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Appendix 2A
Engineering Design Criteria

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Appendix A1
Foundations and Civil Engineering Design Criteria

Appendix A1. Foundations and Civil Engineering Design Criteria

The design, engineering, procurement, and construction activities on the Project will be in accordance with various predetermined standards and project-specific practices. This appendix summarizes the civil engineering codes and standards, design criteria, and practices that will be used during design and construction. These criteria form the basis of the design for the foundations and civil systems of the Project. More specific design information will be developed during the detailed design phase to support equipment procurement and construction specifications. It is not the intent of this appendix to present the detailed design information for each component and system, but rather to summarize the codes, standards, and general criteria that will be used.

Section B1.1 summarizes the applicable codes and standards, and Section B1.2 includes the general criteria for foundations, design loads, and site work.

A1.1 Design Codes and Standards

A1.1.1 General Requirements

The design and specification of work will be in accordance with all applicable laws and regulations of the federal government, the State of California, and the applicable local codes and ordinances. Except where noted otherwise, the latest issue of all codes and standards, including addenda, in effect at the start of the project will be used, or as otherwise specified by governing agencies. The codes and standards, including all addenda, in effect at the time of purchase will be utilized for material and equipment procurement.

The codes and the standards to be used in the design and construction include:

- Seismic standards and design criteria will follow the California Building Code (CBC).
- Specifications for materials will follow the standard specifications of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI), unless noted otherwise.
- Field and laboratory testing procedures for materials will follow ASTM standards.
- Design and placement of structural concrete and reinforcing steel will be in accordance with the codes, guides, and standards of the American Concrete Institute (ACI) and the Concrete Reinforcing Steel Institute (CRSI).
- Specifications for materials for roads will follow the California Department of Transportation (Caltrans) Standard Specifications.
- Design and construction of roads will follow the American Association of State Highway and Transportation Officials (AASHTO), Caltrans standards, and California Fire Code (CFC).
- Design and construction of the sanitary sewer system will conform to the California Plumbing Code (CPC), if applicable.
- Design and construction will conform to the federal and California Occupational Safety and Health Administration (OSHA and Cal/OSHA) requirements.

Other recognized standards will be used where required to serve as guidelines for the design fabrication, and construction.

A1.1.2 Government Rules and Regulations

The following laws, ordinances, codes, and standards are applicable to the civil engineering design and construction. In cases where conflicts between cited codes (or standards) exist the requirements of the more stringent code will govern.

A1.1.2.1 Federal

- Title 29, Code of Federal Regulations (CFR). Part 1910. Occupational Safety and Health Standards
- Title 29, CFR. Part 1926. National Safety and Health regulations for construction
- Walsh-Healy Public Contracts Act (Public Law [PL] 50-204.10)
- National Pollutant Discharge Elimination System (NPDES) (U.S. Environmental Protection Agency [EPA])

A1.1.2.2 State

- Business and Professions Code Section 6704, et seq.; Sections 6730 and 6736. Requires state registration to practice as a Civil Engineer or Structural Engineer in California.
- Labor Code Section 6500, et seq. requires a permit for construction of trenches or excavations 5 feet or deeper into which personnel must descend. This also applies to construction or demolition of any building, structure, false work, or scaffolding that is more than three stories high or equivalent.
- Title 24, California Code of Regulations (CCR) Section 2-111, et seq.; Section 3-100, et seq.; Section 4-106, et seq.; Section 5-102, et seq.; Section 6-T8-769, et seq.; Section 6- T8-3233, et seq.; Section 6-T8-3270, et seq.; Section 6-T8-5138, et seq.; Section 6-T8- 5465, et seq.; Section 6-T8-5531, et seq.; and Section 6-T8-5545, et seq. Adopts current edition of CBC as minimum legal building standards.
- Caltrans, Standard Specifications
- Title 8, CCR Section 1500, et seq.; Section 2300, et seq.; and Section 3200, et seq. Describes general construction safety orders, industrial safety orders, and work safety requirements and procedures.
- Regulations of the following state agencies as applicable:
  - Department of Labor and Industry Regulations
  - Bureau of Fire Protection
  - Department of Public Health
  - Water and Power Resources
- Vehicle Code, Section 35780 et seq. requires a permit from Caltrans to transport heavy loads on state roads.
- CPC California Plumbing Code 2022, if applicable.
- Other recognized standards will be used where required to serve as guidelines for design, fabrication, and construction. When no other code or standard governs, the CBC 2022 Edition will govern.

A1.1.2.3 Local

Alameda County, CA – Public Works Agency

A1.1.3 Industry Codes and Standards

A1.1.3.1.1 American Association of State Highway and Transportation Officials (AASHTO)

A Policy on Geometric Design of Highways and Streets

A1.1.3.1.2 American Concrete Institute (ACI)

ACI 117	Standard Specification for Tolerances for Concrete Construction and Materials
ACI 211.1	Standard Practice for Selecting Proportions of Normal, Heavyweight and Mass Concrete

ACI 301	Specifications for Structural Concrete for Buildings
ACI 302.1R	Guide for Concrete Floor and Slab Construction
ACI 304R	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 308	Standard Practice for Curing Concrete
ACI 309R	Guide for Consolidation of Concrete
ACI 311.4R	Guide for Concrete Inspection
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 318.1	Building Code Requirements for Structural Plain Concrete
ACI 347R	Guide to Formwork for Concrete

A1.1.3.1.3 American Society for Testing and Materials (ASTM)

ASTM A82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A116	Standard Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A121	Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens)
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C150	Standard Specification for Portland Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete

ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C289	Standard Test Method for Potential Reactivity of Aggregates (Chemical Method)
ASTM C443	Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C586	Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C1064	Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1752	Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D3034	Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3740	Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E329	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

A1.1.3.2 Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice

A1.2 Civil Design Criteria

A1.2.1 Foundations

A1.2.1.1 General

Geotechnical exploration, testing, and analysis determine the most suitable bearing methods for foundations. Criteria will be established to permit design of the most economical foundation that is compatible with the life expectancy and service of the structure. The results of the subsurface investigation, laboratory testing program, and geotechnical assessment will be performed and will define the design standards.

A1.2.1.2 Foundation Design Criteria

Foundations for all critical structures and equipment will be supported on reinforced concrete foundations. The design of reinforced concrete foundations will satisfy the requirements of ACI 318.

Detailed foundation design criteria, including allowable bearing pressures, will be developed based on the results of subsurface investigations.

A1.2.1.3 Equipment Foundations

Each piece of equipment will be supplied with a reinforced concrete foundation suitable for its operation. Where the equipment could induce excessive vibration, the foundation will be provided with adequate mass to dampen vibratory motions. Special consideration will be given to vibration and stiffness criteria where specified by an equipment manufacturer.

Minimum temperature and shrinkage reinforcing steel will be provided for equipment foundations unless additional reinforcement is required by design. Anchor bolts designed to develop their yield strength will be provided for critical equipment. For noncritical or lightly loaded equipment, concrete expansion anchors may be utilized to secure equipment to foundations.

A1.2.1.4 Rotating Equipment Foundations

Dynamic behavior will be considered in the design of foundations subjected to significant rotating equipment loads such as foundations for the steam turbine and the brine injection pumps. A dynamic analysis will be performed to determine the natural frequencies and dynamic responses of the foundation. To account for soil and structure interaction, geotechnical data will be used to determine the soil stiffnesses and damping coefficients used in the dynamic analysis.

A1.2.2 Design Loads

A1.2.2.1 General

Design loads for pavements and buried items will be determined according to the criteria described in the following sections unless the applicable building code or local condition require more severe design conditions.

A1.2.2.2 Wheel Loads

Loads excited on roadway pavements, buried piping, electrical duct banks, and culverts will be reviewed and selected prior to design of the underlying items. As a minimum, these items will be designed for

HL-93 loadings in accordance with AASHTO Standard Specifications. Loadings exceeding the HL-93 loadings will be considered where found applicable during the detailed design phase.

A1.2.3 Site

A1.2.3.1 Site Arrangement

The site arrangement will conform to all applicable laws, regulations, and environmental standards. The principal elements to be considered in selection of the site arrangement are the physical space requirements and relationships dictated by each of the major plant systems, and the constraints imposed by the physical size and existing topography of the site. Distances between various systems will be minimized for economy. However, adequate clearance between various plant systems will be provided as needed for construction, operations, maintenance, and fire protection. The plant will be configured to minimize construction costs and visual impacts while remaining operationally effective. Utility interconnections will be optimized.

A1.2.3.2 Site Preparation

Site preparation will consist of clearing and grubbing, the excavation of soils to design grade, and the preparation of fill slopes and embankments designed in such a fashion as to be stable and capable of carrying anticipated loads from either equipment or structures.

Root mats or stumps, tiles if any, will be removed and holes will be refilled with material suitable for embankment and compacted.

A1.2.3.3 Earthwork

Earthwork requirements are based on the results of the subsurface investigation. If additional geotechnical data is required for final design, the EPC Contractor will be responsible to obtain.

Shallow foundations built on controlled compacted structural fill and natural dense granular soils are expected to provide adequate bearing pressures. Estimated total static settlements and estimated liquefaction induced settlements will be summarized in the Geotechnical Study.

A1.2.3.3.1 Excavation

Excavation work will consist of the removal, storage, and/or disposal of earth, sand, gravel, vegetation, organic matter, loose rock, boulders, and debris to the lines and grades necessary for construction.

Confined temporary excavations will be sloped or braced to prevent cave-ins during construction. All excavation and trenching operations will comply with local, state, and federal OSHA regulations.

A1.2.3.3.2 Grading and Embankment

Graded areas will be smooth, compacted, free from irregular surface changes, and sloped to drain.

Final earth grade adjacent to buildings will be sloped away from the building to maintain proper drainage.

Cut-and-fill slopes for permanent embankments will be designed to withstand horizontal ground accelerations for seismic design criteria as defined by site-specific geotechnical investigation, this will likely result in flat slopes. Geogrid reinforcement for fill slopes and soil nailing for cut slopes may be used for steep slopes requiring soil reinforcement to resist seismic loading. Slopes for embankments will be no steeper than 2:1 (horizontal: vertical). The grading plan may require the use of retaining walls. These will also be designed for seismic design criteria as defined by site specific geotechnical investigation.

A1.2.3.3.3 Backfilling and Compaction

Areas to be backfilled will be prepared by removing unsuitable material and rocks. The bottom of an excavation will be examined for loose or soft areas. Such areas will be excavated fully and backfilled with compacted fill in accordance with the geotechnical investigation and recommendations.

Structural fill supporting foundations, roads, parking areas, etc., will be compacted as determined by ASTM D698. Embankments, dikes, bedding for buried piping, and backfill surrounding structures will be compacted in accordance with the Geotechnical Investigation and recommendations.

The subgrade (original ground), subbases, and base courses of roads will be prepared and compacted in accordance with Caltrans requirements or as specified by geotechnical investigation. Testing will be in accordance with ASTM and Caltrans standards.

A1.2.3.4 Site Drainage

The site drainage system will be designed to comply with all applicable federal, state, and local regulations. Onsite drainage will be accomplished by gravity flow, whenever possible. The surface drainage system will consist of mild slopes and open channels with road culvert crossings. The ground floor elevations and top of foundation of structures will be maintained at a minimum of 12 inches above the hydraulic grade line of the internal storm drainage network for a 100-year rainfall event. The graded areas away from structures will be at a minimum slope of 1%.

Design of the site drainage facilities will be performed in accordance with state and local government requirements. Drainage facilities will be designed for the flow resulting from a 50-year, 24-hour rainfall. They will also be designed to prevent flooding of permanent plant facilities and overflow of plant roads during a 50-year, 24-hour storm. The flow of stormwater within the site will be designed to generally follow the existing flow.

A1.2.3.4.1 Erosion and Sedimentation Control

The proposed site development will alter the land areas of the site. Existing vegetation will be removed during site preparation operations. This will be followed by the earthwork activities required for construction of specific facilities. Final finish grading will begin when all other earthwork operations are complete.

Erosion and sedimentation control will be provided to retain sediment on site and prevent violations of water quality standards.

A1.2.3.5 Roads

Access to the project site will be from a privately owned unpaved road from Altamont Pass Road to the project site. Access within the plant site will be provided via a graveled loop road that encircles the major equipment in the BESS equipment yard.

Unless otherwise required by Governing agencies, all other plant roads will generally be a minimum of 20 feet in width with a graveled and/or asphaltic cement paved surface.

A1.2.3.6 Fencing and Security

Chain-link security fencing will be provided around the facility site, substation, and other areas requiring controlled access. Fencing heights will be in accordance with applicable codes and regulatory requirements. Controlled access gates will be located at the entrances to secure areas.

A1.2.3.7 Sanitary Waste System

No sanitary waste system will be included as part of this Project.

A1.2.3.8 Spill Protection

Limited hazardous material and hazardous waste will be stored onsite. Spill containment measures will be provided for chemical storage areas as needed. In addition, all outdoor containment structures will have a volume equal to at least the capacity of the storage container plus the volume of rainfall from a 100-year, 24-hour storm additional volume from deluge systems or other fire protection measures shall also be considered. Where required for protection of the containment structure, appropriate surface coatings will be provided.

Appendix A2
Structural and Seismic Engineering Design Criteria

Appendix A2. Structural and Seismic Engineering Design Criteria

The Project design, engineering, procurement, and construction activities will be in accordance with various predetermined standards and Project-specific practices. This appendix summarizes the structural and seismic engineering codes and standards, design criteria, and practices that will be used during design and construction. These criteria form the basis for the structural design work. More specific design information will be developed during detailed design to support equipment procurement and construction specifications. It is not the intent of this appendix to present the detailed design information for each component and system, but rather to summarize the codes, standards, and general criteria that will be used.

Section B2.1 summarizes the applicable codes and standards, and Section B2.2 includes the general criteria for natural phenomena, design loads, materials, seismic design, and architecture. Section B2.3 describes the structural design methodology for structures and equipment. Section B2.4 addresses project hazard mitigation.

A2.1 Design Codes and Standards

A2.1.1 General Requirements

Work will be designed and specified in accordance with applicable laws and regulations of the federal government and the State of California and applicable local codes and ordinances. Except where noted otherwise, the latest issue of codes and standards, including addenda, in effect at the start of the project will be used. The codes and standards, including addenda, in effect at the time of purchase will be used for material and equipment procurement.

- A summary of the codes and the standards to be used in design and construction follows:
- Seismic standards and criteria will follow the California Building Code (CBC).
- Specifications for materials will follow the standard specifications of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI), unless noted otherwise.
- Field and laboratory testing procedures for materials will follow ASTM standards.
- Structural concrete and reinforcing steel will be designed and placed in accordance with the codes, guides, and standards of the American Concrete Institute (ACI) and the Concrete Reinforcing Steel Institute (CRSI).
- Structural steel will be designed, fabricated, and erected in accordance with the American Institute of Steel Construction (AISC)
- Steel components for metal wall panels and roof decking will conform to the American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members.
- Welding procedures and qualifications for welders will follow the recommended practices and codes of the American Welding Society (AWS).
- Metal surfaces for coating systems will be prepared following the specifications and standard practices of the Steel Structures Painting Council (SSPC) and the specific instructions of the coatings manufacturer.
- Masonry materials will be designed and erected in accordance with the ACI Building Code Requirements for Masonry Structures.
- Roof covering design will comply with the requirements of the National Fire Protection Association (NFPA).

- Design and construction will conform to federal and California Occupational Safety and Health Administration (OSHA and Cal/OSHA) requirements.

Other recognized standards will be used where required to serve as guidelines for design, fabrication, and construction. When no other code or standard governs, the CBC 2022 Edition will govern.

A2.1.2 Government Rules and Regulations

The following laws, ordinances, codes, and standards are applicable to structural design and. construction. In cases where conflicts between cited codes (or standards) exist, the requirements of the more stringent code will govern. The sections in the CBC have been quoted throughout this document as reference. These sections are based on the 2022 edition of CBC. However, the latest edition of CBC at the start of the project will apply to the engineering design.

A2.1.2.1 Federal

- Title 29, Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health Standards.
- Title 29, CFR, Part 1926, National Safety and Health regulations for construction.
- Walsh-Healy Public Contracts Act (Public Law [PL] 50-204.10).

A2.1.2.2 State

- Business and Professions Code Section 6704, et seq.; Sections 6730 and 6736. Requires state registration to practice as a Civil Engineer or Structural Engineer in California.
- Labor Code Section 6500, et seq. Requires a permit for construction of trenches or excavations 5 feet or deeper into which personnel descend. This also applies to construction or demolition of any building, structure, false work, or scaffolding that is more than three stories high or equivalent.
- Title 24, California Code of Regulations (CCR) Section 2-111, et seq.; Section 3-100, et seq.; Section 4-106, et seq.; Section 5-102, et seq.; Section 6-T8-769, et seq.; Section 6-18-3233, et seq.; Section 6-T8-3270, et seq.; Section 6-T8-5138, et seq.; Section 6-T8- 5465, et seq.; Section 6-T8-5531, et seq.; and Section 6-T8-5545, et seq. Adopts current edition of CBC as minimum legal building standards.
- Title 8, CCR Section 1500, et seq.; Section 2300, et seq.; and Section 3200, et seq. Describes general construction safety orders, industrial safety orders, and work safety requirements and procedures.
- Regulations of the following state agencies as applicable:
  - Department of Labor and Industry Regulations
  - Bureau of Fire Protection
  - Department of Public Health
  - Water and Power Resources

A2.1.2.3 Local

Alameda County – Public Works Agency

A2.1.3 Industry Codes and Standards

A2.1.3.1 American Concrete Institute (ACI)

ACI 117	Standard Specification for Tolerances for Concrete Construction and Materials
ACI 211.1	Standard Practice for Selecting Proportions of Normal, Heavyweight, and Mass Concrete

ACI 301	Specifications for Structural Concrete for Buildings
ACI 302.18	Guide for Concrete Floor and Slab Construction
ACI 304R	Guide for Measuring. Mixing, Transporting. and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 308	Standard Practice for Curing Concrete
ACI 309R	Guide for Consolidation of Concrete
ACI 311.4R	Guide for Concrete Inspection
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 318.1	Building Code Requirements for Structural Plain Concrete
ACI 347R	Guide to Formwork for Concrete
ACI 530	Building Code Requirements for Masonry Structures
AC1 530.1	Specifications for Masonry Structures

A2.1.3.2 American Institute of Steel Construction (AISC)

Code of Standard Practice for Steel Buildings and Bridges

Manual of Steel Construction

Specification for Structural Steel Buildings

Design Specification for Structural Joints Using ASTM A325 or A490 Bolts

A2.1.3.3 American Iron and Steel Institute (AISI)

Specification for the Design of Cold-Formed Steel Structural Members

A2.1.3.4 American Society for Testing and Materials (ASTM)

ASTM A36	Standard Specification for Structural Steel
ASTM A53	Standard Specification for Pipe. Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A82	Stranded Specification for Steel Wire, Plain, For Concrete Reinforcement
ASTM A106	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A108	Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel hardware

ASTM A185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A240	Standard Specification for Heat-resisting Chromium and Chromium-Nickel Stainless Steel plate, Sheet and Strip for Pressure Vessels
ASTM A276	Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A446	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Structural (Physical) Quality
ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM B695	Standard Specification for Coatings of Zinc mechanically Deposited on Iron and Steel
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C90	Standard Specification for Load-Bearing Concrete Masonry Units
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C109	Standard Test method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
ASTM C129	Standard Specification for Non-Load Bearing Concrete Masonry Units
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C270	Standard Specification for Mortar for Unit Masonry
ASTM C289	Standard Test Method for Potential Reactivity of Aggregates (Chemical Method)
ASTM C494	Standard Specification for Chemical Admixtures for Concrete

ASTM C586	Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks for Concrete Aggregates (Rock Cylinder Method)
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcinated natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete
ASTM C1064	Standard Test method for Temperature of Freshly Mixed Portland Cement Concrete
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
ASTM D1752	Standard Specification for Performed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E329	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

A2.1.3.5 American Society of Civil Engineers (ASCE)

ASCE 7-16	Minimum Design Loads for Buildings and Other Structures

A2.1.3.6 American Water Works Association (AWWA)

AWWA D100	Welded Steel Tanks for Water Storage

A2.1.3.7 American Welding Society (AWS)

AWS D1.1	Structural Welding Code - Steel
AWS D1.4	Structural Welding Code - Reinforcing Steel
AWS D1.6	Structural Welding Code – Stainless Steel

A2.1.3.8 California Energy Commission

Recommended Seismic Design Criteria for Non-Nuclear Generating Facilities in California

A2.1.3.9 Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice

A2.1.3.10 California Building Code

CBC California Building Code 2022

A2.1.3.11 Metal Building Manufacturers Association (MBMA)

Low Rise Building Systems Manual

A2.1.3.12 National Fire Protection Association (NFPA)

NFPA 22	Standard for Water Tanks for Private Fire Protection
NFPA 24	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 80	Standard for Fire Doors and Fire Windows

NFPA 850 Recommended Practice for Fire Protection for Electric Generating Plants

A2.1.3.13 Steel Structures Painting Council (SSPC)

Steel Structures Painting Manual, Volume 2, Systems and Specifications

A2.2 Structural Design Criteria

A2.2.1 Natural Phenomena

The design criteria based on natural phenomena are discussed in this section. The climatological data listed were retrieved from isopluvials for 100-year, 24-hour precipitation for the northern half of California, prepared by the U.S. Department of Commerce. National Oceanic and Atmospheric Administration, National Weather Service Office of Hydrology. The detailed design will be based on the latest available data at the start of the Project.

A2.2.1.1 Seismicity

A ground motion hazard analysis has yet to be performed and will be conducted at a later date.

A2.2.1.2 Snow

The plant site is located in a zero ground snow load area.

A2.2.2 Design Loads

A2.2.2.1 Dead Loads

Dead loads include the weight of all components forming the permanent parts of structures and all permanent equipment. The dead load of permanent equipment will be based on actual equipment weights. For major equipment, structural members and foundations will be specifically located and designed to carry the equipment load into the structural system. For equipment weighing less than the uniform live load, the structural system will be designed for the uniform live load.

The contents of tanks and bins at full operating capacity will be considered as dead loads. The contents of tanks and bins will not be considered effective in resisting uplift due to wind forces but will be considered effective for seismic forces.

A2.2.2.2 Live Loads

Live loads are the loads superimposed by the use and occupancy of the building or structure. They do not include wind loads, snow loads, or seismic loads.

Uniformly distributed live loads are specified to provide for movable and transitory loads, such as the weight of people, office furniture and partitions, portable equipment and tools, and other nonpermanent materials. These uniform live loads will not be applied to floor areas permanently occupied by equipment, with no access beneath. Uniform live loads for equipment lay-down areas will be based on the actual weight and size of the equipment and parts that may be temporarily placed on floors during dismantling, maintenance, installation, or removal.

The design live loads will be as follows:

- **Ground Floor (Grade Slab).** A uniform load of 250 psf, nonpermanent equipment weights, storage weights, or lay-down weights, whichever is greater, will be used.

- **Elevated Concrete Slabs.** A uniform load of 100 psf, nonpermanent equipment weights, storage weights, or lay-down weights, whichever is greater, will be used.

  Elevated concrete slabs will be designed to support either the prescribed live load or a single concentrated load of 2 kips, whichever produces the greater stresses. The concentrated load will be treated as uniformly distributed load acting over an area of 2.5 square feet and will be located to produce the maximum stress conditions in the metal decking for concrete slabs will be designed for a load during construction equal to the weight of concrete plus 50 psf (no increase in allowable stress).
- **Truck Loads.** A surcharge load of 250 psf will be applied to plant structures accessible to truck traffic. Road pavements, underground piping, conduits, sumps, and foundations subject to truck traffic will be designed for wheel loadings in accordance with Appendix C.1, Section 3.2.2.
- **Thermal Forces.** Thermal forces caused by thermal expansion of equipment and piping under all operating conditions will be considered.
- **Dynamic Loads**. Dynamic loads will be considered and applied in accordance with the manufacturer's criteria/recommendations and industry standards.

A2.2.2.3 Wind Loads

Wind loads for structures and their components will be determined in accordance with ASCE 7-16, using a basic wind speed of 104 mph at 33 feet above grade. Risk Category III will be used. Exposure category D should be used.

A2.2.2.4 Seismic Loads

Seismic loads will be determined in accordance with the requirements specified in Section B2.2.4.

A2.2.2.5 Other Loads

Other expected loads required to predict the structural response of structures will be considered where appropriate (i.e., water hammer, test loads, etc.).

A2.2.2.6 Load Combinations

Applicable code prescribed load combinations will be considered in the design of structures. As a minimum, the following load combinations will be considered, where allowable stress design is used:

- Dead load
- Dead load + live load + operating loads
- Dead load + live load + operating loads + 1.3 wind load
- Dead load + live load + operating loads + seismic /1.4
- Dead load + construction loads
- Dead load + live load + emergency loads
- 2/3 Dead load + wind load
- 0.9 Dead load + seismic/1.4 load

Operating loads include all loads associated with normal operation of the equipment (e.g., temperature and pressure loads, piping loads, normal torque loads, impact loads, etc.).

A2.2.2.7 Strength Requirements

Each load combination will not exceed the stress or strength levels permitted by the appropriate code for that combination.

A2.2.2.7.1 Concrete Structures

The required strength (U) of concrete structures will be at least equal to the following, or as required by 2022 CBC Section 1605.2:

- U 1.4 Dead
- U 1.2 Dead + 1.6 (Live + Earth) + 0.5 Roof Live
- U 1.2 Dead + 1.6 Roof Live + (0.5 Live or 0.8 Wind)
- U 1.2 Dead + 1.6 Wind + 0.5 Live + 0.5 Roof Live
- U 1.2 Dead + 1.0 Seismic + 0.5 Live
- U 0.9 Dead + 1.6 Wind + 1.6 Earth Pressure
- U 0.9 Dead + 1.0 Seismic + 1.6 Earth Pressure

A2.2.2.7.2 Steel Structures

The required strength (S) based on elastic design methods and allowable stresses (without 1/3 increase allowed for wind or seismic loading) defined in the AISC Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design, will be at least equal to the following:

- S = Dead
- S = Dead + Live
- S = 0.75 (2/3 Dead + Wind)
- S = 0.75 (0.9 Dead + Seismic/1.4)
- S = 0.75 (Dead + Live + 1.3 Wind)
- S = 0.75 (Dead + Live + Seismic/1.4)

For load combinations including seismic loading, frame members and connections will conform to the additional requirements of Sections 1633A and 2213A of the CBC.

A2.2.2.8 Factors of Safety

Minimum factors of safety for structures, tanks, and equipment supports will be as follows:

- Overturning - 1.50
- Sliding - 1.50
- Buoyancy - 1.20
- Uplift due to wind - 1.50

A2.2.3 Materials

A2.2.3.1 Structural Steel

Structural steel will conform to ASTM A572, GR 50 or other materials as required and accepted for use by the AISC Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design.

High-strength bolts for connections will conform to ASTM A325. Bolts other than high- strength bolts will conform to ASTM A307, Grade A. Non-headed anchor bolts will conform to ASTM A36, unless higher strength bolting materials are required by design. Drilled-in expansion bolts for concrete will be Hilti-Kwik Bolt TZ2, designed in accordance with ICC ESR-4266.

Structural steel will be detailed and fabricated in accordance with the AISC Code of Standard Practice and the AISC Specification for Structural Steel Buildings. Structural material will be fabricated and assembled in the shop to the greatest extent possible. Structural members will be welded in accordance with AWS D1.1. Columns will be milled to bear on the baseplate or cap plate. Connections will have a minimum of two bolts.

Exterior structural steel will be either hot-dip galvanized or shop-primed and finish painted after installation. Interior structural steel will be shop primed after fabrication. Surface preparation and painting will be in accordance with Steel Structures Painting Council standards. Galvanizing will be in accordance with the requirements of ASTM standards.

A2.2.3.2 Design

Reinforced concrete structures will be designed by the Ultimate Strength Method in accordance with the CBC and ACI 318, Building Code Requirements for Reinforced Concrete.

A2.2.4 Seismic Design Criteria

This section provides the general criteria and procedures to be used for the seismic design of buildings, structures, and structural components.

A2.2.4.1 Seismic Performance Objectives

The seismic performance objectives for this facility are:

- Resist minor levels of earthquake ground motion without damage.
- Resist moderate levels of earthquake ground motion without structural damage, but with some nonstructural damage.
- Resist major levels of earthquake ground motion without collapse, but with some structural as well as nonstructural damage.

To achieve these objectives and to meet the requirements of the CEC and local codes, the facility will be designed in accordance with the CBC.

A2.2.4.2 General Criteria

The plant site is located in Seismic Category D according to CBC Chapter 16. For seismic load calculations, the Importance Factor for Risk Category III structures (power plants) is 1.25 based on ASCE 7-16 Table B2-1. Accordingly, an Importance Factor of 1.25 will be used for all plant buildings, structures, and structural components except special use structures requiring higher Importance Factors as noted in Table B2-1.

Buildings and structures will be designed in accordance with ASCE 7-16 Chapter 12. Nonbuilding structures will be designed in accordance with ASCE 7-16 Chapter 15, and nonstructural components will be designed in accordance with ASCE 7-16 Chapter 13.

In addition to the 2022 CBC requirements, water storage tanks will meet the seismic design requirements of AWWA D100, Appendix C.1.

A2.2.4.3 Critical Structures

Critical structures are those structural components that are necessary for facility operation and are costly to repair or replace or that require a long lead time to repair or replace, or are used for the storage, containment, or handling of hazardous or toxic materials.

Seismic loads for critical structures will be determined by the equivalent lateral force procedure of ASCE 7-16. Table B2-1 identifies the critical structures and the associated seismic load coefficients that will be used in their design.

A2.3 Structural Design Methodology

This section describes the structural aspects of the design of the proposed facility. Each major structural component of the plant is addressed by defining the design criteria and analytical techniques that will be employed.

A2.3.1 Structures

A2.3.1.1 Enclosures

The various plant enclosures will provide support, protection, and access to the systems contained within their boundaries. Generally, each enclosure will be one story and pre-engineered.

A2.3.1.1.1 Foundation Loads

Foundation loads will be determined from the analysis and design of the superstructure and from the support of the equipment contained within the structure. The following loads will be considered:

- Dead loads
- Live loads
- Equipment and piping loads
- Wind loads
- Seismic loads

A2.3.1.1.2 Induced Forces

Each enclosure will be securely anchored to its foundation using cast-in-place steel anchor bolts designed to resist any induced forces.

A2.3.1.1.3 Structural System

Enclosures will be designed as AISC Type 1 rigid frames or as Type 2 simple braced frames. For resisting seismic lateral loads, the structures will be classified as ordinary structures with a concentric braced frame, an ordinary moment-resisting frame, or a special moment-resisting frame, in accordance with the definitions of ASCE 7-16.

The foundation systems for enclosures will typically consist of individual spread footings to resist the column loads, and an isolated slab-on-grade floor system.

A2.3.1.1.4 Structural Criteria

Building and enclosure steel frames will be designed and constructed using the materials and criteria set forth in Section B2.3.

A2.3.1.1.5 Analytical Techniques

Building and enclosure foundations will be designed as simple spread footings or mat foundations, using static analysis techniques. The foundations will be analyzed assuming a linear soil pressure distribution.

A2.3.2 Tanks

A2.3.2.1 Field-Erected Storage Tanks

Field-erected storage tanks will typically be vertical, cylindrical shells consisting of stainless steel or carbon steel construction with a protective interior coating. Tank roofs will be either self-supported domes or cones. Tank bottoms will be ground-supported, flat-bottomed, with a slope of 1 percent. Tanks will have ladders, landing platforms, and handrails to provide access to working areas. Vents, manholes, overflow piping, and grounding lugs will be provided as necessary.

A2.3.2.1.1 Foundation Loads

Foundation loads will be determined using project-specific design criteria. Tank and foundation design will include the following loads:

- Dead loads (including contained fluid load)
- Live loads
- Wind loads
- Seismic loads (including hydrodynamic loads)

A2.3.2.1.2 Induced Forces

Storage tanks will be securely anchored to their foundations using cast-in-place steel anchor bolts designed to resist tank-induced forces.

A2.3.2.1.3 Structural System

Each tank will be a cylindrical steel shell that resists lateral loading through shear in the tank wall. Overturning will be resisted by anchor bolts connecting the tank wall to the foundation.

A2.3.2.1.4 Structural Criteria

Tank structures will be designed and constructed using the criteria established in API 650 or NFPA 22, as applicable.

Foundations will be designed and constructed as reinforced concrete structures using the criteria in Section B2.3.

A2.3.2.1.5 Analytical Techniques

Tank foundations will typically be designed as circular ringwalls using static analysis techniques. Each ringwall will be proportioned to resist the design load of the tank and the maximum overturning moment due to wind or seismic loading. The ringwall will also be proportioned to resist maximum anchor bolt uplift force. Circumferential reinforcing steel will be provided in the ringwall to develop the hoop stress produced by the lateral soil pressure within the ringwall.

A2.3.2.2 Shop-Fabricated Storage Tanks

Shop-fabricated storage tanks will be either vertical or horizontal, cylindrical, carbon steel shells. The tanks will have ladders, landing platforms, and handrails, to provide access to working areas. Each tank will have nozzles for fill connection, fill drain, overflow, vent connections, manholes, and grounding lugs as necessary.

A2.3.2.2.1 Foundation Loads

Foundation loads will be furnished by the tank manufacturer and will be superimposed with loads for the foundation itself.

Typical loadings supplied by the manufacturer include:

- Dead loads
- Live loads
- Wind loads

- Seismic loads (including hydrodynamic loads)
- Temperature and pressure loads

A2.3.2.2.2 Induced Forces

Each tank will be securely anchored to its foundation using cast-in-place steel anchor bolts or concrete expansion anchors designed to resist tank-induced forces.

A2.3.2.2.3 Structural System

Each tank will consist of a cylindrical steel shell, either supported by integral legs or saddle supports, or with a flat bottom hearing directly on the foundation.

A2.3.2.2.4 Structural Criteria

Tanks will be designed by a tank manufacturer in accordance with the relevant ASME code, ANSI code, and ASTM standards.

A2.3.2.2.5 Analytical Techniques

The tank foundations will typically be designed using static analysis techniques assuming a rigid mat. The foundations will be analyzed assuming a linear soil pressure distribution. The mats will be proportioned such that the resultant of the soil pressure coincides as nearly as possible with the resultant of the vertical loading.

The tanks will be designed and analyzed by a tank manufacturer to satisfy the requirements of the relevant ASME code, ANSI code, and ASTM standards.

A2.3.3 Equipment and Equipment Foundations

Equipment will be designed in accordance with manufacturers' standards and applicable codes and industry standards. Equipment will be designed to resist project-specific environmental loadings, as applicable.

Foundations will be designed to resist the loadings furnished by the manufacturers and will be constructed of reinforced concrete.

A2.3.3.1 Equipment/Foundation Loads

Equipment and foundation loads will be determined by the manufacturers using project- specific design criteria. Typical loadings used for design will include:

- Dead loads
- Live loads
- Operating loads
- Wind loads
- Seismic loads
- Emergency loads

Foundation loads furnished by the equipment manufacturers will be superimposed with loads for the foundation itself.

A2.3.3.2 Induced Forces

The equipment will use steel anchor bolts, concrete expansion anchors, welds, and other equipment anchorage devices to resist equipment-induced forces.

A2.3.3.3 Structural System

Foundations will typically consist of individual pads bearing directly on a ground improvement system or compacted fill. For equipment located in enclosures, the pads may be constructed integrally with the grade slab.

A2.3.3.4 Structural Criteria

Equipment will be designed to resist project-specific criteria in accordance with the manufacturers' standards and applicable codes and industry standards.

A2.3.3.5 Analytical Techniques

Equipment foundations will typically be designed using static analysis techniques assuming a rigid mat. Foundations will be analyzed assuming a linear soil pressure distribution. Mats will be proportioned such that the resultant of the soil pressure coincides as nearly as possible with the resultant of the vertical loading.

Equipment will be designed and analyzed by the manufacturer to satisfy the requirements of the relevant codes and industry standards.

A2.4 Hazard Mitigation

The project will be designed to mitigate natural and environmental hazards caused by seismic and meteorological events. This section addresses the structural design criteria used to mitigate such hazards.

A2.4.1 Seismic Hazard Mitigation Criteria

This section describes the civil and structural design criteria that will be applied to the Project.

Project seismic design criteria were selected based on the following considerations:

- Compliance with applicable laws, ordinances, regulations, codes, and standards
- Life safety
- Structural behavior and performance
- Reliability of the plant
- Financial impacts from seismically induced outages
- Seismic probability and magnitude

The Project seismic design criteria were developed to incorporate these considerations using a systematic approach to correlate performance criteria with assumed risk level. The following procedure was used to establish the design criteria:

- The seismic hazards were assessed by studying the geologic features of the surrounding area. Major faults were identified, and information was collected regarding each fault’s proximity, capability, recurrence, and magnitude.
- The seismic risk associated with each source was assessed considering historical magnitudes.
- Appropriate design criteria and analysis methods consistent with the seismic performance criteria were established for each major plant structure, equipment, and component.

Specific design features that will be incorporated into the plant to mitigate the identified seismic hazards include:

- Appropriate analysis techniques will be employed to calculate structure-specific seismic loads.

- Plant structures, equipment, piping, and other components will be designed to resist the project-specific seismic loads.
- Critical equipment will be positively anchored to its supporting structure.
- Anchorages will be designed to resist project-specific seismic loadings.
- Adequate factors of safety against overturning and sliding due to seismic loads will be provided.
- The design of piping connections to structures, tanks, and equipment will consider differential seismic displacements between components.
- Adjacent structures will be seismically isolated from one another.
- Structural elements will be designed to comply with special detailing requirements intended to provide ductility.
- Connections for steel structures will have a minimum load carrying capability without regard to the calculated load.
- Lateral and vertical displacements of structures and elements of structures will be limited to specified values.
- Appropriate measures will be taken for soil liquefaction to limit damage.

The foregoing design features are intended to provide the degrees of safety for structures and equipment as follows:

- Resist minor earthquakes without damage. Plant remains operational.
- Resist moderate earthquakes without structural damage but with some nonstructural damage. Plant remains operational or is returned to service following visual inspection and/or minor repairs.
- Resist major earthquakes without collapse but with some structural and nonstructural damage. Plant is returned to service following visual inspection and/or moderate repairs.

A2.4.2 Meteorological and Climatic Hazard Mitigation

Meteorological and climatic data were used to establish the Project design basis. Portions of the data and the design basis that pertain to structural engineering are provided in this section.

Specific design features that will be incorporated into the plant to mitigate meteorological and climatic hazards include:

- Structures and cladding will be designed to resist the wind forces.
- Sensitive structures will be designed for wind-induced vibrational excitation.
- Roofs will be sloped and equipped with drains to prevent accumulation of rainfall.
- Site drainage systems will be designed to convey the runoff from a 24-hour rainfall event with a 10-year recurrence interval.
- Ground floor levels of structures will be placed a minimum 6 inches above finished grade.
- A variable height dike will surround the project site completely.
- Building drain lines will be installed with backflow prevention devices.
- The bases of plant equipment will be placed a minimum 6 inches above finished grade.
- The plant site will be graded to convey runoff away from structures and equipment.
- The foregoing design features will be incorporated in accordance with the applicable codes and standards identified in this appendix.

The degree of safety offered by these features is consistent with the requirements of the applicable codes and standards and the economic benefits these features provide.

Table A2-1. Seismic Load Coefficients of Critical Structures

Critical Structure	Importance Factor (I)
Fire Pump Pad	1.5
Fire Water Tank	1.5

Appendix A3
Architectural Design Criteria

Appendix A3. Architectural Design Criteria

The design, engineering, procurement, and construction activities on the P roject will be in accordance with various predetermined standards and project-specific practices. This appendix summarizes the architectural design and engineering codes and standards, design criteria, and practices that will be used during design and construction. These criteria form the basis that govern the architectural design of plant facilities. More specific design information will be developed during the detailed design phase to support equipment procurement and construction specifications. It is not the intent of this appendix to present the detailed design information for each component and system, but rather to summarize the codes, standards, and general criteria that will be used.

Section B3.1 summarizes the basic criteria, Section B3.2 identifies applicable codes and standards, and Section B3.3 includes the general performance requirements for building components.

A3.1 Criteria

Plant enclosures typically will be designed as single-story pre-engineered metal buildings (PEMB), with insulated metal wall and roof panels, and will be in compliance with the California Building Code and other applicable local, state and federal codes, standards and regulations, as well as site environmental conditions.

The enclosures will be laid out to accommodate the spaces required for plant equipment and operations. Aisles and clearances will provide access for operation, maintenance, equipment removal and egress. Personnel walkways to equipment (for routine maintenance), doors and other access points will be provided. Plant security, fire protection and fire rated separations, and life safety features will also be considered in the building layout.

The PEMB system shall be designed, engineered, and supplied by the vendor and shipped to the site as components to be erected in the field. Components include, but are not limited to the following:

1. Structural steel framing.
2. Metal roof panels.
3. Insulated and non-insulated metal wall panels.
4. Mineral wool core fire rated metal wall panels.
5. Translucent panels, where shown.
6. Thermal insulation and vapor barrier.
7. Metal liner panels.
8. Personnel and equipment doors, frames and door hardware.
9. Overhead coiling door.
10. Crane/Monorail beams and supports, where shown.
11. Trim, flashing, closures and sealants.
12. Accessories, including gutters, downspouts and splash blocks.
13. Other appurtenances as required for a complete installation.

Enclosures shall include equipment and systems to be fully functional for their intended use including, but not limited to the following: electrical, HVAC, fire protection, plumbing, lighting, telecommunication, security, furnishings, fixtures, and accessories. Steel backing and support shall be provided for all wall mounted equipment as required.

PEMBs designed for similar facilities typically are Type II-B non-combustible construction. The construction type and occupancies will be evaluated during detailed design. Wood framing material that supports combustion and materials containing asbestos shall not be used. Wood or other materials that support combustion shall not be used for interior finish materials or trim, except as included during detail design.

Highly polished, slippery materials shall not be used for finish floor surfaces.

A3.2 Codes and Standards

The Project will meet or exceed the requirements set forth in the latest adopted editions and published addenda of the following publications in effect on the date of contract award are a part of this section. Where conflicting codes, regulations or specifications occur, the more stringent supersedes.

A3.2.1 Building Codes

- California Building Code (Title 24, Part 2)
- California Electrical Code (Title 24, Part 3)
- California Mechanical Code (Title 24, Part 4)
- California Plumbing Code (Title 24, Part 5)
- California Energy Code (Title 24, Part 6)
- California Fire Code (Title 24, Part 9)
- California Green Building Standards Code (Title 24, Part 11)
- California Reference Standard Code (Title 24, Part 12)
- Standard for the Installation of Sprinkler Systems of California
- Americans with Disabilities Act (ADA Standards)

A3.2.2 Standards

A3.2.2.1 AAMA – American Architectural Manufacturers Association

AAMA 501.1	Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure
AAMA 501.2	Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems
AAMA 621	Voluntary Specifications For High Performance Organic Coatings On Coil Coated Architectural Hot Dipped Galvanized (HDG) And Zinc-aluminum Coated Steel Substrates
AAMA 1503	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
AAMA 2603	Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)
AAMA 2604	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)

A3.2.2.2 AISC – American Institute of Steel Construction

ANSI/AISC 303	Code of Standard Practice for Steel Buildings and Bridges
AISC 325	Steel Construction Manual (15th Edition)

AISC	Detailing for Steel Construction (3rd Edition)
ANSI/AISC 341	Seismic Provisions for Structural Steel Buildings
ANSI/AISC 360	Specification for Structural Steel Buildings
Design Guide 3	Serviceability Design Considerations for Steel Buildings
Design Guide 5	Design of Low- and Medium-Rise Steel Buildings
Design Guide 7	Industrial Building Design

A3.2.2.3 AISI – American Iron and Steel Institute

S100	North American Specification for the Design of Cold-Formed Steel Structural Members

A3.2.2.4 ASCE/SEI – American Society of Civil Engineers/Structural Engineering Institute

ASCE/SEI 7-22	Minimum Design Loads for Buildings and Other Structures
ASCE/SEI 7-22	Minimum Design Loads and Associated Criteria for Buildings and Other Structures

A3.2.2.5 ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers

90.1	Energy Standard for Buildings except Low-Rise Residential Buildings

A3.2.2.6 ASME – American Society of Mechanical Engineers

B30.17	Cranes and Monorails (With Underhung Trolley or Bridge)

A3.2.2.7 ASTM – American Society for Testing and Materials

A36/A36M	Standard Specification for Carbon Structural Steel
A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A307	Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60,000 PSI Tensile Strength
A529/A529M	Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
A563/A563M	Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)
A572/A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A755/A755M	Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products

A759	Standard Specification for Carbon Steel Crane Rails
A780/A780M	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A792/A792M	Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
A924/A924M	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
A992/A992M	Standard Specification for Structural Steel Shapes
A1008/A1008M	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable
A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B221M	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
C754	Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
C920	Standard Specification for Elastomeric Joint Sealants
C991	Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings
C1047	Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
C1107/C1107M	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
C1325	Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
C1363	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
D1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
D3841	Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels

D4214	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
D6226	Standard Test Method for Open Cell Content of Rigid Cellular Plastics
E72	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
E84	Standard Test Method for Surface Burning Characteristics of Building Materials
E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
E119	Standard Test Methods for Fire Tests of Building Construction and Materials
E283	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
E330	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
E331	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
E1592	Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
E1646	Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
E160	Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems
E1980	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
F436/F436M	Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
F1136/F1136M	Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
F1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
F2329/F2329M	Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
F3125/F3125M	Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

A3.2.2.8 AWS – American Welding Society

AWS A2.4	Standard Symbols for Welding, Brazing, and Non-destructive Examination
AWS D1.1	Structural Welding Code - Steel
AWS D1.3	Structural Welding Code - Sheet Steel

AWS QC1	Standard for AWS certification of Welding Inspectors

A3.2.2.9 CMAA – Crane Manufacturers Association of America

A3.2.2.10 DASMA – Door and Access Systems Manufacturers Association

A3.2.2.11 FM Global – FM Approvals

A3.2.2.12 GA – Gypsum Association

A3.2.2.13 IAS – International Accreditation Service

AC472	Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems

A3.2.2.14 MBMA – Metal Building Manufacturers Association

MBMA	Energy Design Guide for Metal Building Systems, Second Edition
MBMA	Metal Building Systems Manual
MBMA	Metal Roofing Systems Design Manual
MBMA	Seismic Design Guide for Metal Building Systems

A3.2.2.15 NAIMA – North American Insulation Manufacturers Association

A3.2.2.16 NEMA – National Electrical Manufacturers Association

A3.2.2.17 NFPA – National Fire Protection Association

NFPA 10	Portable Fire Extinguishers
NFPA 72	National Fire Alarm and Signaling Code
NFPA 80	Standard for Fire Doors and Other Opening Protectives
NFPA 252	Standard Method for Fire Tests of Door Assemblies

A3.2.2.18 OSHA – Occupational Safety and Health Administration

A3.2.2.19 PIP – Process Industry Practices

ARS08111	Standard Steel Doors and Frames Supplier Specification
ARS08112	Standard Steel Doors, Frames and Related Hardware Installation Specification
ARS08710	Standard Steel Door Hardware Supplier Specification
ARS13120	Pre-Engineered Metal Buildings
CVC01017	Plant Site Data Sheet
CVC01018	Project Data Sheet
STC01015	Structural Design Criteria

A3.2.2.20 RCSC – Research Council on Structural Connections

RCSC	Specification for Structural Joints Using High-Strength Bolts

A3.2.2.21 SDI – Steel Door Institute

A3.2.2.22 SMACNA – Sheet Metal and Air Conditioning Contractors' National Association

SMACNA	Architectural Sheet Metal Standards
SMACNA	HVAC Duct Construction Standards
SMACNA	Industrial Duct Construction Standards
SMACNA	Seismic Hazard Standards

A3.2.2.23 SSPC – Society for Protective Coatings

SP-1	Solvent Cleaning
SP-2	Hand Tool Cleaning
SP-6	Commercial Blast Cleaning
SP-15	Commercial Grade Power Tool Cleaning
Paint 15	Steel Joist Shop Primer/Metal Building Primer
Paint 20	Zinc-Rich Coating (Type I – Inorganic, and Type II – Organic)

A3.2.2.24 SJI – Steel Joist Institute

SJI	Standard Specifications and Load and Weight Tables for Open Web Steel Joists and for Joist Girders

A3.2.2.25 UL – Underwriters Laboratories

UL 10B	Standard for Safety Fire Tests of Door Assemblies

UL 10C	Standard for Safety Positive Pressure Fire Tests of Door Assemblies
UL 580	Standard for Tests for Uplift Resistance of Roof Assemblies
UL 723	Standard for Test for Surface Burning Characteristics of Building Materials
UL 790	Standard for Standard Test Methods for Fire Tests of Roof Coverings
UL 1040	Standard for Fire Test of Insulated Wall Construction
UL 2218	Standard for Impact Resistance of Prepared Roof Covering Materials

A3.3 Building Components

A3.3.1 Performance Requirements

A3.3.1.1 Structural Performance

Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual." The design of structures and their members, components, and covering will be per governing codes and references, except where the minimums are exceeded by other provisions of this document.

Design members to withstand all dead loads, live loads, snow loads, collateral loads from lighting, cable trays, piping, HVAC, fire suppression/detection, utility supports, overhead door loads, crane/monorail loads, seismic loads, and design loads due to pressure and suction of wind calculated in accordance with the applicable code.

A3.3.1.2 Thermal Movements

Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

A3.3.1.3 Metal Roof Panels

Structural Standing Seam Metal Roof Panels: Formed with 24-gauge face sheet, 3-inch high vertical ribs at panel edges and evenly spaced raised longitudinal planks, manufactured for sequential installation by attaching panels to supports using concealed clips and engaging edges of adjacent panels and mechanically seaming panel ribs together, sealed with factory applied sealant. Provide a factory coil coated finish with a Fluoropolymer two-coat system.

A3.3.1.4 Insulated Metal Wall Panels

Factory-foamed vertical wall panel system consisting of a 24-gauge exterior metal face sheet with a 26-gauge interior metal face sheet, bonded to factory foamed-in-place core in thermally-separated profile, with no glues or adhesives, and with factory sealed double tongue-and-groove joint, attached to supports using concealed fasteners. Provide a factory coil coated finish with a Fluoropolymer two-coat system.

A3.3.1.5 Mineral Wool Core Metal Wall Panels

If required, a fire-resistant vertical wall panel system consisting of a 24-gauge exterior metal face sheet with a 26-gauge interior metal face sheet laminated to a structural mineral wool core. Minimum 6-inch panel thickness to comply with 1-hour and 2-hour fire rating. Provide a factory coil coated finish with a Fluoropolymer two-coat system.

A3.3.1.6 Metal Liner Panels

Factory formed, 26-gauge, concealed fastener panels with interconnecting side joints, fastened to supports with concealed fasteners, with factory applied sealant inside laps when added moisture resistance is required. Provide a factory coil coated finish with a Fluoropolymer two-coat system.

A3.3.1.7 Thermal Insulation

Unfaced Metal Building Insulation: ASTM C991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; continuous, vapor-tight edge tabs, in thickness required to achieve minimum required thermal values.

A3.3.1.8 Exterior Hollow Metal Doors and Frames

Exterior steel doors shall be maximum duty, 14-gauge steel faced, full flush, factory assembled units conforming to requirements of ANSI/SDI A250.8. Fire rated doors shall comply with the requirements of NFPA 252, UL 10B and UL 10C. Select doors will have cardkey secured access, which will be defined in detailed design.

A3.3.1.9 Accessories

Provide components required for a complete metal roof panel assembly including copings, fascia, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items.

Appendix A4
Mechanical Engineering Design Criteria

Appendix A4. Mechanical Engineering Design Criteria

This section summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of mechanical engineering systems. More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement specification, and construction specifications.

A4.1 Codes and Standards

The design of the mechanical systems and components will be in accordance with the laws and regulations of the federal government, State of California, Alameda County, California Codified Ordinances, and industry standards. The current issue or revision of the documents at the time of the filing of this Application for Certification (AFC) will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirements shall apply.

The following codes and standards are applicable to the mechanical aspects of the power facility.

- California Building Standards Code, 2022
- American Gear Manufacturers Association (AGMA)
- Air Moving and Conditioning Association (AMCA)
- American Society for Testing and Materials (ASTM)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- American Welding Society (AWS)
- National Fire Protection Association (NFPA)

A4.2 Mechanical Engineering General Design Criteria

A4.2.1 General

The systems, equipment, materials, and their installation will be designed in accordance with the applicable codes; industry standards; and local, state, and federal regulations, as well as the design criteria; manufacturing processes and procedures; and material selection, testing, welding, and finishing procedures specified in this section.

Detailed equipment design will be performed by the equipment vendors in accordance with the performance and general design requirements to be specified later by the project A/E firm. Equipment vendors will be responsible for using construction materials suited for the intended use.

A4.2.2 Materials – General

Asbestos will not be used in the materials and equipment supplied. Where feasible, materials will be selected to withstand the design operating conditions, including expected ambient conditions, for the design life of the plant. It is anticipated that some materials will require replacement during the life of the plant due to corrosion, erosion, etc.

A4.2.2.1 Pumps

Pumps will be sized in accordance with industry standards. Where feasible, pumps will be selected for maximum efficiency at the normal operating point. Pumps will be designed to be free from excessive vibration throughout the operating range.

A4.2.2.2 Tanks

Large outdoor storage tanks will not be insulated except where required to maintain appropriate process temperatures or for personnel protection.

Overflow connections and lines will be provided. Maintenance drain connections will be provided for complete tank drainage.

Manholes, where provided, will be at least 24 inches in diameter and hinged to facilitate removal. Storage tanks will have ladders and cleanout doors as required to facilitate access/maintenance. Provisions will be included for proper tank ventilation during internal maintenance.

A4.2.2.3 Welding

Welders and welding procedures will be certified in accordance with the requirements of the applicable codes and standards before performing any welding. Records of welder qualifications and weld procedures will be maintained.

A4.2.2.4 Painting

Except as otherwise specified, equipment will receive the respective manufacturer's standard shop finish. Finish colors will be selected from among the paint manufacturer's standard colors.

Finish painting of uninsulated piping will be limited to that required by OSHA for safety or for protection from the elements.

Piping to be insulated will not be finish painted.

Appendix A5
Instrumentation and Control Design Criteria

Appendix A5. Instrumentation and Control Design Criteria

This appendix summarizes the codes, standards, criteria, and practices that will be generally used in the design and installation of instrumentation and controls for the Project. More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement specification and construction specifications.

A5.1 Codes and Standards

The design specification of all work will be in accordance with the laws and regulations of the federal government, the State of California, and local codes and ordinances. A summary of general codes and industry standards applicable to design and control aspects of the power facility follows.

- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- Institute of Electrical and Electronics Engineers (IEEE)
- California Independent System Operator (CAISO)
- International Society of Automation (ISA)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- North American Electric Reliability Council (NERC)
- American Society for Testing and Materials (ASTM)

A5.2 Control Systems Design Criteria

A5.2.1 Distributed Control System

The distributed control system (DCS) consists of several automation systems that will monitor, control, and manage various aspects of facility’s operation remotely.

The measurement and control devices are installed at the process equipment inside the environmentally controlled Satellite control room or PDC buildings. DCS I/O modules, controllers and communication devices are installed in cabinets and located in PDC via and interfaced with field instruments and MCC.

Each of packaged equipment control systems shall be physically independent and dedicated to their function. Each system shall have separate dedicated cabling, field instruments and hardware and shall be based on programmable electronic monitoring/control systems.

The DCS controls the process between its safe operating parameters, provides all essential data to the plant operator, displays alarms for out-of-range parameters, and alerts the operations staff of equipment malfunctions. A comprehensive graphical display is available to the operator to monitor any part of the process in the required detail, through its human machine interface (HMI). The DCS also receives data from various packaged equipment PLC-based control systems via an ethernet. The DCS collects and archives data to be used by various business management systems. The DCS is designed with sufficient redundancy, so that no single core component failure can cause loss of monitoring and control over the facility.

A5.3 Instruments Design Criteria

A5.3.1 General

In general, instrumentation design and selection will be based on the applicable process industry practices (PIPs) and API RP 551.

All instrumentation shall be fitted with a permanent label made of stainless steel. The label shall show, as a minimum, the instrument tag number and service description. American Customary Units (ACUs) shall be used for all process measurements, plot plans and dimensional layouts, instrumentation drawings and human machine interfaces. The design of the packaged units will be consistent with the balance of the plant as practically possible. The shutdown and safety protection of the package, if required, shall be implemented in the Plant Safety Instrumented System (SIS).

A5.3.2 Temperature Instruments

In general, temperature instruments will have scales with temperature units in degrees Fahrenheit. Exceptions to this are electrical machinery resistance temperature detectors (RTDs) and transformer winding temperatures, which are in degrees Celsius.

Temperature elements will be protected by thermowells except when measuring gas or air temperatures at atmospheric pressure. Temperature test points will have thermowells and caps or plugs.

A5.3.3 Level Instruments

Gauge glasses used in conjunction with level instruments will cover a range that includes the highest and lowest trip/alarm set points.

A5.3.4 Flow Instruments

Flow transmitters for general use will be the differential pressure-type with a range similar to the primary element. In general, linear scales will be used for flow indication and recording. In addition, as appropriate for service, the use of magnetic, Coriolis or Pitot tubes such as Annubar will be used.

A5.3.5 Control Valves

Control valves in throttling service will generally be the globe-body cage type with body materials, pressure rating, and valve trims suitable for the service involve other style valve bodies (e.g., butterfly, eccentric disk) will be specified as appropriate for the intended service.

Valves will be designed to fail in a safe position.

A5.3.6 Pressure and Temperature Switches

Field-mounted pressure and temperature switches will have either NEMA Type 4X housings or housings suitable for the environment.

In general, switches will be applied such that the actuation point is within the center ⅓ of the instrument range.

Appendix A6
Electrical Engineering Design Criteria

Appendix A6. Electrical Engineering Design Criteria

Project design, engineering, procurement, and construction activities will be controlled in accordance with various predetermined standard practices and project-specific programs/practices. An orderly sequence of events for project implementation is planned, consisting of the following major activities:

- Conceptual design
- Licensing and permitting
- Detailed design
- Procurement
- Construction and construction management
- Checkout, testing, and startup
- Project completion

This section summarizes the codes and standards, standard design criteria, and industrial good practices that will be used during the Project. The general electrical design criteria defined herein form the basis of the design for project electrical components and systems. More-specific design information will be developed during detailed design to support equipment and erection specifications. It is not the intent of this appendix to present the detailed design information for each component and system, but rather to summarize the codes, standards, and general criteria that will be used.

Section B6.1 summarizes the applicable codes and standards, and Section B6.2 includes the general design criteria for motors, power and control wiring, protective relaying, classification of hazardous areas, grounding, lighting, heat tracing, lightning protection, raceway and conduit, and cathodic protection.

A6.1 Design Codes and Standards

Work will be designed and specified in accordance with applicable laws and regulations of the Federal Government and the State of California and applicable local codes and ordinances.

The latest version of the following general codes and industry standards will be used in design and construction:

- Antifriction Bearing Manufacturers Association (AFBMA)
- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- National Electrical Code (NEC) 2023
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC) 2023
- National Fire Protection Association (NEPA)
- Occupational Safety and Health Act (OSHA)
- Underwriters' Laboratories Inc. (UL)

In addition to these general codes and standards, the following specific standards will be used.

A6.1.1 Batteries

IEEE 450 — Recommended Practice for Maintenance, Testing and Replacement of Large lead Storage Batteries

IEEE 484 — Recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Substations

A6.1.2 Battery Chargers

NEMA AB-1	Molded Case Circuit Breakers
NEMA PE-5	Electric Utility Type Battery Chargers

A6.1.3 Cable: Low Voltage Power, Control, and Instrument

ASTM B 3	Standard Specification for Soft or Annealed Copper Wire
ASTM B 8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-hard, or Soft
ASTM B 33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM B 496	Standard Specification for Compact Round Concentric–Lay Standard Copper Conductors
ICEA S-66-524	Cross-Linked-Thermosetting-Polyethylene-insulated Wire (NEMA WC 7) and Cable for the Transmission and Distribution of Electrical Energy
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the (NEMA WC 8) transmission and Distribution of Electrical Energy
ICEA S-73-532	Standard for Control Cables (NEMA WC 57)
ICEA S-82-552	Instrumentation Cables and Thermocouple Wires (NEMA WC 55)
IEEE-1202	Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies
NEC	National Electrical Code, NFPA 70
NEMA WC 26	Wire and Cable Packaging

A6.1.4 Cable Medium Voltage Power

ASTM B 3	Standard Specification for Soft or Annealed Copper Wire
ASTM B 8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM B 496	Standard Specification for Compact Round Concentric-Lay Stranded Copper Conductors
ICEA S-66-524	Cross-Linked-Thermosetting-Polyethylene-Insulated Wire
(NEMA WC 7)	and Cable for the Transmission and Distribution of Electrical Energy
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the (NEMA WC 8) Transmission and Distribution of Electrical Energy
IEEE-1202	Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies

NEC	National Electrical Code, NFPA 70
NEMA WC 26	Wire and Cable Packaging
UL 1072	Standard for Medium-Voltage Power Cables

A6.1.5 Cable Tray

NEMA VE-1	Cable Tray Systems

A6.1.6 Cathodic Protection Equipment

ANSI B1.1	Unified Inch Screw Threads
ANSI B2.1	Pipe Threads
ASTM A 518	Corrosion-Resistant High Silicon Cast Iron
ASTM B 418	Cast and Wrought Galvanic Zinc Anodes for use in Saline Electrolytes

A6.1.7 Circuit Breakers, High Voltage

ANSI/IEEE C37.04	Rating Structure for AC High Voltage Circuit Breakers rated on a Symmetrical Current Basis
ANSI C37.06	Preferred Ratings and Related Required Capabilities for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.09	C High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI/IEEE C37.010	Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI C37.11	Requirements for Electrical Control for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis and a Total Current Basis

A6.1.8 Conduit

UL 6. ANSI C80.1	Rigid Steel Conduit
UL 797, ANSI C80.3	Electrical Metallic Tubing
UL 514, ANSI C80.4	All Fittings
UL 886	Hazardous Area Fittings
UL 360	Flexible Liquid-tight Conduit
NEMA TC6	PVC and ABS Plastic Utilities Duct and Underground Installation
NEMA TC9	Fittings for ABS and PVC Plastic Utilities for Duct for Underground Installation
UL 651	Electrical Rigid Nonmetallic Conduit
NEMA TC2, UL 514	Fittings for Electrical Rigid Nonmetallic Conduit

A6.1.9 Distribution Panels

ANSI C97.1	Low Voltage Cartridge Fuses, 600 volts or less
NEMA AB-1	Molded Case Circuit Breakers
NEMA PB-1	Panelboards
UL 50	Electrical Cabinets and Boxes
UL 67	Panelboards
NEMA ICS	Industrial Controls and Systems
NEMA KSI	Enclosed Switches

A6.1.10 Grounding Cable

ASTM B8	Specifications for Concentric-Lay Stranded Copper Conductors

A6.1.11 Grounding Connectors and Accessories

NEMA CC-1	Electrical Power Connectors for Substations

A6.1.12 Lighting Fixtures

NEMA FA-1	Outdoor Floodlighting Equipment
NEMA LE-1	Fluorescent Luminaries
UL 57	Standard for Safety, Electric Lighting Fixtures
UL 844	Standard for Safety, Electric Lighting Fixtures for Use in Hazardous Locations
UL 924	Standard for Safety, Emergency Lighting Equipment

A6.1.13 Lightning Arresters

ANSI/IEEE C62.11	Standard for Metal-Oxide Surge Arresters for AC Power Circuits

A6.1.14 Secondary Unit Substations

ANSI C37.13	Low-Voltage AC Power Circuit Breakers Used in Enclosures
ANSI C37.16	Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors
ANSI/IEEE C37.20.1	Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
ANSI/IEEE C37.20.2	Standard for Metal-Clad and Station -Type Cubicle Switchgear
ANSI C37.50	Test Procedures for Low-Voltage AC Power Circuit Breakers used in Enclosures
ANSI C37.51	Conformance Testing of Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear Assemblies

ANSI C57.12.00	General Requirements for Distribution, Power and Regulation Transformers
ANSI/IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers
ANSI/IEEE C57.12.90	Test Code for Liquid Immersed Distribution and Power, and regulating Transformers
ANSI/IEEE C57.12.91	Test Code for Dry-Type Distribution and Power Transformers

A6.1.15 Metal-Clad Switchgear and Nonsegregated Phase Bus

ANSI A58.1	Minimum Design Load in Buildings and Other Structures
ANSI C37.04	Rating Structure for AC High-Voltage Circuit Breakers on a Symmetrical Current Basis
ANSI C37.06	Preferred Ratings and Related Required Capabilities for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
ANSI C37.20	Switchgear Assemblies Including Metal-Enclosed Bus
ANSI C37.23	Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus
ANSI C57.13	Requirements for Instrument Transformers

A6.1.16 Motor Control Centers

NEMA ST-20	Dry-Type Transformers for NEMA General purpose Applications
NEMA AB-1	Molded Case Circuit Breakers
NEMA ICS-1	General standards for Industrial Controls and Systems
NEMA ICS-2	Industrial Control Devices, Controllers and Assemblies
UL 489	Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 508	Industrial Control Equipment
UL 845	Motor Control Centers

A6.1.17 Motors, Low Voltage

NEMA MG-1	Motors and Generators
AFBMA 9/	Antifriction Bearing Manufactures Association
NEMA MG-2	Safety Standard for Construction and Guide for Selection,
APBMA 11/	Installation and Use of Electrical Motors and Generators
NEMA MG-13	Frame Assignment for Alternating Current Integral Horsepower Induction Motors

A6.1.18 Motors, Medium Voltage

ANSI/IEEE C50.41	Polyphase Induction Motors for Electric Power Generating Stations

IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
NEMA MG-1	Motors and Generators
NEMA MG-2	Safety Standard for Construction and Guide for Selection, Installation, and Use of Electrical Motors and Generators

A6.1.19 Neutral Grounding Resistors

ANSI C76.1	Requirements and Test Costs for Outdoor Apparatus Bushings
IEEE 32	Requirements, Terminology, and Test Procedures for Neutral Grounding Devices

A6.1.20 Relay Panels

ANSI C37.20	Switchgear Assemblies Including Metal-Enclosed Bus
ANSI C37.90	Relays and Relay Systems Associated with Electric power Apparatus

A6.1.21 Transformers, Dry-Type

ANSI U1	General Requirements for Dry-Type Distribution and Power Transformers
NEMA ST-20	Dry-Type transformers for General Application
UL 506	Standard for Safety, Specialty transformers
IEEE 693	Recommended Practice for Seismic Design of Substations
IEEE 62271-37-013	Alternating Current Generator Circuit Breakers
California	Rules for Overhead Line Construction

A6.1.22 G.O. No. 95

Other recognized standards will be used as required to serve as design, fabrication, and construction guidelines when not in conflict with the above-listed standards.

The codes and industry standards used for design, fabrication, and construction will be the codes and industry standards, including all addenda, in effect as stated in equipment and construction purchase or contract documents.

A6.2 Electrical Design Criteria

A6.2.1 Power and Control Wiring

A6.2.1.1 Design Conditions

In general, all cables shall be UL listed. In areas with higher ambient temperatures, larger conductors will be used, or higher temperature rated insulation will be selected. Conductor size and ampacity will be coordinated with circuit protective devices. Cable feeders from 4.16 kV switchgear to power equipment will be sized so that a short-circuit fault at the terminals of the load will not result in damage to the cable before normal operation of fault interrupting device (breaker is tripped or fuse is melted).

Instrument cable will be shielded and twisted to minimize electrical noise interference as follows:

- Aluminum-polyester tape with 100% coverage and copper drain wire will be used for shielding.
- Low-level analog signal cables will be made up of twisted and shielded pairs.
- Except where specific reasons dictate otherwise, cable shields will be electrically continuous. When two lengths of shielded cable are connected at a terminal block, a point on the terminal block will be used for connecting the shields.
- For multi-pair cables using individual pair shields, the shields will be isolated from each other. To be effective, instrument cable shields will be grounded on one end.
- Multi-pair cables used with thermocouples will have individually isolated shields so that each shield will be maintained at the particular couple ground potential.
- Each resistance temperature detector (RTD) system will be a three-wire system consisting of one power supply and one or more RTDs and will be grounded at only one point.
- RTDs embedded in windings of transformers and rotating machines will be grounded at the frame of the respective equipment.

A6.2.1.2 Conductors

A6.2.1.2.1 Design Basis

Electrical conductors will be selected with an insulation level applicable to the system voltage for which they are used and ampacities suitable for the load being served. The type of cable used will be determined by individual circuit requirements and individual equipment manufacturer's recommendations.

A6.2.1.2.2 Cable Ampacities

The maximum ampacities for any cable will be in accordance with the NEC. In addition to ampacity, special requirements such as voltage drop, fault current availability, temperature derated ampacity and environment will be taken into consideration when sizing cable.

A6.2.1.3 Insulation

Cable insulation and construction will be as follows.

A6.2.1.3.1 Flame Retardance

To minimize the damage that can be caused by a cable fire, cables will have insulations and jackets with non-propagating and self-extinguishing characteristics. As a minimum, these cables will meet the flame test requirements of IEEE 383, using a gas-burner flame source. These characteristics are essential for cables installed in electrical cable tray in the plant.

A6.2.1.3.2 Medium Voltage Power Cable

Power cable with minimum 5 kV class and 133 percent insulation level will supply all 4.16 kV service and will be routed in trays, channel, conduits, or underground duct banks.

A6.2.1.3.3 Low Voltage Power Cable, 600 Volts

Power cable with 600V class insulation will supply power to loads at voltage levels of 480 VAC and below and 125 VAC and below. Cables will be routed in trays, channel, conduits, or ducts. All cables shall meet or exceed flame test requirements of IEEE 1202.

A6.2.1.3.4 Control Cable, 600 Volts

Non-shielded control cable with 600V class insulation will be used for control, metering, and relaying. Cables will be routed in trays, channel, conduits, or ducts.

A6.2.1.3.5 Instrument Cable, 300 or 600 Volts

Instrument cable will be used for control and instrument circuits that require shielding to avoid induced currents and voltages.

A6.2.1.3.6 Thermocouple Extension Cable

Thermocouple extension cable will be used for extension leads from thermocouples to junction boxes and to instruments for temperature measurements. Cables will be routed in trays or conduits. The cable jacket shall be UL listed type PLTC in accordance with NEC.

A6.2.1.3.7 High Temperature Cable

High temperature cable will be used for wiring to devices located in areas with ambient temperatures normally above 75°C. Cables will be routed in conduit. Cable lengths will be minimized by terminating the cable at terminal boxes or conduit outlet fittings located outside the high temperature area and continuing the circuit with control or thermocouple extension cable.

A6.2.1.3.8 Lighting and Fixture Cable

Lighting and fixture cable designations and conductor sizes will be identified on the drawings. The wire used for interior lighting and receptacles will be copper 600V, 75-degree type THWN insulation or equal.

A6.2.1.3.9 Grounding Cable

Grounding cable will be insulated, or un-insulated bare copper conductor sized as required.

A6.2.1.3.10 Switchboard and Panel Cable

Switchboard and panel cable will be insulated to 600V. Cable will be NEC Type SIS or XHHW-2, meeting the LTL VW-1 flame test.

A6.2.1.3.11 Special Cable

Special cable will include cable supplied with equipment, prefabricated cable, coaxial cable, communication cable, etc. This cable will normally be supplied by a particular manufacturer. Special cable will be routed in accordance with the manufacturer's recommendations.

A6.2.1.3.12 Miscellaneous Cable

If other types and constructions of cable are required as design and construction of the unit progress, they will be designated and routed as required.