

2023

Shoalwater Bay Tsunami Refuge Tower - Operations and Maintenance
(O&M) Plan



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Operations and Maintenance (O&M) Plan

Shoalwater Bay Tsunami Refuge Tower

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1.0 Overview and Purpose:

1.1 Description of Tsunami Refuge Tower

The Tsunami Refuge Tower is a steel and concrete structure that is designed to provide a safe haven for people during a tsunami event located at coordinates 46.71036666950159, -123.99076771024555. The project location is listed as 4 Blackberry Lane, in Tokeland, Washington, about 1.2 miles south from 2373 Tokeland Road, Tokeland Washington. It is constructed with steel-reinforced footers that go 51 feet into the ground, providing a strong foundation that can withstand the forces of a tsunami. The tower stands about 33' at the first refuge level and approximately 43' at the second level. It is 40'x50' in width, with about 2,000 square feet per deck allowing for 400 people to occupy the structure safely at about 10' square feet available to each person. The tower is equipped with 12 backup batteries in cabinets on the first refuge level, as well as emergency food and water supplies, first aid, radio communications, and sheltering items in storage bins to ensure the safety and survival of those seeking refuge.

1.2 Purpose

The purpose of this Operations and Maintenance (O&M) Plan is to ensure that the Tsunami Refuge Tower is maintained to the highest standards and is always ready to provide a safe and secure shelter for people during a tsunami event. The O&M Plan outlines the maintenance schedule and procedures, emergency response plan, training and education requirements, record-keeping, quality control and quality assurance measures, communication and coordination protocols, budget and funding requirements, and additional resources.

1.3 Goals

The goals of this O&M Plan are to:

- Ensure the Tsunami Refuge Tower is properly maintained and is always in a state of readiness to provide a safe haven for people during a tsunami event.
- Establish clear procedures and protocols for maintenance, emergency response, training and education, and communication and coordination to ensure that all stakeholders are prepared and equipped to respond effectively.
- Foster a culture of safety and preparedness among personnel responsible for O&M of the Tsunami Refuge Tower, as well as among other stakeholders, including emergency services, local government agencies, and the public.
- Ensure that the Tsunami Refuge Tower conforms to relevant codes and standards, including FEMA p-646 and ASCE/SEI 7, and that it continues to meet the highest safety and security standards over time.



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2.0 Maintenance Schedule:

To ensure the Tsunami Refuge Tower is always in a state of readiness to provide a safe haven for people during a tsunami event, a comprehensive maintenance schedule must be established. This maintenance schedule should include regular inspections, repairs, and replacements to ensure that all components of the tower are functioning correctly and that they remain in good condition over time.

2.1 Regular Inspections

The following maintenance schedule is recommended for the Tsunami Refuge Tower:

- Monthly inspections of the tower's exterior, including the steel and concrete components, to identify any signs of damage, wear, or corrosion.
- Quarterly inspections of the interior of the tower, including the emergency supplies, backup batteries, and communication systems, to ensure they are functioning correctly and to identify any signs of damage or wear.
- Annual inspections of the steel-reinforced footers to ensure that they remain stable and secure.
- Bi-annual inspections of the backup batteries to ensure they are fully charged and functioning correctly.
- Regular testing of the communication systems to ensure they are functioning correctly and to identify any areas of weakness that need to be addressed.
- Regular replenishment of emergency supplies, including food, water, and first aid, to ensure they remain fresh and ready for use.
- Regular cleaning and maintenance of the tower's exterior and interior to ensure that it remains clean and free from debris, mold, and other hazards.
- Regular training and education for personnel responsible for O&M of the Tsunami Refuge Tower to ensure that they are equipped with the skills and knowledge necessary to perform their duties effectively.



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It is important to note that this maintenance schedule may be adjusted as necessary based on the specific conditions and requirements of the Tsunami Refuge Tower, as well as any changes in relevant codes and standards. Regular review and assessment of the maintenance schedule are critical to ensure that it remains effective and up-to-date over time.

3.0 Maintenance Procedures:

To ensure the Tsunami Refuge Tower is maintained to a high standard, it is important to establish detailed procedures for performing maintenance tasks. These procedures should be comprehensive and easy to follow to ensure that all maintenance tasks are performed correctly and in a timely manner.

3.1 Steel and Concrete Components

The following maintenance procedures are recommended for the Concrete and Steel components:

- Inspection and repair of the steel and concrete components:
- Visual inspection of the exterior of the tower for signs of damage, wear, or corrosion.
- Non-destructive testing to detect any signs of internal damage to the steel or concrete components.
- Repair or replacement of any damaged or corroded components.
- Regular cleaning and maintenance to ensure that the tower remains free from debris and hazards.

3.2 Backup Batteries

The following maintenance procedures are recommended for the maintenance of Backup Batteries:

- Inspection and maintenance of the backup batteries:
- Regular testing of the batteries to ensure they are functioning correctly and are fully charged.
- Replacement of any damaged or malfunctioning batteries.
- Cleaning and maintenance of the battery cabinets to ensure they remain free from debris and hazards.

3.3 Storage Bins:

The following maintenance procedures are recommended for inspection and maintenance of the storage bins and their contents:

- Regular inspection of the emergency supplies to ensure they remain in good condition and are ready for use.
- Replacement of any expired or damaged supplies.
- Cleaning and maintenance of the storage bins to ensure they remain free from debris and hazards.



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3.4 Communications Systems:

- Inspection and maintenance of the communication systems:
- Regular testing of the communication systems to ensure they are functioning correctly and are able to provide reliable communication in an emergency.
- Replacement of any damaged or malfunctioning components.
- Cleaning and maintenance of the communication equipment to ensure it remains free from debris and hazards.

It is important to note that these maintenance procedures should be adjusted as necessary based on the specific conditions and requirements of the Tsunami Refuge Tower, as well as any changes in relevant codes and standards. Regular review and assessment of the maintenance procedures are critical to ensure that they remain effective and up-to-date over time.

4.0 Emergency Response Plan:

In the event of a tsunami, the Tsunami Refuge Tower is designed to provide a safe haven for people in the affected area. To ensure the safety of those seeking refuge, it is important to establish a comprehensive emergency response plan that outlines procedures for evacuating to the tower, accessing emergency supplies, and contacting emergency services.

The following emergency response plan is recommended for the Tsunami Refuge Tower:

4.1 Evacuation to the tower:

- Refugees should be directed to the Tsunami Refuge Tower in the event of a tsunami warning or a tsunami event.
- Signage and other communication materials should be used to direct refugees to the tower and to inform them of the emergency response procedures.
- Refugees should be encouraged to move quickly and calmly to the tower, taking only essential items with them.
- Provide community members with copies of DNR tsunami evacuation walk map

4.2 Accessing emergency supplies:

Emergency supplies, including food, water, and first aid, are located in numbered bins on both refuge levels of the tower.

Refugees will be directed to the appropriate bins to access the supplies they need.

Volunteers and/or personnel responsible for O&M of the Tsunami Refuge Tower should be available to assist refugees in accessing the emergency supplies as needed – See Training.

4.3 Contacting emergency services:



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- The radio communications bench, located next to the Battery Cabinets on Refuge Level 1, is prominently marked for refugees to see when they first arrive.
- The radios available include Public Service bands to contact local emergency response personnel, as well as a HAM Radio.
- Refugees should be instructed on how to use the radios to contact emergency services and should be encouraged to do so in the event of an emergency.

It is important to note that this emergency response plan should be adjusted as necessary based on the specific conditions and requirements of the Tsunami Refuge Tower, as well as any changes in relevant codes and standards. Regular review and assessment of the emergency response plan are critical to ensure that it remains effective and up-to-date over time.

5.0 Training and Education:

To ensure that the Tsunami Refuge Tower is maintained to a high standard and that all stakeholders are prepared and equipped to respond effectively in an emergency, it is important to establish training and education requirements for personnel responsible for O&M of the tower, as well as for the public.

The following training and education requirements are recommended for the Tsunami Refuge Tower:

5.1 Emergency Response Procedures

- Training on emergency response procedures, including evacuation procedures, accessing emergency supplies, and contacting emergency services should be conducted one to two times a year during community wide events such as the Great Shake Out and Yellow Brick Road.

5.2 Maintenance Procedures

- Training on maintenance procedures, including inspection and repair of the steel and concrete components, backup batteries, storage bins, and communication systems.

5.3 Communications Protocols

- Training on communication protocols, including the use of the radios available on the tower.
- Regular refresher training to ensure that personnel remain up-to-date on emergency response procedures, maintenance procedures, and communication protocols.

5.3.1 Public Education

- Informational materials, including brochures, videos, and signage, should be developed to educate the public on the use, function, and life-saving features of the Tsunami Refuge Tower.
- Public education events, such as town hall meetings, should be held to provide an opportunity for members of the public to learn more about the tower and to ask questions.
- Regular drills and exercises should be held to allow members of the public to practice evacuating to the tower and accessing emergency supplies.



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It is important to note that the first public education on the use, function, and life-saving features of the Tsunami Refuge Tower occurred in October of 2022. Regular review and assessment of the training and education requirements are critical to ensure that they remain effective and up-to-date over time.

6.0 Record Keeping:

To ensure that the Tsunami Refuge Tower is maintained to a high standard and that all stakeholders are prepared and equipped to respond effectively in an emergency, it is important to establish record-keeping requirements that conform to FEMA P-646 and ASCE/SEI7. These requirements should include documentation of maintenance activities, emergency response drills, and personnel training.

The following record-keeping requirements are recommended for the Tsunami Refuge Tower:

Maintenance activities:

Records should be kept of all maintenance activities, including inspections, repairs, and replacements.

- Documentation should include the date and time of the activity, the name of the person or team responsible for the activity, a description of the activity performed, and any notes or observations regarding the condition of the component or system.
- These records should be retained for a period of at least five years.

6.2 Emergency response drills:

- Records should be kept of all emergency response drills, including the date and time of the drill, the name of the person or team responsible for conducting the drill, a description of the scenario, and any notes or observations regarding the performance of the participants.
- These records should be retained for a period of at least five years.

6.3 Personnel training:

- Records should be kept of all personnel training, including the date and time of the training, the name of the person or team responsible for conducting the training, a description of the training content, and any notes or observations regarding the performance of the participants.
- These records should be retained for a period of at least five years.

It is important to note that these record-keeping requirements conform to the recommendations set forth in FEMA P-646 and ASCE/SEI7. Regular review and assessment of the record-keeping requirements are critical to ensure that they remain effective and up-to-date over time.



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7.0 Quality Control and Quality Assurance:

To ensure that the Tsunami Refuge Tower is maintained to the highest standards, it is important to implement robust quality control and quality assurance measures. These measures should include regular review and assessment of maintenance activities, emergency response procedures, and personnel training to ensure that they are effective and up-to-date.

The following quality control and quality assurance measures are recommended for the Tsunami Refuge Tower:

7.1 Maintenance activities:

- Regular review and assessment of maintenance activities to ensure that they are being performed correctly and in a timely manner.
- Verification of maintenance records to ensure that all activities are being properly documented.
- Auditing of maintenance procedures to ensure that they conform to relevant codes and standards, including FEMA P-646 and ASCE/SEI7.
- Emergency response procedures:
 - Regular review and assessment of emergency response procedures to ensure that they are effective and up-to-date.
 - Verification of emergency response drill records to ensure that all drills are being properly documented.
 - Auditing of emergency response procedures to ensure that they conform to relevant codes and standards, including FEMA P-646 and ASCE/SEI7.

7.2 Community and Personnel Training:

- Regular review and assessment of personnel training to ensure that it is effective and up-to-date.
- Provide 1 to 2 community wide training exercises annually to the public.
- Verification of training records to ensure that all training activities are being properly documented.
- Auditing of training procedures to ensure that they conform to the Whole Community Approach and meet the benchmarks of FEMA's five mission areas of Protection, Preparedness, Mitigation, Response, and Recovery as well as meeting the prescribed elements of applicable core capabilities.

It is important to note that these quality control and quality assurance measures should be adjusted as necessary based on the specific conditions and requirements of the Tsunami Refuge Tower. Regular review and assessment of the quality control and quality assurance measures are critical to ensure that they remain effective and up-to-date over time.



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8.0 Communication and Coordination:

To ensure effective communication and coordination between personnel responsible for O&M of the Tsunami Refuge Tower and other stakeholders, it is important to establish clear communication protocols. These protocols should outline the roles and responsibilities of each stakeholder and should provide guidance on how to communicate and coordinate in an emergency.

The following communication and coordination protocols are recommended for the Tsunami Refuge Tower:

8.1 Emergency services:

- The radio communications bench, located next to the Battery Cabinets on Refuge Level 1, should be used to contact local emergency services, including police, fire, and medical services.
- Refugees should be instructed on how to use the radios to contact emergency services, and personnel responsible for O&M of the Tsunami Refuge Tower should be trained on the appropriate communication protocols.

8.2 Local government agencies:

- Personnel responsible for O&M of the Tsunami Refuge Tower should establish regular communication with local government agencies, including emergency management departments, to ensure that they are aware of the tower's capabilities and to facilitate coordination in an emergency.
- Communication should include regular updates on the status of the tower, including maintenance activities and emergency response drills.

8.3 Public

- Public education materials, including brochures, videos, and signage, have been developed to educate the public on the use, function, and life-saving features of the Tsunami Refuge Tower.
- Public education events, such as town hall meetings, annual Yellow Brick Road Health and Safety Fair should be held to provide an opportunity for members of the public to learn more about the tower and to ask questions.
- Regular drills and exercises should be held to allow members of the public to practice evacuating to the tower and accessing emergency supplies.

It is important to note that these communication and coordination protocols should be adjusted as necessary based on the specific conditions and requirements of the Tsunami Refuge Tower. Regular review and assessment of the communication and coordination protocols are critical to ensure that they remain effective and up-to-date over time.



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9.0 Budget and Funding

To ensure that the O&M Plan for the Tsunami Refuge Tower is adequately funded, it is important to establish a budget that reflects the estimated costs of maintaining the tower over time. The budget should include funding sources, estimated costs, and contingency plans to ensure that the tower remains safe and functional.

The following budget and funding requirements are recommended for the Tsunami Refuge Tower:

9.1 Estimated Cost

- The estimated cost of maintaining the Tsunami Refuge Tower over a five-year period should be approximately \$115,000.
- This should include costs for fresh paint application, replacement of emergency supplies, general maintenance (such as replacement of lights and other common items that break), and replacement of backup batteries.

9.2 Funding Sources

- The primary funding source for the O&M Plan is the Shoalwater Bay Indian Tribe.
- Additional funding sources may include grants, donations, and fundraising efforts.
- The budget should be broken down into typical budget lines, including personnel costs, materials costs, and equipment costs.

9.3 Contingency plans

- A contingency plan should be established in the event that unexpected maintenance or repair costs arise.
- This may include setting aside a percentage of the budget for unforeseen expenses or establishing a reserve fund for emergencies.
- A reserve fund of \$10,000 should be set aside to cover any unforeseen expenses. **Estimated**

Costs:

- Materials Costs: \$70,000
 - Paint and Batteries are expected to cost this much in a five-year period
- Personnel Costs: \$15,000
- Equipment Costs: \$20,000
- Contingency Fund: \$10,000
- The estimated cost for maintaining the Tsunami Refuge Tower over the next five years is approximately \$100,000. This includes costs for fresh paint application, replacement of emergency supplies, general maintenance (such as replacement of lights and other common items that break), and replacement of backup batteries.

Budget Conclusion:

It is important to note that the proposed budget and funding requirements may be adjusted based on the specific conditions and requirements of the Tsunami Refuge Tower. Regular review and assessment



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of the budget and funding requirements are critical to ensure that they remain effective and up-to-date over time. The proposed budget will help to ensure that the Tsunami Refuge Tower remains safe and functional for years to come.

It is important to note that these budget and funding requirements may be adjusted as necessary based on the specific conditions and requirements of the Tsunami Refuge Tower. Regular review and assessment of the budget and funding requirements are critical to ensure that they remain effective and up-to-date over time.



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Appendix A: Additional Resources

This section includes additional resources for the O&M Plan for the Tsunami Refuge Tower, including reference materials, forms, and checklists. The following documents are included:

Appendices

- A.1 Battery Maintenance Checklist**
- A.2 Lighting Schematic Diagram and Checklist**
- A.3 Lock Maintenance Checklist**
- A.4 Radio Equipment Checklist**
- A.5 Emergency Supplies Checklist**



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A.1 Backup Battery Maintenance Checklist:

Use this checklist to perform regular maintenance and inspections on the backup batteries in the Tsunami Refuge Tower.

Battery Type: _____

Date of Inspection: _____

Inspector Name: _____

Inspection Checklist:

- Verify that the batteries are securely housed in the designated cabinets on Refuge Level 1.
- Check the batteries for physical damage, including cracks, leaks, or other signs of wear and tear.
- Check the voltage level of each battery using a voltmeter or other testing device.
- Verify that the batteries are properly connected and that all cables and connections are secure.
- Inspect the battery terminals for corrosion or other signs of damage.
- Record the voltage level of each battery on the battery maintenance log.
- Charge any batteries that are below the recommended voltage level.
- If a battery is damaged or fails to hold a charge, replace it immediately.



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A.2 Lighting Maintenance Checklist:

Use this checklist to perform regular maintenance and inspections on the lighting systems in the Tsunami Refuge Tower.

Date of Inspection: _____

Inspector Name: _____

Inspection Checklist:

- Verify that all lights are working and are properly illuminated.

- Check for physical damage to light fixtures, including cracks, breaks, or other signs of wear and tear.

- Inspect light covers for damage or discoloration that may impact the amount or quality of light produced.

- Verify that all light bulbs are securely screwed in and functioning properly.

- Test light switches to ensure that they turn the lights on and off as intended.

- Verify that all lights are properly aimed and focused in the intended direction.

- Inspect electrical cords and wires for damage or fraying, and ensure that they are properly grounded.

- Verify that emergency lighting systems are properly charged and functioning.



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A.3 Lock Maintenance Checklist:

Use this checklist to perform regular maintenance and inspections on the locks in the Tsunami Refuge Tower.

Lock Type: _____

Date of Inspection: _____

Inspector Name: _____

Inspection Checklist:

- Check for physical damage to the lock, including cracks, dents, or other signs of wear and tear.

- Check that the lock is securely attached to the door or other surface, and that all screws and fasteners are tightened.

- Test the lock mechanism to ensure that it operates smoothly and without resistance.

- Verify that the lock can be opened and closed with the key or combination.

- Check the condition of the key or combination, and verify that it is the correct key or combination for the lock.

- If the lock is a combination lock, verify that the combination has not been changed or tampered with.



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A.4 Radio Equipment Maintenance Checklist:

Use this checklist to perform regular maintenance and inspections on the radio equipment in the Tsunami Refuge Tower.

Date of Inspection: _____

Inspector Name: _____

Inspection Checklist:

- Verify that all radio equipment is functioning properly and is properly connected.

- Test the radio equipment by making a test call to ensure that it is properly transmitting and receiving.

- Inspect all antennas to ensure that they are properly mounted and that their connections are secure.

- Test backup batteries to ensure that they are properly charged and functional.

- Verify that all radio equipment is properly labeled and easily identifiable to users.

- Test all radio bands to ensure that they are properly tuned and configured.

- Ensure that all necessary manuals and documentation are readily available for all radio equipment.

- Test all available channels to ensure that they are functioning properly and that they are able to communicate with the appropriate personnel.



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A.5 Emergency Supplies Checklist

Emergency Supplies Checklist:

Use this checklist to ensure that all necessary emergency supplies are stocked and readily available in the Tsunami Refuge Tower.

Date of Inspection: _____

Inspector Name: _____

Checklist:

1. Meals Ready-to-Eat (MREs):
 - Packs: 34 (12 packs per case)
 - Qty 408 MRE's
2. Emergency Blankets:
 - Quantity: 400
3. Survival Coffee:
 - Quantity: 2 (720-serving buckets)
4. Emergency Drinking Water:
 - Cases: 200 (64 pouches per box)
 - Qty 12,800 mylar pouched water
5. Tarps:
 - Size: 8x10 ft
 - Quantity: 25
6. Propane Patio Heaters:
 - BTU: 47,000
 - Quantity: 4
 - Full Propane Bottles: 4 (20 lb each)
7. Solar Rechargeable Flashlights:
 - Lumen: 1000
 - Quantity: 6



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8. Eco Gel Sanitation Packs:
 - Quantity: 4 (for camp toilets)
9. Bungee Cord Set:
 - Lengths: 10in, 18in, 24in, 32in, 40in
 - Quantity: 4 sets (24 pieces each)
10. Rugged Camp Toilets:
 - Quantity: 2
11. Zip Ties:
 - Quantity: 200
12. Pop-up Camp Showers:
 - Quantity: 2 (for toilet privacy)
13. Expanded Medical Kit
14. Toilet Paper:
 - Quantity: 20 rolls
15. Paper Towels:
 - Quantity: 20 rolls
16. Hand Sanitizers:
 - Quantity: Case of 20

Once all items have been checked and confirmed, sign and date the checklist to document the inspection.

Signed: _____ Date: _____

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SECTION 265000
GENERAL LIGHTING PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general information related to providing and installing all interior and exterior lighting systems throughout the project.

1.03 RELATED REQUIREMENTS

- A. Section 260923 "Interior Lighting Controls."
- B. Section 265600 "Exterior Lighting Systems."

1.04 DEFINITIONS

- A. Fixture: See "Luminaire."
- B. IP: International Protection or Ingress Protection Rating.
- C. LED: Light-emitting diode.
- D. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.05 WARRANTIES

- A. Submit a copy of manufacturers' written guarantees for each manufacturer for transmittal to the Owner, agreeing to repair or replace any and all defects in workmanship and/or materials for a period of two years, or as otherwise specified, from the date of final acceptance of the installation, without cost to the Owner.
- B. Submit the Contractor's written guarantee for a period of one year after the date of final acceptance, all apparatus installed by the Contractor to be free of mechanical and electrical defects in workmanship, and to replace the same if, in the opinion of the Architect, the responsibility lies with the Contractor.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

- A. All equipment covered in this section shall comply with all applicable standards of IESNA, National Electrical Code and all laws, codes and regulations of Federal, State, County and City authorities having jurisdiction over this work.
- B. All equipment shall be UL Listed. Equipment shall be listed for Wet or Damp locations, as stated in the luminaire schedule, or as specified by the luminaire catalog number.
- C. Luminaires shall be located so as not to provide any conflicts with barrier free spaces: Public Law 90-480 and American National Standards Institute A1117.1-1961
- D. NEMA WD 6 – Wiring Devices-Dimensional Requirements
- E. All work shall be inspected and approved by the appropriate authorities.

1.07 MATERIALS AND WORKMANSHIP

- A. All materials and apparatus required for the work, except as specified otherwise, shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the spaces. Where no specific kind or quality of material is given, an article acceptable to the Architect shall be furnished.
- B. All component parts of each item of equipment or device shall bear the Manufacturer's Nameplate, giving at least the name of the manufacturer, description, size, type, serial number, and electrical characteristics in order to facilitate maintenance or replacement. This nameplate shall not be visible during normal operation of the equipment.

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- C. Blemished, damaged, or unsatisfactory luminaires shall be replaced at the direction of the Architect in a satisfactory manner at no cost to the Owner. This includes manufacturer defects as well as damage or blemishes to luminaires during handling and installation. Special attention should be paid to the blades and baffles of luminaires.
- D. Luminaires that are installed and or used during construction must be protected from the construction activities, dirt and debris. Any luminaires showing dirt or debris must be cleaned prior to turnover of the area to the Owner.
- E. Whenever possible luminaires should not be used during construction. Whenever luminaires are used for work lights during construction, light sources shall be replaced according to the project specifications and/or luminaire schedule prior to turnover of area to Owner. All luminaires installed during construction must be sealed, bagged, and covered in plastic to prevent dirt and construction debris from entering the luminaire and accumulating on the reflector.

1.08 SUBMITTALS

- A. Cost Estimate:
 - 1. Contractor to provide line item pricing for each luminaire type listed in the luminaire schedule. Contractor to specify if labor is included.
 - 2. Contractor to provide line item pricing for each control type listed in the luminaire schedule. Contractor to specify if labor is included.
- B. Substitute Products Approval during Bidding:
 - 1. Substitutions for lighting equipment other than that specified will be considered if equal (or better and/or higher) in quality, performance, ratings and function; and similar in type, size and appearance.
 - 2. Substitutions are to be provided to the Architect, Electrical Engineer and Lighting Consultant at least fourteen days prior to proposals being presented to the Owner. Said substitution package shall include data on both the proposed substitution and the specified product is such detail as to permit the two products to be adequately compared. Said substitution package shall include samples of each substitution being proposed. Substitutions are solely at the proposer's risk and should not be considered as being acceptable until a written approval from the Architect, Electrical Engineer, or Lighting Consultant is issued to that effect. In the absence of approval not occurring prior to bid, the substitution should be considered as not being approved.
 - 3. Submit Electronic Submittals or four hard copies on request, of the substitution requests to the Architect. The Architect will distribute to the Owner, Electrical Engineer and Lighting Consultant. Contractor shall submit bid alternates for approval prior to bidding. Proposed alternates shall include specification sheets with adequate information for comparison. The Architect, Electrical Engineer or Lighting Consultant will issue a statement of approval or rejection within fourteen days of receiving the substitution documents.
- C. Shop Drawings and Product Submittals:
 - 1. Before releasing any materials, the Contractor shall submit manufacturers catalog cut sheets, diagrams, and a complete list of all of the equipment and materials which the Contractor intends to install. This list shall include, but is not limited to, the following:
 - a. Light standards and anchor bolts;
 - b. Bases including elevations showing depth in to soil, depth above finished surface, interface with adjacent surface elements, reinforcing steel, and concrete mix and strength.
 - c. Details on backing to be provided for wall mounted fixtures over 10 pounds to be wall mounted.
 - d. Luminaire mountings, luminaires, finishes, light sources, fixture hickey's, fixture studs, visible chains, visible cables, seismic supports, and ballasts;
 - e. Bolt plate covers;

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- f. Performance and Photometric data, and UL listing;
 - g. Wiring and connection diagrams of all luminaires, etc.
 - h. Lighting dimming control components specifications, if applicable.
- 2. The list shall include the brand name, any identifying numbers, relevant technical data, and any other information necessary for the agency responsible for maintenance of the system to procure exact replacements of any and all equipment and material used on the project. All equipment shall be new, first quality and approved by Underwriter's Laboratories, Inc.
 - 3. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 - 4. All luminaires of the same type classification shall be provided by the same manufacturer.
 - 5. Before releasing any non-standard, modification of standard specification product, semi-custom, or custom luminaires, the Contractor shall submit shop drawings which detail methods of assembly and fastening. Shop drawings shall also indicate colors and their locations on each lighting element for review and approval prior to releasing. Contractor shall also supply manufacturer descriptions on luminaires, light standard materials, fabrication performance, and installation.
 - 6. The Contractor shall submit all Certificates of Compliance supplied by the manufacturer of the equipment. This equipment shall include, but is not limited to, the following:
 - a. Luminaire mountings.
 - b. Luminaire standards and accessories.
 - c. Pole base and accessories.
 - d. Luminaires, light sources, drivers and ballasts.
 - e. Photometric data (if requested).
- D. Samples (when requested by the Architect, Electrical Engineer or Lighting Consultant)
- 1. Submit samples of finishes and also submit photometric data in electronic format from an independent testing laboratory to completely describe luminaire performance. Unless otherwise indicated, samples shall be as follows:
 - a. For standard catalog types: complete, production line samples, with all installation hardware, proper lamp(s), and equipped with a cord and plug.
 - b. Sample of a specially designed or developed luminaire shall be submitted for the purpose of ascertaining its photometric performance, quality of visible parts and details, maintenance features (including relamping process), method of installation, and safety features.
 - c. Luminaire samples shall be submitted for final review within thirty days after review of shop drawings. If, after a period of thirty days from rejection of samples, the luminaire cannot be made acceptable, then a luminaire (shop drawing and sample) by an alternative manufacturer shall be submitted at no cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS REQUIREMENTS

- A. Provide accessories as required for compatibility with installation requirements. Luminaire catalog numbers do not necessarily denote specific mounting accessories for where/how luminaire is to be installed.
- B. All materials used in fabrication and mounting luminaires shall be of a non-corrosive nature.
- C. Luminaires shall be free of light leaks. Luminaires shall be designed to provide adequate ventilation for both light sources and drivers or transformers.
- D. Luminaires shall be designed to hide mounting hardware from view when luminaire is completely installed. Exposed fasteners shall not be acceptable, except as noted on details.
- E. Wiring channels and lamp holder mountings shall be rigid and accurately manufactured.
- F. In adjustable luminaires, aiming and positive locking devices shall be provided.

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- G. All luminaires when installed shall be set true and free of warps, dents, or other irregularities. The finish of exposed parts or trims shall be as specified or as directed by the Architect/Engineer.
- H. All lamp holders shall be of high quality and shall securely hold light sources preventing vibration.
- I. Rivets, springs, and other hardware shall not be visible after installation.

2.02 PRODUCT DELIVERY AND STORAGE

- A. All components shall be packed in a manner consistent with ICC regulations to minimize damage during shipping.
- B. Store all luminaires, light sources, drivers and hardware flat, in a clean, dry area off the ground under watertight cover.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Report all defects. Contractor shall be held responsible for any existing defects that adversely affect the luminaire or its performance.
- B. Upon Architect's request, Contractor shall provide one sample of selected luminaires.

3.02 INSTALLATION

- A. The installation shall be in accordance with all governing local ordinances and regulations, the Drawings, these special provisions and those sections of the Standard Specifications which apply. All workmanship shall be first class and finished work shall present a neat, uncluttered appearance. The Contractor shall coordinate his work with other construction phases so as to provide a minimum of interference to the combined operations. Contractor shall also coordinate their work with the work on adjacent projects where required.
- B. Provide seismic calculations as necessary to validate the installation of all fixtures as appropriate for the seismic zone into which they are being installed. Furnish and install seismic components as necessary to complete the installation.
- C. Clean the housing, trim, reflector surfaces, lens of all luminaires after construction is complete, so as to render them free of any material.
- D. Any luminaire or lamp or lighting device damaged during construction shall be replaced without cost to the Owner.
- E. Replace all inoperative light sources, ballasts, drivers and transformers just prior to acceptance of Project by Owner. Verify that all light sources are installed are exactly as specified for each luminaire type.
- F. Notify Owner and/or Architect about field conditions at variance with contract documents before commencing installation. This includes but is not inclusive of changes in landscape type and location, and field verification of walls, boundary markers, signs, walkways, and other changes that affect location of equipment.
- G. It shall be the Contractor's responsibility to replace and restore all surface materials in kind, equal to, or exceeding those disturbed by trenching, excavation or backfilling operations. This includes but is not limited to: seeding, sodding, replacement of subbase, pavement, trees, and shrubs. All excess materials shall be disposed of as directed by the Architect.
- H. It is the contractor's responsibility to review and coordinate with the Architectural drawings for placement of luminaires and lighting control devices. The contractor shall also coordinate with Landscape drawings for location of luminaires at the exterior of the project.

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- I. It is the Contractor's responsibility to coordinate with other trades and with the local utility locator service.

3.03 LIGHTING AIM AND FOCUS

- A. It is the Contractor's responsibility to provide all necessary labor and materials for final focusing of all adjustable luminaires under the Architect's and/or Lighting Consultant's observation. The focusing of all adjustable luminaires will take place in a night test of system.
- B. Focusing shall take place immediately before the Project is turned over to the Owner. Focusing shall be complete after approval by the Architect and/or Lighting Consultant.
- C. All track mounted luminaires and accessories shall be stored by the contractor during construction and only installed during the focusing period. Track mounted luminaires should not be installed prior to the focusing period unless directed by the Architect and/or Lighting Consultant.
- D. Prior to the focusing, the Contractor shall verify in writing to the Architect and/or Lighting Consultant that all materials stored on site, including track luminaires, accessories and light sources are accounted for and ready for the focusing procedure.

3.04 TESTS

- A. Prior to final acceptance, the Contractor shall demonstrate by test to the Architect's and/or Lighting Consultant 's satisfaction that all the electrical and lighting equipment installations are in proper condition per drawings and specifications. The Contractor shall furnish all equipment and appliances to make the test.
- B. The Architect shall be notified at least two working days prior to energizing the lighting system and the system shall not be put into operation before the Architect is present. All lighting circuits and equipment shall be given an initial operational test, consisting of having the entire system energized for seventy-two consecutive hours without any failures of any type occurring anywhere in the system. All circuits shall test clear of faults, grounds and open circuits to the satisfaction of the Architect.
 1. Submit information of witness participation for all testing including but not limited to:
 - a. Witness(s) name, title, employer, address of the associated business, e-mail, and telephone information.
 - 1) Date, and time of arrival
 - 2) Date and time of departure
- C. After satisfactory completion of all tests, the illumination system shall be placed in operation. Final acceptance will not be made until the system has operated satisfactory for a period of not less than fourteen days.
- D. The Contractor shall be fully responsible for the system during this period of operation and he shall make any adjustment or repairs which may be required, and remedy any defects or damages which may occur, at Contractor's expense.
- E. Operation of the system shall not in any way be construed as an acceptance of the system or any part of it or as a waiver of any of the provision of the contract. Acceptance of the system is to occur when the Owner accepts the building.
- F. The Contractor shall not be required to pay for electrical energy consumed by the system during the period of trial operation.

END OF SECTION

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SECTION 265619
LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes all exterior luminaires used on the exterior of the building.
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices."
 - 2. Section 265000 "General Lighting Provisions."

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 SUBMITTALS, SAMPLES, HANDLING AND SHOP DRAWINGS

- A. See Section 265000 "General Lighting Provisions."
- B. See Luminaire Schedule located on drawings for additional information.

1.05 WARRANTY

- A. See Section 265000 "General Lighting Provisions."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7ement.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 LUMINAIRE REQUIREMENTS

- A. Manufacturers: See luminaire Schedule on drawings for acceptable manufacturers of individual luminaires.
- B. General:
 - 1. Provide new exterior luminaires of sizes, types, and ratings indicated, complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters, bases, backing, and wiring. Ship luminaires factory-assembled, with parts and components required for a complete installation. Design luminaires with concealed hinges and catches, with metal parts grounded as common unit, and construct as to dampen ballast-generated sound. Luminaires shall be UL Listed for Wet or Damp Location.
 - 2. The finish of all luminaires shall be treated in such a manner as to render it corrosion resistant. All metal surfaces of new luminaires shall be bonderized, galvanized or sherardized after fabrication and treated to provide rust inhibiting and finish coat

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adherence properties. All metal surfaces of refurbished materials should be made to match the original new condition.

- C. Lamp Rating: Lamp marked for **outdoor use**.
- D. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- E. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.03 LUMINAIRE STANDARDS

- A. A light standard shall consist of a metal pole, base, reinforcing, and connector bolts.
- B. All structural components of light standards, bases, couplers anchor bolts, luminaires, and other attachments to be used for lighting shall be designed for wind velocity or as required by local wind loading conditions.
- C. All standards shall have cable-entrance holes and hand holes with appropriate covers. Metal surfaces shall be free of any imperfections marring the appearance and or any burrs or sharp edges that may damage the cable.
- D. All metal poles shall be supplied with pole caps.
- E. All metal poles and base flanges shall have a powder coat finish. Paint color shall be as specified in the luminaire schedule.
- F. After erection and alignment of the light standard, the space between the foundation and the base plate shall be filled with non-shrink grout.
- G. Light standard assemblies shall be fabricated and placed in accordance with the details and dimensions shown on the Drawings, or as directed by the Architect. The careful erection and aligning of the components furnished shall be considered a most essential feature of the installation and shall be as near to true vertical alignment as practical.
- H. Where dissimilar metals are used in the materials of the light standard, contractor shall ensure protection against galvanic corrosion.
- I. The light standard and its accessories must be manufactured of material of like appearance.
- J. Provide removable unitized ballast/component tray with separable connector in all pole mounted luminaires.
- K. Luminaire Pole Bases: Size and construct as indicated on Drawings. Project anchor bolts per luminaire manufacturer and structural requirements or 2 inches minimum above base if not otherwise noted. Install poles on bases plumb; provide shims for adjustment. Provide structural grout around pole base.

2.04 FOUNDATIONS

- A. The Contractor shall be required to construct a new foundation at each location according to the electrical and structural details.
- B. All foundations shall be constructed to not less than minimum dimensions as designed by structural consultant including but not necessarily limited to reinforcing, concrete strength and mixture, depth, and elevation of the top of the base above finished grade, etc.. The size and number of conduit bends shall be installed in each foundation as indicated in the Drawings. The caged anchor bolt assembly shall be placed in the foundation so that it remains plumb and with the projection set as specified by the pole manufacturer. Anchor bolts shall be "caged" in a manner specified by the manufacturer and approved by the Structural Engineer. The top elevation of the foundation shall be set accurately and leveled.

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- C. All materials removed from the foundations and not required shall be disposed of as directed by the Owner.
- D. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- E. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- F. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: Dark bronze.
- G. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of custom color.
 - c. Color: As selected by Architect from manufacturer's full range.

2.05 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.

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4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Install all luminaires at locations and heights as indicated, in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that luminaires fulfill all requirements. All workmanship shall be first class and finished work shall present a neat, uncluttered appearance. The Contractor shall coordinate his work with other construction phases so as to provide a minimum of interference to the combined operations.
- E. Coordinate layout and installation of luminaires with other construction.
- F. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.
- G. Where a ground wire is indicated, connect ground wire to pole and luminaire ground; otherwise, provide a ground rod at each pole with grounding conductors.

3.02 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.254-mm thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

END OF SECTION

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SECTION 263100
DC BATTERY SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. System description.
 - 2. Inverters.
 - 3. System overcurrent protection.

1.03 DEFINITIONS

- A. IP Code: Required ingress protection to comply with IEC 60529.
- B. MPPT: Maximum power point tracking.
- C. PTC: PVUSA Test Condition. Commonly regarded as a "real-world" measure of PV output. See below for definition of "PVUSA."
- D. STC: Standard Test Conditions defined in IEC 61215.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and dimensions of individual components.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: To include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Open to manufacturers meeting the specifications as described herein and on the Contract Drawings.

2.02 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Seismic Qualification Certificates: For equipment, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2.03 SYSTEM OVERVIEW

- A. The system shall be designed to operate as a battery energy storage system that is grid connected to provide a utility connected source for battery charging and system loads. Upon

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failure of the utility electrical service the battery system will disconnect from the utility and continue to provide power to the connected loads using the batteries as the energy source. Refer to the system one line diagram on the drawings and the table below for the connected loads. The loads comprise of 24 V DC lighting loads, 12 V DC radio equipment loads, and one combination 120V NEMA 5-15R duplex / USB Charging receptacle. A summary of the connected loads and load profile is as follows:

Qty	Load Description	Amps	Volts	Watts	Hours per day	Watt hr/day
1	Lighting	45	24	1080	14.5	15,660
1	Receptacle (AC Power)	1.5	120	180	6	1080
1	USB Charging Station	0.05	24	1.2	16	19
1	Radio Transmit	7	12	84	6	504
1	Radio Standby	0.5	12	6	18	108
2	Gate Security Power Supply	0.25	24	6	24	288

2.04 INVERTER / CHARGER

- A. Manufacturer (Basis of Design. Other products acceptable):
 - 1. Samlex America Evolusion EVO-2224
- B. Inverter Type: Central.
- C. Control Type: Pulse-width-modulation control.
- D. Inverter Electrical Characteristics:
 - 1. Maximum Recommended PV Input Power: 2,200 kW.
 - 2. Nominal PV System Voltage: 24 V dc
 - 3. Nominal AC System Voltage: 120V ac
 - 4. Utility Interface: Utility-interactive inverter.
- E. Operating Conditions:
 - 1. Operating Ambient Temperatures: Minus 4 to plus 122 deg F.
 - 2. Relative Humidity: Zero to 95 percent, noncondensing.
- F. Charge controllers shall have the following:
 - 1. Overcurrent protection.
 - 2. Automatic transfer relay.
 - 3. Digital display.
 - 4. Transformer.
 - 5. Disconnect switch.
 - 6. Shunt controller.
 - 7. Shunt regulator.
 - 8. Surge overload protection.
- G. Enclosure:
 - 1. NEMA 250, Type 3R
 - 2. Enclosure Material: Coated Galvanized steel.
 - 3. Cooling Methods:
 - a. Fan convection cooling.
 - b. Passive cooling.
 - 4. Protective Functions:
 - a. AC over/undervoltage.

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- b. AC over/underfrequency.
 - c. Ground overcurrent.
 - d. Overtemperature.
 - e. AC and dc overcurrent.
 - f. DC overvoltage.
5. Standard LCD, four lines, 20 characters, with user display and on/off toggle switch.
- H. Disconnects: Rated for system voltage and conductor.
- I. Regulatory Approvals:
- 1. IEEE 1547.1.
 - 2. IEEE 1547.3.
 - 3. UL 1741.

2.05 AC AND DC OUTPUT

- A. Circuit breaker box with DIN rail mounted circuit breakers for the following output:
- 1. 120V AC
 - 2. 24V DC
 - 3. 12V DC
- B. Refer to the system one-line diagram on the Contract Drawings for quantity and rating of circuit breakers.
- C. Enclosure:
- 1. NEMA 250, Type 3R
 - 2. Enclosure Material: Coated Galvanized steel.

2.06 SYSTEM OVERCURRENT PROTECTION

- A. Circuit Breakers: Sized as needed for loads served. Refer to one-line diagram on the drawings.

2.07 ENERGY STORAGE

- A. Battery Array Capacity: Sized to support loads for a nominal 24 hours run time independent of the utility grid. (Estimated nominal capacity of 17kWh of usable energy storage.)
- B. Battery Type: Lithium iron phosphate.
- C. Battery Enclosure: NEMA 250, type 3R made from coated galvanized steel, independent from other system component enclosures.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Do not begin installation until mounting surfaces have been properly prepared.
- C. If preparation of mounting surfaces is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of equipment with other construction.
- C. Install inverters, energy storage, charge controller, rapid shutdown, and system control in locations indicated on Drawings.

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- D. Seismic Restraints: Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electric Systems."
- E. Wiring Method: Install cables in raceways.
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.03 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.

END OF SECTION