breaker shall include lockout capability.
- D. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open

the switch to disconnect the generator from load circuits. Protector performs the following functions:

- 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
- 2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
- 3. As over-current heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
- 4. Senses clearing of a fault by other over-current devices and controls recovery of rated voltage to avoid overshoot.
- E. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.
 - 1. Trip generator protective device on ground fault.

2.11 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- B. Shall be of a salient pole synchronous type generator with a temperature rise not to exceed 130° C.
- C. Single bearing flange mounted design. Bearing to be laminated, steel, semi-flexible, piloting device. The couplings shall be properly guarded to prevent injury to personnel.
- D. Excitation through a permanent magnet generator (PMG)
- E. Comply with NEMA MG 1.
- F. Electrical Insulation: Class H.
- G. Range: Provide limited range of output voltage by adjusting the excitation level.
- H. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- I. Enclosure: Drip-proof.
- J. Instrument Transformers: Mounted within generator enclosure.
- K. Voltage Regulator: Solid-state, volts-per-hertz type, separate from exciter, providing performance as specified and as required by NFPA 110. Voltage Regulation shall be a standalone unit and not integrated into the generator control panel.

- 1. Adjusting Rheostats on Control and Monitoring Panel: Provide manual control for plus or minus 5 percent adjustment of output-voltage operating band, voltage-drop, and voltage-gain.
- 2. Maintain voltage within 30 percent on one step, full load.
- 3. Provide anti-hunt provision to stabilize voltage.
- 4. Maintain frequency within 15 percent and stabilize at rated frequency within five seconds.
- 5. Printed circuit board and power control diodes shall be hermetically sealed for moisture protection.
- L. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- M. Subtransient Reactance: 12 percent, maximum.
- N. Skid-mounted design.
- O. Incorporate a power terminal cabinet with adequate size for connection of load conductors.

2.12 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Standard neoprene separated by steel shims.
 - 2. Shore A Scale Durometer Rating: 50.
 - 3. Number of Layers: Two.
 - 4. Minimum Deflection: 1 inch (25 mm).
- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint mounted to structure steel base tank.
 - 1. Housing: Steel with resilient, vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Minimum Deflection: 1 inch (25 mm).
- C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.13 LOAD BANK AND CONTROLLER

A. Radiator-mounted, manually-controlled load bank installed within the generator enclosure. Load bank to be 50% generator capacity in two equal steps. Include all accessories such as cables, connections, control power transformers, and disconnect circuit breaker, ventilation fans, enclosure, and indication/control panel.

2.14 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than two working days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Comply with NECA 1 and NECA 404.
- C. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.
- D. Equipment Mounting:
 - 1. Install packaged engine generators with sub-base fuel tanks on cast-in-place concrete equipment bases.
 - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- E. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- F. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.
- G. Fuel Piping:
 - 1. Copper and galvanized steel shall not be used in the fuel-oil piping system.

H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.2 CONNECTIONS

- A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.
- B. Connect cooling-system water piping to engine generator and heat exchanger with flexible connectors.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
- E. Ground equipment according to "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to applicable electrical power conductor and cable sections of this specification. Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.
- G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.3 IDENTIFICATION

A. Identify system components as necessary for HVAC piping and equipment and according to "Identification for Electrical Systems."

3.4 FACTORY TEST WITNESS PROVISION

- A. Generator supplier shall provide the owner with a full-load test to witness at the factory.
- B. Factory tests shall be made in a testing cell designed for full-load testing.
- C. Factory tests shall require owner approval prior to shipping the final product for installation at the project site.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a NETA certified, qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:

- 1. Perform tests recommended by manufacturer and in "Visual and Mechanical Inspection" and "Electrical and Mechanical Tests" subparagraphs below, as specified in the NETA ATS. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection:
 - 1) Compare equipment nameplate data with Drawings and the Specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify that the unit is clean.
 - b. Electrical and Mechanical Tests:
 - 1) Perform insulation-resistance tests according to IEEE 43.
 - a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, over-temperature, over-speed, and other protection features as applicable.
 - 5) Conduct performance test according to NFPA 110.
 - 6) Verify correct functioning of the governor and regulator.
- 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
- 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
- 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and floatcharging conditions.
- 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- 6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
- 7. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

- D. Coordinate tests with tests for transfer switches, and run them concurrently.
- E. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.
- K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component, indicating satisfactory completion of tests.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative for 2-hours of two persons each to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators, at the project site.
- B. Simulate power outage by interrupting normal source; demonstrate that the system operates to provide standby power.

END OF SECTION 263213