SECTION 26 05 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to provide and install the Electrical Work as shown on the drawings and as specified hereinafter, including, but not limited to the following:
   1. Electrical poriovisions as outlined on the drawings, including temporary power for construction.
   2. Circuit breakers and feeders (including all conduits, wiring, and terminations).
   3. Back-up power generator.
   4. Battery energy storage system (BESS)
   5. Ethernet connection from building to BESS.
   6. Exterior alarm strobe, heat sensing cameras, PLC controller, and all related conduits and wiring / programming for battery thermal runaway annunciation.
   7. All required incidental work, such as trenching, saw cutting, patching, and electrical testing.
   8. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the the drawings.
   9. It is the intent of the drawings and specifications that systems be complete and, except as otherwise noted, be ready for operation.

1.2 RELATED WORK

A. Division 1 - General Requirements

1.3 INCORPORATED DOCUMENTS

A. Requirements of the General Conditions, Supplementary Conditions, and Division 1 Sections apply to all work in this Section, unless modified herein.

B. Published specifications, standard tests or recommended methods of trade, industry or government organizations apply to work of this Section where cited by abbreviations noted below, unless modified herein.
   1. 2022 California Code of Regulations.
   2. 2022 California Building Standards Administrative Code, Part 1, Title 24, C.C.R.
   3. 2022 California Building Code (CBC), Part 2, Title 24, C.C.R. (Based on 2021 International Building Code with 2022 California Amendments).
   4. 2022 California Electrical Code (CEC), Part 3, Title 24, C.C.R. (Based on 2017 National Electrical Code with 2022 California Amendments).
   5. 2022 California Fire Code (CFC), Part 9, Title 24, C.C.R. (Based on 2021 International Fire Code with 2022 California Amendments).
   6. 2022 California Green Building Standards (CALGreen) Code, Part 11.
   7. American Society of Civil Engineers 7-16 (ASCE/SEI), Minimum Design Loads for Buildings and Other Structures.
   8. Underwriters' Laboratories, Inc. (UL).
   9. Local Utility Company regulations.

C. All State and Municipal Codes and Ordinances.

1.4 CONDITIONS AT SITE:

A. Visit to site is required of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

B. Lines of other services that are damaged as a result of this work shall promptly be repaired at no expense to the Owner to the complete satisfaction of the Owner.

1.5 QUALITY ASSURANCE

A. Conformance:
   1. All work shall conform to the applicable requirements of Article 1.3 above.
   2. The Contractor shall notify the Architect, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
   3. If after contract is awarded, minor changes and additions are required by aforementioned authorities, even though such work is not shown on the drawings or covered in the specifications, they shall be included at Contractor's expense.

B. Coordination:
   1. The Contractor shall become familiar with the conditions at the job site, and with the drawings and specifications and plan the installation of the electrical work to conform with the existing conditions and that shown and specified so as to provide the best possible assembly of the combined work of all trades.
   2. The Contractor shall work out in advance all "tight" conditions, involving all trades and if found necessary, supplementary drawings shall be prepared by this Contractor, for the Architect's approval, before work proceeds in these areas. No additional costs will be considered for work, which must be relocated due to conflicts with the work of other trades.
   3. The Contractor shall coordinate and verify all backbox, device, or equipment mounting requirements with the devices or equipment to be installed, prior to rough in.

1.6 SUBMITTALS

A. Product Data:
   1. Within 15 days after award of the Contract, submit:
      a. Complete electrical, lighting, and signal systems material list of all items proposed to be furnished and installed under this Division. Provide manufacturers data sheets for all devices, raceways, fixtures, equipment, and related products to be used for the Division 26 work.
      b. Manufacturers' specifications and other data required demonstrating compliance with the specified requirements.
      c. Manufacturers' recommended installation procedures which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
   2. Shop Drawings: Furnish shop drawings and/or equipment cuts for the following:
      a. Back-up power generator.
      b. Battery enetgy storage system (BESS).
      c. Disconnects.
      d. Alarm strobe and heat sensing camera / PLC controller.
   3. Test Reports:
      a. Factory Tests: As specified for specific equipment.
      b. Field Tests: Performance tests as specified for specific equipment.
      c. Megger Tests: As specified under TESTING.

d. When series rated circuit breakers are used, provide a letter from the manufacturer of the equipment confirming that U.L. series rating exists for all protective devices. State the available fault current from the Utility Company and indicate that the overcurrent devices exceed the available fault current at the respective point of protection.

4. Maintenance and Operating Manuals:
   a. Systems Description: Description of operating procedures.
   b. Controls: Diagrams and description of operation of each system.
   c. Equipment: Manufacturer's brochures, ratings, certified shop drawings, maintenance data, and parts lists with part numbers. Mark each sheet with equipment identification number and actual installed condition.
   d. Materials and Accessories: Manufacturer's brochures, parts lists with part numbers, and maintenance data where applicable. Mark each sheet with identification number of system and location of installation.
   e. The Maintenance and Operation Manual shall be presented in a bookmarked PDF file with tabbed sections as stated below. Provide all information in each section as stated below.
      1) 26 32 14:
         (a) Insert the approved submittals for the generator.
         (b) Insert all operating instructions.
         (c) Provide the names, addresses and telephone numbers of the manufacturer and the closest manufacturer's representatives of the equipment.
         (d) Include the manufacturer's recommended maintenance of the equipment.
      2) 26 32 01:
         (a) Insert the approved submittals for the Battery energy storage system.
         (b) Insert all operating instructions and programmed sequence of operation.
         (c) Provide the names, address and telephone numbers of the manufacturer and the closest manufacturer's representative for the system.
      3) 26 27 00:
         (a) Insert the approved submittals for the transformer and circuit breakers used in the systems.
         (b) Insert all operating instructions.
         (c) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
         (d) Include the manufacturer's recommended maintenance of the equipment.
      4) 26 0800:
         (a) Insert all systems testing results.
5. Record Documents: "As-builts": As specified under Paragraph 3.2 of this Section.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all trades.

B. Delivery and Storage: Deliver all materials to the job site in their original containers with all labels intact and legible at time of use. Store in strict accordance with approved manufacturers' recommendations.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

D. This Contractor shall personally, or through an authorized representative, check all materials upon receipt at jobsite for conformance with approved shop drawings and/or plans and specifications.

1.8 SCHEDULING/SEQUENCING

A. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet the construction schedule, together with any special handling charges, shall be borne by this Contractor.

B. The Contractor shall coordinate production and delivery schedule for all Owner-supplied equipment with the equipment suppliers to ensure that all Owner-supplied equipment is delivered to site in coordination with the construction schedule and in such a manner as to cause no delays in completion of the Contract as scheduled.

1.9 REQUIREMENTS

A. The contract drawings indicate the extent and general arrangements of the conduit wiring systems, etc. If any departures from the contract drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable, and within (15) days after award of the electrical contract.

B. Unless material list and data is received as a complete and all-inclusive submittal within the stipulated time all items shall be provided as specified, with no deviations permitted.

C. Any and all additional costs incurred by the substitution of electrical material or equipment, or installation thereof, whether architectural, structural, or electrical, shall be borne by the Contractor under this Section.

D. Burden of proof of equality of any substitution for a specified product is the responsibility of this Contractor.

E. Where required by Architect to ascertain equality of substitute product, Contractor may be requested to provide the specified item and the submitted substitution for comparison, at no additional cost to the Owner.

1.10 DESCRIPTION OF DEMOLITION AND REPLACEMENT WORK

A. This project includes the installation of new power system components into an existing electrical system at an operating facility. As such, the project scope for this contractor shall include all associated electrical system modifications at the existing building and site, as described on the plans ande in these specifications. The intent is that all systems will be complete and functional at the completion of this contract and that all old systems, equipment, feeders, circuits, wiring, and related devices (no longer used) be completely and neatly removed. Where discrepancies between the drawings and existing conditions are noted, the Architect or Owner shall be notified immediately for resolution.

B. As with every renovation project, the electrical work will include (and require) exploration and other field work on a daily basis to complete the new designed equipment and connections within the constraints of the existing building and existing site conditions.

C. The contractor shall include as part of the base bid, sufficient labor hours to provide such exploration and field work throughout the duration of the project. Change orders for miscellaneous coordination of existing conditions will not be approved unless specific and latent conditions are uncovered that warrant such additional compensation or require additional work not shown on the drawings or included in the specifications, or implied by the designed conditions.

1.11 GUARANTEE

A. This Contractor shall guarantee that all work executed under this Section will be free from defects of materials and workmanship for a period of one (1) year or as per the General Conditions of this project, whichever is longer. Dates shall be from the date of final acceptance of the building. The contractor shall further guarantee that he will, at his own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the guarantee. Such repair or replacement shall be guaranteed for one (1) year from the date of repair or replacement.

1.12 PERMITS AND INSPECTIONS

A. This Contractor shall arrange for and obtain all required permits and inspections.

B. Do not allow or cause any of the work to be covered or enclosed until it has been tested and/or inspected.

1.13 IDENTIFICATION

A. Switchgear, switchboards, distribution panels, and feeder circuit breakers therein, panels, disconnect switches, motor starters, transformers, motor disconnect switches, cabinets, and other apparatus used for the operation of, or control of circuits, appliances or equipment, shall be properly identified by means of engraved laminated plastic descriptive nameplates mounted on apparatus using stainless steel screws. Nameplates shall have white letters with black background and be submitted to the Architect for approval. Cardholders in any form are not acceptable.

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to applicable Division 26 Sections for complete products specifications.

2.2 MATERIALS

A. Materials of the same type or classification, used for the same purpose, shall be the product of the same manufacturer.

2.3 ACCEPTABLE MANUFACTURERS

A. Materials shall be of make mentioned elsewhere in this specification. All materials shall be the best of their several kinds, perfectly new and approved by the Underwriters' Laboratories.

B. Where material, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of desired quality, style and utility and shall be the basis of the bid. Materials so specified shall be furnished under the contract unless changed by written approval of the Architect. Where two or more designations are listed, choice shall be optional with this Contractor, but this Contractor must submit his choice for final approval.

2.4 POSTED OPERATING INSTRUCTIONS

A. Furnish approved operating instructions for systems and equipment where indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instruction exposed to the weather. Operating instruction shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

2.5 CATALOGED PRODUCTS/SERVICE AVAILABILITY

A. Materials and equipment shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The 2-year period shall be satisfactorily completed by a product for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished. The equipment items shall be supported by service organizations which are reasonable convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which the work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Drawings:
   1. The general arrangement and location of wiring and equipment is shown on the electrical drawings and shall be installed in accordance therewith, except for minor changes required by conflict with the work of other trades.
   2. The Contractor shall coordinate and verify all backbox, device, or equipment mounting requirements with the devices or equipment to be installed, prior to rough in.
   3. Drawings indicate the circuit and panel which supplies each device or fixture. Provide and install conduit and conductors to make all connections.
   4. Control wiring is generally not shown on the plans. Contractor shall refer to control requirements and provide and install all wiring and raceways required to make all interconnections between the BESS, Generator, and related monitoring, power, and/or control locations.
   5. All dimensions, together with locations of doors, partitions, etc. are to be taken from the Architectural Drawings, verified at site by this Contractor.

6. Maintain "as-built" records at all times, showing the exact location of concealed conduits and feeders installed under this contract, and actual numbering of each circuit. Upon completion of work and before acceptance can be considered, this Contractor must forward to the Architect, updated CAD plans, corrected to show the electrical work as actually installed.

B. Measurements: Before ordering any material or closing in any work, verify all measurements on the job. Any differences found between dimensions on the drawings and actual measurements shall be brought to the Architect's attention for consideration before proceeding.

3.3 FIELD QUALITY CONTROL

A. All workmanship shall be first class and carried out in a manner satisfactory to and approved by the Architect.

B. This Contractor shall personally, or through an authorized and competent representative, constantly supervise the work and so far as possible keep the same foreman and workmen on the job throughout.

3.4 TEMPORARY LIGHTING AND POWER

A. Provide and install temporary lighting and power systems for the duration of construction, of adequate size to accommodate the required lighting and power loads. Coordinate with other trades to insure adequate sizing.

B. Provide distribution equipment as required to support all construction activities.

3.5 ADJUSTING AND CLEANING

A. All electrical equipment, including existing equipment not "finish painted" under other sections, shall be touched up where finished surface is marred or damaged.

B. All equipment shall be left in clean condition, with all shipping and otherwise unnecessary labels removed there from.

3.6 SCHEDULES

A. Coordination: Coordinate installation of electrical items with the schedule for other work to prevent unnecessary delays in the total Work.

3.7 WARNING SIGN MOUNTING

A. Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.8 PAINTING OF EQUIPMENT

A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.

B. Field Applied: Paint electrical equipment as required to match finish or meet safety criteria. Painting shall be as specified in the respective equipment section.

3.9 TESTS

A. Testing and inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 08 00
TESTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included in This Section: All materials, labor, equipment, services, and incidentals necessary to perform the testing and inspection of the electrical work, including but not limited to the general systems noted below:
   1. Grounding system.
   2. Distribution system.
   3. Generator.
   4. Battery energy storage system.
   5. Alarm strobe and heat sensing camera system.
   6. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.
   7. All work shall comply with Sections 26 05 00 and 26 27 00.
   8. In addition to the general system tests and inspections indicated above, the Contractor shall perform the following inspections and tests. The Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections:
      a. System Grounding.
      b. Service panel and circuit breakers / disconnects.
      c. Feeders.
   9. The purpose of these tests is to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

1.2 APPLICABLE CODES, STANDARDS, AND REFERENCES

A. All inspections and tests shall be in accordance with the International Electrical Testing Association - Acceptance Testing Specifications ATS-2021 (referred to herein as NETA ATS-2021).

1.3 QUALIFICATIONS

A. Qualifications of the Testing Firm shall be as listed in NETA ATS-2021.

PART 2 - PRODUCTS

2.1 THIS ARTICLE DOES NOT APPLY TO TESTING.

PART 3 - EXECUTION

3.1 GENERAL

A. Final test and inspection to be conducted in presence of the Authority having Jurisdiction (AHJ) or Inspector of Record (IOR). Test shall be conducted at the expense of, and managed by, the Contractor, at a mutually agreed time. Submit written test report of all tests, with test result values and overall outcome.

B. All portions of the electrical installation shall be inspected and tested to ensure safety to building occupants, operating personnel, conformity to code authorities and Contract Documents, and for proper system operation.

3.2 INSPECTIONS AND TESTS

A. Tests: Field tests shall be performed and reports submitted, as per Section 26 05 00, Part 1.
   1. Final Inspection Certificates: Prior to final payment approval, deliver to the Owner, with a copy to the Architect, signed certificates of final inspection by the appropriate local authority having jurisdiction.
   2. Grounding System:
      a. All ground connections shall be checked and the entire system shall be checked for continuity. The resistance of grounding electrodes in the system shall be measured using a 3 point fall-of-potential method. The maximum ground resistance shall be three ohms. If the measured ground resistance exceeds three ohms, install (1) additional ground rod, bonded and interconnected with the grounding electrode system.
      b. Ground tests shall meet or exceed the requirements of the National Electric Code.
   3. Power Distribution System:
      a. Test main service panel, panel boards, generator, and BESS for grounds and shorts with mains disconnected from feeders, branch circuits connected and circuit breakers closed, all fixtures in place and permanently connected and grounding jumper to neutral lifted and with all wall switches closed.
      b. Test each individual feeder portion at each panel or equipment with equipment connected for proper operation.
      c. Check verification of color coding, tagging, numbering, and splice make-up.
      d. Verify that all conductors associated with each circuit are in same conduit.
      e. Demonstrate that all equipment operates satisfactorily.
      f. Perform megger tests of all new distribution system feeders prior to energizing. All Cables failing megger tests or with evidence of damage shall be removed and replaced in their entirety (no splices), at no cost to the Owner. Damaged cables may not be field repaired without specific approval of the Architect.
   4. Where the following systems are specified herein and/or indicated on the drawings, verify that all equipment, components, and devices function as specified and meet all additional testing as described in related individual Sections of this specification:
      a. Back-up power generator.
      b. Battery energy storage system.
      c. Alarm strobe and heat sensing camera system.

END OF SECTION

SECTION 26 27 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to install the electrical work as shown on the drawings and as specified hereinafter, including but not limited to the work listed below:
   1. Raceways, feeders, branch circuit wiring, wiring devices, safety switches and connections to all equipment requiring electric service.

B. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

C. All work shall comply with Section 26 05 00.

1.2 SUBMITTALS

A. Comply with the provisions of Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to Section 26 05 00, Basic Electrical Requirements, Part 2 - Products.

B. List of Equipment Manufacturers:

C. Conduit and Conduit Fittings
   1. Allied Tube and Conduit, Wester Tube and Conduit, LTV Steel Tubular, National Electric Products, AFC, Republic Steel Corporation, Rome Cable Corporation, United States Steel Corporation, Killark Electric Manufacting Company, Raco, VAW Aluminum Company, Bridgeport, Steel City, Thomas & Betts, Carlon, O.Z. Gedney, Appleton, Regal.

D. Wire and Cable (600V)
   1. American Wire Company, General Wire and Cable Corporation, Okonite Company, Rome Cable Corporation, Cerrowire, American Insulated Wire, AFC Cable Systems, Essex, Simplex Wire and Cable Company, Southwire.

E. Solderless Lugs and Grounding Connections
   1. Burndy Engineering Company Inc, O.Z. Gedney Company Inc, Penn Union Electric Corporation, Thomas and Betts Company Inc.

F. Pull Boxes, Gutters, Special Cabinets
   1. Schneider-Square D Company, Columbia Electric Manufacturing Company, General Electric Company, Eaton Inc.

G. Conduit Racks, Hangers

1. General Electric Company, Killark Electric Manufacturing Company, Caddy, National Electric Products Corporation, Republic Steel Corporation, Rome Cable Corporation, United States Steel Corporation, VAW Aluminum Company, Superstrut, B-Line.

H. Safety Switches (Disconnect and Fusible)
   1. Schneider-Square D Company, Eaton-Cutler Hammer Inc, General Electric Company.

2.2 MATERIALS

A. Raceways: Only the raceways specified below shall be utilized on this project. Substitutions shall be pre-approved in writing. All bare conduit ends (stub-ups or stub-outs) shall be provided with bushed ends or manufactured insulated throat connectors:
   1. Rigid Type - hot dip galvanized or sherardized steel, use on all exterior locations, below grade or in concrete slab, and to 18" on either side of structural expansion joints in floor slabs, with completely watertight, threaded fittings throughout. Compression fittings are not acceptable.
      a. All rigid steel conduit couplings and elbows in soil or concrete or under membrane to be ½ lap wrapped with Scotch #50 tape and threaded ends coated with T&B #S.C.40 rust inhibitor prior to installation of couplings.
      b. ½ lap wrap all rigid steel conduit stub-ups from slab or grade to 6" above finished grade level with Scotch #50 tape.
   2. In lieu of rigid steel conduit for power and control raceways and branch circuit conduits in soil or concrete slabs, "Schedule 40" PVC with Schedule 80 PVC conduit elbows and stub-ups may be used with code size (minimum No. 12) ground wire. A “stub-up” is considered to terminate 6" above the finished surface.
      a. Schedule 80 PVC conduit shall be used in all concrete footings or foundations and to 18" of either side of footings or foundation walls.
      b. Where schedule 80 PVC is coupled to schedule 40 or other raceways with differing interior dimensions, each end shall be reamed with a reaming tool to reduce the edge profile for protection of the passing conductors during the pull.
   3. All conduit cuts (factory or field cut) shall be perfectly square to the length of the conduit and cut ends shall be reamed with a reaming tool to provide a smooth edge to the passing conductors and to remove all burs and scrapes. Use of a hand file is not acceptable.
   4. All electrical raceways shall be installed concealed, unless otherwise noted. Cut and patch to facilitate such installation to match adjacent and original finish. All exposed conduits, where required, shall be installed parallel to building members.
   5. Fasten conduits securely to boxes with locknuts and bushings to provide good electrical continuity.
   6. Provide chrome escutcheon plates at all exposed wall, ceiling and floor conduit penetrations.
   7. Support individual suspended conduits with heavy malleable strap or rod hangers; supports for ½ inch or 3/4 inch conduit placed on maximum 7-foot centers; maximum 10-foot centers on conduits 1 inch or larger.
   8. Support multiple conduit runs from Kindorf B907 channels with C-105 and C-106 straps.
   9. Conduit bends - long radius.
   10. To facilitate pulling of feeder conductors, install junction boxes as shown or required.
   11. All empty conduits on the project shall be provided with a nylon pull rope to allow pulling of future conductors intended for the specific raceway. Provide plastic wire-tie style nameplate tags on each end of pull rope with printed identification of conduit use and the location of the opposite end of the rope.
   12. Minimum cover of conduits in ground outside of building - 24 inches, unless otherwise noted.

B. Conduit bodies and pull boxes:

1. Conduit Bodies: Malleable iron type, with lubricated spring steel clips over edge of conduit body, O-Z/Gedney type EW, or equal.
2. Pull boxes: All site pull boxes shall be flush in-ground concrete, with engraved covers identifying service use (i.e. electrical, communications, etc.). Boxes shall be Nema 250, Type 6, outside flanged, with recessed cover for flush mounting, by Christy or equal, with required depth to provide box and conduit depths shown or required.
   a. Provide concrete covers for all boxes in planted or paved areas (up to available concrete cover size).
   b. Provide galvanized steel covers for all larger boxes (when concrete is not available), or in traffic areas. No cast iron covers.
   c. Provide bolted covers and slab bottoms (with grouted perimeter) or vault type boxes for all electrical distribution and signal system pull boxes used for site distribution, to prevent rodent entry. No collar type boxes with dirt or gravel bottoms
   d. Provide drain hole at bottom of all vault type boxes, with loose aggregate base below, for proper drainage.
   e. All covers to be completely flush with finished adjacent surfaces.
   f. Provide galvanized steel H20 rated covers and installation of box rated for H20 in all traffic areas.
   g. Provide pullboxes per utility company specifications for all electrical primary and secondary services and for telecommunications service runs. Verify exact size and type prior to order with each utility company.

C. Wire and Cable (line voltage and signal systems):
1. 600-volt class where used for or run with line voltage power wiring, insulation color coded, minimum No. 12 AWG for power branch circuits, No. 14 for power control circuits, and wiring size and type as directed by signal system manufacturer for each signal system.
2. All conductors shall be copper.
3. Size and insulation type:
   a. Standard locations: #12 to #1 AWG: THWN for wet locations and THHN for dry locations. #1/0 through #4/0 AWG: XHHW (55 Mils). 250MCM and larger: XHHW (65 Mils). All wire sizes used shall be based on a 75 degree insulation rating, unless specifically used with 90 degree rated breakers and devices.
   b. All wiring (power and signal) installed underground between buildings, or in wet or damp locations, shall be outside listed and rated for wet locations.
   c. High temperature and non-standard locations: Provide wire type and insulation category suitable for area of use as defined in NEC table 310-13.
4. Conductors No. 8 and larger and as otherwise noted on drawings shall be stranded. Power conductors No. 12 and No. 10 shall be solid or stranded. Power conductors No. 14 or smaller shall be solid.
5. Provide control system wiring to meet the system manufacturers requirements and recommendations for each device or equipment type connection. Signal wiring systems shall be provided with shielding and/or insulation type and cable quantities as directed by the manufacturer, and meet all NEC requirements for locations used.
6. Install all wiring branch circuits and feeders (low voltage and line voltage) in conduit unless noted otherwise on the drawings. Contractor shall mandrel all feeders and pass a "sock" (or utilize other suitable means) through each raceway prior to pull to remove all water and construction debris. All raceways shall be completely clear of any obstructions or debris and all cut ends shall be reamed, prior to pull. Utilize pulling compound on all runs to insure minimum friction and pulling tension.
7. Megger test all new feeders prior to energizing. See section 26 08 00 for additional information.
8. Approximately balance branch circuits about the neutral conductors in panels.
9. Connections to devices from "thru-feed" branch circuit conductors to be made with pigtails, with no interruption of the branch circuit conductors.
10. Neutral conductor identified by white outer braid, with different tracers of "EZ" numbering tags used where more than one neutral conductor is contained in a single raceway.

11. Neatly arrange and "marlin" wires in panels and distribution panelboards with "T and B Ty-rap" or approved equal plastic type strapping.
12. All wire and cable shall bear the Underwriters' Label, brought to the job in unbroken packages; wire color-coded as follows:

a.	Voltage	Phasing	A	B	C	N
b.	120/240	3PH4W	Black	Orange	Blue	White
c.	2403PH	3W	Black	Red	Blue	--

13. The equipment grounding conductor shall be insulated copper; where it is insulated, the insulation shall be colored green.
14. Label each wire of each electrical system in each pull box, junction box, outlet box, terminal cabinet, and panelboard in which it appears with "EZ" numbering tags indicating the connected circuit numbers.
15. Properly identify the “high leg” of 4-wire delta connected systems (in each accessible location) as required by CEC 110.15 and 230.56.
16. Install feeder cables in one continuous section unless splices are approved by Architect. Exercise care in pulling to avoid damage or disarrangement of conductors, using approved grips. No cable shall be bent to smaller radius than the spool on which it was delivered from the manufacturer. Color code feeder cables at terminals. Provide identifying linen tags in each pullbox.

D. Equipment Disconnects: All disconnects shall be located to allow proper code required clearance in each area. Locations shown on drawings are diagrammatic only. The contractor shall coordinate exact locations in the field (with other trades) prior to rough-in to insure proper clearances.
1. Motor Disconnect Switches and Safety Switches: General Electric Company Heavy Duty Type "THD", cover interlocked with operating handle so that cover cannot be opened with switch in closed position and switch cannot be closed with cover in open position. 240V or 480V rating, single or multi-pole as required or as noted on drawings, in Nema 1 enclosure indoors or Nema 3R enclosure outdoors unless otherwise noted. Provide dual element motor circuit fuses sized as recommended by equipment manufacturer (for final equipment actually installed).
2. Code required disconnects: Provide a local disconnect in addition to the branch circuit protection device for all equipment as required by code (whether shown or not). Disconnects shall consist of a motor rated switch (or disconnect) for all motor loads less than 3/4HP or other suitable disconnect sized to match branch circuit conductors and load current of equipment, with number of poles as required.

E. Lugs and Connectors: Thomas and Betts "lock-tite", for No. 4 and larger wire; 3M "Scotchlock" fixed spring screw-on type wire connectors with insulator for No. 6 and smaller wire.
1. All splices shall be made up with screw-on type connectors - no plug-in or push-in style connectors acceptable. Wires shall be solidly twisted together with electricians pliers before screw-on connector is installed to ensure a proper connection in the event of wire nut failure. No exceptions.
2. Connectors listed or labeled for “no wire twisting required” are not an acceptable substitute for actual wire twisting.
3. Utilize porcelain type connectors in all high temperature environments (above 105 degrees Celsius).

F. Splice Insulation: "Scotch" electrical tape with vinyl plastic backing or rubber tape with protective friction tape for interior work.
1. Splices in electrical cables of 600 volt insulation class in underground system duct shall be made only in accessible locations such as pullboxes, light pole handholes, etc., using a compression connector on the conductor and by insulating and waterproofing (for exterior and underground locations) by one of the following methods:

a. Cast type splice insulation shall be provided by means of a molded casting process employing a thermosetting epoxy resin insulating material which shall be applied by a gravity poured method or by a pressure injected method. The component materials of the resin insulation shall be in a packaged form ready for convenient mixing after removing from the package. Do not allow the cables to be removed until after the splicing material has completely set.
b. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be applied. When the mold is in place around the joined conductors, the resin mix shall be prepared and poured into the mold. Do not allow cables to be moved until after the splicing materials have completely set.

G. Identification: Refer to Section 26 05 00.

PART 3 - EXECUTION

3.1 REFER TO BASIC ELECTRICAL REQUIREMENTS - SECTION 26 05 00 FOR WORK UNDER THIS SECTION.

3.2 TESTS

A. Testing and Inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 32 01
LITHIUM-ION BATTERY STORAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Battery Energy Storage System (BESS) design shown in the contract documents and these specifications is a "basis of design", to be used to establish the minimum system performance, sizing, function, and quality.

B. The system shall be configured as a non-export BESS system, with internal grid-isolation (for microgrid operation), generator input, and critical panel output.

C. The BESS shall normally operate in parallel with the electrical utility system to provide peak demand shaving (i.e. energy arbitrage) in a non-export configuration. Include all required CT's, monitoring, programming, and controls. Maximize owner benefit, with respect to utility rate plan and TOU schedules.

D. While isolated from the utility company via an internal transfer and grid isolation function, the BESS shall include microgrid capability, to provide power to the critical Panel as shown on the drawings (Panel A). This shall include required interface with the generator controls, and with a complete microgrid control system to operate the system (grid isolation, generator, and BESS) during both normal and microgrid use.

E. The BESS grid-forming inverter output maximum kW power rating shall be derated to 26kW in order to allow code compliant interconnection to the existing electric service panel bussing per CEC 705.12(B)(3)(2).

F. The BESS shall include a complete control system (with internal uninterruptable power system UPS) to provide the sequence of operation and other requirements as listed in these specifications.

G. The BESS shall include all equipment interface wiring and connections / CT's to allow monitoring and control of the facility electrical system as required to operate with the existing system.

H. The BESS shall include the following functions and equipment:
   1. Shall be interconnected to the facility main service panel to provide energy arbitrage/peak shaving of normal building loads during normal parallel utility operation.
   2. Shall include a set of batteries for energy storage, a grid-forming inverter for AC system output, and all monitoring and control system components.
   3. Shall include all required feeder CT's and interconnection wiring and programming to the system controller to monitor the normal utility supply, monitor and control the natural gas generator supply, monitor and control the grid-isolation function, and monitor and control the BESS supply or charging load.
   4. Shall allow microgrid operation when normal utility power fails. Microgrid operation shall occur when the main service isolation transfer switches away from the normal input source.
   5. During microgrid operation, the controller shall operat the critical power output panel, the generator, and the BESS, to allow proper and safe system operation witout the normal utility company connection.
   6. The generator shall be configured to feed the BESS when required, to support loads and charge the batteries.

7. After a normal power failure event and microgrid operation, the microgrid controller shall automatically reconnect to the normal utility grid when normal power is available again for a pre-determined delay time.This shall occur by transferring back to the normal supply source when normal utility supply is available and de-energizing the natural gas generator, if required. The BESS shall provide normal parallel utility operation when normal power is restored.

I. Since energy storage products and availability actively change over short periods of time, there is no guarantee that the specified products will be available at the time of bid and construction. This contractor shall include a complete system bid to equal the basis of design shown in the contract documents, including finalized shop drawings and any substituted products and installation, design parameters, and/or modified design calculations, and equipment or conduit / wiring / protection sizing.

J. Change orders for differences between the specified products and the products available at the time of bid and construction will not be approved. The intent is that the contractor include a complete battery energy storage / microgrid system to equal the basis of design, at the time of installation.

1.2 WORK INCLUDED

A. The Contractor shall provide and install a behind-the-meter Lithium-ion Battery Energy Storage System (BESS), sized as indicated on the single line diagram. Contractor shall provide all labor, material, equipment, engineering, maintenance, and capital to design, install, commission, and interconnect a BESS as required herein.

B. The BESS will be part of a micro-grid system along with the generator power system.

C. Electricity from the BESS must be provided at 60 Hertz and at the appropriate voltage and phase for electrical interconnection to the site distribution / electric service system. The BESS will interconnect at the main switchboard distribution section as indicated on the plans.

D. The BESS, and associated equipment, shall be provided in self-contained National Electrical Manufacturers Association (NEMA) enclosure(s) rated for the site conditions. BESS enclosures will be installed on a concrete pad constructed by Contractor at a location as indicated on the site plan. Contractor shall meet all the seismic requirements for equipment mounting as indicated in Section 260500 of the Specifications. Contractor provided thermal conditioning systems shall maintain ambient temperature within warranty requirements.

E. BESS components and associated ancillary equipment shall have working space clearances required by local code, and electrical circuitry shall be within weatherproof enclosures marked with the environmental rating suitable for the type of environment in compliance with NFPA 70.

F. The Contractor shall commission the BESS and provide a commissioning report documenting BESS performance during normal grid-tied operations and during grid failure.

G. Contractor is responsible for all permits, approvals, environmental compliance, freight, financing, procurement, monitoring, site inspection, billing, and incidentals as necessary to design, construct, and interconnect the complete BESS, described hereinafter.

H. Contractor shall provide a complete system of an alarm strobe light and related heat sensing cameras and/or sensors, with controls, and all related conduits and wiring, to alert when the battery system exceeds a specific heat threshold or exhibits flames.

1.3 WARRANTIES

A. Contractor shall provide 1 year of turnkey BESS maintenance and warranty service. Contractor shall also provide a warranty from the BESS manufacturer for the full life of the installation for consideration by the Owner.

B. Battery pack performance warranty for at least 10 years after the date of successful completion of commissioning. Battery pack shall retain at least 70% of nominal energy capacity for the earlier of either 10 years after commissioning.

C. Power conversion system warranty of at least 10 years from successful completion of the commissioning.

D. Full turnkey system warranty for 1 year from successful completion of the commissioning. Contractor shall respond within 3 days if maintenance is required.

1.4 APPLICABLE GUIDELINES / REGULATIONS / STANDARDS

A. All work must follow current National Electrical Code requirements:
   1. NFPA 855, “Standard for the Installation of Stationary Energy Storage Systems”

B. Battery cell:
   1. UL 1642 “Standard for Lithium Batteries”

C. Battery module:
   1. UL 1973 “Batteries for Use in Light Electric Rail Applications and Stationary Applications”

D. Battery system:
   1. UL 9540 “Energy Storage Systems and Equipment”
   2. UL 9540A “Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems”

E. Grid interconnection standards, as applicable to the project as a whole:
   1. Institute of Electrical and Electronics Engineers (IEEE) 1547
   2. UL 1741, “Standard for Static Inverters and Charge, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources”
   3. UL 62109-1 “Safety of power converters for use in photovoltaic power systems – Part 1: General requirements”

F. Other codes and standards that will apply include:
   1. UN 38.3 “Certification for Lithium Batteries” (Transportation)
   2. American National Standards Institute (ANSI) C12.1 (electricity metering)
   3. American Society of Civil Engineers (ASCE)-7 Minimum Design Loads for Buildings and Other Structures
   4. IEEE 2030.2, Guide for the Interoperability of Energy Storage Systems Integrated with the Electric Power Infrastructure

1.5 QUALITY ASSURANCE

A. Underwriters’ Laboratories shall certify the system.

B. Contractor Qualification - The contractor shall be approved by the BESS equipment manufacturer(s) to install the BESS materials, where such approvals are required.

1.6 INTERCONNECTION TO ELECTRICAL DISTRIBUTION SYSTEMS

A. It is the responsibility of the Contractor to meet the utility company interconnection requirements. The Contractor shall provide supporting documentation or drawings required by the utility company. Any local codes required by utility interconnection laws and regulations shall be followed by the Contractor.
   1. The system shall be non-export type.
   2. Serving Utility Electrical Distribution Systems Interconnections:
      a. The Contractor shall provide for interconnection of the behind-the-meter BESS with the Utility-owned electrical distribution system and take actions to ensure that the utility systems are compatible. Modifications or upgrades to the electrical system for interconnection are the responsibility of the Contractor. The Contractor will assume the costs of these modifications. Any modifications to the approved BESS design that would affect the electrical distribution system shall require the written approval of the Owner.
      b. The Contractor is responsible for complying with all electric utility interconnection requirements, including upgrades, providing all necessary BESS details for the interconnection applications, and funding any required interconnection studies to be performed. The Contractor is responsible for gaining approval from the electric utility for interconnection and any electric utility-required upgrades.

1.7 WORK PLANNING

A. The Contractor shall notify the Owner of any Contractor-planned utility service interruption not later than 21 working days prior to beginning the scheduled work that requires the utility service interruption. The Owner shall coordinate all utility outages and secure a final date when the outage may proceed. Every reasonable attempt shall be made to secure the Contractor's requested date. Under no conditions shall the utility service be interrupted by Contractor without prior written approval by the Owner.

1.8 PERMITS AND LICENSING

A. The Contractor shall be responsible for:
   1. Preparing all permitting and licensing applications for the project
   2. Paying all fees and complying with all requirements
   3. Providing any supporting documentation, data, and information that may be required for permitting
   4. Coordinating and acting as the primary liaison with permitting and licensing agencies

1.9 **LOCAL FIRE MARSHALL APPROVAL**

A. The Contractor shall involve the fire marshal or organization responsible for fire protection to provide design approval. The Contractor shall review the design of the system with the fire marshal and also observe design guidelines regarding firefighter access in the International Association of Fire Fighters and the CEC 2022.

B. The Contractor shall invite local firefighters to a training where firefighters will be shown how the BESS works and how to shut it down, form a fire suppression plan, and shall work with the fire marshal to determine where to post the permanent instructions and required markings. The

Contractor shall coordinate with local fire marshals on BESS setback requirements, first responder training, and posted instructions for shutoffs.

1.10 FEDERAL, STATE, AND LOCAL REBATES AND INCENTIVES

A. The Contractor shall complete and submit in a timely manner all documentation required to qualify each system for available incentives.

1.11 SUBMITTALS

A. The Contractor shall include BESS submittals, including:
   1. A site plan showing the BESS footprint
   2. Electrical schematic diagrams (interconnection, system one-line diagrams)
   3. Usable energy storage capacity (kWh)
   4. Rated power (kW AC)
   5. AC:AC efficiency (including auxiliary loads)
   6. Cycle life
   7. Annual degradation factor
   8. Ambient temperature control system
   9. Fire protection/suppression system description as required by code
   10. Equipment manufacturers and product names
   11. Battery Management System provider
   12. Maintenance requirements

B. The Contractor shall identify an appropriate location for the balance of system enclosure, and its related components and environmental control systems that will meet the following criteria:
   1. Ease of maintenance and monitoring
   2. Efficient operation
   3. Low operating losses
   4. Secured location and hardware
   5. Compatibility with existing facilities
   6. Minimum vegetative and landscape impact

C. All system wiring, components, conduits, and connections shall be suited for conditions for which they are to be installed.

1.12 OPERATIONS AND MAINTENANCE

A. The Contractor shall conduct annual O&M and continuous monitoring to verify that the BESS is performing as intended per the proposed battery storage strategy and manufacturer recommendations and submit an annual report to Owner. The report shall include:
   1. Use case performance
   2. Battery outages with root cause summary and start and end time periods.
   3. Summary of all O&M operations; repair and replacements
   4. Summary of safety incidents, causes and resolutions
   5. Contractor shall perform all required maintenance to the BESS and BMS to ensure that the monthly demand reduction is provided.
   6. Contractor will provide O&M training and supporting manuals to Owner personnel.
   7. Perform updates to the BMS dispatch strategy if required due to rate tariff or major site load profile changes.
   8. Ensure that all system firmware is up to date and meets cybersecurity requirements.

1.13 DELIVERY, STORAGE, AND HANDLING

A. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.

B. Appropriate protective clothing shall be worn when handling the equipment. Such clothing shall include hard hats and steel-toe boots when lifting materials to roof, and insulated gloves when working on an active system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable system manufacturers/vendors shall have been in the business of producing and/or installing similar commercial grade systems for the last 5 years minimum. Manufacturers shall provide their latest line of equipment, meeting all current industry standards.

B. For basis of design systems, the minimum performance of the system shall match the physical and electrical equipment characteristics as shown on the electrical drawings.

C. Substitute equipment is acceptable when meeting the minimum system performance matching the basis of design, requirements listed herein, and complying with all other technical aspects of the system.

2.2 PERFORMANCE

A. Grid outage scenario: Integrate the BESS with the generator being provided as part of this project. Install a microgrid control system and control generator as necessary to provide electricity to the critical panel upon grid failure.
   1. Configure BESS to provide seamless transition between utility power and microgrid. Optimize system to minimize generator use to conserve fuel.
   2. The BESS shall be demonstrated to perform on a recurring basis to ensure the Owner's desired site resilience and energy assurance. This interval testing frequency shall occur approximately every twelve months following final acceptance to ensure provision of power to the site in the event of a utility-provided power outage or interruption. This activity requires pre-coordination with the servicing utility in accordance with the approved interconnection agreement, and that coordination shall be led by the Contractor in consultation with the Owner's facilities management staff. This periodic demonstration shall stagger months, seasons, load, time of day, and weather variabilities, but shall be conducted at least every twelve (12) months. Periodic testing will be the responsibility of the BESS supplier. In the event of an actual utility power interruption exceeding 24 hours, the BESS's performance will satisfy this requested demonstration, thereby resetting the interval to twelve (12) months prior to the next required demonstration. Any deficiencies or anomalies beyond expected design parameters, in an actual event or demonstration event, are to be reported to the Owner within twenty-four (24) hours in writing, with recommended remediation or corrective steps to prevent recurrence.

B. Demand control scenario: Integrate the BESS to provide grid electricity usage and demand control/ peak shaving to limit demand (kW) to programmed setting. The BESS shall have a method for forecasting the peak load and automatically dispatching the battery or scheduling the charge/discharge in advance.

1. Time of Use Charge Reduction: Integrate the BESS to discharge during on-peak hours in accordance with the site's rate tariff.
2. A BMS (battery management system) shall be provided to control the charging and discharging of the equipment. The BMS shall be field programmable by connecting with a laptop and viewing/editing on a locally hosted web browser. Programming instructions and setpoints shall be shared with Owner staff.
3. BESS shall maintain a round-trip efficiency greater than 70% AC-in to AC-out (confirmable by operation over a single round-trip cycle from 0% state of charge to 100%, and back to 0% at standard conditions specified by the manufacturer), including thermal losses and auxiliary loads, over 10 years.
4. Contractor shall guarantee annual BESS savings as established in the proposal. Savings will be generated by discharging the battery during on-peak periods, as well as during peak billing demand periods. Contractor shall propose a methodology to calculate optimal savings, subject to review by Owner, and guarantee optimal savings.
5. Operations and Maintenance for the first year of operation.

2.3 THERMAL MANAGEMENT

A. The Contractor shall provide all components to operate the BESS within acceptable operating temperatures. Provide any thermal management systems and operating strategies required to maintain the BESS and inverter temperatures within manufacturer's recommendations at all times.

2.4 MODIFICATIONS AND ALTERATIONS OF OWNER PROPERTY

A. Modifications, alterations, and/or additions to existing facilities shall be designed and certified to satisfy applicable requirements of governing codes and standards.

2.5 GROUNDING

A. A suitable equipment grounding system shall be installed for the BESS. The grounding system shall provide personnel protection for step and touch potential in accordance with IEEE 80. The system also shall be adequate for the detection and clearing of ground faults within the BESS. The system should be grounded in all anticipated operating modes (e.g., grid-tied and islanded).

2.6 CONDUIT AND PREVENTING WATER INTRUSION

A. Conduit routing and fittings must be selected to prevent water intrusion into inverter enclosures, combiner boxes, switchgear, and transformers. Conduits are to connect through the bottom of enclosures and provide fittings to allow water to drain prior to entering the electrical enclosure. Any exterior PVC conduit must be Schedule 80.

2.7 LOCATING EQUIPMENT

A. Major electrical components, including the inverter, isolation transformer, and controls shall be installed in code-compliant enclosures. BESS location shall be above the 20 year flood plain and surge levels and shall be elevated higher than any pull vaults and conduit not sloped toward any BESS electrical component in order to prevent equipment flooding. BESS shall be located within a thermally conditioned enclosure.

2.8 EXPECTED SERVICE LIFE

A. Unless noted otherwise, all materials furnished for the project shall have an expected service life of at least 10 years.

2.9 SITE SERVICE CONDITIONS

A. Materials shall be designed to withstand the year-round temperatures and conditions to which they are exposed (sunlight, heat, humidity, rain, wind, sand/dust, seismic activity, salt air, fog, marine corrosiveness, etc.)

2.10 NEW EQUIPMENT

A. The Owner shall not accept used, reconditioned, after-market, or grey-market products or equipment. Any offeror supplying used, reconditioned, after-market, or grey-market products may be held responsible for damages to the Owner.

2.11 MARKINGS (LABELING)

A. Strict conformance to system marking requirements of BESS and their components is crucial for the safety of operators, service personnel, emergency responders, and others. Include all required and desired labeling language in the design drawings for Owner review.
   1. Electrical equipment and components used in BESS shall have markings that identify the manufacturer, size, type, ratings, hazard warnings, and other specifications.
   2. Labelling shall include posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.
   3. All disconnects shall be clearly labelled, indicating operating system voltage, current, and system rating.
   4. Equipment markings should never be removed and should be able to withstand the environmental conditions in which the equipment is installed (e.g., “UV rated” for outdoor labels, or on an embossed steel placard, designed for outdoor use and fastened with adhesive and rivets).
   5. Markings must be visible or easily accessible during and after installation. The Contractor shall be responsible for all field-applied markings as required by local, state, and federal codes.

2.12 DATA ACQUISITION AND MONITORING

A. Contractor shall provide a turnkey data acquisition and display system that allows the Owner to monitor, diagnose, and track the charging, discharging, and operating data of the BESS. Minimum requirement is the provision of a web-based monitoring and tracking system. Contractor shall provide internet connection to the BESS, distinct from Owner internet. Ensure that the data acquisition and monitoring solution is compliant with Owner cybersecurity. Monitoring and tracking systems shall include a historical database and real time data portal capturing the data in 15-minute intervals. A minimum of 36 months of data shall be stored by the Contractor and be made available for Owner download via the web portal. The data shall, at a minimum, comprise the following information and frequency of collection:
   1. Date, time.
   2. Apparent power (kVA)/phase, real power (kW) and Volts on each phase; recorded in 15-minute intervals.
   3. BESS state of charge
   4. Ambient temperature, hourly average at hourly intervals, either from on-site measurements or a reliable climate data service.

5. The web-based monitoring system shall report actual system performance and an estimate of expected performance.
6. The system shall allow Contractor to interact with BESS BMS to update settings and modify setpoints.

2.13 BESS SAFETY

A. The BESS shall have a Data Acquisition/monitoring/alarm system. System shall be described in the offeror’s proposal and shall include:
   1. Full monitoring of electrical power and related operational data, including voltage, current, and system temperature.
   2. Visual and audible alarm if potential safety hazard exists.
   3. Notification when preventive maintenance is needed.
   4. System level alerts shall be provided by the manufacturer over customer interface.

B. The BESS shall contain protective relays, circuit breakers, or fuses which self-protect the BESS in the case of internal electrical faults.

C. A detailed plan surrounding battery cell thermal runaway detection and mitigation systems in the BESS will be included in the submittal process, where applicable.

D. A visible disconnect shalll be installed that isolates BESS in accordance with utility interconnection requirements.

E. All electrical equipment, enclosures, disconnects, and overcurrent devices shall be clearly marked and identified. Markings shall reference the same designations called out in the final design drawings.

F. Develop posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.

PART 3 - EXECUTION

3.1 COMMISSIONING

A. A commissioning plan shall be provided by Contractor and approved by Owner prior to proceeding with inspection and commissioning:
   1. After Owner’s utility provides permission (interim for testing) to operate in parallel with the grid, the Contractor shall complete commissioning in accordance with Owner safety and commissioning plans, its own quality-control plan, manufacturer's recommendations, and franchise utility interconnection requirements. The Contractor shall document all performance measurements.
   2. The Contractor shall perform all work required for testing, start-up, and commissioning.
   3. The BESS shall be commissioned per the Electric Power Resource Institute (EPRI) “ESIC Energy Storage Commissioning Guide”, or by a similar standard reviewed and approved by Owner.
   4. Contractor shall give Owner ten (10) business days advance notice prior to starting commissioning. An Owner manager or representative shall be present during any or all phases of the start-up, commissioning, and testing activities.
   5. The system shall be started-up and tested in accordance with the regulations of the applicable interconnection standards. All possible anticipated modes of operation shall be tested (grid-tied, islanded).

6. The Contractor shall request and coordinate System Acceptance Testing with the utility and Owner for acceptance and certification of the BESS and permission to operate, after commissioning and final inspections are complete.
7. Commissioning shall include the Contractor's Data Acquisition System and enclosure thermal conditioning system.
8. A commissioning report shall be provided to Owner.

3.2 INSPECTIONS

A. The Project Manager or the delegated Project Manager's Representative may inspect the Systems at any time during construction or after the Systems have been put in operation. The Contractor may be ordered to stop work, or shut the systems down, if unsafe conditions or code violations are noted.

B. An initial inspection for Substantial Completion will be made when the work is complete to the point that the Contractor is ready to begin starting, testing, and commissioning the system. Following this inspection, the Owner will provide the Contractor with a punch list describing any incomplete work that must be complete prior to the Contractor's request for final inspection.

C. The Contractor shall give the Project Manager ten (10) business days advance notice, in writing, of the date the work will be ready for initial inspection.

D. A final inspection of all Systems shall be made only when all construction is complete in accordance with the terms and conditions set forth in the Contract and all punch list items identified in the initial inspection are complete. If, upon examination by the Project Manager and/or Owner inspection personnel, the project is determined not sufficiently completed to have warranted a final inspection, the Contractor may be charged for any additional cost of re-inspection.

E. The Contractor shall give the Project Manager ten (10) business days advance notice, in writing, of the date the work will be fully completed and ready for final inspection.

F. The Contractor's request for final inspection will not be approved unless documentation below, at a minimum, has been provided to, and accepted by, the Project Manager, in addition to all other contract requirements:
   1. Final as built drawings (record drawings), meeting as-built requirements
   2. Preventive maintenance work schedules and procedures
   3. Operation and maintenance manuals (electronic and hardcopy)
   4. Training manuals (electronic and hardcopy)
   5. Equipment documentation and spare parts lists
   6. Certificates of Authority Having Jurisdiction (AHJ) inspections

G. After commissioning is complete, the Contractor shall instruct and train Owner designated personnel on normal system operation and how to shut down the System in the event of an emergency. Owner may reasonably request additional training and Contractor will conduct such training at Contractor expense. Training may take place over multiple sessions to accommodate Owner's staff availability. The training session(s) may be recorded.

H. As soon as practicable, following final inspection, the Project Manager will inform the Contractor, in writing, of any discrepancies and/or omissions noted at the final inspection. The Project Manager shall also state the time allowable for replacement of material and performance or re-performance of any unsatisfactory work necessary before written notification of System Acceptance Testing.

I. Upon written notification that all deficiencies identified during the final inspection have been corrected, the Project Manager may schedule a follow up inspection to confirm all correct work is acceptable. Contractor shall then coordinate with utility, Owner, and any other AHJ to schedule System Acceptance Testing.

3.3 SUMMARY OF PROCESS

A. In summary, inspections and commissioning will follow the following sequence:
   1. Initial inspection for Substantial Completion of construction
   2. Commissioning may begin concurrently with the initial inspection
   3. Final inspection may be scheduled following completion of commissioning and approval of all documents shown in Section 3.2(vi) of this specification
   4. Contractor will be responsible for completing any re-work identified in the Final inspection prior to scheduling System Acceptance Testing

3.4 FINAL ACCEPTANCE

A. The Contractor shall notify the Owner not less than ten (10) business days prior to the anticipated date of System Acceptance Testing. The Owner shall be present at and observe the System Acceptance Testing, at the Owner’s sole cost.
   1. The System Acceptance Testing shall be witnessed by utility if required for interconnection approval and the Contractor shall meet the utility’s test notification requirements.
   2. In addition to utility and Owner System Acceptance Test standards, the test shall include, at a minimum, the following:
      a. While connected to grid power, start up the BESS until it achieves the minimum specified performance requirements. The acceptable productive power output will be measured in kW (AC) at the building electrical interconnection point and must be consistent with the specifications for the system.
      b. Contractor shall demonstrate the operation of one full charge/discharge cycle of the BESS and report on system performance.
   3. Approvals as required by the fire marshal and local electric utility will be a pre-requisite for acceptance and for authorization to energize the system(s).

B. Upon successful completion of System Acceptance Testing, Contractor shall send a Completion Notice and a copy of the System Acceptance Test report to the Project Manager so that the Owner can complete their final acceptance. Owner shall have ten (10) Business Days after receipt of the Completion Notice to review the System Acceptance Testing results and verify that the System installation is complete, safe, aesthetically acceptable, functional, constructed to all code requirements, does not interfere with Owner or tenant operations, and otherwise meets all other requirements. The Project Manager will notify the Contractor in writing of Final Acceptance.

C. If any of these requirements are not met, then the Owner shall provide Contractor with a detailed notice of such failure (a "Rejection Notice") within the ten (10) business day period, with details regarding the required remedy (including repeat of either partial or full System Acceptance Testing, if appropriate, at the discretion of the Project Manager or Project Manager’s Representative, and the time allowed to complete remedy. The Contractor shall promptly remedy, at Contractor’s cost, the items identified in the Rejection Notice and conduct any additionally required System Acceptance Testing (if required by the Rejection Notice) until the System Acceptance Testing indicates that the System meets the contract requirements. In each such case, the Contractor shall send a new Completion Notice to the Owner with a copy of the results of the new System Acceptance Testing as provided above and the foregoing procedures shall be repeated.

D. Written acceptance shall be final and conclusive except as regards latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's right under any warranty or guarantee, subject to the system performance warranty.

E. In summary, the following requirements must be fulfilled before final acceptance:
   1. System Acceptance Testing has been completed, with the System having operated at specified performance for one full charge/discharge cycle with power production levels consistent with proposed System's estimated production with 100% system availability, measured with applicable instruments and meters.
   2. The System has been approved for interconnected operation by utility (with signed interconnection agreement).
   3. Submission of as-built drawings and all documents required prior to final inspection described in Section 3.2 of this specification.
   4. Training fulfillment documentation.
   5. Commissioning report provided to Owner.

END OF SECTION

SECTION 26 32 14
BACK-UP POWER ELECTRIC GENERATOR

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide a complete natural gas powered back-up power generator plus accessories in a single common housing, as noted herein and as indicated on the Drawings. The generator shall be compatible with the existing 120/240V, 1PH, 3W, power branch being used for the BESS critical panel.

B. Provide CBC 2022 compliant seismic installation.

C. Manufacturer shall be responsible for providing a complete assembly of all components in one overall housing, which is certified to comply as an integrated assembly with CBC 2022 requirements.

D. If required due to local air regulations, the manufacturer shall provide technical assistance to Owner in securing all required local Air Quality Management District permits for installation of the back-up power generator, including review and inclusion of existing nearby engine generators, where applicable, in the site analysis.

E. The generator controls shall be interfaced with the battery energy storage system controls to provide automatic operation to accommodate the sequence of operation as determined by the battery energy storage system controller.

F. The Contractor shall include a Manufacturer-provided three-year engine-generator maintenance agreement as described herein as part of the bid. The maintenance agreement shall include an annual 2-hour full load test using a portable load bank.

1.2 SUBMITTALS

A. Refer to Section 26 05 00 for procedure.

B. Tests and Reports (Test Requirements are detailed in Paragraph 1.4).
   1. Provide certified test reports of the following:
      a. Factory tests.
      b. Field Tests: Test reports shall include dates performed, method of testing, test results, test interpretation and recommended action.
   2. Shop Drawings and Product Data
      a. The following list includes the required Shop Drawing information that shall be submitted for the generator:
         1) Physical dimensions and weights.
         2) CBC Special Certificate of Compliance with importance factor of 1.5 for all components and overall assembly.
         3) Brake horsepower of engine.
         4) Natural gas fuel consumption.
         5) Cooling requirements.
         6) Noise db level. Provide details of acoustical housing and factory testing to prove acoustical housing performance (74dbA at 7 meters).
         7) Electrical characteristics of generator, voltage regulator, and battery charger.
         8) Load graphs.

9) Control panel.
10) Elevation.
11) Wiring and control diagrams.
12) Interface with battery energy storage system.
13) Engine and generator details, including governor.
14) Location of available parts and service.
15) Confirmation that engine meets the latest required EPA Tier Exhaust Emission Compliance Statement, complies with latest CARB requirements for back-up standby equipment, and complies with the local Air Quality Management District requirements.
16) Details of base natural gas connection requirements.

3. Maintenance and operating instruction manuals; fully bookmarked PDF file, including approved shop Drawings, parts list, list of recommended spare parts, sources of purchase and similar information.

1.3 GUARANTEE

A. Provide a written guarantee against all defects in materials and application, which prevent proper functioning for one (1) year from date of acceptance of the project.

1.4 TESTS

A. Certified copies of factory test giving guaranteed performance characteristics to meet the Specifications should be furnished by the Manufacturer. The unit shall be tested at the Manufacturer's plant for performance of all functions including a 2-hour full load test, using 0.8pf reactive to 1.0pf resistive load banks and until all temperatures have been stabilized for at least 30 minutes.

B. The Manufacturer shall have field tests made of the generator and wiring systems in place by a qualified factory technician. The complete engine generator set with all of its appurtenances shall be tested after installation for all functions, including a 2-hour full load test with full-rated resistive (1.0pf) load bank. The Manufacturer shall supply all equipment necessary for the tests.

1.5 FUNCTION

A. The back-up generator shall function to start automatically and immediately upon a signal from the battery energy storage system controller. This may be upon failure of the normal power supply, or may be when the battery system cannot support the load completely or needs to be recharged, while also supporting load. The unit shall be automatically removed from the line upon resumption of the battery system taking over full power support, or after normal power is restored.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide and install a complete back-up power system, including power plant powered by natural gas and operated by means of a signal from the battery energy storage system. The system shall be complete, tested and meet all the functional requirements of a fully automatic back-up power source serving full load power stabilized at rated voltage and frequency within three seconds after normal power source failure.

2. The generating set shall be fully automatic and shall be complete with starting and control equipment, skid-mounted batteries, charger, acoustical enclosure, and other equipment necessary to provide a complete, fully automatic system.
3. Arrange for the services of a factory erection engineer for checking installation, making specified and all other necessary tests, making initial start, instructing operating personnel in operating unit through all of its functions to ensure that the unit is performing in accordance with the intentions of the Specifications.
4. Generator set shall be provided with a vertical scoop on discharge.
5. Manufacturers: Generac, Cummins-Onan, Kohler, or Caterpillar.
6. Power Plant:
    a. Rating shall be based on continuous standby power rating of the generator and with capabilities to carry 100% full load without damage to the engine, generator or components, and with capabilities for starting the largest motor scheduled for the standby power system while carrying full connected load at an altitude of 350 feet above sea level. Full load power ratings shall be as indicated on the drawing, continuous standby at 0.8 PF at 120/240V, 1PH, 3W.
        1) Voltage regulation shall be +/-0.5% for any constant load between no load and rated load.
        2) Frequency regulation shall be isochronous from steady state no load to steady state rated load.
        3) The engine generator set shall be capable of single step load pick up of 100% nameplate KW and power factor, less applicable derating factors, with the engine-generator set at rated operating temperature.
        4) Under motor starting conditions the generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified KVA load at near zero power factor applied to the generator set.
        5) Maximum transient voltage dip shall not exceed 35 percent below rated on application of the single largest surge load step.
    b. Provide unit and all accessories in a common weatherproof acoustical enclosure, with a common base for unit capable of skidding into place. Provide sound absorbing insulation on interior of weatherproof enclosure to produce overall sound rating noted above. All accessories, including muffler shall be concealed within common generator enclosure.
    c. Provide minimum 18" flexible section in all electrical, fuel and exhaust lines at connection to power plant.
    d. Provide flexible steel disc coupling to engine-generator.
    e. Provide lifting brackets.
7. Engine:
    a. The engine shall be 4-cycle design, water-cooled; series turbo charged with after cool, having no inherent unbalanced reciprocating forces. Operating speed shall be 1800 RPM.
    b. Starting by battery-driven starter. Include cranking sequencer, which shall give three (3) start attempts before locking out over-cranking protection.
    c. Governor shall be isochronous electronic as required to maintain generated frequency at 60 Hz. at 75% full load within a steady state band-width of (+/-) 0.25%. Frequency shall not vary over 3% from no load to full load. Governors using engine crankcase lube oil will not be acceptable. Governor shall be type EFC, Electronic Isochronous.
    d. Provide a cooling system with sufficient capacity for cooling engine when generator is delivering 100% full load for four hours at ambient of 40 degrees C at an altitude of 350 feet. Include water-circulating pump and thermostatic valve to maintain recommended engine temperature; radiator with drain and air vent and fan with protective guard; jacket water corrosion resistant heating elements (wattage as specified by engine manufacturer, rated at 240V, 1PH). Radiator shall be filled with antifreeze solution of strength as recommended by Manufacturer. Exhaust air shall be discharged vertically, using a scoop design.

e. All areas within 24 inches of the muffler shall be covered with 6 lb. density mineral wool. All piping shall be schedule 40 black pipe.
  1) The exhaust system, piping, and insulation shall be factory supplied and installed. Extend black standard weight iron pipe from the engine with 18" flexible connection between engine and muffler. The muffler shall be installed within the same overall enclosure as the engine-generator.

f. Provide a unit-mounted battery for engine start, 24-volt DC with a capacity of not less than 160-ampere hours at 20-hour rate. The battery shall also be sized for six starts of 30-second cranking duration each, with ambient 15 degree F, mounted on earthquake-proof tray on pad with all necessary battery cables, hydrometer and enclosure-mounted voltage-regulated battery charger in Nema 3R enclosure with float, taper, and equalize charge settings and with DC voltmeter, DC ammeter and circuit for low voltage alarm. Battery shall be lead-acid type.

g. Auxiliary switches for over-speed trip and automatic over-speed shut down at a speed 10% greater than the normal specified operating RPM. The engine shall shut down on over-speed, low oil pressure, high oil temperature and high water temperature by means of auxiliary switches, actuating signal lights and alarms.

h. Temporary batteries may be used for testing, but new, unused batteries shall be furnished after final testing is complete and before acceptance. New batteries shall be used for one generator start to demonstrate adequacy of final battery installation.

i. Engine exhaust emissions shall meet the latest adopted EPA Tier Exhaust Emission Compliance Statement, the latest CARB requirements for back-up standby applications, and the local Air Quality Management District standards.

B. Generator:

1. Rated for continuous standby service, complying with NEMA standards.
2. Brushless, balanced 4-pole revolving field type with rotating rectifier exciter mounted on end of shaft, single ball bearing support to starter housing, rotor connected by semi-flexible steel disc coupling to engine flywheel to assure permanent alignment free of injurious tensional vibrations at speeds up to 125% of synchronous. Rated for 105 degrees Centigrade rise.
3. Generator insulation shall be in accordance with latest NEMA standards using minimum Class H materials. All insulation system components shall meet NEMA MG1 temperature rise limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees centigrade.
4. A permanent magnet generator (PMG) shall provide excitation power for immunity to voltage distortion caused by non-linear loads. The PMG shall sustain excitation power for optimum motor starting and to sustain short circuit current at approximately 300% of rated current for not more than 10 seconds.
5. Voltage regulator of static solid state design to give (+/-) 2% regulation from no--oad to full load; instantaneous voltage dip less than 20% of rated when full load at rated power factor suddenly applied; and recovery to stable operation of voltage within 1% of rated within four seconds. The voltage regulator shall be of the asynchronous pulse width modulated type and shall be insensitive to severe load-induced waveshape distortion from SCR or thyristor circuits such as those used in UPS and motor speed control equipment. Manual adjustment of (+/-) 5% of normal to be included by a lockable device or screwdriver slot in rheostat shaft. All voltage sensing shall be 3-phase.
   a. The automatic voltage regulator shall be temperature compensated, solid-state design. The voltage regulator shall control build up of AC generator voltage to provide a linear rise and limit overshoot. The regulator shall include a torque-matching characteristic, which shall use differential rate of frequency change compensation to use the maximum available engine torque and provide optimal transient load response. Regulators, which use a straight line fixed volts per hertz characteristic, are not acceptable.
   b. Shielding of generator, exciter and regulator to prevent radio frequency interference.

c. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine-generator set manufacturer so that the characteristics shall be matched to the torque wave of the engine to provide the fastest possible system recovery from transient load changes and to prevent engine stall during transient overload conditions.

6. Control Equipment:
   a. Panel mounted with vibration isolators to plant frame. Top of panel shall not exceed 6'-6" above slab.
   b. The generator set shall be provided with a microprocessor-based control system, which shall be designed, to provide automatic starting, monitoring and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set and remote monitoring and control as described in this Specification. The control panel shall be mounted on the generator set.
   c. The control panel shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
   d. The control panel shall be UL508 labeled, CSA282-M1989 certified and meet IEC8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight and the enclosure door shall be gasket. There shall be no exposed points in the control panel (with the door open) that operate in excess of 50 volts. The controls shall met or exceed the requirements of Mil-Std 461C part 9 and IEC Std 801.2, 801.3 and 801.5 for susceptibility, conducted and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance.
   e. The generator set mounted control panel shall include the following features and functions:
      1) Three position control switch labeled RUN/OFF/AUTO: In the RUN position the generator set shall automatically start and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
      2) Red “mushroom-head” push-button EMERGENCY STOP switch: Depressing the emergency stop switch shall cause the generator set to immediately shut down and be locked out from automatic restarting.
      3) Push-button RESET switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
      4) Push-button PANEL LAMP switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed or after the switch is depressed a second time.
      5) Generator Set Metering: The generator set shall be provided with a metering set with the following features and functions:
         (a) 2.5-inch, 90-degree scale analog voltmeter, ammeter, frequency meter and kilowatt (KW) meter. These meters shall be provided with a phase select switch and an indicating lamp for upper and lower scale on the meters. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
         (b) Digital metering set, 0.5% accuracy, RMS type to indicate generator voltage, frequency, output current, output KW, KW-hours and power factor. Generator output voltage shall be available in line-to-line neutral voltages and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

6) Generator Set Alarm and Status Indication: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel.
   (a) Low oil pressure (alarm)
   (b) Low oil pressure (shutdown)
   (c) Oil pressure sender failure (alarm)
   (d) Low engine temperature (alarm)
   (e) High engine temperature (alarm)
   (f) High engine temperature (shutdown)
   (g) Engine temperature sender failure (alarm)
   (h) Low coolant level (alarm or shutdown--selectable)
   (i) Fail to crank (shutdown)
   (j) Over-crank (shutdown)
   (k) Over-speed (shutdown)
   (l) Low DC voltage (alarm)
   (m) High DC voltage (alarm)
   (n) Weak battery (alarm)
   (o) High AC voltage (shutdown)
   (p) Low AC voltage (shutdown)
   (q) Under frequency (shutdown)
   (r) Over current (warning)
   (s) Over current (shutdown)
   (t) Short circuit (shutdown)
   (u) Ground fault (alarm)
   (v) Under frequency (alarm)
   (w) In addition, provisions hall be made for indication of two customer-specified alarm or shutdown conditions. The non-automatic indicating lamp shall be red and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
7) Engine Status Information: The following information shall be available from a digital status panel on the generator set control:
   (a) Engine oil pressure (psi or kPA)
   (b) Engine coolant temperature (degrees F or C; both left and right bank temperature shall be indicated on V-block engines)
   (c) Engine oil temperature (degrees F or C)
   (d) Engine speed (rpm)
   (e) Number of hours of operation (hours)
   (f) Number of start attempts
   (g) Battery voltage (DC volts)
8) The Generator Control Panel shall monitor the status of each Automatic Transfer Switch. The monitoring for each Automatic Transfer Switch shall be:
   (a) ATS Normal Position
   (b) ATS Emergency Position
9) The ATS status for each switch shall also be displayed on the Generator Remote Annunciator.

f. Control Functions: The control system provided shall also include a cycle cranking system, which allows for user selected crank time, rest time and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each with 15-second rest periods between cranking periods.

g. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode the alternator excitation system shall be disabled.
h. The control system shall include an engine governor control which functions to provide steady state frequency regulation as noted elsewhere in this Specification. The governor control shall include adjustments for gain; damping and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
i. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
j. The control system shall include sender failure monitoring logic, which is capable of discriminating between failed senders or wiring components and an actual failure conditions.

7. Remote Indicator Panel: The remote annunciator panel shall be flush-mountable at the location indicated on the plans, with micarta label reading "Back-Up Generator Conditions," and with the following devices:
a. Green pilot light with engraving to indicate "ENGINE RUNNING."
b. One audible alarm with silencing switch to indicate engine start failure for any of the following reasons:
1) High water temperature.
2) Low oil pressure.
3) Over-speed.
4) Over-crank.
5) Low battery voltage.
c. Remote indicator panel shall include an amber light indication for each of the following:
1) Control switch not in auto position.
2) Low water temperature.
3) ATS in normal position (for each ATS).
4) ATS in emergency position (for each ATS).
d. Each of the functions listed previously in Paragraphs 2.(a) through (f) shall be indicated by a separate red warning light and each warning light shall be so engraved.

8. Output Circuit Breaker:
a. Provide engine-generator mounted circuit breaker with ratings as noted on the Drawings. Breaker handles shall not exceed 6’-6” above grade.

9. Weather Protective Sound Attenuated Enclosure:
a. The generator set and accessories, including muffler, shall be completely housed in a weather protective and sound attenuated enclosure. The enclosure shall have a cambered roof to prevent rain accumulation, shall include stainless steel hardware to prohibit rust, and shall include stainless steel retainers to hold doors securely in place. The enclosure sound level shall be as specified herein. The generator set and enclosure shall be U.L 2200 listed as a package.
b. Material used for the enclosure shall be 14-gage steel for panels and 12-gage steel for posts. Three hinged lockable access doors shall be provided on each side, with hold-open retainers as indicated in Paragraph 1 above. Non-hygroscopic sound insulating materials shall be provided on the interior walls. Rodent barriers shall be provided on inlet and outlet sides. Louvers shall be fixed. Oil and coolant drains shall be run to the exterior of the enclosure. Interior valves on the oil and coolant lines shall be provided for ease of service.
c. The enclosure shall completely house the muffler on the generator set.
d. Provide sheet metal scoop on radiator output, to direct the radiator exhaust air directly up and vertically out of the generator enclosure. Provide screen on output of scoop to prevent dirt, leaves, and bird incursions. Provide drain on floor of scoop to drain off any water. Provide access door in scoop for cleaning of any accumulated debris.

Scoop shall be factory-mounted as part of the engine-generator package. Provide detailed shop drawings of scoop with engine-generator submittals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The engine-generator set shall be mounted on a rigid steel chassis suitable for installation on seismic isolators.

B. The Contractor shall assist the Owner in preparing and submitting a permit-to-construct application to the local Air Quality Management District for installation of the engine-generator. The Contractor shall pay for permit and permit approval fees, and the Owner shall pay for annual operational fees. Granting of such permit will require a site-specific screening application followed by an analysis by the local Air Quality Management District.

C. Load tests shall be run as required in Paragraph 1.4 of this Section to the generator rated load after generator installation is complete. The Manufacturer shall provide auxiliary load banks for full-load testing of the generator. Manufacturer shall schedule the tests with the Owner so that final tests may be witnessed. Verify correct reading and operation of all meters, indicators and controls.

D. Readings required during both preliminary and final tests requested in Paragraph 1.04 shall be taken and shall include the following:
1. Frequency.
2. Voltage.
3. Current.
4. Wattage.
5. Ambient temperature.
6. Water temperature.
7. Oil pressure and temperature.
8. Protection: Provide protection facilities and procedures to prevent damage and deterioration.
9. Verify utility phase rotation prior to connection of the Generator to the distribution system. Modify the Generator output phase rotation to match the Utility Company.

3.2 INSTRUCTION AND MAINTENANCE

A. Instruct the Owner's personnel in the proper use, operation and maintenance of the set. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in the procedures to be followed, checking for the source of an operational failure or malfunction.

B. Maintenance Period: Starting at the date of acceptance of the Work, provide complete systematic inspection and maintenance for the first three years. Furnish trained experts and equipment to check, adjust, lubricate and otherwise maintain the generator set in operation without defects or deterioration. Replace or repair materials and parts, which become defective or deteriorated for any reason.

C. Furnish a factory-trained Engineer for a minimum of one working day prior to final acceptance of the generator installation, or as needed to satisfy Owner that the system is functioning properly. Testing and training for the new engine-generator installation will take place at non-standard times. Training and testing will take place on weekends, and could be scheduled on holidays and in the middle of the night, at the discretion of the Owner. Provisions shall be made in the bidding for this contract for such scheduling requirements.

D. Provide 3 year Manufacturer maintenance Contract, for the new engine-generator installation. This shall include two site visits per year and annual load-bank testing as specified in Paragraph 1.1 of this Section.

END OF SECTION