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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

A. Work is located approximately 2-miles north of Folsom, California, in Sacramento County.

1.02 PRINCIPAL COMPONENTS OF WORK

A. Design, build, furnish and install one 30 ton bridge crane to replace the existing bridge crane in the Folsom Dam Warehouse.

B. Principal Components of work include:

1. Existing crane removal and disposal.
   a. Asbestos and other hazardous materials are present.
2. New crane design, fabrication, and installation.
3. New crane power supply up to the main power disconnect.
4. Perform a rail survey and optionally repair or replace existing rail system.
5. Perform commissioning tests and load test.
6. Perform operation and maintenance training.
7. Coordination with the Government to accomplish principal components of work.

1.03 SPECIFICATIONS REQUIREMENTS

A. Requirements in Division 1, General Requirements, apply to Divisions 2 through 52.

B. Imperative statements in these specifications are Contractor requirements, unless otherwise stated.

C. Where specifications are written in streamlined form, words “shall be” are included by inference where a colon (:) is used within sentence or phrase.

1.04 DEFINITIONS

A. When specifications use a word or term defined in Federal Acquisition Regulations (FAR), definition of the word or term shall be in accordance with FAR sections in effect at the time solicitation was issued.

1.05 ACRONYMS

A. The following acronyms apply to specifications Divisions 1 through 52:

1. CCAO (AO): Central California Area Office.
2. COR: Contracting Officer Representative.
3. TSC: Technical Service Center.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 12 10
OTHER CONTRACTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of coordinating with other Contractors in the prices offered in the Price Schedule for other items of work.

1.02 OTHER WORK

A. During work under this contract, other work that may be performed in the vicinity of the work by Reclamation and other contractors. Coordinate with COR at NTP meeting.

B. Cooperate and coordinate with other contractors on access to and use of work areas and contractor use areas. Comply with the clause at FAR 52.236-8 - Other Contracts.

C. Do not interfere with work of other contractors or the Government in the vicinity of the work.

D. Cooperate and coordinate with other contractors on use of temporary utilities.

E. Cooperate and coordinate with other contractors on maintaining dust-free operations.

F. Cooperate and coordinate with other contractors on the use of Government owned cranes.

G. Cooperate and coordinate with other contractors on the use of staging areas.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 14 10
USE OF SITE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. Cleaning Manual-2012 — Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species (Technical memorandum No. 86-68220-07-05) 2012 Edition Available online at: www.usbr.gov/mussels/prevention

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 14 10-1, Land Use and Landscape Rehabilitation Plan:

1. For each Contractor use site on Government land.

a. Show use location and extent of impact. Uses include but are not limited to the following:

1) Buildings and service areas including offices, shops, warehouses, storage areas, fuel and oil storage areas, and fabrication yards.

2) Parking areas, temporary roads, and haul routes.

3) Utilities including air, power, and water lines; fire hydrants; and compressor station.

4) First-aid and medical facilities.

5) Areas for processing, storing, and disposing of waste materials from construction operations.

6) Temporary fences.

b. Describe methods to preserve, protect, and repair, vegetation (such as trees, shrubs, and grass) and other landscape features on or adjacent to jobsite, which are not to be removed and which do not interfere with work

required under this contract. Include methods to mark work area limits, protect disturbed areas, and prevent erosion.

c. Describe methods to protect, and repair if damaged, existing improvements and utilities at or near jobsite.

d. Describe methods for removing temporary structures and facilities, cleanup, and rehabilitating site after completion of construction activities.

2. Submit revised drawings of changes in use of Government land made during design and erection stages or after use of Government land is in operation.

C. RSN 01 14 10-2, Permit to Work:

1. Includes all requirements in 1.04 A through E.

1.04 PROJECT CONDITIONS

A. Before beginning onsite work, obtain Permit to Work from Bureau of Reclamation, Central California Area Office (CCAO):

1. Comply with CCAO permit requirements as shown below.

2. Permit will not be issued until the following submittals have been received and approved/accepted by Government:

a. RSN 01 14 10-1; Land Use and Landscape Rehabilitation Plan.

b. RSN 01 32 10-2; Baseline Schedule.

c. RSN 01 32 10-3; Updated Schedule required for issuing of permit as specified in Section 01 32 10 – Construction Program.

d. RSN 01 35 20-1; Safety Program.

e. RSN 01 35 50-1; Security Program.

B. Comply with all security requirements as indicated in Section I – Contract Clauses of Solicitation and these specifications prior to accessing/mobilizing to site, or as directed by COR.

C. Comply with Bureau of Reclamation and CCAO Hazardous Energy Control Program requirements. Any work under clearance will require a Special Work Permit that must be issued to Contractor prior to beginning work requiring interruption of service. See Section 01 14 30 – Interruption of Service for additional information.

D. Access to site is limited to Monday through Friday, 6:00 AM until 6:00 PM, excluding Federal holidays, unless a written request, 96-hours in advance is approved by COR.

E. Government land may be used for required construction facilities, coordinate land use with COR.

F. Location, construction, operation, maintenance, and removal of construction facilities on Government land will be subject to approval of COR.

G. Do not interfere with work of other contractors or Government in vicinity, or with reservations made by Government for use of such land.

H. Cooperate and coordinate with other Contractors on use of access and haul routes, staging areas, and stockpile areas; maintaining roads; maintaining dust-free operations, and abiding by all applicable safety regulations, especially during hauling operations.

I. Consult with COR for coordination efforts.

J. Housing for Contractor personnel will not be permitted on Government land.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 RESTORATION

A. Restore Contractor use areas to pre-construction condition, as approved by COR.

END OF SECTION

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SECTION 01 14 12
WORK RESTRICTIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 WORK RESTRICTIONS

A. Allowable work hours are 6:00 am to 6:00 pm, Monday through Friday, unless otherwise approved by COR.

B. Alternate work schedules including weekends and holidays may be allowed as approved by COR. Provide COR a written notice 14 working days in advance of proposed alternate work schedule for review and approval.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 14 30
INTERRUPTION OF SERVICE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for items of work for which interruption of services are required.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 14 30-1, Interruption of Service Request:

1. Area where work will be done annotated onsite plan drawing showing pertinent features.
2. Show construction outage greater than 2-hours in construction schedule.
3. Commencement time of work.
4. Duration of work.
5. Number of personnel and their classification.
6. Description of equipment to be used.
7. Information indicating that required materials are on site or data indicating shipping dates of materials not onsite.
8. Provide Job Hazard Analyses (JHAs) or written procedure for isolating and removing each hazard source through lockout and tagout procedures for approval.
9. List any impacts to power system operating conditions.
10. Coordinate use of Warehouse and list areas that will be occupied at different parts of the project.

1.03 PROJECT CONDITIONS

A. Schedule and coordinate interruption of services with COR who shall coordinate work and approvals with Operations and other Government entities as necessary.

B. Any interruption of service shall be minimized to extent possible:

1. Contractor shall have approved Design drawings, Materials and Installation/Demolition Plans prior to approval of Interruption of Service Request, and any work occurring under an interruption of service.

2. All materials/fabrications for installation shall be approved and readily available prior to start of interruption of service.

C. No specific request for an interruption of service will be considered unless COR has reasonable assurances that materials and equipment required for work will be on site and Contractor will be prepared to perform work on start date and during period of time requested for specific interruption of service.

D. An interruption of service period starts when equipment and systems are de-energized or otherwise affect normal intended operation of equipment and system in any way because of work required under these specifications:

1. Interruption of service period ends when Government accepts work and equipment/system is restored to normal operation.

2. See Facilities Instructions, Standards, and Techniques (FIST) Volume 1-1 for interruption of service requirements:

a. COR or local Government representative shall be final authority in interpreting FIST 1-1 and applicability of any interruption of service deemed necessary.

E. Special work Permit must be issued to Contractor prior to any work starting under an interruption of service.

F. The following requirements must be met before beginning onsite work associated with interruption of service:

1. Coordinate with COR to obtain Special Work Permit per Hazardous Energy Control Program (HECP) requirements from an authorized Bureau of Reclamation representative/Job Supervisor:

a. Special Work Permit will not be issued until the following requirements have been met:

1) Proposed work is described and in compliance with Bureau of Reclamation and CCAO's HECP and FIST 1-1, copies of which can be made available to Contractor upon request.

2) Interruption of service request is approved.

3) Mandatory: Minimum 1-hour HECP familiarization for all Contractor personnel working onsite prior to entering areas under interruption of service. Coordinate with OGR a minimum of 3 working days in advance to schedule training.

4) CCAO Operations implements approved Interruption of Service Request via actual lockout/tagout therefore isolating hazardous energy.

G. Work not associated with an interruption of service can be accomplished after CCAO Permit to Work is issued in accordance with Section 01 14 10 – Use of Site.

H. When work cannot be performed during an approved interruption of service period, notify COR that interruption of service is not required, and requires rescheduling as applicable:

1. Interruption of service may be scheduled during off-peak periods, nights, or weekends, with required 96-hour advance notice.
2. Government reserves the right to schedule interruption of services for any period during 24-hour day, any day of the week.
3. Contractor's request for interruption of services, work scheduling, and delivery of materials on site will be governed by available time and interruption of service periods.

I. Provide temporary power for critical loads as may be required by specific work plan. Temporary power for these loads is only required if Contractor is disconnecting or removing the permanent power source from the load:

1. Critical loads include the following:
   a. Cranes.
   b. Station lighting and receptacles.
   c. Station Battery and UPS System.
   d. Life Safety Systems (including fire related systems and smoke control systems).
   e. Security Systems.
   f. Facility control components.
   g. Sump pumps.
2. Maximum outage for critical loads: 4-hours or as limited by applicable national, State or local code, whichever is more restrictive.

J. Outages for electrical distribution equipment that does not impact critical loads limited to a maximum of 5-days.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 22
COORDINATION MEETINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost

1. Include in prices offered in the Price Schedule for other items of work.

1.02 DEFINITIONS

A. Interruption of Service: A Contractor requested temporary suspension or interruption of normal facility operations including blocking or closing roads, temporary disconnection of utilities, draining systems of water for access, reduction of stopping pumping activities, locking out of electrical systems or equipment, disconnection of fire alarm systems, or other activities that prevent normal activities of a facility. May also be known as an Outage.

1.03 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS Reclamation Safety and Health Standards including revisions posted at www.usbr.gov/ssle/safety/RSHS/rshs.html.

1.04 PRECONSTRUCTION SECURITY MEETING

A. The preconstruction security meeting shall be scheduled before the Contractor's Site Security Plan has been submitted and accepted. The meeting will be coordinated between Contractor project management and COR. Topic covered will include:

1. Contractor's Site Security Program.
2. Site Security Coordination.

1.05 PRECONSTRUCTION SAFETY MEETING

A. Coordinate preconstruction safety meeting with COR at work site project office before starting onsite work in accordance with RSHS 1.03 2.C, 1.03 6.a and 1.03 2.b.

B. The meeting shall be scheduled after the Contractor's Safety Program has been submitted and accepted. The meeting will be coordinated between Contractor project management, COR, and Reclamation Safety Manager. Topics covered will include:

1. Contractor's Safety Program Review:

   a. Site-specific hazards for the major phases of the work:

1) The meeting will cover site-specific hazards for the major phases of the work including requirements for the specific operations, equipment, inspections, qualifications, and other job specific requirements.

2) A simple reading of the Contractors safety program shall not be considered adequate and is not intended for the meeting.

2. Required joint safety policy meetings.

3. Required toolbox safety meetings.

4. Weekly joint safety inspections.

5. Job hazard analyses (JHAs).

1.06 COORDINATION MEETINGS

A. Weekly Coordination Meetings:

1. Contractor shall conduct weekly coordination meeting with Government.

a. Weekly Coordination Meetings do not relieve the Contractor from the responsibility of other meetings required by the specifications.

2. Purpose: Review work progress, performance, issues, and contract administration with Government representatives.

3. Contractor Attendees shall include the Contractor's project manager, superintendent, Safety Professional, and other representatives, as needed – who understand the specifications, drawings, work, schedule, technical requirements, components, and contract administration.

4. Reclamation Attendees will include the Construction Office On-site Government Representative and may include the Contract Officer's Representative (COR), Construction Office Safety Manager, Construction Office Construction Manager, Contract Specialist (CS), Contract Officer (CO), Area Manager's Representative, Field Offices Representative, and Regional Engineer's and Technical Service Center's Design Representatives as determined based on need.

5. The meeting will be convened and led by the Contractor to discuss and provide updates for the following:

a. Work Schedule to include:

1) Submittal status, due dates, delivery time frames, and questions or concerns.

2) Contractor's progress.

3) Contractor three week look-ahead schedule.

b. Safety issues and Weekly Safety Walk.

c. Drawing questions including the status of shop drawings as required and the status of As-built drawings on a weekly basis.

d. Outages.

e. Environmental compliance.

f. Security.

g. Personnel.

h. Contract Administration:

1) Modifications.

2) Requests for Equitable Adjustment (REA's). (Contractor generated document).

3) Requests for Changes (RFC's). (Contractor generated document).

4) Requests for Information (RFI's). (Contractor generated document).

5) Requests for Proposal (RFP's).

6) Requests for Substitution's (RFS's). (Contractor generated document).

7) Quantities and Invoices.

6. Other outstanding issues.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. Contractor shall coordinate meeting time, place, invitation list, notifications, and teleconference access with the COR and allow adequate time for weekly safety walk prior to the Weekly Coordination Meeting.

1. Contractor shall have the capability to conduct meetings via Microsoft TEAMS or Webex Meeting to support weekly coordination meetings, and other meetings as they come up, with attendees from multiple offices at multiple worksites.

B. Contractor shall prepare and distribute agendas 1 day before each meeting.

C. Contractor shall provide a 3-week look-ahead schedule at least 2 hours before start of meeting and be prepared to discuss the look-ahead schedule meeting.

D. Contractor shall compile and distribute meeting minutes within 1 day of the meeting.

E. Government reserves the right to comment on and suggest edits to the minutes for clarity and accuracy.

END OF SECTION

SECTION 01 31 30
CONTRACT DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Contract Document Management System (CDMS):

1. Payment: Lump sum price offered in the Price Schedule.

   a. Payment of the lump sum price offered will be made incrementally throughout the duration of the contract and will not be paid in full until completion of the contract.

   b. Only costs directly associated with the CDMS shall be included in this cost.

1.02 DEFINITIONS

A. CDMS: Contract Document Management System.

B. CO: Contracting Officer.

C. COR: Contracting Officer's Representative.

D. PM: Project Manager.

E. RFC: Request for Change.

F. RFI: Request for Information.

G. RFP: Request for Proposals.

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Submittals.

B. RSN 01 31 30-1, Approval Data:

1. System provider experience, number of systems operating, references.
2. Documentation of system capabilities.
3. Instructions for system use.

C. RSN 01 31 30-2, Final Data:

1. Enable bulk download feature for Contract Manager, Contract Officer Representative, Contract Officer and /or Contract Specialist.

2. Submit via:

   a. Electronic storage device approved by Government, of all documents uploaded to CDMS or,

   b. Use IronKey, by Kingston Technology, or approved equal, Encrypted Hard Drive or Encrypted Flash Drive, meeting FIPS 140-2 requirements for Level 3 Security and chain-of-custody procedures. Submit with all documents uploaded to CDMS.

      1) All passwords and access shall be sent via United States Postal Service using Express Mail or equal.

1.04 APPLICATION

A. CDMS: Contract Document Management System:

1. Contract Documents include, but are not limited to:

   a. Specifications.

   b. Contract Drawings.

   c. Submittals.

   d. Approval Drawings (Contractor generated document).

   e. Shop Drawings (Contractor generated document).

   f. Final Drawings (Contractor generated document).

   g. As-built Drawings (Contractor generated document).

   h. REA: Request for Equitable Adjustment (Contractor generated document).

   i. RFC: Request for Change (Contractor generated document).

   j. RFI: Request for Information (Contractor generated document).

   k. RFP: Request for Proposal (Government generated document).

   l. RFS: Request for Substitution (Contractor generated document).

   m. MOD: Contract Modification.

   n. VECP: Value Engineering Change Proposals (Contractor generated document).

   o. Government Inspection Reports.

   p. Contract Schedules.

   q. Meeting Agendas and Meeting Minutes.

   r. Letters, Memos, and other typical contract correspondence.

1.05 QUALIFICATIONS

A. System provider: At least 5 years successful performance in providing required services.

1.06 CDMS REQUIREMENTS

A. CDMS shall be capable of generating, storing, tracking, categorizing, and managing construction contract documents. Construction Contract Documentation includes: Submittals (typically .pdf files of text documents or drawings); RFIs, RFCs, and RFPs; Contractor Proposals; Value Engineering Change Proposals; Invoices and Progress Payments; Construction Schedules; Meeting Agendas and Meeting Minutes; Correspondence; Memos and Deficiency Notices; Contract Modifications and similar documents. Documentation may be prepared by the Construction Contractor or by Reclamation.

B. Reclamation shall be able to easily access documents and to track when documents were received or returned, as well as determine the status of the documents. Reclamation shall be able to generate reports that list and sort the documents by status as well as generate alerts when documents requiring review exceed allowable review time. Document generation shall include submittals and RFIs, responses, Meeting Minutes, RFCs, RFPs, and correspondence.

C. Documents may be generated by either the Contractor or by Reclamation. Each party needs the capability to maintain document security within its organization unless/until it chooses to share it with the other party. Once documents are shared, they shall be secured so that no changes can occur without a record of the changes being made. The CDMS shall be capable of producing a complete and logically organized set of all documents within the CDMS in both .pdf and .xml format. The documents shall be downloadable to ftp sites where Reclamation and other organizations can each access their own data confidentially.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. Document Access:

1. Web-based document storage where all project construction documents are stored and may be accessed by authorized organizations and individuals via an internet site.

2. Accessed via Web Browser from any computer including remote sites with internet access. Compatible with Apple Safari, Mozilla Firefox, and Internet Explorer.

3. Ability to upload documents in a variety of formats including but not limited to Word, Excel, Adobe Acrobat, MS Project, Primavera 6.0 or higher, AutoCad 2020 or higher, and Contract Manager, and make them available to users for download. Documents shall be grouped into separate categories.

4. Ability to upload Contract Documents and make available for user download in supported file formats, minimum:

    a. Adobe Acrobat, Portable Document Format (.pdf).

    b. Microsoft Word; Microsoft Word 97-2003 Document (.doc), Word Document (.docx).

        1) With a copy provided in Adobe Acrobat, Portable Document Format (.pdf).

    c. Microsoft Excel; Microsoft Excel 97-2003 Worksheet (.xls), Excel Workbook (.xlsx).

        1) With a copy provided in Adobe Acrobat, Portable Document Format (.pdf).

    d. Oracle Primavera P6 Project Manager, XML and XER file Extension (.xml and .xer) and P6 layout file (.plf).

        1) With a copy provided in Adobe Acrobat, Portable Document Format (.pdf).

    e. Autodesk Drawing File AutoCAD 2023 (.dwg) or later.

        1) With a copy provided in Adobe Acrobat, Portable Document Format (.pdf).

5. Allow Contract Documents to be prepared by the Contractor or by Government.

    a. Preparing organization will control access of documents. See Document Security and Backup paragraph below.

6. Contractor and Government shall each have a project manager for CDMS:

    a. Each project manager shall have capabilities to assign users within organization and assign user rights that control access to documents based on user class and document type.

    b. Each organization shall be capable of defining access hierarchy.

    c. Inclusion of users will be prerogative of organizational project manager.

    d. Government shall be able to create and modify project properties (i.e. Contractor, project location, description, bid amount, project directory, etc.).

7. Email notifications shall be automatically sent to selectable users when new documents are submitted and available for viewing, or alerts are generated. Examples:
   a. Updates to project information (e.g. entry of new submittal);
   b. Changes to project information (e.g. approval of submittal);
   c. Alerts (e.g. submittal under review for greater than 21 days without action).
8. Ability to link files; examples:
   a. RFP linked to Modification.
   b. Submittal linked to Specification Section or Drawing.
9. Ability for Government to perform bulk downloads of CDMS Data. Bulk downloads will be used to download Final CDMS data, shop drawings and other large sets of CDMS data.
10. Data shall be preserved for a period of 3 months after completion of Contract to allow Government time to completely download all necessary documents and final data stored in the CDMS System.
11. No Cost Time Extension:
   a. If the Contractor agrees to a No-Cost Time Extension the contractor shall maintain the CDMS service during the of the period of the No-Cost Time Extension in addition to other requirements.

B. Reports:
1. Generate reports that list and sort documents by status, examples include:
   a. Submittals that are approved or are not approved.
   b. RFIs under review.
2. Generate alerts when documents requiring action approach or exceed allowable time.
3. Generate customizable summary reports, examples include:
   a. Submittal Turn-around.
   b. RFI Turn-Around.
   c. Modification processing Turn-Around.
   d. Total Modification costs.
   e. Total Modification Request Exposure.
4. Reports shall be printable, exportable as searchable pdf or printer friendly HTML, and exportable to Excel, XML, or CSV.
5. Ability to link from an item in a report directly to item by clicking on it.

a. For example: in submittal report, clicking on submittal that is 15 days old takes you directly to information on that submittal.

6. Capable of producing a complete and logically organized set of documents within CDMS in both PDF and XML format.

C. Document Security and Backup:

1. Secure Sockets Layer (SSL) encryption for secured data exchange between browser and server to enable secure access to documents and information.

2. Allow document access security until authoring party chooses to share it with others.

a. Show parties that have access to a document.

b. Extent of document sharing shall be determined by authoring party.

c. Once documents are shared, track documents so that changes cannot occur without a record of changes.

3. Backup/archiving to File Transfer Protocol (FTP) site of documents to which an organization has access on a regular (minimum monthly) basis.

a. Backups shall be in PDF format.

4. Documents shall be downloadable to FTP sites where Government and other organizations can each access their own data confidentially.

D. General Tracking and Control:

1. Documents shall be grouped into categories (Submittals, REA, RFC, RFI, RFP, RFS, Modification, Daily Inspection Reports, Meeting Minutes, etc.).

2. CDMS shall track:

a. When documents were received or returned, as well as status of documents (e.g. Under Review; or Returned Approved, Conditionally Approved, Not Approved, Accepted, Conditionally Accepted or Not Accepted, and resubmittal requirement in accordance with Section 01 33 00 – Submittals, Part 1.06 – Review of Submittals).

b. Document changes including who entered or changed document and date change was made.

c. When a reviewer has opened an item.

E. Submittal Tracking and Control:

1. Ability to create master list of submittals ("Schedule of Submittals").

2. Supply standard submittal form for entering information. CDMS shall allow customizing of standard submittal form. Contractor shall be able to enter submittal summary information (required submittal number, title, description, due

date, and specification section shall be required fields) and then upload submittal data in electronic format.

3. CDMS shall track date received, date response due, date returned, and approval status:

   a. Status designations may be modified to fit Government standard designations – A, CA, NA, Acc, CAcc, NAcc (Approved, Conditionally Approved, Not Approved, Accepted, Conditionally Accepted, Not Accepted in accordance with Section 01 33 00 – Submittals, Part 1.06 – Review of Submittals.).

4. Supply Submittal Tracking form for Government to enter review comments and action taken. CDMS shall allow customizing of submittal tracking form.

   a. Allow for Government to route submittal to third parties by generating design-review transmittals with each submittal package item, to track status of individual sub-items within submittal package, and to route each sub-item to appropriate reviewers.

5. Ability to generate automatic notification after specified days without response.

F. RFI Tracking and Control:

1. Supply standard RFI form to enter information.

2. Ability to create or attach documents to RFI form or links to other documents within CDMS.

3. Ability for Government to route RFI to appropriate reviewers and for reviewers to enter comments into standard response form.

G. Inspection Reports Tracking and Control:

1. Ability to attach Government standard inspection and report forms into CDMS and ability to create customizable inspection forms in CDMS. Typical forms:

   a. Daily Inspection Report (DIR).

   b. Survey requests.

   c. Inspection reports.

   d. Testing reports.

2. Ability to link or attach photos to forms and link forms to other documents within CDMS.

H. Contract Modifications:

1. Provide standard Contractor Proposal form with ability to attach documents and link to other documents within CDMS.

2. Provide ability to upload Government's standard Modification form and RFP forms, or create an acceptable alternative, to enter information.

3. Ability to attach documents to these forms, and link to other documents within CDMS.
4. Ability for Contractor to respond to RFP and Modification form with Cost & Time impacts.
5. Ability to track date Modification issued and date responded, with automatic notification after specified days without response.

I. Correspondence:

1. Ability to generate letters and memos.
   a. Ability to attach documents to letters and memos, and to reference other documents within CDMS.
   b. CDMS shall automatically assign sequential numbers to letters and memos.
2. Ability to generate responses to letters and memos.
   a. System automatically generates memo suffixes, e.g. first response to Memo 32 to be 32.1, second response to be 32.2, etc.
3. Official correspondence from Government to Contractor shall contain Government's official letterhead and corresponding logos.
4. Ability to generate meeting agendas and meeting minutes and to attach documents to minutes.
   a. CDMS shall automatically assign sequential meeting numbers.

J. Miscellaneous Tracking and Controls.

1. Ability to generate reports tracking REAs, RFCs, RFIs, RFPs, RFSs, Modifications, Submittals, Memos, DIR's, survey requests, plant inspection reports, and testing reports.
2. Ability to filter logs based on criteria:
   a. Submittals: Specification Section, Days Out, Status (Approved {A}, Conditionally Approved {CA}, Not Approved {NA}, Accepted [Acc], Conditionally Accepted {CAcc}, Not Accepted {NAcc}).
   b. RFI's: Days out, Status (Open/Closed), Specification Section/Dwg No., Responsibility/Ball-In-Court.
3. Ability to sort Logs based on a criterion, e.g. for Submittal, Specification Section, Days Out, Status, or other criterion determined by COR.
4. Ability to provide forms to match Reclamation's Contract Modification form and Progress Payment form or other forms when needed.
5. Ability to track cost exposure with links to Requests for Information and Change Order Requests.

6. Ability to measure productivity benchmarks on a project such as computing average review days for RFIs and submittals, categorize Modifications, and track total Modification percentages by category.

7. Ability for keyword search of documents in database.

8. Ability for CDMS Generated Notification via email to Team Members of: updates to project information; changes to project information; and alerts.

9. Ability for Reclamation to create Master List of Anticipated Submittals ("Schedule of Submittals") and require Contractor to pick from that list when submitting submittal.

K. Administration:

1. Contractor shall be administrator of CDMS site. Contractor shall maintain and manage CDMS services directly with software provider. All data and stored information shall belong to Contractor who has sole responsibility for CDMS solution. At the end of the project all information stored in the CDMS shall be transferred to the Government by the Contractor.

2. The Contractor shall provide administrator rights to Government administrator(s) for Government access and sharing of CDMS data within the Government. Government administrator(s) may include:

a. Contract Manager,

b. Contract Officer's Representative,

c. Field Engineer, and/or

d. Contract Officer/Specialist.

L. Contractor shall share access to CDMS site and data with Government for Contract purposes as described herein.

M. In accordance with Reclamation Directive and Standard RCD 05-01, all information received, created, or compiled by Reclamation officials, employees, contractors, and other staff (employees) is property of Federal Government and must be maintained in accordance with established standards.

1. CDMS shall not be considered as storage of official records or correspondence.

N. CDMS shall be in place and operating before Contractor transmits contract documents to Government, except RSN 01 31 30-1, Approval Data:

1. CDMS operation includes COR, or other authorized Government representative, having program control to assign users and user rights to Government personnel to access appropriate areas of system.

O. Contractor shall input complete Schedule of Submittals before making submittals. Include:

1. RSNs listed in Table 01 33 00A – List of Submittals.
2. Submittal due dates from Table 01 33 00A.

P. Contractor shall provide a report of submittal status weekly for review at weekly coordination meetings or as otherwise requested by COR. Submittal status reports shall be in table format and include:

1. Required Submittal Numbers (RSN).
2. Section Titles.
3. Submittal Titles.
4. Dates Submitted.
5. Dates of Responses.
6. Approval status (listed above).
7. Days in review.
8. Due dates.

Q. CDMS shall be operational until final project closeout.

3.02 TRAINING

A. Contractor shall provide at least 4 hours of on-line CDMS training for Contractor and Government employees associated with the project. Training shall be performed by the system provider for Contractor and Government simultaneously at an agreed time prior to system implementation. The total 4 hours training can be provided in a single session or in multiple sessions as recommended by the system provider. A list of up to 10 Government employees that require training will be provided to the Contractor by the COR with approval of RSN 01 31 30-1.

END OF SECTION

SECTION 01 32 10
CONSTRUCTION PROGRAM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Costs:

1. Developing Baseline Schedule: Include in lump sum price offered in the Prices Schedule for Mobilization and Preparatory Work.
2. Updating and Using Construction Program: Include as part of Contractor's overhead.

1.02 DEFINITIONS

A. Out of Sequence Work: An activity that starts before its predecessor activities are completed.

B. Project Calendar(s): Cross reference of numerical work days with calendar days. Project calendars serve as the basis for day/date conversion and assign work days and non-workdays.

C. Resources: Equipment, labor or crews, materials, subcontractors, fabricators, manufacturers, and consultants.

D. Schedule: The Critical Path Method (CPM) of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the project.

1.03 REFERENCE STANDARDS

A. Associated General Contractors of America (AGC)

1. AGC Manual — Construction Planning and Scheduling Manual, 2004

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

1. Furnish database files in format compatible with Oracle Primavera P6 Professional Project Management.
2. Furnish schedule in CDMS.

3. Upon request, provide information and data used to develop and maintain the Construction Program to the CO.

B. RSN 01 32 10-1, Representative Information:

1. Designation of authorized representative to develop and maintain Construction Program. Include resume with training and experience.

C. RSN 01 32 10-2, Baseline Schedule:

1. Include:

a. Construction Program/Schedule database.

b. Definition of project calendars.

c. Primavera layout file (.plf).

1) With a copy provided in Adobe Acrobat, Portable Document Format (.pdf).

d. Gantt chart (Bar chart) for project on 11 by 17-inch print(s) and in portable document format (.pdf).

e. Activity report including logic constraints consisting of predecessors, successors, and constraint dates.

f. Tabular listings of resources and resource limitations used to produce baseline schedule. Correlate resources with schedule assumptions and offered price. Resource listings may be independent of schedule database.

g. Narrative explanation of project schedule development. Include impacts of resource limitations and weather conditions on project schedule development. Include planned number of work hours per day and hours per day for subcontractors.

D. RSN 01 32 10-3, Updated Schedule Reports:

1. This submittal is required for a proper invoice for progress payments in accordance with the clauses at FAR 52.232-27 - Prompt Payment for Construction Contracts. In accordance with subparagraph (a)(i)(A) of the clause at FAR 52.232-27 - Prompt Payment for Construction Contracts, Government disapproval of this submittal will be considered failure of the Contractor to comply with contract requirements and payment due date may be delayed until 14 days after submittal contents are approved.

a. Include:

1) Construction Program database with updated activity and milestone data.

2) Definition of project calendars if revised from baseline calendars.

3) Primavera layout file (.plf).

4) Gantt chart for project on 11 by 17-inch print(s) and in portable document format (.pdf).

5) Narrative report specifically stating status of project.

a) When negative float exists, cite specific actions and conditions which caused "behind schedule" condition and provide proposed course of action to complete the project within the specified delivery time. When float changed from previous month's updated schedule, explain reason for change.

b) List of Contractor-initiated changes to current schedule stating reason for action taken and unresolved issues relating to the Construction Program. Government reserves the right to reject Contractor-initiated changes to current schedule which negatively impact Government action which was initiated on the basis of current schedule.

c) Discuss contract milestones and significant activities that were started, continued, or completed during the update period or scheduled during the next update period.

6) Submittal Register:

a) List submittals as listed in Table 01 33 00A.

b) Update Submittal Register monthly to include submittals and revised submittals. Register fields shall include RSN name and number, date submitted, date of response, status (e.g., approved, not approved, resubmittal required).

c) This register document is separate from scheduling database.

E. RSN 01 32 10-4, Time Impact Analysis:

1. Include:

a. Construction Program database with proposed revised activity and milestone data.

b. Proposed revised schedule due to change or delay. Highlight or list added, changed, or deleted activities.

c. Primavera layout file (.plf).

d. Gantt chart for project on 11 by 17-inch print(s) and in portable document format (.pdf).

e. Narrative report explaining results and conclusions.

1.05 QUALIFICATIONS

A. Representative: Experienced in developing and maintaining construction schedules and knowledgeable of activities and progress on-site to develop and maintain accurate and reliable schedules.

1.06 GENERAL

A. Develop, maintain, and use Construction Program to plan, monitor, evaluate, and report accomplishment of work.

1.07 SCHEDULES

A. Prepare construction schedules using Critical Path Method outlined in AGC Manual. Use a computer software program to perform mathematical analysis of scheduling data.

1. Prepare schedule based on required sequence and interdependence of activities. Logically sequence activities.
2. Prepare detailed activity network for accomplishing required work organized by Work Breakdown Structure (WBS). Utilize WBS in lieu of activity codes for organization of schedule. If activity codes are utilized in addition to WBS, use unique activity code names assigned as project codes rather than global codes.
3. Activities except “Award” shall have predecessor activities and activities except “Contract Complete” shall have successor activities.
4. Meet contract requirements; milestone(s), Commencement, Prosecution, and Completion of Work; and relevant clauses and specification sections. Include interim milestone dates, Government interface dates, contract completion date, and other time or seasonal constraints specified in contract documents.
5. Include work of subcontractors, Government interfaces, and contract milestones.
6. Adjust Construction Program/schedule for seasonal weather conditions. Provide a narrative explaining the expected weather and plan for incorporation in schedule. Consider work influenced by high or low ambient temperatures or precipitation. Utilize Primavera P6 calendars to depict historical weather days that impact work. Assign weather calendars to work impacted by weather.
7. Define activities to level of detail resulting in their durations being no greater than 20 workdays.
    a. Durations for administrative activities (e.g., submittals and reviews) fabrication, manufacturing, and typical level of effort activities (e.g., dewatering, storm water management) will not be subject to workday duration limitation.
8. Include separate activities for submittal preparation and submittal reviews when submittal addresses work that involves significant quantities, long lead times, is on the critical path or near critical path, or as requested by the COR. Assign Government submittal review activities to a seven-day calendar with durations as

specified in Section 01 33 00 - Submittals. Include Required Submittal Number (RSN) in activity description.

9. Include separate activities for fabrication or manufacturing when work involves significant quantities, long lead times, is on the critical path or near critical path, or as requested by the COR

10. Include contract title, contract number, and Contractor's name on transmittal cover sheet and each sheet of Gantt chart.

11. For each activity on Gantt chart, display activity identification number, activity description, planned or original duration, start date, finish date, total float, and calendar identification. Do not display early start and late start fields.

12. Include table of abbreviations used in the schedule, listed and defined alphabetically.

13. Use finish to start logic relationships between activities. Do not utilize start to start, finish to finish, or start to finish logic relationships. Do not use negative lead or lag times.

14. Use durations in units of whole workdays.

15. Provide best estimate of time required to complete activity considering quantity of work, work conditions, location of work, and planned resources for activity.

16. Equate durations of Government reviews and other identified actions to maximum number of calendar days specified in their respective paragraphs.

17. Establish workday calendar(s) and use these in the schedule to translate activity's workday duration into calendar dates. Use unique calendar names; do not use software default calendar names. Save calendars as project calendars, not global calendars.

B. Baseline Schedule:

1. Represents Contractor's as-planned approach to accomplishing the work. Do not include actual start dates, percent completes, or actual finish dates.

C. Updated Schedule:

1. Meet monthly with COR at Government's project office, or at a location approved by the COR, to review progress made to end date of progress payment period. Establish dates that activities were started and completed and remaining duration for each activity started but not completed during the period.

   a. Discuss and mutually agree upon changes to the schedule.

   b. Out-of-sequence activities are not allowed. Revise logic to reflect change in work plan.

   c. Finalize updated Construction Program database with mutually agreed upon changes.

2. Following receipt of executed contract modification, incorporate activity data stipulated in modification into current schedule for inclusion in next scheduled progress update. Provide appropriate logic relationships for revised activities.

3. Assign a unique project file name for each schedule update.

1.08 TIME IMPACT ANALYSIS

A. Provide time impact analysis for contract changes (e.g., change order, proposed modification, or value engineering change proposal) to support a claim or request for equitable adjustment to the contract due to delay or accelerated schedule.

B. The CO may use time impact analysis to determine if time extension or reduction to contract milestone dates is justified.

1. Time impact analysis is required for contract changes whether the Contractor's current schedule milestone dates are the same as, earlier than, or later than, those required under the contract.

2. Changes, additions, or deletions to activities; activity durations; activity time frames; or activity predecessors and successors will not automatically determine that extension or reduction of contract time is warranted or due the Contractor.

3. Time extensions for performance will be considered only to the extent that the Contractor's current scheduled milestone dates exceed contract milestone dates.

C. Float is not for exclusive use by or benefit of either the Government or the Contractor.

D. Perform time impact analyses using data in most recent approved schedule update prior to change or delay event.

1. Prepare proposed revised schedule and narrative description describing and highlighting changes or delays.

2. Prepare summary comparing results of two schedule analyses: One using current schedule data from last approved updated schedule prior to event requiring analysis, and one using proposed schedule data incorporating changes or delays.

a. Show contract milestones and activities whose periods of performance have shifted as result of change which affects production and/or manufacture schedules, material orders, construction seasons, and labor and/or equipment utilization.

b. For activities directly affected by change or delay, include the current and proposed items:

1) Activity description.

2) Types and quantities of major pieces of equipment, principal manpower, and pacing materials (materials that affect activity start, duration, or finish).

3) Activity duration.

4) Narrative containing rationale used in developing the proposed logic relationships and activity data.

c. Data date for impacted schedule used in comparison shall be the same as approved updated schedule data date.

d. Base schedule comparisons on status of work and available float at time the CO directs or proposes change to the work, the Contractor submits a value engineering change proposal, or when a delay occurs as shown in approved updated schedule.

1.09 REVIEW AND EVALUATION

A. Baseline Schedule:

1. Within 21 calendar days after receipt of baseline schedule:

a. CO will approve or not approve proposed baseline schedule.

b. Upon request from the CO, meet with COR for a joint review of proposed baseline schedule.

c. If schedule is not approved, revise and resubmit within 7 calendar days following date of rejection letter.

2. Do not proceed with onsite work, except mobilization and surveying, until baseline schedule has been approved by the Government.

B. Updated schedules:

1. Submit updated Construction Program schedule monthly.

2. Submit updated schedule at least seven days prior to the submission of each invoice request for progress payment.

3. If updated schedule is not approved, revise and resubmit updated schedule within 7 calendar days following date of rejection letter.

4. The COR will schedule pre-submittal meeting with the Contractor's representative each month to review draft updated schedule prior to the Contractor submitting RSN 01 32 10-3, Updated Schedule.

C. Failure to include elements of the work in schedules will not release Contractor from completing required work under the contract.

D. Performance will be evaluated by the Government using approved CPM schedules.

1.10 FAILURE TO COMPLY

A. Failure to comply with requirements of this Section shall be grounds for determination by the CO that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within specified time.

B. The CO may terminate the Contractor's right to proceed with the work, or separable part of it, in accordance with default terms of this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00
SUBMITTALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for items of work requiring submittals.

1.02 DEFINITIONS

A. CDMS: Construction Document Management System.

B. Days: Calendar days.

C. Design Calculations:

1. Calculations and verifications specified in the Government-furnished contract documents. Design calculation and technical requirements are described in relevant specification sections.
2. Design calculations shall be certified by a registered professional.

D. Final Drawings:

1. Complete electronic set of drawings produced by the Contractor as required by these specifications, updated to reflect all changes made in the field during construction.

E. Operations and Maintenance (O&M) Manuals:

1. Final documentation for functional elements, equipment and systems installed in the finished work, including all information necessary for Government personnel to operate, maintain, and troubleshoot such elements, equipment and systems in a safe, clear, effective, and efficient manner. Include instructions, final drawings and equipment certifications for each element of work.

F. Record As-built Drawings:

1. Set of full-size, hard-copy drawings that contain both Government drawings furnished with this contract and Contractor-produced drawings necessary to clearly identify as-built conditions of the completed project.

G. Required Submittal Number (RSN):

1. Identifies items to be submitted together as a complete submittal.

H. Schedule of Values (SOV):

1. Detailed cost breakdown for construction products and execution activities for lump sum Contract Line-Item Number (CLIN) shown in Section B Price Schedule.

   a. Include separate SOV line items for each major product purchase, execution activity, and sequential process required to complete the work associated with each lump sum CLIN.

   b. Do not include costs associated with RSN preparation and submission.

   c. SOV will be used to accurately assess and confirm progress payment amounts for each CLIN.

2. Planned Progress Payments:

   a. Submit monthly with monthly schedule.

I. Submittals are considered "shop drawings" within the terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME Y14.1-12 — Decimal-inch Drawing Sheet Size and Format

B. National Institute of Building Sciences (NIBS)

1. NIBS NCS-14 — United States National CAD Standards, Version 6

C. National Institute of Standards and Technology (NIST)

1. NIST FIPS 140-3-19 Security Requirements for Cryptographic Modules, available at https://csrc.nist.gov/pubs/fips/140-3/final.

1.04 SUBMITTAL REQUIREMENTS

A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, requirements included elsewhere take precedence.

B. General:

1. Prepare in English.
2. Label with contract number and title, and RSN.
3. Measurement Units: US Customary Units.

4. Provide a unique sequential numbering extension for identification of each RSN resubmittal (e.g. first submittal of RSN 01 14 10-1 to be identified as 01 14 10-1, first resubmittal to be identified as 01 14 10-1-2, etc.).

5. Reserve a 3" X 3" block in the upper right-hand corner of the Contractor's submittal cover sheet for Reclamation approval.

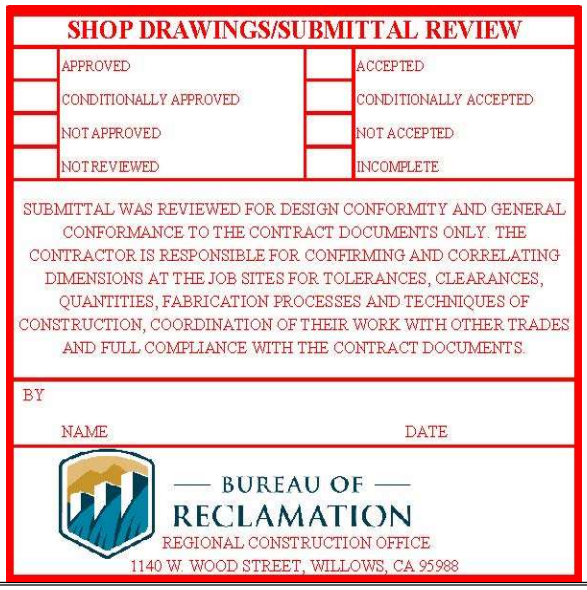

Figure 1. Reclamation Submittal Approval Stamp.

C. Drawings:

1. Minimum Identification in Title Block:

   a. Contract number and title.

   b. Contractor's or supplier's title and drawing number.

   c. Name of responsible party.

   d. Date of original drawing.

   e. Revision identification.

   f. Date(s) of revision and revision description.

2. Reserve 3- by 3-inch space next to title block for review stamps at bottom right corner.

3. Size: D size (22 inches by 34 inches) as defined by ASME Y14.1.

4. Draw to scale using computer drafting or drafting equipment, unless otherwise specified.

   a. Computer drafted drawings:

      1) In accordance with NIBS NCS.

2) Electronic file format: Compatible with AutoCAD, Version 2020 or later.

3) Utilize BOR color table provided to ensure proper line weights.

4) Compile using "eTransmit" utility in AutoCAD.

b. Drawings prepared with drafting equipment, when allowed:

1) Lettering shall be neat.

5. Drawings Designated as "Government Format" in Specifications:

a. Computer drafted.

b. Government will provide an electronic AutoCAD format template and color table.

c. Title block and sheet format:

1) As shown on standard drawing 40-D-7102.

a) Government will provide template.

b) Government will provide specific title block information to be used.

6. As-built Drawings: Refer to Section 01 78 30 – Project Record Documents.

7. Final Drawings:

a. Computer drafted.

1) AutoCAD format (.dwg) version 2020 or later.

b. Government will provide an electronic AutoCAD format template.

c. Title block and sheet format:

1) As shown on standard drawing 40-D-7102.

2) Request AutoCAD version of drawing boarder from COR.

d. Show changes, including revision dates, made during installation. Indicate changes by clouding with revision description in the titleblock.

8. Electronic Files:

a. Submit in CDMS, and use other electronic device(s) approved by Government or:

1) Use IronKey by Kingston Technology Group, or equal, meeting FIPS 140-2 requirements for Level 3 Security. Refer to: FIPS 140-2 (nist.gov).

a) Follow a chain of custody with the external partner documenting when, how, and by whom individual items of electronic data were collected, handled, analyzed, or otherwise controlled.

D. Product Data:

1. Mark manufacturer's data for commercial products or equipment, such as catalog cut sheets.

   a. Identify manufacturer's name, type, model, size, and characteristics.

   b. Illustrate that product or equipment meets requirements of specifications.

   c. Mark data sheets with identifiers corresponding to specification paragraph, bill of materials, drawing detail, or other design documentation.

   d. Mark items to be furnished in a manner that will photocopy (no highlighter).

   e. Strike through items that do not apply.

E. Certifications:

1. Certifications by a Registered California Professional: Signed and sealed by a Professional Engineer with the appropriate discipline registered in the State of California.

2. Manufacturer’s Certifications: Signed by authorized representative of manufacturer.

F. Manuals:

1. Copies:

   a. Printed copies:

      1) Bound and indexed and include Table of Contents, assembled into one or more books with enclosing covers.

      2) Use double-sided copying for all multi-page data, brochures, manuals, documents, etc. Do not double-side drawings or pages that include graphs.

      3) Binders: 3-ring; 1-inch ring size minimum.

   b. Electronic copies: Adobe pdf.

      1) Bookmark files to assist in navigating.

      2) Conform to format for print copies.

2. Contents:

   a. Index sheet at front of each book which provides page or index tab number information for each device or item of equipment in book.

   b. Complete parts identification lists for replacement, lists of special tools, and accessories, including list of recommended spare parts and components.

   c. Schematics and wiring diagrams, as applicable.

d. Detailed instructions for installing, operating, lubricating, and maintaining equipment.

e. Manufacturer's full-size circuit breaker and fuse time-current curves, as applicable.

f. Copies of all factory test reports.

g. Copies of bills of materials.

h. Copies of all drawings.

1) Final Drawings of equipment and systems.

2) As-built Drawings.

3) Maximum size: 11- by 17-inch.

i. Manufacturer's operation and maintenance procedures; installation details, as necessary; and catalog data sheets for each device or item of equipment.

j. As-built drawings, photographs and test records or reports if required by the specifications.

k. Include one (1) copy in electronic format, Microsoft Office or PDF compatible with each hard copy manual. Sample Submittals:

G. Sample Submittals:

1. Label with complete manufacturer's product identification.

2. Include type and quantity of materials specified in the referenced section in each "set" of samples.

3. Samples: Representative of product to be installed.

4. Label each sample or sample kit with contract number and title.

5. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

6. Reclamation reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.

7. CDMS Special Documentation Requirements for Paint Samples:

a. In addition to paint sample cards, include PDF's of the paint sample cards for digital documentation. Include manufacturer color name and number. Although the color in the PDF may not match the sample card exactly, the PDF is required for electronic filing at the National Archives and Records Administration (NARA) Federal Records Center (FRC).

b. The Government will select architectural color and pattern after product approval.

8. Color Selection Submittals:

a. Samples: Representative of product to be installed. Xerographic sheets for color selection are not acceptable.

b. Color Chips: Sample paint chips.

1) Ink color reproductions are not acceptable for NARA FRC electronic documentation.

c. Label each sample, sample kit, set of color chips, or color chart with contract number and title.

d. The Government will select architectural color and pattern after product approval.

9. CDMS Special Documentation Requirements for Physical Samples:

a. In addition to physical samples, include PDF's of photographs with descriptions of the physical samples for digital documentation although important characteristics may not be exactly represented. Include manufacturer color name and number.

b. PDF is required for electronic filing of color samples at the NARA FRC. Additional acceptable file types for other documents include Word and Excess files.

c. Individual file sizes shall not exceed 2-Gigabytes. Files larger than 500 megabytes may require upload to SharePoint drive.

d. Files may be allowed in a Zip format.

10. Approved Samples:

a. Approval of a sample is only for the characteristics or use named in such approval and is not to be construed to change or modify any contract requirements.

b. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

1) Clear direction on the substitution of materials prior to submittal for approval is covered in Section 01 60 00 – Product Requirements, Part 2.02 – Substitutions.

c. Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at their expense, if so requested.

1.05 SUBMITTALS PROCEDURES

A. Submit only checked submittals. Submittals without evidence of Contractor's approval will be returned for resubmission.

B. Submit complete sets of required materials for each RSN as specified in "Submittals Required" column in Table 01 33 00A - List of Submittals. A complete set includes listed items for RSNs with multiple parts.

C. Submit sets specified in "Sets to be sent:" columns in Table 01 33 00A – List of Submittals.

1. Submittals identified with "CDMS" in the "Sets to be sent" column shall be submitted electronically in accordance with Section 01 31 30 – Contract Document Management System (CDMS).

D. Include the following information in transmittal letters:

1. Contract number and title.
2. RSN for each attached submittal.
3. Responsible code.
4. Number of sets for each RSN.
5. Identify submittal as initial or resubmittal.

E. Resubmittal of submittals other than approved or accepted:

1. Mark changes such that they are readily identifiable and show revision date.
2. Describe reasons for significant changes in transmittal letter.
3. Resubmit returned submittals within 14 days after receiving the comments, unless otherwise directed.
4. Requirements for initial submittals apply to resubmittals.
5. Resubmittals shall be a complete set, in accordance with Paragraph 1.05 B.

F. More than one RSN may be submitted under a transmittal letter, provided responsible code is same.

1.06 REVIEW OF SUBMITTALS

A. Submittals will be returned Approved (A), Conditionally Approved (CA), or Not Approved (NA), with the following exceptions:

1. Baseline Schedule, Updated Schedule Reports, Safety Data Sheets, Safety Program, Contractor's Onsite Safety Personnel, Weekly Safety Reports, Monthly Safety Summary Reports, Weekly Safety Inspection Reports, Fire Prevention and Protection Plan, will be returned Accepted (Acc), Conditionally Accepted (CAcc), or Not Accepted (NAcc).

B. Approval Standards for RSNs:

1. Approved RSNs: A copy of the Contractor's transmittal sheet marked "Approved" is enclosed and returned to the Contractor.

a. Approval comments and conditions are not intended to direct the Contractor's work and shall not relieve the Contractor of their responsibility for the accuracy, completeness and correctness of details, and with complying with the contract requirements.

b. Approval shall not relieve the Contractor of their responsibility for compliance with Federal Acquisition Regulation 52.236-21, Specifications and Drawings for Construction.

c. Rarely an RSN will be returned with comments.

1) The comments are intended to clarify specific interpretations or RSN language and shall not direct the Contractor's work, shall not relieve the Contractor of their responsibility for the accuracy, completeness, correctness of details, and with complying with the contract requirements.

2) Approval with comments shall not relieve the Contractor of their responsibility for compliance with Federal Acquisition Regulation 52.236-21, Specifications and Drawings for Construction.

2. Conditionally Approved RSNs: A copy of the Contractor's transmittal sheet marked "Conditionally Approved" is enclosed and returned to the Contractor with comments.

a. Conditional approval comments and conditions are not intended to direct the Contractor's work and shall not relieve the Contractor of the Contractor's responsibility for the accuracy, completeness, correctness of details, and with complying with the contract requirements.

b. Conditional approval shall not relieve the Contractor of responsibility for compliance with Federal Acquisition Regulation 52.236-21, Specifications and Drawings for Construction.

3. Not Approved RSNs: A cop or copies of the Contractor's transmittal sheet(s) marked "Not Approved" is/are enclosed.

a. Comments and conditions are not intended to direct the Contractor's work.

b. Comments and conditions shall not relieve the Contractor of the Contractor's responsibility for the accuracy, completeness, correctness of details, and with complying with the contract requirements.

C. Acceptance Standards for RSNs:

1. Accepted RSNs: A copy of the Contractor's transmittal sheet marked "Accepted" is enclosed and returned to the Contractor.

a. Accepted comments and conditions are not intended to direct the Contractor's work, shall not relieve the Contractor of the Contractor's responsibility for the accuracy, completeness, correctness of details, and with complying with the contract requirements.

b. Acceptance shall not relieve the Contractor of the Contractor's responsibility for compliance with Federal Acquisition Regulation 52.236-21, Specifications and Drawings for Construction.

c. Acceptance shall complete all of the requirements under this Submittal.

d. Proposed changes to accepted submittals shall be submitted and accepted before being implemented.

2. Conditionally Accepted RSNs: A copy of the Contractor's transmittal sheet marked "Conditionally Accepted" is enclosed and returned to the Contractor with comments.

a. The Contractor shall submit a response of the any portion of the submittal that is not conditionally within the time required for the Contractor to return submittals.

b. Conditionally accepted comments and conditions are not intended to direct the Contractor's work, shall not relieve the Contractor of the Contractor's responsibility for the accuracy, completeness, correctness of details, and with complying with the contract requirements.

c. Conditional acceptance shall not relieve the Contractor of responsibility for compliance with Federal Acquisition Regulation 52.236-21, Specifications and Drawings for Construction.

3. Not Accepted RSNs:

a. A copy or copies of the Contractor's transmittal sheet(s) marked "Not Accepted" is/are enclosed.

b. Comments and conditions are not intended to direct the Contractor's work, shall not relieve the Contractor of the Contractor's responsibility for the accuracy, completeness, correctness of details, and with complying with the contract requirements.

D. Time Required:

1. Submittal review will require 21 days for Government review of each submittal or resubmittal, unless otherwise specified.

2. Time required for review of each submittal or resubmittal begins when complete sets of materials required for a particular RSN are received and extends through return via CDMS or mailing postmark date. Submittals uploaded to CDMS after 5:00 pm Pacific Time will be marked received the next business day.

E. Time in Excess of Specified:

1. CO may extend contract completion date to allow additional time for completing work affected by excess review time.

a. Time extension will be to extent that excess review time caused delay to contract completion date.

b. Time extension will not exceed time used in excess of specified number of days for review of submittals or resubmittals.

c. Concurrent days of excess review time resulting from review of 2 or more separate submittals or resubmittals will be counted only once in extending contract completion date.

2. No time extension will be allowed if Contractor fails to make complete action submittals in sequence and within time periods specified.

3. Adjustment for delay will be made only to the extent that:

a. Approval was required under the contract, and.

b. Requests for approval were properly and timely submitted and were approved.

4. Adjustment will be subject to terms of paragraphs (b) and (c) of clause at FAR 52.242-14, Suspension of Work; however, no such delay shall be deemed to be a "suspension order" as term is used in that clause. Adjustment will be subject to terms of clause at FAR 52.247-17, Government Delay of Work.

F. Return of Submittals:

1. Submittals will be returned either approved, approved subject to identified changes, or not approved with the exception of RSNs 01 35 10-1, 01 35 10-2, 01 35 20-1, 01 35 30-1, 01 35 30-2, 01 57 20-1, and 01 74 00-2, which will be accepted or not accepted. Submittal responses will be returned via the CDMS or hard copy, as applicable.

2. Government will acknowledge acceptance of submittals.

a. Submittals will not be returned when they comply with the specifications.

b. Revise and resubmit submittals not approved or not accepted, as instructed.

1.07 HARD COPY TRANSMITTALS

A. Addresses for codes listed in Table 01 33 00A - List of Submittals:

1. Contracting Officer Representative (COR), Bureau of Reclamation:

a. Regional Construction Office, Willows Field Office, Attn: RCO-200, 1140 West Wood Street, Willows CA 95988-2615.

2. Area Manager (AM), Bureau of Reclamation, Attn: Mazyar Daneshgar, Central California Area Office, 7794 Folsom Dam Road, Folsom, CA 95630

3. Technical Service Center (TSC), Bureau of Reclamation, Attn: 86-68160, P.O. Box 25007, Denver CO 80225-0007; Express Mail: Sixth and Kipling, Building 67, Room 152.

B. Send original transmittal letter with appropriate number of sets to office listed in "Responsible Code" column in Table 01 33 00A - List of Submittals.

1. Responsible codes starting with "86-6" are located in TSC. Send these submittals to the TSC address shown above.

2. Submittals identified with "CDMS" in the "Sets to be sent" column shall be submitted in electronic format in accordance with Section 01 31 30 – Contract Document Management System. However, the following items should be submitted via hardcopy in accordance with Article 1.04 – Submittal Requirements:

a. At the discretion of the Government, the Contractor may be required to provide complete sets of hardcopies of all documents which appear unclear or illegible in their electronic format.

C. Send copy of transmittal letter with appropriate number of sets to offices that are not responsible code but show "Sets to be sent" in Table 01 33 00A - List of Submittals.

D. When "Sets to be sent" is 0, send a copy of transmittal letter to that office.

E. Submittals required by specifications, but not listed in Table 01 33 00A - List of Submittals:

1. Submit in accordance with this section.

2. Submit to COR, unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01 33 00A. - List of Submittals

* CO indicates Contracting Officer, AM indicates Area Manager, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.
** Submit one hardcopy of each submittal, in addition to CDMS to the COR, unless otherwise indicated in table.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
1	Schedule of Values	Schedule of Values for lump sum CLINs	Submitted and approved before first payment	COR	CDMS			
01 14 10-1	Use of Site	Land Use and Landscape Rehabilitation Plan	At least 21-days before use of Government land	COR	CDMS			
01 14 10-2	Use of Site	Permit to Work	Within 21-days after receipt of Notice to Proceed	COR	CDMS			
01 14 30-1	Interruption of Service	Interruption of Service Request	At least 14-days before Interruption of Service is required	COR	CDMS			
01 31 30-1	Contract Document Management System	Approval Data	At least 28-days prior to beginning onsite work	COR	1	0	1	1
01 31 30-2	Contract Document Management System	Final Data	At least 28-days prior to beginning onsite work	COR	1	0	1	1
01 32 10-1	Construction Program	Representative Information	Within 21-days after receipt of Notice to Proceed	COR	0	1	1	1
01 32 10-2	Construction Program	Baseline Schedule	Within 21-days after receipt of Notice to Proceed	COR	0	1	1	1
01 32 10-3	Construction Program	Updated Schedule Reports	With monthly requests for progress payments	COR	CDMS			
01 32 10-4	Construction Program	Time Impact Analysis	With monthly requests for progress payments	COR	0	1	1	1
01 35 10-1	Safety Data Sheets	Complete LHM And SDS	At least 14-days before jobsite delivery of hazardous material	COR	CDMS			
01 35 10-2	Safety Data Sheets	Updated LHM And SDS	At least 14-days before jobsite delivery of hazardous material not previously listed	COR	CDMS			
01 35 20-1	Safety and Health	Safety Program	At least 14-days before work begins	COR	CDMS			
01 35 20-2	Safety and Health	Monthly Accident Summary Report	Monthly	COR	CDMS			
01 35 30-1	Contractors Onsite Safety Personnel	Qualifications	Prior to employment	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
01 35 50-1	Site Security	Security Program	At least 21-days before beginning work	COR	CDMS			
01 35 50-2	Site Security	List of Onsite Employees and Vehicles	At least 7-days before employee reports to site and updated at least monthly	COR	CDMS			
01 57 30-1	Water Pollution Control Plan	Spill Prevention, Control, and Countermeasure (SPCC) Plan	At least 28-days prior to beginning onsite work	COR	CDMS			
01 74 00-1	Cleaning and Waste Management	Waste Production and Disposal Plan	At least 28-days before starting onsite work	COR	CDMS			
01 74 00-2	Cleaning and Waste Management	Waste Production and Disposal Records	Within 7-days of waste disposal	COR	CDMS			
01 74 00-3	Cleaning and Waste Management	Environmental Consultant Resume	At least 35-days before beginning environmental assessment	COR	CDMS			
01 74 00-4	Cleaning and Waste Management	Environmental Site Assessment	Within 14-days of completion of work	COR	CDMS			
01 78 30-1	Project Record Documents	Draft O&M Manual	Within 14-days prior to first training session	COR	CDMS			
01 78 30-2	Project Record Documents	Operation and Maintenance (O&M) Manuals	Within 60-days of commissioning	COR	CDMS			
01 78 30-3	Project Record Documents	Extra Materials	Within 14-days of completion of onsite work	COR	CDMS			
01 79 20-1	Training	Training Outline, Materials, Notification and Summary	Within 14-days prior to first training session	COR	CDMS			
01 79 20-2	Training	Training Video Recording	Within 14-days after last training session	COR	CDMS			
02 80 10-1	General Requirements for Asbestos Abatement	Resumes and Qualifications	At least 28-days before starting onsite work	COR	CDMS			
02 80 10-2	General Requirements for Asbestos Abatement	Worker Protection Plan	At least 28-days before starting onsite work	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
02 80 10-3	General Requirements for Asbestos Abatement	Worker Background Exposure Test Results	At least 28-days before starting onsite work	COR	CDMS			
02 80 10-4	General Requirements for Asbestos Abatement	Working Level Test Results	At least 28-days before starting onsite work	COR	CDMS			
02 80 10-5	General Requirements for Asbestos Abatement	Visual Inspection and Final Air Clearance	Within 7-days of completion of onsite work	COR	CDMS			
02 80 11-1	General Requirements for Coatings Containing Regulated Metals Abatement	Resumes and Qualifications	At least 28-days before starting onsite work	COR	CDMS			
02 80 11-2	General Requirements for Coatings Containing Regulated Metals Abatement	Worker Protection Plan	At least 28-days before starting onsite work	COR	CDMS			
02 80 11-3	General Requirements for Coatings Containing Regulated Metals Abatement	Preconstruction Test Results	At least 28-days before starting onsite work	COR	CDMS			
02 80 11-4	General Requirements for Coatings Containing Regulated Metals Abatement	Working Level Test Results	Within 14 days of test	COR	CDMS			
02 80 11-5	General Requirements for Coatings Containing Regulated Metals Abatement	Post-construction Test Results	Within 14 days of test	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
02 82 20-1	Removal and Disposal of Asbestos Containing Materials	Qualifications	At least 28-days before starting onsite work	COR	CDMS			
02 82 20-2	Removal and Disposal of Asbestos Containing Materials	Asbestos Survey	At least 28-days before starting abatement	COR	CDMS			
02 82 20-3	Removal and Disposal of Asbestos Containing Materials	Asbestos Hazard Abatement Plan	At least 28-days before starting abatement	COR	CDMS			
02 82 20-4	Removal and Disposal of Asbestos Containing Materials	Copy of Asbestos Abatement Notification Form	At least 28-days before starting abatement	COR	CDMS			
02 82 20-5	Removal and Disposal of Asbestos Containing Materials	Manifest for COR Signature	At commissioning	COR	CDMS			
02 82 20-6	Removal and Disposal of Asbestos Containing Materials	Shipping and Disposal Documentation	At commissioning	COR	CDMS			
02 83 33-1	Recycling of Scrap Metal with Coatings Containing Hazardous Materials	Qualifications	At least 28-days before starting abatement	COR	CDMS			
02 83 33-2	Recycling of Scrap Metal with Coatings Containing Hazardous Materials	Coatings Removal Debris Abatement Plan	At least 28-days before starting abatement	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
02 83 33-3	Recycling of Scrap Metal with Coatings Containing Hazardous Materials	Recycling of Scrap Metal with Coatings Containing Hazardous Materials Handling Plan	At least 28-days before starting abatement	COR	CDMS			
02 83 33-4	Recycling of Scrap Metal with Coatings Containing Hazardous Materials	Bills of Lading and Recycling Records for Scrap Metal with Coatings Containing Hazardous Materials	At commissioning	COR	CDMS			
02 87 20-1	Removal and Disposal of Used Oil	Qualifications	At least 28-days before starting onsite work	COR	CDMS			
02 87 20-2	Removal and Disposal of Used Oil	Used Oil Characterization, Handling, and Disposal Plan	At least 28-days before starting onsite work	COR	CDMS			
02 87 20-3	Removal and Disposal of Used Oil	Characterization Report	At least 28-days before starting onsite work	COR	CDMS			
02 87 20-4	Removal and Disposal of Used Oil	Manifests, Bills of Lading, Disposal Certificates	At commissioning	COR	CDMS			
03 62 20-1	Nonshrink Grout	Packaged Nonshrink Grout Data	At least 28-days before starting onsite work	COR	CDMS			
09 96 20-1	Coatings	Approval Data	At least 28-days before starting onsite work	COR	CDMS			
09 96 20-2	Coatings	Final Approval Data	At least 28-days before starting onsite work	COR	CDMS			
09 96 20-3	Coatings	Paint Chip Samples	At least 28-days before starting onsite work	COR	0	0	1	1
09 96 20-4	Coatings	Qualifications	At least 28-days before starting onsite work	COR	CDMS			
09 96 20-5	Coatings	Quality Control Plan	At least 28-days before starting onsite work	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
09 96 20-6	Coatings	Contractor Quality Testing Report	Within 3 days of testing	COR	CDMS			
25 00 01-1	Automation Control System	Qualifications	At least 28-days before start of design work	COR	CDMS			
25 00 01-2	Automation Control System	Approval Drawings and Data (Government Format)	At least 28 days before procurement	COR	CDMS			
25 00 01-3	Automation Control System	Installation Plan and Procedures	At least 14-days before starting onsite work	COR	CDMS			
25 00 01-4	Automation Control System	Software Development Documentation: Automation Control Systems	Submitted and approved at least 60 days before starting Factory Acceptance Test	COR	CDMS			
25 00 01-5	Automation Control System	Factory Acceptance Test Procedure	At least 60-days before starting Factory Acceptance Test	COR	CDMS			
25 00 01-6	Automation Control System	Factory Acceptance Test Report Automation Control System	Within 14 days of test completion	COR	CDMS			
25 00 01-7	Automation Control System	Pre-Start Checkout Test Procedure Automation Control System	At least 28-days before starting onsite work	COR	CDMS			
25 00 01-8	Automation Control System	Pre-Start Checkout Test Report Automation Control System	Within 14-days of test completion	COR	CDMS			
25 00 01-9	Automation Control System	Check Prints (Government Format)	At the same time equipment is shipped to site	COR	CDMS			
25 00 01-10	Automation Control System	Site Acceptance Test Procedure Automation Control System	At least 42-days before Site Acceptance Test	COR	CDMS			
25 00 01-11	Automation Control System	Site Acceptance Test Report Automation Control System	Within 28 days of test completion	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
25 00 01-12	Automation Control System	Commissioning of Electrical Equipment – Automation Control System	Within 14 days of completion of commissioning.	COR	CDMS			
25 00 01-13	Automation Control System	Final As-Built Drawings (Government Format), Final Software File and Documentation Automation Control System	At Commissioning	COR	CDMS			
25 00 01-14	Automation Control System	Operation and Maintenance Manual; Crane Automation Control System	Within 28 days of completion of installation	COR	CDMS			
26 05 02-1	Basic Electrical Materials and Methods	Equipment Layout Plan and Coordination Approval Drawings	At least 35-days before starting onsite work	COR	CDMS			
26 05 02-2	Basic Electrical Materials and Methods	Resumes	At least 28-days before starting onsite work.	COR	CDMS			
26 05 10-1	Conductors and Cables	Approval Data	At least 35 days prior to procurement.	COR	CDMS			
26 05 10-2	Conductors and Cables	Notification of Field Tests	At least 14-days before starting testing	COR	CDMS			
26 05 10-3	Conductors and Cables	Field Test Reports	Within 7 days of test completion	COR	CDMS			
26 05 20-1	Grounding and Bonding	Approval Drawings and Data	At least 35 days prior to procurement.	COR	CDMS			
26 05 20-2	Grounding and Bonding	Field Test Reports	Within 7 days of test completion	COR	CDMS			
26 05 33-1	Raceways and Boxes	Approval Drawings and Product Data	At least 35 days prior to procurement.	COR	CDMS			
26 05 33-2	Raceways and Boxes	Site Acceptance Test Reports	Within 7 days of test completion	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
26 05 60-1	Identification, Warning and Safety Signs	Approval Drawings and Data (Government Format)	At least 28-days before procurement.	COR	CDMS			
26 05 90-1	Wiring Checkout and Tests	Test Notifications	At least 14 days before testing	COR	CDMS			
26 05 90-2	Wiring Checkout and Tests	Test Reports	Within 7 days of test completion	COR	CDMS			
26 08 00-1	Commissioning of Electrical Equipment	Schedule for Commissioning Tests	At least 28-days before starting onsite work	COR	CDMS			
26 24 42-1	Distribution Panelboards	Approval Drawings and Data (Government Format)	At least 35 days prior to procurement.	COR	CDMS			
26 24 42-2	Distribution Panelboards	Factory Test Report	Within 14 days of test completion.	COR	CDMS			
26 24 42-3	Distribution Panelboards	Site Acceptance Test Report	Within 14 day of test completion.	COR	CDMS			
26 24 42-4	Distribution Panelboards	Commissioning Test Reports for Distribution Panelboards	Within 14 days of test completion	COR	CDMS			
26 43 13-1	Surge Protection Devices for Electrical Circuits	Product Data	At least 35 days prior to procurement.	COR	CDMS			
26 43 13-2	Surge Protection Devices for Electrical Circuits	Approval Drawings and Data (Government Format)	At least 28-days before starting onsite work	COR	CDMS			
26 43 13-3	Surge Protection Devices for Electrical Circuits	Final Schematics and Wiring Diagrams (Government Format)	At commissioning.	COR	CDMS			
26 43 13-4	Surge Protection Devices for Electrical Circuits	Operations and Maintenance Manual	Within 28 days of completion of installation.	COR	CDMS			
41 22 13-1	Removal of Existing Crane	Report and Plan	At least 28-days before starting onsite work	COR	CDMS			

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Respon-sible code	Sets to be sent: *			
					CO	AM	COR **	TSC
41 22 13-2	Removal of Existing Crane	Existing Condition As-Built Drawings	At least 28 days prior to demolition	COR	CDMS			
41 22 14-1	Bridge Crane	Qualifications	14 days after Notice to Proceed	COR	CDMS			
41 22 14-2	Bridge Crane	Runway Rail Survey and Report	Submitted and approved prior to beginning onsite work	COR	CDMS			
41 22 14-3	Bridge Crane	Approval Drawings and Data	At least 28-days before starting onsite work	COR	CDMS			
41 22 14-4	Bridge Crane	PLC Code	At least 28-days before starting onsite work	COR	CDMS			
41 22 14-5	Bridge Crane	Installation Plan and Procedures	At least 56-days before starting onsite work	COR	CDMS			
41 22 14-6	Bridge Crane	Crane Operational and Load Test Plan	At least 28-days before commissioning	COR	CDMS			
41 22 14-7	Bridge Crane	Factory Acceptance Test Procedure	At least 28-days before starting onsite work	COR	CDMS			
41 22 14-8	Bridge Crane	Factory Acceptance Test Report – 30-Ton Bridge Crane	At least 28-days before starting onsite work	COR	CDMS			
41 22 14-9	Bridge Crane	Final Data	Within 28-days of completing commissioning	COR	CDMS			
41 22 15-1	Bridge Crane Electrical Components	Approval Drawings and Data	Submitted and approved at least 56 days prior to beginning onsite work.	COR	CDMS			
41 22 15-2	Bridge Crane Electrical Components	Installation Plan and Procedures	At least 42-days before starting onsite work	COR	CDMS			
41 22 15-3	Bridge Crane Electrical Components	Final Product Data	Within 28-days of completing commissioning	COR	CDMS			
41 22 16-1	Crane Motors	Motor Design Data	At least 28-days before starting onsite work	COR	CDMS			

END OF SECTION

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SECTION 01 33 26
ELECTRICAL DRAWINGS AND DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for items requiring electrical drawings and data.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME Y14.1-20	Decimal Inch Drawing Sheet Size And Format

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 315-1975(1993)	Graphic Symbols For Electrical And Electronics Diagrams (Including Reference Designation Letters)
2.	IEEE C37.2-2008	Electrical Power System Device Function Numbers, Acronyms, and Contact Designations
3.	IEEE Y32.9-1972(1989)	Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA ICS 1-2000(2008)	Industrial Control and Systems: General Requirements

1.03 SUBMITTAL PROCEDURES

A. In addition to requirements in Section 01 33 00 - Submittals, prepare electrical drawings and data submittals in accordance with the following.

B. Drawings, general:

1. Device designations and symbols:
   a. Conform to IEEE 315, IEEE C37.2, IEEE Y32.9, and NEMA ICS-1.
   b. As indicated on Standard Drawing 104-D-1150.

2. Size: D-size prints as defined in ASME Y14.1 made from original drawings.

3. Indicate changes on revised drawings to distinguish them from previous submittals. Describe reasons for significant changes in submittal letters.

C. Approval Drawings in Government Format:

1. General:

a. Furnish with Government title block and in form as indicated on standard drawing 40-D-7102.

b. Government will provide specific title block information when drawings are submitted.

c. Government may revise conductor or device designations on Contractor's drawings when drawings are approved at no change in contract price or completion time.

2. Schematic Diagrams:

a. In accordance with standard drawing 104-D-1150.

b. Format:

1) Vertical ladder diagram form.

2) Label rungs with sequential numbers starting with number 1.

3) Locate rung numbers adjacent and to left of associated rung.

4) Provide unique rung numbers for each circuit.

c. Conductor designations: As indicated on drawings.

d. Indicate device terminal designations.

e. Indicate functional operation.

f. Describe unusual or nonstandard operation.

g. Indicate ratings and/or values of devices.

h. Indicate contacts, including spare contacts, for motor contactors, auxiliary relays, timers, and protective relays.

i. Indicate cross-referencing between other schematic and wiring diagrams.

j. Do not include current and potential transformer circuits on drawing with direct-current control and protective relaying circuits.

k. Conductor designations: As indicated on drawings or as developed by Contractor. Contractor-developed conductor designations shall consist of:

1) Circuit prefix.

2) Rung number.

3) Unique rung wire letter such as 5P15C ("5"-Unit Number, "P"-Protection Circuit, "15"-Rung Number, "C"-Unique Rung Wire Letter).

l. Base instrument current and potential transformer circuit conductor designations upon primary conductor designations indicated on single-line diagram drawings.

m. Show switch developments for control, selector, and limit switches.

n. Show device and terminal block designations.

3. Wiring Diagram Drawings:

a. Match with schematic diagram drawings.

b. Indicate point-to-point wiring in accordance with standard drawing 104-D-1165.

c. Indicate equipment as mounted on back, side, swing, and door panels. Show panel as viewed from wiring side of panel.

d. Identify each item of equipment with designation indicated on schematic diagram.

e. Identify control and protective devices with IEEE device number as indicated on specifications drawings or on Standard Drawing 104-D-1150.

f. Identify components such as fuses and resistors by value.

g. Indicate wiring of devices and items of equipment including terminal number.

h. Indicate cables, cable and individual wire designations, and connections to external circuits.

i. Cable designations: Similar to designations on standard drawing 104-D-1165.

j. Show no more than one panel per drawing.

4. Sample Wiring Diagram: Sample of actual wiring diagram that will be submitted as check print and final drawing.

D. Approval Drawings and Data in Manufacturer's Format:

1. General: Furnish with manufacturer's standard format, except as noted below.

2. Equipment Layout Drawings:

a. Indicate dimensions of equipment.

b. Indicate location of devices and items of equipment including nameplates, terminal blocks, wiring ducts, bus, conduit entries, and other features in their relative physical location.

c. Indicate method of securing equipment to deck, floor, or wall.

d. Identify each device and item of equipment with a bill of material reference number.

Bill of Material List:

e. Provide information on manufacturer, style, type, rating, quantity, and other identifying information for each device or item of equipment.

f. Provide unique reference number for each device or item of equipment listed on bill of material.

3. Nameplate Lists: Provide information on type of material, size, and engraved lettering.

4. Manufacturer's Technical Catalog Data:

a. Provide technical data for each device or item of equipment.

b. Include manufacturer's name and address; catalog number, type, style, or model number; electrical ratings; and dimensions.

c. Where several items are listed on same sheet, indicate items being submitted for approval.

d. Demonstrate proposed device or item of equipment meets specifications requirements.

e. Mark catalog data sheet with appropriate bill of material (BOM) item number.

f. Assemble catalog data sheet into one enclosing cover with bill of material (BOM) index.

5. Time-Current Characteristic and Equipment Coordination Curves:

a. Provide time-current characteristic curves for adjustable and non-adjustable protective devices.

b. Provide equipment coordination curves for:

1) Transformer inrush current.

2) Transformer full load current.

3) Transformer thermal and mechanical damage.

4) Motor inrush current.

5) Motor full load current.

c. Original plot on log-log graph paper.

d. Illustrate degree of selectivity being provided.

E. Check Prints:

1. Schematic and wiring diagrams which indicate "As-built" condition of equipment at time of shipment.

2. Mark as changes and revisions are made during installation and checkout of equipment.
3. Keep drawings at the jobsite and mark as work progresses.
4. Maintain separate, identical set of prints for use in preparing final drawings.

F. As-built Drawings:

1. Mark prints of electrical specifications drawings to indicate as-built changes made to equipment and systems during construction.
2. Provide for grounding, conduit, and lighting systems.
   a. Indicate as-built changes made during construction.
   b. Indicate dimensions of:
      1) Location of grounding electrodes.
      2) Embedded and direct buried grounding cables.
      3) Embedded and direct buried conduit.
3. Include revision dates.
4. Mark the drawings in the following colors:
   a. Red - Additions to original drawings.
   b. Green - Deletions to original drawings.
   c. Blue - Notations necessary for explanation of as-built markings.

G. Final Drawings:

1. Revised to reflect approval comments and as-built condition of installed equipment at time of contract completion.
2. Provide original plot of schematic and wiring diagrams, equipment layout drawings, bill of materials, and nameplate drawings/lists.
3. Provide computer drawing files on DVD disc or other electronic device approved by Government in AutoCAD (*.dwg).

H. Test Reports:

1. Typed, 8 1/2- by 11-inch sheets.
2. Certified.
3. Submit multi-page reports in bound folder or three-ring binder.

I. Operation and Maintenance Instructions Books:

1. Print copies:
   a. Assemble each set of material into one or more books with enclosing covers.

2. Electronic copies:
   a. Adobe Acrobat (.pdf) format on DVD discs or other electronic device approved by Government.
   b. Conform to print copies.
   c. Bookmark file(s) to aid in navigating.
3. Provide following items:
   a. Index sheet at front of each book which provides page or index tab number information for each device or item of equipment in book.
   b. Manufacturer's operation and maintenance procedures; installation details, as necessary; and catalog data sheets for each device or item of equipment.
   c. List of recommended spare parts and components.
   d. Parts lists for replacement parts.
   e. Manufacturer's full-size circuit breaker and fuse time-current curves.
   f. Copies of factory test reports.
   g. Copies of bills of materials
   h. Copies of drawings:
      1) Revised to reflect approval comments.
      2) Maximum size: 11- by 17-inch.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 10
SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 DEFINITIONS

A. LHM: List of Hazardous Materials.

B. SDS: Safety Data Sheet:

1. Referred to as Material Safety Data Sheets in the clause at 52.223-3, Hazardous Material Identifications and Material Safety Data - Alternate 1.

1.03 APPLICATION

A. For the purposes of this contract, "delivered under this contract" in paragraph (b) of the clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1, includes:

1. Materials delivered to Government.
2. Materials incorporated into work.
3. Materials used by the Contractor during contract performance at the jobsite.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 35 10-1, Complete LHM and SDS.

C. RSN 01 35 10-2, Updated LHM and SDS:

1. Comply with paragraph (e) of clause at FAR 52.223-3, Hazardous Material Identification and Material Safety Data - Alternate 1.

1.05 DELIVERY

A. Do not deliver hazardous materials to jobsite which are not included on original or previously updated LHM and SDS before receipt of updated LHM and SDS by CE.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 20
SAFETY AND HEALTH

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. Reclamation Safety and Health Standards (RSHS), current version will be provided to the Contractor at the Notice to proceed meeting.
2. [FIST 1-1 (2012) Hazardous Energy Control Program:
   a. Available online at: www.usbr.gov/power/data/fist_pub.html.
   b. FHECP Facility Hazardous Energy Control Program.

B. Occupational Safety and Health Administration (OSHA)

1. 29 CFR Part 1910 OSHA General Industry Standards
2. 29 CFR Part 1926 OSHA Construction Industry Regulations
3. Available online at: https://www.osha.gov/.

C. Applicable State Safety and Health Regulations

1. California Code of Regulations (CCR) Title 8 – CAL/OSHA
   a. Available online at: https://www.dir.ca.gov/title8/index/T8index.asp.
2. California Department of Public Health, Valley Fever Tailgate Training Guide for California Construction Workers.
   a. Available online at: https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/HESIS/CDPH%20Document%20Library/ValleyFeverWorkerTraining.pdf.

D. If conflict occurs between Federal and State Laws or standards, the most stringent having jurisdiction shall apply.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 01 35 20-1, Safety Program:

1. Written Safety Program in accordance with Section 1.03 of the RSHS and WBR 1452.223-81-- SAFETY AND HEALTH -- BUREAU OF RECLAMATION (OCT 2022).

2. Cover all aspects of onsite and applicable off-site operations and activities associated with this contract.

3. Program must follow the format of the Site-Specific Safety and Health Plan outline in Part 1.08.D below.

4. Will not be accepted for review by the COR unless it addresses, in order, lettered and numbered, in accordance with, the Site-Specific Safety and Health Plan outline in Part 1.08.D below.

   a. For items in the outline that do not apply to this contract write "Not Applicable to Contract" next to the number/letter.

   b. The outline is the minimum required safety elements. The Contractor may add elements to the outline that the Contractor believes are omitted but are relevant to the work being performed on the contract.

5. Provide a list of Job Hazard Analyses (JHA) for each distinct phase of work that will be submitted throughout the project.

6. A generic Company Safety Plan is not acceptable. The Safety Program must be <u>site specific</u> for this contract. Do not cut-and-paste parts from the RSHS.

7. The Contractor's Safety Program must be submitted and accepted by Reclamation prior to commencing on site work, including mobilization.

C. RSN 01 35 20-2, Monthly Accident Summary Report:

1. Form 7-2218 or other acceptable form in accordance with paragraph 1.03.5.f of RSHS.

1.04 SAFETY AND HEALTH

A. The Contractor shall not require any person employed in the performance of this contract (including subcontracts) to work under conditions which are unsanitary, hazardous, or dangerous to an employee's health or safety in accordance with the current version of WBR 1452.223-81-- SAFETY AND HEALTH -- BUREAU OF RECLAMATION (OCT 2022).

1. Do not allow Contractor employees (including subcontractors), Government personnel, or the Public to be exposed to, or work under, conditions which are unsanitary, physically hazardous, or a potential exposure danger to their health or safety during performance of the contract.

B. The Contractor shall comply with the most current version of the Bureau of Reclamation's Reclamation Safety and Health Standards (RSHS) and, if incorporated,

52.236-13 Accident Prevention in accordance with WBR 1452.223-81-- SAFETY AND HEALTH -- BUREAU OF RECLAMATION (OCT 2022).

C. The Contractor shall comply with the standards (29 CFR) issued by the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, www.osha.gov in accordance with WBR 1452.223-81-- SAFETY AND HEALTH -- BUREAU OF RECLAMATION (OCT 2022).

1. In the event there is a conflict between the requirements contained in paragraphs (B) and (C) referenced herein, or in the Specifications, the more stringent requirement having jurisdiction shall prevail.

D. Under no circumstances will onsite work, including mobilization, be permitted until the Safety Program has been accepted by the COR.

E. Fully participate in a Contractor Safety Program Review meeting, according to RSHS Section 1.03, prior to mobilization. If applicable, include subcontractor management representatives.

F. The minimum work crew at any time on the construction site shall consist of no less than two people and shall be in accordance with other contractual obligations.

G. Develop Job Hazard Analysis for each distinct phase of work under the contract.

1. Work shall not begin on the phase of work until a JHA is acceptable to COR and shared with all construction employees.

2. Activities involving hazardous materials shall have the appropriate Safety Data Sheet(s) attached to the JHA.

H. In addition to requirements of the clause at FAR 52.236-13 “Accident Prevention”, fully comply with RSHS.

1. RSHS is available online at https://www.usbr.gov/safety/rshs/index.html.

2. Maintain onsite a copy of the accepted RSHS Safety Program.

3. Construction Safety and Health Standards promulgated by the Secretary of Labor may be obtained from any regional or area office of the Occupational Safety and Health Administration of the U.S. Department of Labor.

4. California Code of Regulations (CCR) Title 8 Occupational Safety and Health Standards that apply to all (Non-Federal) places of employment in California.

5. Maintain onsite a required for every California employer a copy of the written Injury and Illness Prevention (IIP) Program.

I. Be cognizant of and ensure compliance with requirements set forth in paragraphs above.

1. Contractor’s responsibility applies to all operations, including those of the Contractor’s Subcontractors.

2. When violations of safety and health requirements contained in these specifications or referenced standards are called to the Contractor's attention by the CO and COR immediately correct the condition to which attention has been directed.

3. Either oral or written notice shall be deemed sufficient.

J. When the Contractor fails or refuses to promptly correct a compliance directive, the CO or the COR may issue an order to stop all or any part of the work.

1. When satisfactory corrective action is taken, an order to resume work will be issued.

2. The Contractor shall not be entitled to extension of time, nor to claim for damage or to additional compensation by reason of either the directive or the stop order.

3. Failure of the CO and COR to order discontinuance of any or all of the Contractor's operations shall not relieve the Contractor of the responsibility for the safety of personnel and property.

K. The Contractor shall maintain an accurate record of, and shall report to the Contracting Officer (or authorized representative) in the manner prescribed by the Contracting Officer, all cases of death, occupational diseases, or traumatic injury to employees or the public involved, and property damage in accordance with the RSHS, OSHA guidelines, and with WBR 1452.223-81-- SAFETY AND HEALTH -- BUREAU OF RECLAMATION (OCT 2022).

1. The Contractor shall immediately notify the Construction Office Safety Manager following the reporting to OSHA of a work-related OSHA-Reportable case including, fatality, inpatient hospitalization, amputation, or loss of an eye.

2. Maintain an accurate record of, and report to the COR in the manner prescribed by the CO for <u>all</u> near misses, accidents or incidents, occupational diseases, traumatic injury, cases of death to Contractor employees (including subcontractors), Government personnel, or the Public, and <u>any</u> property damage occurring during the performance of work under this contract.

L. The rights and remedies of the Government provided in this section are in addition to any other rights and remedies provided by law or under this contract.

1. In the event there is a conflict between requirements contained in RSHS, specification paragraphs, Contractor's approved Safety Program, referenced safety and health codes, and standards, or the U.S. Department of Labor Construction Safety and Health Standards, promulgated under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.), as amended, the more protective requirement having jurisdiction shall prevail.

M. If the contractor deems that an updated version of the RSHS constitutes a substantive change to the contract, affecting price or time (or both), the contractor may request a contract modification in accordance with the terms of the contract in accordance with

WBR 1452.223-81-- SAFETY AND HEALTH -- BUREAU OF RECLAMATION (OCT 2022).

1.05 SPECIAL CALIFORNIA VALLEY FEVER REQUIREMENTS

A. Coccidioidomycosis, also known as "Valley Fever" or "cocci", is a disease caused by Coccidioides fungi which infect the lungs. When the fungus spores present in soil are disturbed, the spores may become airborne and can be inhaled.

B. The Contractor is hereby notified that the spores which cause Valley Fever are endemic to the Counties of Fresno, Kern, Kings, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Santa Barbara, Tulare, and Ventura.

C. Activities which disturb soil or expose workers to dust, such as digging, operating earth-moving equipment, driving vehicles, and working in wind-blown areas, may increase the risk of Valley Fever in workers.

D. Information regarding preventing and recognizing the symptoms of Valley Fever are available from the California Department of Public Health and the California Department of Industrial Relations.

1. The provisions of this section shall be made a part of every subcontract executed pursuant to this contract.

2. State Law (amendment to the California Labor Code) effective May 1, 2020, applies to employers in 11 Counties in the Central Valley Region.

a. State Law requires Construction firms and other employers in these California Counties to conduct awareness training, covering 8 required topics, to employees, initially and annually.

b. The Valley Fever Tailgate Training Guide for California Construction Workers is available at site described in References above.

1.06 CYANOBACTERIAL HARMFUL ALGAL BLOOMS (CYANOHABS) IN WATER BODIES

A. In freshwater systems, cyanobacteria (previously known as blue-green algae) are microorganisms that can produce harmful algal blooms (HABs). The contractor shall provide basic employee training to identify potential HABs and shall immediately notify the COR if potential HABs are discovered.

1.07 SAFETY TRAINING VISUAL DOCUMENTATION

A. Provide visual documentation of completed safety trainings (i.e. hard hat stickers).

1. The visual documentation will enable people to be identified who have or have not received quarry safety training.

2. Quarry safety training is required for access into the quarry area unless escorted by an individual who has been trained.

1.08 SAFETY AND HEALTH PLAN

A. Unless waived by the Contracting Officer's Representative (COR), prime and supplementary safety program submittals shall, as a minimum, address all appropriate contractual requirements shown under the program outline. Program items will be so detailed that reviewers can ascertain adequacy. The original program submittal can cover all work phases, or only address the initial work phase with timely supplementary submittals as major work phases occur. Contractors desiring to follow this latter course of action will, in the initial submission, clearly define the original work covered and the work phases to be covered by supplements.

B. In no case will any phase of work commence until a program for that portion of the work has been accepted by the COR. Original and supplemental submissions covering hazardous operations and/or activities will include a standing operating procedure (SOP) and hazard analysis. The SOP will break down the operation or activity into specific basic steps. The hazard analysis will define the hazards associated with each basic step and proposed method(s) for eliminating or minimizing the hazard. Such methods will outline, as a minimum, employee training requirements, personal protective equipment requirements, procedural changes, methods for evaluating program effectiveness, etc.

C. All activities involving use of hazardous and/or toxic materials, work in confined spaces, work at heights over 6 feet, or underwater require an SOP and hazard analysis. Material Safety Data Sheets will be attached to all SOPs governing work that involves use of hazardous or toxic materials.

D. Prepare a Site-Specific Safety and Health Plan with major components labeled in accordance with the following Program Outline:

1. General Requirements:

   a. Statement of Policy.

   b. Statement of Safety and Health Responsibilities.

   c. Statement of Compliance with Regulations, Standards, and Codes.

   d. Statement of Subcontractor Compliance.

   e. Safety Inspection Procedures.

   f. Accident Investigation and Reporting Procedures.

   g. Applicable Emergency Plans.

   h. Confined Space Procedures.

   i. Lockout/Tagout Procedures.

   j. Fire Protection Plans.

k. Type and location of suppression equipment or systems.

l. Offsite assistance agreement.

m. Temporary heating devices.

2. Medical:

a. Facilities.

b. Training.

c. Certifications.

d. Physician.

e. Ambulance (Name, location, and telephone number).

f. Physical Qualification of Employees.

g. Records.

3. Communications:

a. Employee Training.

b. Safety Meetings.

c. Onsite Training.

d. Supervisor Training.

4. Occupational Health:

a. Procedures and Equipment to Minimize Hazards.

b. Testing program for employees and work environments.

c. Qualified personnel.

d. Personal protective equipment.

e. Ventilation plans.

5. Machinery and Mechanical Equipment:

a. Procedures and Equipment to Minimize Hazards.

1) Testing program for employees and work environments.

2) Mobile and stationary equipment.

b. Inspection Procedures.

c. Maintenance Procedures.

d. Operating Personnel.

e. Protective Safety Devices and Certifications.

f. Elevators and Aerial Lifts.

6. Excavation and Demolition:

a. Tunnels and Shafts:

1) Internal combustion engines.

2) Ventilation plans.

3) Transportation systems and equipment.

4) Work environment testing.

5) Ground support.

b. Blasting:

1) Blaster certification.

2) Written procedures.

3) Storage.

4) Transportation.

c. Excavations Other Than Tunnels and Shafts:

1) Slide protections.

2) Support systems.

3) Inspections.

4) Access.

d. High Scaling:

1) Definition.

2) Personal protective equipment.

3) Standing operating procedure.

e. Haulage:

1) Haul roads.

2) Equipment and Procedures.

7. Working Surfaces:

a. Access:

1) Ladders.

2) Platforms, stairways, and ramps.

b. Personal Protective Equipment.

c. Scaffolding.

d. Safety Nets.

8. Protection of the Public:

a. Signs and Barricades.

b. Flagging Procedures.

c. Jurisdictional Approvals.

9. Marine and Diving Operations:

a. Detailed Plan and Written Procedures.

10. Electrical Facilities:

a. Substations.

b. Required Safety Program Coordination:

1) Confined Space Program.

2) Electrical and Lockout/Tagout Program.

11. Fall Protection:

a. Worksite Hazard Analysis.

b. System Selection.

c. System Installation.

d. System Inspection.

e. Rescue Planning.

f. Fall Protection Training.

E. This outline provides guidance in preparing a safety program and does not cover all material that may be necessary. The Contractor shall review specifications and all safety and health regulations to ensure a comprehensive plan.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 35 30
CONTRACTOR'S ONSITE SAFETY PERSONNEL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions posted at: www.usbr.gov/ssle/safety/RSHS/rshs.html

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 35 30-1, Qualifications:

1. Contractor's Onsite Safety Representative.

1.04 QUALIFICATIONS

A. Contractor's Onsite Safety Representative:

1. Competent supervisory employee with current safety and health related training, experience and duties on at least three projects of similar nature, size, complexity, and work to be performed as the current project.
2. Include resume with current telephone numbers of references, description of safety representative responsibilities, and copies of training certifications.

1.05 APPLICATION

A. Designate a qualified Contractor's Onsite Safety Representative Alternate prior to start of construction.

B. Contractor's Onsite Safety Representative Authorities, Duties, and Responsibilities:

1. Responsible for effectively implementing Contractor's Safety Program.
2. Safety Representative shall coordinate all emergency response activities.
3. Recommend controls for observed hazards or predicted hazards.

4. Full authorization to correct unsafe acts on the spot, including the authority to stop work to correct safety and health problems.
5. Lead weekly safety meetings at jobsite.
6. Onsite, during any and all construction activities.
7. Assemble, review, and sign each Job Hazard Analysis (JHA):
   a. Review of JHA with employees.
8. Verify the correct use of respiratory protection and personal protective equipment.
9. Conduct and prepare weekly safety inspections in conjunction with the onsite government representative listing noted deficiencies, their abatement dates, follow up action. Report shall be available for review onsite.
10. Provide direct oversight and assemble a detailed report of all incident reviews, near-misses, accidents, and emergency response or rescue actions.
11. Onsite Safety Representative may have other non-safety duties.

1.06 QUALITY ASSURANCE

A. Contractor's Onsite Safety Representative:

1. The effectiveness of Contractor's Onsite Safety Representative in prosecuting the safety program will be subject to continued review and approval by COR.
2. Should Contractor's onsite safety representative's effort be deemed insufficient Contractor may be required to provide services of qualified, full-time safety and health representative at no additional cost to Government.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 35 50
SITE SECURITY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REQUIREMENTS FOR WORKING AT FOLSOM DAM AND FACILITY

A. Background:

1. Folsom Dam and Facility is formally designated as a National Critical Infrastructure (NCI) facility according to Presidential Decision Directive 63 (PDD-63) issued May 22, 1998.

B. Authorities for Requirements:

1. Security requirements at Folsom Dam and Facility are based on Homeland Security Presidential Directive (HSPD) 12; Reclamation Manual Directives and Standards, SSLE 01-01, Personnel Security and Suitability; Decision Document – Folsom Dam and Powerplant; CCAO SOP – Folsom Dam Access and Key Control Policy.

C. References:

1. Standard Operating Procedures (SOP), Folsom Dam Facilities Access and Key Control, latest revision:

   a. This reference is CONTROLLED MATERIAL; limited distribution will be available upon award of the contract. Persons receiving this SOP must sign a Non-Disclosure Agreement prior.

D. Work will occur in Controlled Access Areas including Critical Areas:

1. Contractor personnel will be required to be badged or escorted at all times.

E. Personnel Access Requirements:

1. Critical Areas: All Contractor personnel entering Critical Areas shall be properly badged and/or escorted as described below:

   a. Unescorted Access:

      1) Contractor shall designate individuals requiring unescorted access and/or escort privileges into Critical Areas. Those individuals shall be subjected to a low-risk background investigation (Tier 1) check

in accordance with Article 1.09 – Personal Identification Verification (PIV) – Critical Areas requirements.

2) In addition, personnel shall complete 1-hour of Folsom Security Training. This site-specific training will initially be provided by CCAO personnel.

3) In so far as is practicable, Contractor shall complete required Tier 1 security paperwork, fingerprinting and enrollment for PIV card, along with security training process at least 30-days before anticipated start work date in Critical Areas so as not to impact schedule work. A red Contractor picture badge marked for unescorted access and/or escort privileges to Critical Areas will be issued upon receiving clearance. An interim Unescorted Access badge may be granted after CCAO Safety and Security Office received results of preliminary criminal records check.

b. Escorted Access:

1) Other Contractor personnel may enter Critical Areas if they are escorted by an approved escort (person with Unescorted Access badges marked "escort"). Persons under escort must have a Visitors Badge in their possession and be prepared to show it when requested.

2) Contractors working on site for less than 14 calendar days will be placed on a visitor's list. Contractor is responsible for ensuring that a current list of names is provided to the Government COR at least one day prior to the visit. Visitors will show an approved HSPD-12 compliant form of photo identification to the security officer at the facility entrance and will receive a Visitors badge. The Contractor escort or COR will then escort the visitor to the work site.

3) Contractors working on site for more than 14 calendar days will receive a temporary access badge allowing them entry into non-critical areas of the facility. These persons must still be escorted while in critical areas.

c. Escorts taking persons into Critical areas shall continuously monitor escorted personnel so that employee overseeing activity ensures that escorted personnel do not enter an unsafe or Critical area. Escorts may turn escorted personnel over to another approved escort to ensure uninterrupted monitoring of escorted personnel. Escorted Contractor personnel shall be monitored continuously by approved Contractor escorts:

1) Ratio of escorts to non-escorts is 1:10.

F. Vehicle Access Requirements:

1. Vehicle Access:

a. No personal vehicles are allowed on top of the dam.

1) All personal and Contractor work vehicles coming into the facility are subject to search and/or inspection at any time. Drivers who refuse permission will be turned around at the facility entrance.

2. Deliveries:

a. All delivery vehicles shall wait at designated site access points for an approved escort before proceeding and are subject to search and/or inspection by CCAO Security Staff.

G. Loss of Access Badges:

1. Contractors who lose an access badge shall report it immediately to COR and to CCAO Administrative Office. Failure to report a lost badge may result in denial of replacement badge.

H. Misuse of Access Badges:

1. Contractors that misuse access badges issued by CCAO, enter unauthorized Security Zones, provide badge to others, follow improper escort procedures, or other misuses face the following actions:

a. First offense: Warning and requirement to retake Folsom Security Training.

b. Second offense: Permanent loss of CCAO access badge.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 35 50-1, Security Program:

1. Identify procedures for restricting entry onto project site to authorized persons.

2. Develop and implement Identification Badging process for non-critical areas.

3. Develop security plan and procedures for monitoring personnel and vehicle entry and egress to project site, control access to Critical areas, and develop a security sensitive traffic circulation plan for various phases of work.

C. RSN 01 35 50-2, List of Onsite Employees and Vehicles:

1. Provide list of employees. List shall provide full name, date of birth, purpose or job title, and estimated duration of access:

a. Designate individuals for “Unescorted Access” or “Escorted Access”.

2. Provide list of Contractor vehicles and equipment. List shall provide vehicle description, license number and State as applicable, year, make, and model.

3. Update and resubmit RSN 01 35 50-2 monthly, or as employees and/or vehicles are added or deleted.

1.04 DEFINITIONS

A. Critical areas: Areas within security fences and other security devices protecting concrete section of Folsom Dam and requiring PIV badges as stipulated in clause WBR 1452.237-80 Security Requirements.

B. Non-critical areas: Areas not requiring PIV badges as stipulated in clause WBR 1452.237-80 Security Requirements but requiring CO approved Contractor developed badging system.

1.05 CRITERIA TO DEVELOP SECURITY PROGRAM

A. Site access is limited coordinate access with COR.

B. CCAO is responsible to control access through these site access points and provide overall security for Government facilities.

C. When security fence or device protecting Critical areas is removed for construction, a new "temporary Critical area" perimeter fence shall be installed and maintained until area is secured.

D. It should be assumed all vehicles entering Critical areas and temporary Critical areas shall be subject to thorough CCAO inspection lasting up to 15-minutes.

E. Once vehicles have entered Critical areas and passed security inspection they will be subject to CCAO random daily inspection only, unless there is cause or concern for additional inspections such as if vehicle has left site for an extended period, i.e., greater than 2-hours.

F. Personnel not having required ID on their person at all times shall be subject to immediate removal from the site.

1.06 RESPONSIBILITIES

A. Protect work and existing facilities from unauthorized entry, theft, and vandalism. Contractor is responsible for security of Contractor's own property.

B. Initiate security program in coordination with Government's existing security procedures at job mobilization. Sacramento County Sheriff's Department is the local law enforcement office handling security.

C. Sacramento County Sheriff's Department will not need routine or continuous access to work area during construction. However, Sacramento County Sheriff's Department shall always be allowed access onto work area should any situation warrant it as determined by Sacramento County Sheriff's Department. Continuous rounds by Sacramento County Sheriff's Department will not occur. General security of site shall be Contractor's responsibility.

D. Maintain security throughout construction period until acceptance of work by CO.

1.07 ENTRY CONTROL

A. Photo ID required for each employee entering site.

B. Entrance to site will be limited to authorized personnel and vehicles.

C. Maintain continuous log of workmen and visitors and make available to Government on request.

1.08 PERSONNEL IDENTIFICATION (ID) – NON-CRITICAL AREAS

A. For all employees entering non-critical areas, issue a durable CO approved identification card to each person authorized to enter site with the following information:

1. All ID's: A single unique background color, but not Blue, Red, Green, or Black.
2. Employee's name.
3. Employee's photograph.
4. Assigned identification number or alpha numeric ID.
5. Card issue and expiration date.
6. Responsible employee's supervisor name and phone number(s).
7. Responsible On-site Government Representative name and phone number(s).

B. Maintain list of authorized persons and provide a copy to COR.

C. Collect card from authorized person at completion of their work at site and surrender to COR.

1.09 PERSONNEL IDENTIFICATION VERIFICATION IDENTIFICATION (PIV-ID) – CRITICAL AREAS

A. Follow requirements as stipulated in WBR 1452.237-80 Security Requirements Contract Clause, (c) Contractor Employee Suitability and Issuance of Government Identification Cards.

B. Contractor designated individuals shall provide required MBI (Minimum Background Investigation) paperwork to CCAO Administrative Office. Forms required are OF-306 (Declaration of Federal Employment) and Fair Credit Report Act.

C. After submission of required documentation, a system generated email from HSPD-12 will be sent to the individual notifying them they have been sponsored and to make an appointment to enroll for PIV card. Email will provide a set of instructions on how to make an appointment to enroll and what credentials will be needed for their appointment. Contractor can enroll anywhere across the country where there is a USAccess center.

D. During enrollment, individual will be fingerprinted and photographed.

E. After review of fingerprints PIV card will be issued to Contractor (normally takes two to three weeks). PIV card will be available for pick up at CCAO Administrative building.

F. Maintain list of authorized persons issued PIV-ID and provide copy to COR.

G. Collect PIV-ID card from authorized person at completion of their work at site and surrender to COR.

1.10 BACKGROUND INVESTIGATION PROCESS

A. A security specialist from Security, Safety and Law Enforcement (SSLE) in Denver, Colorado, will contact individual designated as needing MBI via email with instructions on how to complete background investigation security paperwork (provide a valid email address to subject or to another contractor representative that can forward instructions to individual).

B. Individual will complete security paperwork online through Office of Personnel Management's eQIP portal. Contractor will be expected to complete security questionnaire within 7-days of being notified to begin the process.

C. If any derogatory information is found in Contractor's background, SSLE will send Letter of Interrogatory to individual requesting additional information to assist in making determination to favorably adjudicate background investigation.

D. Once individual has submitted required security paperwork through eQIP and has enrolled for PIV card and no issues are found from fingerprint check, a provisional badge may be issued while background investigation is in process.

E. Full completion of background investigation may take one to three months.

F. If SSLE unfavorably adjudicates individual's background investigation Sacramento County Sheriff's Department will immediately remove individual from Government property.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 42 10
REFERENCE STANDARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

A. Referenced editions of standard specifications, codes, and manuals form a part of this specification to the extent referenced.

B. These specifications take precedence when conflicting requirements occur between specifications and referenced standard.

1.03 JOBSITE REFERENCE STANDARDS

A. Maintain at fabrication site, access to referenced standard specifications, codes, and manuals required for work in progress at fabrication site. Make available for use by the Government.

B. Maintain onsite, access to referenced standard specifications, codes, and manuals required for onsite work in progress. Make available for use by Government.

1.04 AVAILABILITY

A. Code of Federal Regulations (CFR): Available online at

1. https://www.ecfr.gov/, authorized by the National Archives and Records Administration (NARA).

B. Bureau of Reclamation Documents:

1. Reclamation Safety and Health Standards (RSHS) may be downloaded at https://www.usbr.gov/safety/rshs/index.html.

2. Bureau of Reclamation Standard Specifications are designated with an M- number. Copies of individual standards may be obtained upon request of the CO. Bureau of Reclamation manuals and other publications including significant scientific, technical, and engineering works are available upon request of the CO.

C. Industrial and Governmental Documents:

1. When a reference has a joint designation (e.g., ANSI/IEEE) these specifications generally cite the proponent organization (e.g., IEEE).
2. Addresses for obtaining industrial and governmental (other than Federal and Bureau of Reclamation specifications and standards) specifications, standards, and codes are listed in Table 01 42 10A – Addresses for Specifications, Standards, and Codes.

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AGC	Associated General Contractors of America 333 John Carlyle Street, Suite 200 Alexandria, VA 22314 www.agc.org	703-548-3118
AGMA	American Gear Manufacturers Association 1001 N. Fairfax Street, Suite 500 Alexandria, Va 22314-1587 www.agma.org	Phone: 703-684-0211 Fax: 703-684-0242
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 3100 Chicago, IL 60601-2001 www.aisc.org	312-670-2400
ANSI	American National Standards Institute 1899 L Street, NW 11th Floor Washington DC 20036 www.ansi.org	202-293-8020
ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5990 www.asme.org	800-843-2763
ASTM	ASTM International P.O. Box C700 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 www.astm.org	610-832-9585
CMAA / MHI	Crane Manufacturers Association of America 8720 Red Oak Boulevard, Suite 201 Charlotte, NC 28217-3996 www.mhia.org	704-676-1190 Fax 704-676-1199

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
ICEA	Insulated Cable Engineers Association P.O. Box 493 Miamitown, OH 45041-9998 www.icea.net/	
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue,17th Floor New York, NY 10016-5997 www.ieee.org	212-419-7900
IEC	International Electrotechnical Commission 3, rue de Varembé, 1st floor P.O. Box 131 CH - 1211 Geneva 20 – Switzerland www.iec.ch	+41 22 919 02 11 Fax +41 22 919 03 00
ISA	International Society of Automation 67 T.W. Alexander Drive PO Box 12277 Research Triangle Park, NC 27709 E-Mail: info@isa.org	919-549-8411 Fax: 919-549-8288
ISO	International Organization for Standardization 1, ch. de la Voie-Creuse, Case postale 56 CH-1211 Geneva 20, Switzerland www.iso.org	+41 22 749 01 11
NECA	National Electrical Contractors Association 7041 Koll Center Parkway, Suite 100 Pleasanton, CA 94566 www.norcalneca.org	925-828-6322
NEMA	National Electrical Manufacturers Association 1300 17th St N, Suite 900 Arlington, VA 22209, USA www.nema.org	703-841-3200
NETA	International Electrical Testing Association Inc. 3050 Old Centre Ave., Suite 101 Portage, MI 49024 www.netaworld.org/	888-300-6382

Table 01 42 10A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471 www.nfpa.org	800-344-3555 617-770-3000
NIBS	National Institute of Building Sciences 1090 Vermont Avenue, NW., Suite 700 Washington, DC 20005-4905 www.nibs.org	202-289-7800
NIST	National Institute of Standards and Technology 100 Bureau Drive Gaithersburg, MD 20899 www.nist.gov	301-975-2758
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance 1310 North Courthouse Road, Suite 890 Arlington, VA 22201 www.tiaonline.org	703-907-7700
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062-2096 www.ul.com	847-272-8800

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 46 00
QUALITY PROCEDURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 DEFINITIONS

A. Government Contract Quality Assurance (from FAR 46.101): Various functions, including inspection, performed by the Government to determine whether a contractor has fulfilled the contract obligations pertaining to quality and quantity.

B. Contractor Quality Assurance/Quality Control (QA/QC): Activities performed by the Contractor to ensure work conforms to contract requirements:

1. The clause at FAR 52.246-12 - Inspection of Construction, requires Contractor to establish an inspection system to ensure quality.
2. Contractor QA/QC includes activities in addition to specified Contractor Quality Testing to ensure work conforms to contract requirements.

C. Contractor Quality Testing: Specified tests shall be performed by Contractor:

1. Government will evaluate results of these tests when determining acceptability of work.
2. Contractor may use test results as part of Contractor QA/QC:
   a. Government anticipates that these tests will be part of Contractor's QA/QC program, however tests do not relieve Contractor of maintaining adequate quality system in accordance with the clause at FAR 52.246-12 - Inspection of Construction.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-23 National Electrical Safety Code (NESC)

B. National Fire Protection Association (NFPA)

1. NFPA 70-23 National Electrical Code (NEC)

1.03 TEMPORARY ELECTRICITY

A. Coordinate use of power obtained from Government sources with COR.

B. Electric power may be obtained up to a maximum of approximately 2.4 kilovolt ampere from Government. Contractor shall verify availability at supply location.

C. This power will be available as single phase, 60 hertz, and alternating current at approximately 120 volts. No charge will be made for power obtained from this source.

D. Provide additional power if needed.

E. Provide generators, circuits, transformers, and other electrical equipment and facilities required for obtaining power and distributing power to points of use.

F. Comply with IEEE C2 clearances and spacing for temporary communications and supply lines.

G. Comply with NFPA 70.

1.04 TEMPORARY WATER

A. Non-potable water is available onsite for construction purposes:

1. Make arrangements with COR for use of water.
2. Government will designate locations from which water may be obtained.

3. No charge will be made for water obtained from this source.
4. Government does not guarantee water will be available at all times.
5. Contractor is responsible to determine if water meets specified requirements for water used in concrete, grout, and other permanent work.

B. Provide water required for construction purposes and Contractor use:
1. Provide potable water for Contractor personnel.
2. Use water which meets specified requirements for water used in concrete, grout, and other permanent work.
3. Provide water as necessary for construction activities.

C. Provide means of obtaining and conveying water to points of use.

D. Remove temporary equipment and facilities upon completion of work under this contract.

1.05 PORTABLE TOILET FACILITIES

A. Provide portable toilet facilities, temperature controlled as necessary, for construction personnel.

B. Locate as shown on land use plan submitted in accordance with Section 01 14 10 – Use of Site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REMOVAL

A. Remove temporary equipment and facilities upon completion of work under this contract.

END OF SECTION

SECTION 01 55 00
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 REGULATORY REQUIREMENTS

A. Meet requirements established by jurisdictional authority for use of existing roadways and haul routes; including seasonal or other limitations or restrictions, payment of excess size and weight fees, and posting of bonds conditioned upon repair of damage.

B. Comply with applicable regulations for haul routes over public highways, roads, or bridges.

1.03 SITE CONDITIONS

A. Rights-of-way for access to work from existing roads will be established by Government:

1. In accordance with clause at FAR 52.236-10, Operations and Storage Areas, use only established roadways, parking areas, and haul routes; or temporary roadways, parking areas, or haul routes constructed by Contractor when and as authorized by CO.
2. Subject to clause at FAR 52.249-10, Default (Fixed-Price Construction), unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to maintain and repair existing roadways, parking areas, and haul routes: In accordance with requirements of jurisdictional authority.

B. Materials to construct, maintain, and repair temporary roadways, parking areas, and haul routes: As approved by COR.

C. Materials to maintain roadways and parking areas constructed under this contract and used by Contractor for construction work: In accordance with specified requirements for construction of those roadways and parking areas.

PART 3 EXECUTION

3.01 EXAMINATION

A. Investigate condition of available public or private roads for clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect access and transportation operations to and from jobsite.

3.02 ESTABLISHED ROADWAYS AND PARKING AREAS

A. Established roadways and parking areas are available for Contractor's use subject to existing restrictions and approval of COR.

END OF SECTION

SECTION 01 56 10
PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work, except as specified.
2. Costs for repair of installations damaged by Contractor's operations are Contractor's responsibility.

1.02 PROJECT CONDITIONS

A. Drawings included in these specifications show items of existing materials and equipment but may not show all equipment and materials existing at jobsite.

B. Obtain location of embedded conduit, pipe, cable, ground mat, and other buried items before performing any drilling or cutting of concrete.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROTECTION

A. Provide protection for personnel and existing facilities from harm due to Contractor's operations. Protection shall be subject to approval of Government.

B. Arrange protective installations to permit operation of existing equipment and facilities by Government while work is in progress.

C. Do not discharge anything but clear water into building drainage system.

D. Prevent dust from entering ventilating systems.

3.02 REMOVAL OF PROTECTIVE INSTALLATIONS

A. Remove protective installations after purpose has been served. Materials furnished by Contractor to provide protection remain property of Contractor.

3.03 REPAIR

A. Repair, at Contractor's expense, damage to existing installations due to Contractor's operations or Contractor's failure to provide proper protection. At Government's option, damage may be repaired by Government, and Contractor will be back charged repair costs.

END OF SECTION

SECTION 01 56 15
PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 PROJECT CONDITIONS

A. Drawings included in these specifications show existing utilities, but may not show all utilities existing at the jobsite.

B. Obtain location of buried conduit, pipe, cable, ground mat, and other buried items before excavating.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 INTERFERENCE WITH OPERATION OR MAINTENANCE

A. Do not interfere with operation or maintenance service on utilities, existing on date offers are received:

1. Provide for access to utilities in a manner satisfactory to owners and operators and Government.

B. Provide required temporary structures; make necessary repairs, replacements, or similar operations; and furnish indemnity or other bonds.

C. Contractor shall repair any damage to utilities as a result of Contractor's operations at no additional cost to Government.

END OF SECTION

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SECTION 01 57 20
ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work, except as specified.
2. Costs for damages and work stoppage are Contractor's responsibility.

1.02 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1. RSHS — Reclamation Safety and Health Standards, including revisions posted at: www.usbr.gov/ssle/safety/RSHS/rshs.html

1.03 REGULATORY REQUIREMENTS

A. Comply with Federal, State, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

D. Contractor shall be responsible for damages resulting from dust originating from Contractor operations in accordance with clause at FAR 52.236-7, Permits and Responsibilities.

E. CO may stop construction activity in violation of Federal, State, or local laws and additional expenses resulting from work stoppage will be responsibility of Contractor.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 57 30
WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work.

1.02 DEFINITIONS

A. Section 401: Water Quality Certification.

B. Section 402: National Pollutant Discharge Elimination System.

C. Section 404: Discharge of Dredged or Fill Material into the Navigable Waters of the US.

1.03 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions posted at: http://www.usbr.gov/ssle/safety/RSHS/rshs.html

B. Code of Federal Regulations (CFR)

1.	40 CFR, Part 112	Oil Pollution Prevention
2.	33 CFR, Part 323	Permits for Discharges of Dredges or Fill vs Material into the Waters of the United States
3.	40 CFR, Part 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System
4.	40 CFR, Part 123	State Program Requirements
5.	40 CFR, Part 230	Section 404(b)(1) Guidelines for Specifications of Disposal Sites for Dredged or Fill Material
6.	40 CFR, Part 231	Section 404(c) Procedures

C. Public Law

1.	Sections 311, 402, and 404	Clean Water Act (Public Law 92-500, as amended)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 57 30-1, Spill Prevention, Control, and Countermeasure (SPCC) Plan:

1. Submit when SPCC Plan is required in accordance with 40 CFR, Part 112:

   a. Generally, SPCC Plan required where location of construction site is such that oil and oil products from accidental spillage could reasonably be expected to enter into or upon navigable waters of the United States or adjoining shorelines, and aggregate on site oil storage capacity is over 1,320-gallons. Only containers with capacity of 55 gallons and greater are included in determining on site aggregate storage capacity.

2. Reviewed and certified by a registered professional engineer in accordance with 40 CFR, Part 112, as required by section 311 of the Clean Water Act (Public Law 92-500 as amended).

1.05 PROJECT CONDITIONS

A. Contractor shall be responsible for site in "as-is" condition:

1. Including all existing water pollution control structures, materials, and devices on site.

1.06 REGULATORY REQUIREMENTS

A. Construction Safety Standards:

1. Comply with sanitation and potable water requirements of Section 3.01 of RSHS.

B. Laws, Regulations, and Permits:

1. Perform construction operations to comply, and ensure subcontractors comply, with:

   a. Applicable Federal, State, and local laws, orders, regulations, and Water Quality Standards and Plans concerning control and abatement of water pollution; and terms and conditions of applicable permits issued by permit issuing authority.

   b. If conflict occurs between Federal, State, and local laws, regulations, and requirements, the most stringent shall apply.

C. Contractor Violations:

1. If noncompliance should occur, immediately (verbally) report noncompliance to CO. Submit specific information within 2-days.

2. Violation of applicable Federal, State, or local laws, orders, regulations, or Water Quality Standards may result in the CO stopping site activity until compliance is ensured.

3. Contractor shall not be entitled to extension of time, claim for damage, or additional compensation by reason of such a work stoppage.

4. Corrective measures required to bring activities into compliance shall be at Contractor's expense.

1.07 RECORDKEEPING

A. Retain records and data required by permits.

PART 2 PRODUCTS

2.01 POLLUTION CONTROLS

A. Straw bales, if used: Certified weed free.

B. Erosion and sedimentation control fabrics: Woven non-filament-jointed.

PART 3 EXECUTION

3.01 POLLUTION CONTROLS

A. Control pollutants by use of sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls including State and local control requirements.

B. Sediment and Erosion Controls:

1. Establish methods for controlling sediment and erosion which address vegetative practices, structural control, silt fences, straw dikes, sediment controls, and operator controls as appropriate.

2. Institute stormwater management measures as required, including velocity dissipators, and solid waste controls which address controls for building materials and offsite tracking of sediment.

C. Wastewater and Stormwater Management Controls:

1. Pollution prevention measures:

a. Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials which include prevention measures to control silting and erosion, and which will intercept and settle any runoff of sediment-ladened waters.

b. Prevent wastewater from general construction activities such as drainwater collection, aggregate processing, concrete batching, and drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.

c. Divert stormwater runoff from upslope areas away from disturbed areas.

2. Turbidity prevention measures:

a. Use methods for prevention of excess turbidity which include, but are not restricted to, intercepting ditches, settling ponds, gravel filter entrapment dikes, flocculating processes, recirculation, combinations thereof, or other approved methods that are not harmful to aquatic life.

b. Wastewaters discharged into surface waters shall meet conditions of section 402, the National Pollutant Discharge Elimination System (NPDES) permit.

c. Do not operate mechanized equipment in waterbodies without having first obtained a section 404 permit, and then only as necessary to construct crossings or perform the required construction.

D. Construction Site Management:

1. Contractor construction operations:

a. Perform construction activities by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources:

1) Pollutants and wastes include, but are not restricted to: refuse, garbage, cement, sanitary waste, industrial waste, hazardous materials, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

2. Stockpiled or deposited materials:

a. Do not stockpile or deposit excavated materials or other construction materials, near or on, stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can in any way encroach upon watercourse.

3. Petroleum product storage tanks management:

a. Place oil or other petroleum product storage tanks at least 20-feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and any other water source.

b. Do not use underground storage tanks.

c. Construct storage area dikes at least 12-inches high or graded and sloped to permit safe containment of leaks and spills equal to storage tank capacity located in area plus sufficient freeboard to contain 25-year rainstorm:

1) Line diked areas with an impermeable barrier at least 50 mils thick.

d. Areas for refueling operations: Lined with impermeable barrier at least 10 mils thick covered with 2- to 4-inches of soil.

END OF SECTION

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. When the Price Schedules include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in prices offered in the Price Schedules for the item.
2. When the Price Schedules do not include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in prices offered in the Price Schedules for work for which material is required.

1.02 DEFINITIONS

A. Essential Characteristics: As used in these specifications, the term "essential characteristics" is synonymous with the term "salient characteristics."

B. Salient Characteristics: Those qualities of an item that are essential to ensure that the intended use of the item can be satisfactorily realized.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2003(2008)	Unified Inch Screw Threads, (UN and UNR Thread Form)
2.	ASME B1.20.1-2013	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions posted at www.usbr.gov/ssle/safety/RSHS/rshs.html

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle manufactured products in accordance with manufacturer's instructions.

B. Store and protect manufactured products in accordance with manufacturer's instructions and RSHS. Obtain instructions from the manufacturer before delivery of materials to jobsite. Maintain a copy of instructions at jobsite.

C. Protect materials from adverse effects of moisture, sunlight, ultraviolet light, or weather during storage at jobsite.

D. Remove and replace damaged items with new items.

E. Store curing compounds, sealants, adhesives, paints, coatings, sealers, joint compounds, grouts, and similar products at the temperature and environmental conditions recommended by manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials required for completion of work.

B. Provide type and quality described in these specifications. Make diligent effort to procure specified materials from all available sources.

C. Furnish new materials conforming to referenced standards unless otherwise specified:

D. For materials not covered by these or referenced specifications, furnish materials of standard commercial quality.

E. If materials to be used deviate from or are not covered by recognized specifications and standards, submit, for approval, justification for and exact nature of the deviation, and complete specifications for materials proposed for use.

F. Make parts accurately to standard gauge where possible:

1. Use unified screw threads conforming to ASME B1.1 or B1.20.1 for threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipefittings.
2. For internal connections only, Contractor may deviate from ASME standards, provided a complete set of taps and dies are furnished as required to facilitate repair or replacement.

G. Permanently mark fasteners with a symbol identifying the manufacturer and with symbol(s) indicating grade, class, type, and other identifying marks in accordance with reference or applicable standard.

2.02 SUBSTITUTIONS

A. If materials required by these specifications become unavailable, because of Government priorities or other causes, substitute materials may be used.

B. Obtain written approval to use substitute materials from CO. State in the request for approval the amount of the adjustment, if any, to be made in favor of Government.

C. Government's determination as to whether substitution will be permitted and as to what substitute materials may be used, shall be final and conclusive.

D. If approved substitute materials are of less value to the Government or involve less cost to Contractor than specified material, a contract adjustment will be made in favor of Government. Where the amount involved or the importance of substitution warrants, a deductive modification to the contract will be issued.

E. No payments in excess of prices offered in the Price Schedule will be made because of substitution of one material for another or because of use of one alternate material in place of another.

2.03 WORKMANSHIP

A. Accurately manufacture and fabricate materials in accordance with best modern practice and requirements of these specifications, notwithstanding minor errors or omissions therein.

B. Use liberal factors of safety and adequate shock-absorbing features in designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock.

C. Include provisions which prevent components from loosening for shock-absorbing features and parts subject to vibration.

2.04 GOVERNMENT CONTRACT SOURCE QUALITY ASSURANCE

A. Materials will be subject to inspection in accordance with clause at FAR 52.246-12 “Inspection of Construction” at following locations, as determined by CO:

1. At place of production or manufacture.
2. At shipping point.
3. At jobsite.

B. To allow sufficient time to provide for inspection, submit at time of issuance, copies of purchase orders, including drawings and other pertinent information, covering material on which inspection will be made as advised by CO, or submit other evidence if such purchase orders are issued verbally or by letter.

C. Inspection of materials at locations specified above or waiving of inspection shall not be construed as being conclusive as to whether materials and equipment conform to contract requirements under the clause at FAR 52.246-12 “Inspection of Construction,” nor shall Contractor be relieved thereby of the responsibility for furnishing materials meeting the requirements of these specifications.

D. Acceptance of materials will be made only at the jobsite.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's recommendations unless otherwise specified.

3.02 GOVERNMENT CONTRACT FIELD QUALITY ASSURANCE

A. Final inspection and acceptance of materials will be made only at the jobsite after installation and testing.

END OF SECTION

SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for other items of work except as specified.
2. Cost of environmental site assessments are Contractor's responsibility.

1.02 DEFINITIONS

A. Hazardous waste: Defined as hazardous by 40 CFR 261.3; or by other Federal, State, or local laws or regulations.

1.03 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	RSHS	Reclamation Safety and Health Standards, including revisions posted at www.usbr.gov/ssle/safety/RSHS/rshs.html

B. Code of Federal Regulations (CFR)

1.	40 CFR 261.3	Definition of Hazardous Waste
2.	49 CFR 171-179	Transportation - Hazardous Waste Regulations

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 01 74 00-1, Waste Production and Disposal Plan:

1. For each type of waste, list estimated quantity and planned disposal location.

C. RSN 01 74 00-2, Waste Production and Disposal Records:

1. For each type of waste, list quantity and disposal location.
2. Include certifications that waste was properly disposed.
3. Hazardous wastes manifests.

D. RSN 01 74 00-3, Environmental Consultant Resume:

1. Describe experience on similar project.

E. RSN 01 74 00-4, Environmental Site Assessment.

1.05 QUALIFICATIONS

A. Environmental consultant: Minimum 2-years' experience in conducting environmental site assessments for similar construction.

1.06 REGULATORY REQUIREMENTS

A. Comply with Federal, State, and local laws and regulations.

B. Comply with RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and RSHS.

D. Comply with local regulations for presuppression, suppression, and prevention of fires when burning wastes.

1.07 PROJECT CONDITIONS

A. Report waste materials discovered at jobsite to COR:

1. Cease work in areas where waste may be hazardous until waste materials are investigated by Government.
2. If waste is hazardous, CO may order delays in time of performance or changes in work, or both.
3. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. Keep work and storage areas free from accumulations of waste materials and rubbish.

3.02 FINAL CLEANUP

A. Leave premises "broom clean."

B. Clean equipment and fixtures to a sanitary condition.

3.03 DISPOSAL

A. Nonhazardous waste materials:

1. Reuse at jobsite, reuse or recycle waste materials removed from jobsite whenever possible.
2. Dispose of nonhazardous waste materials that are not reused or recycled at appropriately permitted disposal facilities.
3. Noncombustible waste: Dispose by removal from jobsite.

B. Hazardous Waste Disposal:

1. Dispose by removal from jobsite.
2. Recycle hazardous waste whenever possible.
3. Dispose of hazardous waste materials that are not recycled at appropriately permitted treatment or disposal facilities.
4. Transport hazardous waste in accordance with 49 CFR 171-179.

C. Certification: Certify that wastes are disposed of in accordance with Federal, State, and local regulations.

3.04 SITE ASSESSMENT

A. Upon completion of work, perform site assessment at following areas for work done under these specifications:

1. Hazardous waste accumulation areas.
2. Petroleum dispensing and storage areas where aggregate storage of petroleum at jobsite was over 110-gallons.
3. Hazardous material storage areas.

B. Employ qualified environmental consultant to perform assessments.

C. Demonstrate and document by appropriate analytical sampling that site contamination is less than State action cleanup levels.

3.05 RECORDS

A. Keep records of types and amounts of waste materials produced.

B. Keep records of waste material disposal.

END OF SECTION

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SECTION 01 78 30
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Operations & Maintenance (O&M) Manuals for Bridge Crane:

1. Measurement: Number provided.
2. Payment: Unit price offered in the Price Schedule.
   a. Includes the following:
      1) Operations & Maintenance (O&M) Manuals for Bridge Crane.
      2) Contractor's As-built drawings and manufacturer's installation instructions.

1.02 DEFINITIONS

A. Operations and Maintenance (O&M) Manuals:

1. Final documentation package delivered for Crane containing all information necessary for Government to operate and maintain equipment in a safe, effective and efficient manner.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 01 78 30-1, Draft Operation and Maintenance (O&M) Manual:

1. Submit to COR prior to conducting first training session and/or Government possession for Government approval.
2. Transmit in both hardcopy and electronic form for review and use in training sessions.

C. RSN 01 78 30-2, O&M Manuals:

1. Provide O&M Manuals for the Bridge Crane.
   a. Provide in both hardcopy and electronic form.
   b. Number of hard copies as indicated in Section 01 33 00 – Submittals.
   c. Contractor's As-Built Drawings and manufacturer's installation instructions.

2. Submit to Contracting Officer Representative per Section 01 33 00 – Submittal Table 01 33 00A and prior to conducting first training session.

D. RSN 01 78 30-3, Extra Materials:

1. List of extra materials.

1.04 DRAFT OPERATION AND MAINTENANCE (O&M) MANUAL

A. A draft version of the O&M Manual to be used in the interim between commissioning and approval of the O&M Manual and Final Drawings.

B. Shall include information needed by Government personnel to operate, maintain, and troubleshoot equipment including at minimum the following:

1. COR approved electronic records with digital files of data and drawings (in AutoCAD format) contained in manual.
2. Approved commercial product data. Clearly mark data applicable to equipment furnished. Indicate specific models and options provided.
3. As-built general arrangement and equipment detail drawings, including drums, structural supports, block assemblies, and complete parts lists.
4. As-built electrical schematic and wiring diagram for controls.
5. Maintenance data, including:
   a. System maintenance schedule and procedures including instructions on dismantling, replacing, installing, calibrating, configuring, and troubleshooting provided equipment.
   b. Lubrication: specific lubricants, replacement intervals, their point of application, and quantities required.
   c. Replacement schedules and service procedures for wearing parts.
6. Detailed operating instructions.
7. Spare parts inventory and list of any additional recommended spares that were not required by these specifications. Include current unit prices and supply sources.
8. Photographs:
   a. 8-inch x 10-inch
   b. Front and end views of the crane, showing all components, and close-up views of the hoists, hoist blocks, trolley, and bridge, including motor nameplates.
9. Reports and certificates:
   a. Certified copy of field quality test report.
   b. Runway rail alignment confirmation report.
   c. Hook and hook nut magnetic-particle tests.

d. Wire rope manufacturer's certificate of breaking strength.

10. Index sheet at front of each volume which provides page or index tab number information for each device or item of equipment in book.

11. Bill of Materials.

12. On-site commissioning test procedures.

13. PLC and HMI software connection procedures, if applicable or not included in commercial product data.

14. Description of Automation Control System operating procedures.

15. Description of Crane Motors and Drives operating procedures.

16. Processor program listing.

17. The O&M Instruction book shall include the final drawings, or at a minimum, the most current up-to-date drawings as a place holder for when the final drawings are complete and can be inserted into the final O&M Instruction Books.

18. Sufficient detail to enable Government to take over any maintenance, operation or use of crane system, in safe, effective and efficient manner.

19. Complete and finalized prior to Government use or acceptance of bridge crane systems.

1.05 O&M MANUAL

A. Manual shall include the following:

1. General information.

2. Sufficient detail to enable Government to take over any maintenance, operation or use of crane, in a safe, effective and efficient manner.

3. Enable progressive and timely development and checking of Manual in advance of any completion milestones.

4. Complete and finalized prior to Government use or acceptance of Crane.

5. Transmit both bound hardcopy and electronic form.

a. Be developed in standardized and fully electronic data format suitable for upload to Governments Data Management System.

B. In addition to documents required in the Draft O&M Manual include the following:

1. Factory Acceptance Test performance reports.

2. Wiring and cable test reports.

3. Pre-start checkout test reports.

4. Site Acceptance Test reports.

5. Commissioning Test reports.

1.06 EXTRA MATERIALS

A. List extra materials provided in accordance with the specifications and Section 01 60 00 – Product Requirements.

B. Provide the list in the following format:

Table 01 78 30A – List of Extra Materials

List of Extra Materials				
Specification Section	Material Designation	Material	Manufacturer	Extra Material Item

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONSTRUCTION DOCUMENTATION

A. With equipment shipment, provide and maintain at least 2 copies of Contractor's As-Built Drawings and manufacturer's installation instructions at job site.

1. Drawings shall be in 'as-built condition at time of equipment shipment and shall reflect Government approval comments.

B. Mark drawings with changes and revisions made during installation and checkout of equipment following as-built marking procedures.

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents.
2. Mark to define construction actually provided:
   a. Where choice of materials or methods is permitted in specifications.
   b. Where variations in scope or character of methods is permitted in specifications.
   c. Where variations in scope or character of work from that of the original contract are authorized.

C. Upon completion of work:

1. Sign marked prints as certified correct.
    a. One set to be retained by COR.

END OF SECTION

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SECTION 01 79 20
TRAINING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Training:

1. Payment: Lump-sum price offered in the Price Schedule.

   a. Includes two 8-hour training sessions to accommodate Government employees for Bridge Crane.

1.02 QUALIFICATIONS

A. Instructor:

1. Factory authorized service representative qualified in providing required training and having expert knowledge of the operation and maintenance of the equipment and associated components.
2. Familiar with the project requirements.

1.03 COORDINATION

A. Coordinate instruction schedule and location with Government. Training shall be accomplished Mondays through Thursdays. Fridays, Saturdays, Sundays, and legal Federal holidays shall be excluded from potential training days.

B. Conduct training during normal working hours until conclusion of training course.

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data:

B. RSN 01 79 20-1, Training Outline, Materials, Notification and Summary:

1. Syllabus and Outline.
2. Certificates of manufacturer's factory representatives, trained to conduct all sessions of training. This training also covers Operation and Maintenance of new crane system.
3. Schedule.
4. Presentation, including handouts, in pdf format.

5. Submit location request to COR at least 14 days in advance. Include details describing intended operational sequences and locations of inspection to determine Government clearance procedures.

C. RSN 01 79 20-2, Training Video Recording:

1. Coordinate video recording of training sessions with COR.

1.05 TRAINING COURSE REQUIREMENTS

A. Attendees: Facility personnel.

B. Course content shall be plant- and equipment-specific and shall include:

1. Overview of how systems interact and function in overall operation of all systems modified by this project.
2. Safety and protection.
3. Control and monitoring for individual equipment, including programming.
4. Testing.
5. Hardware.
6. Software.
7. As-built drawings.
8. Operation and maintenance manual.
9. Major revisions from previous systems.

C. Government has sole ownership of Contractor-provided training material.

D. Conduct training in English. Training materials shall be in English.

E. Training Duration: The training shall consist of sessions not exceeding 8 hours or as required by COR.

F. Dates:

1. Hands-on training no later than 14 days after commissioning crane, or as approved by COR.
2. Coordinate timing of each training session with the COR.

G. Location: Onsite for both classroom training and hands on training.

1. Use of actual installed equipment for training demonstration to be coordinated with COR.

H. Provide crane operators with initial system training.

1. Purpose: Instruct operators in the basic knowledge needed to operate the equipment during the time period following commissioning and before the formal training session takes place.
2. Demonstrate operational sequences and answer questions about the new equipment.
3. Ensure operators are familiar and comfortable with standard operational sequences.
4. Provide written operations checklists and or procedures as necessary.
5. Verify completion of this testing with the Contracting Officer.

I. Recording:

1. Provide audio and color video recording of trainings.
2. Provide necessary equipment to record classroom portions of training.
3. Ensure projector screen presentations, white board diagrams, and flip chart paper diagrams developed during class are visible and legible on video recording.
4. Ensure audio for both instructor and class participants is understandable.
5. Use DVD or Government approved format suitable for playback on standard equipment available commercially in the United States.

J. Organize training course content into the following sections:

1. Operations: Overview of how the new crane systems interact and function in the overall controls. Familiarization with new equipment including touch screen panels, control switches, pendant control station and indications.
2. Maintenance: Describe and demonstrate all associated maintenance procedures required for the new equipment including calibration procedures. Include troubleshooting training methods.
3. Motors, drives, annunciation, PLC, control, and data communication details: Include brief theory of operation, description of software parameters, uploading and downloading of software files, and modifying control logic for the crane. Any special functionality to the logic shall be included in the training program.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 TRAINING

A. Class Presentation Materials:

1. PowerPoint presentation and handouts.
2. Draft as-built drawings.
3. Operation and maintenance manual.
4. Photos with descriptions of onsite installed equipment.
5. Reclamation reserves the right to reproduce and modify any and all training materials. Training materials shall become the property of the Government after completion of the training.

B. Training shall be provided after commissioning of the equipment.

C. Attendance at each session will not exceed 10.

D. Provide up to 10 copies of bound, hard copy training materials for each training session. Materials for each student shall include detailed and comprehensive manual covering installation, operation, and maintenance.

E. Government will furnish facilities for training and will retain training materials for future reference.

F. Provide necessary laptop and projector to be used for training sessions.

G. Provide video recording equipment and personnel to operate equipment.

END OF SECTION

SECTION 02 80 10

GENERAL REQUIREMENTS FOR ASBESTOS ABATEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of asbestos abatement in applicable lump sum prices offered in the Price Schedule for Asbestos Abatement.

1.02 DEFINITIONS

A. Competent Person, asbestos: See 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

B. ELAP: California Environmental Laboratory Accreditation Program.

C. PELS: Permissible Exposure Limits. See 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

D. PFT: Personal Fit Test.

E. PPE: Personal Protective Equipment.

F. Regulated Area: See 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

G. TEM: Transmission Electron Microscopy.

1.03 REFERENCE STANDARDS

A. California Code of Regulations (CCR):

1.	8 CCR Div 1, Ch 3.2, Subch 2	Regulations of the Division of Occupational Safety and Health
2.	8 CCR Div 1, Ch 4, Subch 7, Gr 16	Control of Hazardous Substances
3.	8 CCR Div 1, Ch 4, Subch 4, Art 4	Dusts, Fumes, Mists, Vapors, and Gases

B. California Business and Professions Code (BPC):

1.	BPC Div 3, Ch 9, Art 11	Asbestos Consultants

C. Code of Federal Regulations (CFR):

1.	40 CFR Part 763, Subpart E, App A	Interim Transmission Electron Microscopy Analytical Methods - Mandatory and

Nonmandatory - and Mandatory Section To
Determine Completion of Response Actions

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 02 80 10-1, Resumes and Qualifications:

1. General: See Article 1.05.
2. Resumes:
   a. Asbestos Consultant (Air Clearances and Monitoring).
   b. Site Surveillance Technician.
3. Qualifications:
   a. First Aid and CPR Trained Persons.
   b. Independent Testing Laboratory: ELAP number with name, contact person, address, and telephone number.

C. RSN 02 80 10-2, Worker Protection Plan:

1. See Subparagraph 1.07A.2.

D. RSN 02 80 10-3, Worker Background Exposure Test Results:

1. See Subparagraph 1.07C.5.

E. RSN 02 80 10-4, Working Level Test Results:

1. Air monitoring with map indicating location of each sample.
2. Personal employee exposure results.
3. Compare with pre-construction test results for increased contaminant levels.
4. Asbestos Consultant to verify results do not exceed PELs.
5. See Subparagraph 1.07C.5.

F. RSN 02 80 10-5, Visual Inspection and Final Air Clearance:

1. Clearance Air Monitoring results.
2. Visual inspection results including photographic verification.

1.05 QUALIFICATIONS

A. Asbestos Consultant (Air Clearance and Monitoring): Current California certification in accordance with:

1. 8 CCR Division 1, Chapter 3.2, Subchapter 2.

2. BPC Division 3, Chapter 9, Article 11.

B. First Aid and CPR Trained Persons: Two persons currently trained in first aid and CPR.

C. Independent Testing Laboratory accreditation:

1. Accredited under California ELAP, 22 CCR Division 4, Chapter 19.

2. Certified to perform: TEM in accordance with 40 CFR Part 763, Subpart E, Appendix A.

D. Site Surveillance Technician: Current California Site Surveillance Technician certification.

1.06 PROJECT CONDITIONS

A. Existing materials contain asbestos. See Section 51 02 82 – Hazardous Materials Survey and Analytical Results.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Asbestos Consultant (Air Clearance and Monitoring):

1. Independent from Asbestos Consultant (Abatement Contractor).

2. Develop Worker Protection Plan.

a. PPE:

1) Respirators.

2) Personal air monitoring equipment.

3) Personal protective clothing.

b. Respirator program as required by 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

1) Records of respirator program as required by 8 CCR Division 1, Chapter 4, Subchapter 7, Group 16.

2) PFT for respirator usage: Record of diagnostic test and examination in accordance with 8 CCR Division 1, Chapter 4, Subchapter 7, Group 16, Article 107, §5144.

c. Asbestos Emissions Monitoring: Plan for monitoring air quality by exposure assessments and air monitoring.

3. Perform Clearance Air Monitoring, review results and provide results.

B. First Aid and CPR Trained Persons:

1. Designate at least 2 persons currently trained in first aid and CPR to be on site during operations.

2. Immediately available to render first aid when needed.
3. May perform other duties.

C. Site Surveillance Technician:

1. Independent from Asbestos Consultant (Abatement Contractor).
2. Be onsite for duration of asbestos abatement activities.
3. Ensure workers use proper hygiene methods and decontamination procedures.
4. Available for emergencies.
5. Perform Exposure Assessments and Monitoring in accordance with 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4:
   a. Worker Background Exposure Test Results.
   b. Working Level Test Results.
6. Monitor asbestos abatement activities.

1.08 SAFETY AND HEALTH

A. For items not covered in this section, refer to:

1. Section 01 35 20 – Safety and Health.
2. Section 01 35 30 – Contractor's Onsite Safety Personnel.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXPOSURE ASSESSMENTS AND AIR MONITORING

A. Perform asbestos Exposure Assessments to determine exposure to asbestos in accordance with 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

B. Not to exceed OSHA PEL.

C. At the same time that employee exposure monitoring is done, monitor asbestos concentrations in Regulated Area boundary.

D. Review results by Certified Asbestos Consultant that levels do not exceed PELS.

E. If emissions exceed PELS:

1. Stop work until the containment system is corrected to meet PELS.

2. Notify COR immediately.

3.02 CLEARANCE TESTING

A. Visual Inspection.

B. Air samples:

1. In accordance with 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.
2. Analyze in accordance with 40 CFR Part 763, Subpart E, Appendix A.

END OF SECTION

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SECTION 02 80 11

GENERAL REQUIREMENTS FOR COATINGS CONTAINING REGULATED METALS ABATEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of coatings containing regulated metals abatement in applicable lump sum items in the Price Schedule for Remove Existing 30 Ton Bridge Crane.

1.02 DEFINITIONS

A. AIHA: American Industrial Hygiene Association.

B. Authorized Person:

1. Arsenic: See 29 CFR Part 1926.1118.

C. Competent Person:

1. Cadmium: See 29 CFR Part 1926.1127.
2. Lead: See 29 CFR Part 1926.62.

D. NELAP: National Environmental Laboratory Accreditation Program.

E. NLLAP: National Lead Laboratory Accreditation Program

F. OSHA: Occupational Safety and Health Administration.

G. PEL: Permissible Exposure Limit.

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D6966-18	Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals

B. Code of Federal Regulations (CFR):

1.	29 CFR Part 1910	Occupational Safety and Health Standards
2.	29 CFR Part 1910.134	Respiratory protection

3.	29 CFR Part 1926	Safety and Health Regulations for Construction
4.	29 CFR Part 1926.62	Lead
5.	29 CFR Part 1926.103	Respiratory protection
6.	29 CFR Part 1926.1118	Inorganic arsenic
7.	29 CFR Part 1926.1127	Cadmium

C. Occupational Safety and Health Administration (OSHA)

1.	OSHA ID-125G	Metals and Metalloid Particulates in Workplace Atmospheres (ICP Analysis)

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 02 80 11-1, Resumes and Qualifications:

1. See Paragraphs 1.05A and 1.05B.

C. RSN 02 80 11-2, Worker Protection Plan:

1. See Paragraph 1.07B.

D. RSN 02 80 11-3, Preconstruction Test Results:

1. See Subparagraph 1.07B.2.

E. RSN 02 80 11-4, Working Level Test Results:

1. See Subparagraph 1.07B.3.

F. RSN 02 80 11-5, Post-Construction Test Results:

1. See Subparagraph 1.07B.4.

1.05 QUALIFICATIONS

A. Competent / Authorized Person: One years' experience in overseeing coatings containing metals removal operations.

B. Independent Testing Laboratory accreditation:

1. General: name, accreditation number, address, and telephone number.
2. NELAP.
3. NLLAP.
4. AIHA for OSHA ID-125G.

1.06 PROJECT CONDITIONS

A. Coatings on metal to be recycled are considered hazardous. See Section 51 02 82 - Hazardous Materials Survey and Analytical Results.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Competent Person / Authorized person:

1. Independent from Coatings Removal Contractor according to State of California regulations.
2. Be onsite for duration of coatings removal activities.
3. Ensure workers use proper hygiene methods and decontamination procedures.
4. If PELs are exceeded, notify COR immediately.
5. Available for emergencies.

B. Worker Protection Plan:

1. Plan to verify removal plan efficacy.
2. Preconstruction Test Results:
   a. Background air and wipe monitoring results:
      1) Area monitoring results by air monitoring.
      2) Surface samples for surfaces related to area where coatings disturbance of removal occurs for metal contamination.
   b. Map indicating location of each sample.
   c. Quality control information to supplement analytical data. Include from blanks, laboratory control samples with percent recovery, duplicates, matrix spike samples with percent recovery, and other appropriate quality control measures.
3. Working Level Test Results:
   a. Air quality and wipe sample monitoring results for arsenic, cadmium, and lead metals.
   b. Map indicating location of each sample.
   c. Provide appropriate quality control information to supplement analytical data. Include from blanks, laboratory control samples with percent recovery, duplicates, matrix spike samples from project with percent recovery, and other appropriate quality control measures.
4. Post-construction Test Results:
   a. Post-construction content data:
      1) Air quality monitoring results for metals concentrations.

2) Surface samples for surfaces related to area where coatings disturbance of removal occurs for metal contamination.

b. Compare with preconstruction test results for increased contaminant levels. Include:

1) Competent / Authorized Person verification that levels did not exceed OSHA PEL for air samples for arsenic, cadmium, and lead.

2) Competent / Authorized Person acceptance for wipe sample analytical comparison between pre- and post-construction.

c. Map indicating location of each sample.

d. Provide appropriate quality control information to supplement analytical data. Include from blanks, laboratory control samples with percent recovery, duplicates, matrix spike samples from project with percent recovery, and other appropriate quality control measures.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 COATINGS REMOVAL

A. Follow accepted Coatings Removal Debris Abatement Plan from RSN 02 83 33-2 from Section 02 83 33 – Recycling of Scrap Metal with Coatings Containing Hazardous Materials.

END OF SECTION

SECTION 02 82 20

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Asbestos Abatement:

1. Payment: Lump sum price offered in the Price Schedule.

1.02 DEFINITIONS

A. ACW: Asbestos-containing waste, greater than 1 percent friable asbestos by weight. See 22 CCR Division 4.5, Chapter 11, Article 3; also known as "California only".

B. ACM: Asbestos-containing material. Any material containing more than 1 percent asbestos. See 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

C. AHERA: Asbestos Hazard Emergency Response Act.

D. Asbestos: Definition, see 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

E. Asbestos Consultant (Abatement Contractor): AHERA certificated Management Planner, Project Designer, Contractor/Supervisor, and Building Inspector. See 8 CCR Division 1, Subchapter 4, Article 4 and BPC Division 3, Chapter 9, Article 11.

F. CARB: California Air Resource Board NESHAP program. https://www.arb.ca.gov/enf/asbestos/asbestos.htm.

G. Friable: 8 CCR Division 1, Chapter 3.2, Subchapter 2, Article 2.7.

H. NESHAP: National Emissions Standards for Hazardous Air Pollutants. See 40 CFR Part 61, Subpart M.

I. NVLAP: National Voluntary Laboratory Accreditation Program.

J. PLM: Polarized Light Microscopy.

K. Regulated Area: See 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4.

L. TSDF: Treatment, Storage, and Disposal Facility.

1.03 REFERENCE STANDARDS

A. California Business and Professions Code (BPC)

1. BPC Division 3, Chapter 9, Art 11 Asbestos Consultants

B. California Code of Regulations (CCR)

1. 8 CCR Div 1, Ch 3.2, Sub 2, Art 2.5 Registration–Asbestos-Related Work
2. 8 CCR Div 1, Ch 3.2, Sub 2, Art 2.7 Approval of Courses and Course Providers
3. 8 CCR Div 1, Ch 4, Subch 4, Art 4 Dusts, Fumes, Mists, Vapors, and Gases
4. 14 CCR Division 7, Chapter 3.5 Standards for Handling and Disposal of Asbestos Containing Waste
5. 22 CCR Div 4.5, Chapter 11, Art 3 Characteristics of Hazardous Waste
6. 22 CCR Division 4.5, Chapter 12 Standards Applicable to Generators of Hazardous Waste
7. 22 CCR Division 4.5, Chapter 13 Standards Applicable to Transporters of Hazardous Waste
8. 22 CCR Division 4.5, Chapter 14 Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities
9. 22 CCR Division 4, Chapter 19 Certification of Environmental Laboratories

C. Code of Federal Regulations (CFR)

1. 40 CFR Part 61, Subpart M National Emissions Standards for Asbestos
2. 40 CFR Chapter I, Subchapter I Solid Wastes
3. 40 CFR Part 763 Asbestos
4. 49 CFR Chapter I, Subchapter C Hazardous Materials Regulations

D. U. S. Environmental Protection Agency (EPA)

1. EPA 600/R-93/116 Method for the Determination of Asbestos in Bulk Building Materials

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 02 82 20-1, Qualifications:

1. General: See Article 1.05.
2. Asbestos Consultant (Abatement Contractor).
3. Asbestos Consultant (Asbestos Building Inspector).
4. Hazardous Waste Transporter for ACW.
5. Independent Testing Laboratory.

6. Solid waste transporter for ACM.
7. Solid waste disposal facility for ACM.
8. TSDF.

C. RSN 02 82 20-2, Asbestos Survey:
1. See Paragraph 1.07A.

D. RSN 02 82 20-3, Asbestos Hazard Abatement Plan.
1. See Subparagraph 1.07B.3.
2. Do not submit until RSN 02 82 20-2, Asbestos Survey has been accepted.

E. RSN 02 82 20-4, Copy of Asbestos Abatement Notification Form.
1. See Subparagraph 1.07B.4.

F. RSN 02 82 20-5, Manifest for COR Signature.
1. Only required if material is ACW.

G. RSN 02 82 20-6, Shipping and Disposal Documentation:
1. See Subparagraphs 1.07B.5.b and 1.07B.5.c.2).

1.05 QUALIFICATIONS

A. Asbestos Consultant (Abatement Contractor):
1. Registration in accordance with 8 CCR Division 1, Chapter 3.2, Subchapter 2, Article 2.5.
2. Current California AHERA Asbestos Consultant certification.
3. Include asbestos abatement workers' current California AHERA asbestos abatement worker certifications who will be working on this project.

B. Asbestos Consultant (Asbestos Building Inspector):
1. Registration in accordance with 8 CCR Division 1, Chapter 3.2, Subchapter 2, Article 2.5.
2. Current California AHERA Asbestos Consultant Certification.

C. Hazardous Waste TSDF:
1. Possess current EPA ID number and permit.
2. Meet requirements of:
   a. 22 CCR Division 4.5, Chapter 14.
   b. 40 CFR Chapter I, Subchapter I.

D. Hazardous Waste Transporter:

1. Possess current EPA ID number and permit.
2. Meet requirements of 22 CCR Division 4.5, Chapter 13.
3. Registration per 49 CFR Chapter I, Subchapter C.

E. Independent Asbestos Testing Laboratory:

1. Accredited under California ELAP, 22 CCR Division 4, Chapter 19.
2. Proficient in analyzing:
   a. Bulk samples using PLM in accordance with EPA 600/R-93/116.
   b. Concrete using CARB Method 435.

F. Transporter:

1. Transports non-friable asbestos containing materials.
2. Possess current EPA ID number and permit.
3. Registration per 49 CFR Chapter I, Subchapter C.

G. Solid waste disposal facility:

1. Possess current EPA ID number and permit.
2. Accepts ACM. See Subparagraph 1.07B.3.c.2)a)i.

1.06 SITE CONDITIONS

A. Existing materials contain asbestos. See Section 51 02 82 – Hazardous Materials Survey and Analytical Results.

1. The bridge crane travel motor brake pads (see Figures 7 through 9 in Section 51 02 82 – Hazardous Materials Survey and Analytical Results) tested positive for asbestos.
2. The bridge crane coating (see Figures 2 and 3 in Section 51 02 82 – Hazardous Materials Survey and Analytical Results) has not been tested for the presence of asbestos. The Asbestos Survey is to be performed on this coating.

B. If hazardous waste or "California-only" hazardous waste are found, the Contractor shall be considered a generator of Hazardous Waste in accordance with 22 CCR Division 4.5, Chapter 12.

C. Facility owner EPA ID number will be provided to Contractor after award.

1.07 ADMINISTRATIVE REQUIREMENTS

A. Asbestos Survey:

1. Asbestos Consultant (Asbestos Building Inspector) shall perform the Asbestos Survey.
2. Provide report in accordance with 8 CCR Division 1, Chapter 4, Subchapter 4, Article 4 showing asbestos types, friable or non-friable, quantities, locations.

B. Asbestos Consultant (Abatement Contractor):

1. Copies of current California certifications. See Paragraph 1.05A.
2. Prior Work Statement:
   a. Record of citations issued by regulatory agencies relating to asbestos activities. Include project names, dates, and resolutions.
   b. List of penalties incurred through non-compliance with asbestos regulations.
   c. Termination of asbestos-related contracts. Include project names, dates, and reasons for terminations.
   d. If there are none, provide negative declaration.
3. Develop and sign Asbestos Hazard Abatement Plan.
   a. Containment, specify which technique is being used and where:
      1) Modified containment: Glove-bag technique.
      2) Enclosed Containment: Include containment techniques, local exhaust ventilation system locations, decontamination units, temporary waste storage facility, location of temporary utilities, and boundaries of Regulated Areas.
   b. Emissions:
      1) Reporting releases.
      2) Decontamination of contaminated areas and surfaces.
      3) Clearance testing.
   c. Disposal Plan:
      1) Recommendation of disposal as:
         a) ACW under 22 CCR Division 4.5, Chapter 11, Article 3.
         b) ACM under 40 CFR Part 61, Subpart M.
         c) Wastewater: Include name, location, and address of proposed treatment facility and contact person at proposed treatment facility.
      2) Transportation:
         a) ACM:

i. Solid waste disposal facility: See Article 1.05B. Include agreement that facility will accept ACM generated under this contract.

ii. Transporter: See Paragraph 1.05E.

b) ACW:

i. Hazardous Waste Transporter: See Paragraph 1.05D.

ii. TSDF: See Paragraph 1.05B.

4. Abatement Notice, in accordance with California Asbestos ARB requirements.

a. Fill out Asbestos NESHAP Notification of Renovation or Demolition. See Asbestos NESHAP: Notification of Renovation or Demolition | California Air Resources Board

b. Mail form to appropriate CARB and USEPA via delivery service with tracking. Send copies of forms and delivery receipts to COR.

5. Transportation and Disposal Tasks:

a. Transportation permits.

b. ACM: Waste shipment records from Transporter and Solid waste disposal facility. Include bills of lading.

c. ACW:

1) Manifest, in accordance with 22 CCR Division 4.5, Chapter 13, before transporting Hazardous Waste for offsite treatment, storage, or disposal.

a) Send manifest to COR for signature as Generator.

2) Copies of manifest signed by Hazardous Waste Transporter and TSDF.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 ASBESTOS SURVEY

A. Test the bridge crane coating in accordance with Paragraph 1.07A.

1. If coating exceeds the regulatory limit for asbestos, abate the coating in accordance with Article 3.02.

3.02 ASBESTOS ABATEMENT

A. Remove, contain, store, transport and dispose of ACM and ACW in accordance with approved Asbestos Hazard Abatement Plan.

B. Abate travel motor brake pads.

C. If required, abate the bridge crane coating.

END OF SECTION

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SECTION 02 83 33

RECYCLING OF SCRAP METAL WITH COATINGS CONTAINING HAZARDOUS MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of recycling of scrap metal with coatings containing hazardous materials in applicable lump sum prices offered in the Price Schedule for Remove Existing 30 Ton Bridge Crane.

1.02 DEFINITIONS

A. CalRecycle: California Department of Resources Recycling and Recovery.

B. Handling: Includes containment, collection, storage, and transportation.

C. RDRS: Recycling and Disposal Reporting System.

D. Scrap metal: As defined in 22 CCR Division 4.5, Chapter 10.

1.03 REFERENCE STANDARDS

A. California Code of Regulations (CCR)

1.	22 CCR Division 4.5, Chapter 10	Hazardous Waste Management System: General
2.	14 CCR Division 7, Chapter 3	Minimum Standards for Solid Waste Handling and Disposal
3.	14 CCR Division 7, Chapter 9.1	Mandatory Commercial Recycling

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 02 83 33-1, Qualifications:

1. General:
   a. See Article 1.06. Qualifications.
   b. Contact person name, address, and telephone number.
2. Solid waste transporter.
3. Scrap metal recycling facility.

C. RSN 02 83 33-2, Coatings Removal Debris Abatement Plan.

1. See Paragraph 1.08A.

D. RSN 02 83 33-3, Recycling of Scrap Metal with Coatings Containing Hazardous Materials Handling Plan:

1. See Paragraph 1.08B.
2. Contact person name, telephone number, and address for:
   a. Solid waste transporter.
   b. Scrap metal recycling facility.

E. RSN 02 83 33-4, Bills of Lading and Recycling Records for Scrap Metal with Coatings Containing Hazardous Materials:

1. See Paragraph 1.08C.

1.05 PROJECT CONDITIONS

A. Coatings on metal to be recycled are considered hazardous. See Section 51 02 82 – Hazardous Materials Survey and Analytical Results.

1.06 QUALIFICATIONS

A. Non-hazardous waste transporter:

1. Meet requirements of 14 CCR Division 7, Chapter 3.
2. Registered with CalRecycle.

B. Scrap metal recycling facility:

1. Registered in RDRS. See https://secure.calrecycle.ca.gov/RDRSOrganizations/Account/SignIn?ReturnUrl=%2frdrsorganizations%2f.

1.07 SAFETY AND HEALTH REGULATIONS

A. In accordance with Section 01 35 20 – Safety and Health.

1.08 ADMINISTRATION

A. Coatings Removal Debris Abatement Plan:

1. Non-particulate Creating Coatings Removal.
   a. Localized method to remove coatings such as chemical strippers or shrouded removal equipment such as a grinder or needle gun with a shroud and high powered vacuum to remove coatings during removal.
   b. Indicate which coatings are to be removed and their location.

B. Recycling of Scrap Metal with Coatings Containing Hazardous Materials Handling Plan:

1. Handling and recycling of project-generated waste and cleaning of reusable items in accordance with 14 CCR Division 7, Chapter 9.1.

   a. Quantities and types of scrap metal with coatings containing hazardous materials to be recycled.

   b. Scrap metal recycling facility: Agreement to accept waste generated under this contract.

   c. Solid waste transporter information included in Paragraph 1.06A.

C. Recycling of Scrap Metal with Coatings Containing Hazardous Materials Handling Plan: Obtain documentation to prove disposal has been accomplished.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 SCRAP METAL WITH COATINGS CONTAINING HAZARDOUS MATERIALS HANDLING AND RECYCLING

A. Comply with approved Coatings Removal Debris Abatement Plan and Recycling of Scrap Metal with Coatings Containing Hazardous Materials Handling Plan.

B. Comply with Section 02 80 11 – General Requirements for Coatings Containing Regulated Metals Abatement.

END OF SECTION

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SECTION 02 87 20
REMOVAL AND DISPOSAL OF USED OIL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of removal and disposal of used oil in lump sum price offered in the Price Schedule for Remove Existing 30 Ton Bridge Crane.

1.02 DEFINITIONS

A. ELAP: California Environmental Laboratory Accreditation Program.

B. Handling: Includes containment, collection, and storage.

C. Hazardous Waste: As defined in 22 CCR Division 4.5, Chapter 11.

D. PCBs: Polychlorinated Biphenyls.

E. TSDF: Treatment, Storage and Disposal Facility.

F. Used Oil: As defined in 22 CCR Division 4.5, Chapter 10.

1.03 REFERENCE STANDARDS

A. California Code of Regulations (CCR)

1.	14 CCR Division 7, Chapter 3	Minimum Standards for Solid Waste Handling and Disposal
2.	22 CCR Division 4, Chapter 19	Certification of Environmental Laboratories
3.	22 CCR Division 4.5, Chapter 11	Identification and Listing of Hazardous Waste
4.	22 CCR Division 4.5, Chapter 12	Standards Applicable to Generators of Hazardous Waste
5.	22 CCR Division 4.5, Chapter 13	Standards Applicable to Transporters of Hazardous Waste
6.	22 CCR Division 4.5, Chapter 14	Standards Applicable to Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities
7.	22 CCR Division 4.5, Chapter 29	Standards for the Management of Used Oil

B. Code of Federal Regulations (CFR)

1. 40 CFR Chapter I, Subchapter I Solid Wastes
2. 40 CFR Chapter I, Subchapter R Toxic Substances Control Act
3. 49 CFR Chapter I, Subchapter C Hazardous Materials Regulations

C. California Health and Safety Code (HSC)

1. HSC Section 25250 Management of Used Oil

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 02 87 20-1, Qualifications:

1. Independent Testing Laboratory:
   a. See subparagraph "Qualifications".
   b. Provide contact person name, address and telephone number.
2. TSDF:
   a. See subparagraph "Qualifications".
   b. Provide contact person name, address and telephone number.
3. Transporter:
   a. See subparagraph "Qualifications".
   b. Provide contact person name, address and telephone number.
4. Used Oil Recycling Facility:
   a. See subparagraph "Qualifications".
   b. Provide contact person name, address and telephone number.

C. RSN 02 87 20-2, Used Oil Characterization, Handling, and Disposal Plan:

1. See subparagraph "Contractor's Responsibilities".

D. RSN 02 87 20-3, Characterization Report:

1. Copy of Independent Testing Laboratory analytical results and Chain of Custody form.

E. RSN 02 87 20-4, Manifests, Bills of Lading, Disposal Certificates:

1. See subparagraph "Contractor's Responsibilities".

1.05 QUALIFICATIONS

A. Independent Testing Laboratory: Accredited under California ELAP, 22 CCR Division 4, Chapter 19 for Methods:

1. TCLP 1311 and 8082 in accordance with 22 CCR Division 4.5, Chapter 11.

B. TSDF:

1. Current EPA Identification Number.
2. Meet requirements of:
   a. 22 CCR Division 4.5, Chapter 14.
   b. 40 CFR Chapter I, Subchapter I.

C. Transporter:

1. Current EPA Identification Number.
2. Meet requirements of 22 CCR Division 4.5, Chapter 13.
3. Registration per 49 CFR Chapter I, Subchapter C.

D. Used Oil Recycling Facility:

1. Current EPA Identification Number.
2. Meet requirements of 22 CCR Division 4.5, Chapter 29.

1.06 PROJECT CONDITIONS

A. The bridge crane travel motor oil has been tested for regulated metals, flashpoint, and volatile organic compounds, and it passes the regulatory Used Oil Specifications for these. The oil needs to be tested for polychlorinated biphenyls to determine proper disposal options.

B. Contractor is a co-generator of Hazardous Waste in accordance with 40 CFR Chapter I, Subchapter I.

C. Facility owner EPA Identification Number will be provided to Contractor after award.

1.07 SAFETY AND HEALTH REGULATIONS

A. In accordance with Section 01 35 20 – Safety and Health.

1.08 ADMINISTRATIVE REQUIREMENTS

A. Contractor is responsible for characterizing, handling, transporting, and disposing of Hazardous Waste and Oil.

1. Obtain EPA Identification Number.

B. Provide Oil Characterization, Handling, and Disposal Plan:

1. Sampling, analyzing, and characterizing of Used Oil.

a. Determine whether Used Oil:

1) Is a Hazardous Waste in accordance with 22 CCR Division 4.5, Chapter 29.

2) Contains PCBs in accordance with 40 CFR Chapter I, Subchapter R.

2. Handling and recycling or disposing of Used Oil.

a. Disposing of Used Oil as Hazardous Waste:

1) TSDF.

a) Name, contact person, telephone number and address.

b) EPA Identification Number and permit.

c) Written agreement to accept waste generated under this contract.

b. Recycling Used Oil:

1) Used Oil Recycling Facility.

a) Name, contact person, telephone number and address.

b) EPA Identification Number and permit.

c. Transporter.

1) Name, contact person, telephone number and address.

2) EPA Identification Number and permit.

C. Prior to Transporting:

1. Used Oil:

a. Before transporting, obtain notice from TSDF owner or operator or Used Oil Recycling Facility, that facility:

1) Has required permits.

2) Will accept waste to be shipped under this contract.

D. Manifests:

1. Prepare manifests before transporting for offsite treatment, storage, or disposal in accordance with:

a. 22 CCR Division 4.5, Chapter 13.

b. 40 CFR Chapter I, Subchapter I.

c. 49 CFR Chapter I, Subchapter C.

2. Obtain signed manifests and disposal documentation:
   a. At time of collection, signed by Transporter.
   b. At time of delivery to TSDF or Used Oil Recycling Facility, signed by Transporter.
   c. At time of disposal, signed by TSDF or Used Oil Recycling Facility.
   d. Certificate of Disposal or Notice of Acceptance from TSDF or Used Oil at Used Oil Recycling Facility.
3. Acceptance of Hazardous Waste, PCB-contaminated Oil or Used Oil at a the approved TSDF or Used Oil Recycling Facility does not meet the definition of final treatment nor final disposal under the contract.
   a. Obtain documentation to prove final treatment or disposal of has been accomplished.
   b. Attach documentation to the Certificate of Disposal or Notice of Acceptance.

E. Recycling Reports:
1. Provide information on the total amount of Oil during the preceding 3 month period.
2. Break down date and quantity.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 WASTE CHARACTERIZATION, HANDLING, AND DISPOSAL

A. Comply with approved for Waste Characterization, Handling, and Disposal Plan.
1. Determine whether oil:
   a. Is a Hazardous Waste as defined in 22 CCR Division 4.5, Chapter 29.
   b. Is Used Oil.
   c. Contains PCBs as defined in 40 CFR Chapter I, Subchapter R.

B. Handle and transport Used Oil as Hazardous Waste in accordance with HSC Section 25250.4.

C. Hazardous Waste, PCB-contaminated Oil and Used Oil:

1. Do not mix different types of Hazardous Waste, PCB-contaminated Oil, or Non-hazardous Waste.
2. Store in DOT approved weatherproof, watertight steel containers.
3. Seal, label, and store in accordance with:
   a. 22 CCR Division 4.5, Chapter 12.
   b. 49 CFR Chapter I, Subchapter C.
4. Transport in accordance with 22 CCR Division 4.5, Chapter 13 and 49 CFR Chapter I.
5. Dispose of:
   a. Hazardous Waste and PCB-contaminated Oil at approved TSDF.
   b. Used Oil at Used Oil Recycling Facility.

D. Non-hazardous Waste:

1. Store in DOT approved containers for liquids, separate from Hazardous Waste and PCB-contaminated Oil storage areas.
2. Dispose waste in accordance with 14 CCR Division 7, Chapter 3.
3. Comply with Section 01 74 00 - Cleaning and Waste Management.

END OF SECTION

SECTION 03 62 20
NONSHRINK GROUT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items requiring nonshrink grout.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM C1107/C1107M-20 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.03 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittals.

B. RSN 03 62 20-1, Packaged Nonshrink Grout Data:

1. Manufacturer's product data.
2. Manufacturer's certification that product meets specifications.
3. Manufacturer's instructions:
   a. Surface preparation, mixing, installation, finishing, curing, and protection recommendations:
      1) Include specific recommendations based on anticipated jobsite temperatures and environmental conditions.
      2) Include manufacturer's recommended methods for float finishing grout.
      3) Include manufacturer's recommended minimum temperature and protection period for protecting grout from freezing and damage after placement.

PART 2 PRODUCTS

2.01 PACKAGED NONSHRINK GROUT

A. Pre-mixed commercial grout mixture:

1. ASTM C1107.

B. Water:

1. Clean.
2. Free of detrimental quantities of silt, organic matters, salts, or other impurities.
3. As recommended by grout manufacturer.

C. Mix: In accordance with manufacturer's instructions to consistency recommended by manufacturer for application.

PART 3 EXECUTION

3.01 APPLICATION

A. Only allowable use for nonshrink grout is pipe penetration and electrical channel bases.

3.02 PREPARATION

A. Clean and prepare base concrete surface to which nonshrink grout will be bonded in accordance with manufacturer's instructions or as directed by COR:

1. Roughen surface.
2. Remove dirt, laitance, loose or defective concrete, curing compound, coatings, and other foreign material.
3. Wash with water.

B. Lubricate concrete surface by washing with water immediately before placing nonshrink grout when delay occurs between washing and placing nonshrink grout.

3.03 PLACING

A. Place nonshrink grout in accordance with manufacturer's instructions to completely fill space to be grouted.

B. Use forms, where required, to confine nonshrink grout.

3.04 CURING

A. Cure exposed surface of packaged nonshrink grout by method recommended by manufacturer.

B. Do not apply loads sooner than 72 hours after placement and only after nonshrink grout has attained compressive strength of at least 3,000 lb/in^2.

END OF CONTENTS

SECTION 09 96 20
COATINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered the Price Schedule for other items of work.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM A780-20	Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
2.	ASTM C920-18	Elastomeric Joint Sealants
3.	ASTM D2244-21	Calculation of Color Differences From Instrumentally Measured Color Coordinates
4.	ASTM D2794-93(2019)	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
5.	ASTM D3276-15e1	Guide for Painting Inspectors
6.	ASTM D4060-19	Abrasion Resistance of Organic Coatings by the Taber Abraser
7.	ASTM D4285-83(2018)	Indicating Oil or Water in Compressed Air
8.	ASTM D4541-17	Pull-Off Strength of Coatings Using Portable Adhesion Testers
9.	ASTM D4587-11(2019)	Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus
10.	ASTM D5894-21	Cyclic Salt Fog/UV Exposure of painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

B. International Organization for Standardization (ISO)

1.	ISO 8502-3-92	Assessment of dust on Steel Surface Prepared for Painting (Pressure-Sensitive Tape Method)

C. The Society for Protective Coatings (SSPC)/NACE International (NACE)

1.	SSPC-AB1-19	Mineral and Slag Abrasives
2.	SSPC-AB2-16	Cleanliness of Recycled Ferrous Metallic Abrasives
3.	SSPC-AB3-17	Newly Manufactured or Re-Manufactured Steel Abrasives
4.	SSPC-Guide 15-13	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates and Other Nonporous Substrates
5.	SSPC-PA 1-16	Shop, Field, and Maintenance Painting of Steel
2.	SSPC-PA 2-22	Measurement of Dry Paint Thickness with Magnetic Gages
6.	SSPC-QP1-15	Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
7.	SSPC-QP2-13	Evaluating Painting Contractors (Field Removal of Hazardous Coatings From Complex Industrial Structures)
3.	SSPC-QP3-10/AISC 420	Evaluating the Qualification of Shop Painting Contractors
4.	SSPC-SP1-16	Solvent Cleaning
8.	SSPC-SP2-04	Hand Tool Cleaning
9.	SSPC-SP3-04	Power Tool Cleaning
10.	SSPC-SP6/NACE 3-07	Commercial Blast Cleaning
11.	SSPC-SP7/NACE 4-06	Brush-Off Blast Cleaning
12.	SSPC-SP10/NACE 2-15	Near-White Blast Cleaning
13.	SSPC-SP11-20	Power Tool Cleaning to Bare Metal, Level 3 minimum requirement
14.	SSPC-SP16-10	Bruch-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steel, and Non-Ferrous Metals
15.	SSPC-VIS1-12	Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
16.	SSPC-VIS3-07	Visual Standard for Power- and Hand-Tool Cleaned Steel

17.	SSPC Paint Manual	Volume 1, Good Painting Practices, Fourth Edition 2002
18.	NACE SP 0178-07	Detail, Finish, and Design Considerations for Immersion Service.
19.	NACE SP 0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
20.	NACE SP 0287-16	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
21.	NACE RP 0288-88	Recommended Practices for Inspection of Linings on Steel and Concrete.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals.

B. RSN 09 96 20-1, Approval Data:

1. For each coating material:
   a. Manufacturer's product data, application, and Safety Data Sheets (SDS) sheets.
   b. Identification of "Items to be coated" including sub-letter and sub-number listed in Coating Tabulations.
2. For each caulk and filler:
   a. Manufacturer's product data, application, and SDS sheets.
   b. Identification of areas of use including sub-letter and sub-number listed in Coating Tabulations.
3. For each substituted coating material "equal" to specified product in Coating Tabulation:
   a. List of not less than 5 similar successful material applications:
      1) Project name, location, type of structure, and application dates.
      2) Owner's name, address, and telephone number.
   b. Certification that material meets or exceeds specified requirements:
      1) Manufacturer's certification including technical representative's signature and date of signature.
      2) Independent laboratory's certified test reports.

C. RSN 09 96 20-2, Final Approval Data:

1. For each coating material and thinner:

    a. Purchase orders including order number, date, manufacturer's designated product name, batch number(s), and quantity purchased.

    a. Supplier's name, address, and phone number.

D. RSN 09 96 20-3, Paint Chip Samples:

1. Color chip samples approximately 4 by 6-inch.

2. Label each sample to include manufacturer's designated product name, color, and gloss.

3. Supply paint chip samples to the COR for selection and approval.

E. RSN 09 96 20-4, Qualifications:

1. Coating Contractor Provide the Following:

    a. Current SSPC QP1 and/or SSPC QP3 certifications to be requested as needed and at the discretion of the COR for Tabulations No. 02 and No. 3.

    b. List not less than 3 comparable completed jobs for each coating type including owner's name, address, and telephone numbers completed within the last five years.

2. Coating Applicator(s):

    a. List of not less than 5 comparable jobs for each coating type including owner's name, address, and telephone number.

    b. Personnel shall be qualified to tradesman level as blast-cleaner, painter, applicator, etc. The personnel shall have relevant knowledge of health and safety hazards, use of protection equipment, coating materials, mixing, and thinning of coatings, coatings pot-life, and surface requirements.

    c. Personnel not qualified to tradesman level shall document training and experience to the same level as a formalized tradesman education.

3. Coating Contractor Inspector(s) Provide the Following:

    a. Letter from contractor listing the personnel performing QC inspections, certified at a minimum as NACE Coating Inspector Level 1 (CIP) or as a SSPC Protective Coatings Inspector (PCI), as they report directly to a QC Supervisor who shall be a NACE Level 3 Coatings Inspector (CIP) or a SSPC Protective Coatings Inspector (PCI).

4. Contract or Third-Party Inspector(s):

    a. Current Level 3 certification for NACE Certified Coatings Inspector (CIP) or SSPC Protective Coatings Inspector (PCI).

    b. List not less than 5 years of comparable jobs including project description, location, and owner's name, address, and telephone numbers.

c. Provide calibrated inspection equipment and demonstrate the use if required by the COR.

F. RSN 09 96 20-5, Quality Control Plan:

1. Quality Control Manager:

a. Name and title.

2. Quality Control Procedure:

a. Quality control plan.

1) Factory, shop, or field testing procedures shall be in accordance with these specifications, product manufacturer's written instructions, and NACE RP 0288, and ASTM D3276.

b. Procedure for addressing identified non-conformities.

G. RSN 09 96 20-6, Contractor Quality Testing Report:

1. Comprehensive report of daily quality control test reports.

1.04 DELIVERY, STORAGE, HANDLING

A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.

B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.

C. Store coating materials and thinners in accordance with the manufacturer's recommendations, and as a minimum, store off the ground, under cover, and at 50- to 95-degrees Fahrenheit (F).

D. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.05 AMBIENT CONDITIONS

A. Maintain environmental conditions to meet coating manufacturer's requirements during surface preparation, coating application, and curing period. Provide heating or cooling, and dehumidification as needed. Complete curing before placing the coating systems into service.

B. Coatings shall be applied when the substrate surface temperature is 5 degrees F or more above the dew point temperature and for at least 8 hours after application.

1.06 PROJECT CONDITIONS

A. Existing coatings may contain hazardous materials. Use caution when disturbing or removing coatings. Refer to Section 02 82 20 – Removal and Disposal of Asbestos Containing Materials and 02 83 33 – Recycling of Scrap Metal with Coatings Containing Hazardous Materials.

B. Galvanic isolation of dissimilar metals shall be required. Coatings in this specification section shall not serve as the primary galvanic isolation.

C. Contractor shall comply with applicable federal, state, and local air pollution and environmental control regulations for surface preparations, blast cleaning, disposal of spent materials and debris, and coatings application.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Surface preparation and spray application equipment:

1. Sized in accordance with coating manufacturer's recommendations.
2. Provide:
   a. Pressure gauges and pressure regulators.
   b. Air supply lines free from oil and moisture.

2.02 ABRASIVES

A. Mineral and slag abrasives: Meets SSPC-AB1, type I (natural minerals) and type II (slags), class A.

B. SSPC-AB2 for recycled cleanliness.

C. SSPC-AB3 Class I (steel) or II (iron) for angular shaped grit. Shot abrasives are not acceptable.

D. Commercially available products or processes to render the hazardous waste stream non-hazardous and not exceeding toxicity threshold limits.

1. Additive stabilizers for leachable toxic metal wastes are allowed, except elemental iron is not permitted.

2.03 COATINGS

A. Specified in Coating Tabulations:

1. Apply only one coating system per option in Coating Tabulations.

2. Apply compatible products of same manufacturer for coating system components.

B. Volatile Organic Compounds (VOC): Do not exceed maximum permitted by Federal, State, and local air pollution control regulations as supplied in container or by addition of thinner material.

C. Factory color or tint only. Do not color or tint at jobsite.

D. Use manufacturer's recommended thinners for coating materials.

E. Do not use accelerator products unless approved by COR.

2.04 FILLERS AND CAULKS

A. Caulks:

1. Coating manufacturer's standard or compatible caulk material.
2. Polyurethane, silicone, or silicone acrylic caulk material: Meets or exceeds ASTM C920 type S or M, grade NS, class 25, suitable for water immersion service.

B. Fillers:

1. Apply compatible products of same manufacturer for coating system components.
2. Approved fillers:
   a. Carboguard 501, as manufactured by Carboline, www.carboline.com.
   b. Devmat 142HB, as manufactured by International Paint, www.international-pc.com.
   c. PPG Amercoat 114 A, as manufactured by PPG, www.ppgpmc.com.
   d. Steel Seam FT910, as manufactured by Sherwin Williams, www.sherwin-williams.com.
   e. Surfacing Epoxy Series 215 as manufactured by Tnemec, www.tnemec.com.
3. Provide one of the above fillers, or equal with following essential characteristics:
   a. Coating manufacturer's standard filler material.
   b. Approved use by manufacturer.

2.05 MISCELLANEOUS MATERIALS

A. Deionized Water.

B. Chlor-Rid as manufactured by Chlor-Rid, https.//Chlor-id.com,

C. HoldTight 102 as manufactured by Holdtight Solutions, www.holdtight.com,

D. Chlor-Gone, as manufactured by Aquron, www.aquron.com

E. Provide one of the above salt removers, or equal with following essential characteristics:

1. Commercially available additive for soluble salt removal.
2. Water soluble.
3. Biodegradable.
4. Zero volatile organic compounds.

PART 3 EXECUTION

3.01 SHOP PAINTING

A. Shop coated and lined equipment shall be primed and finished in the shop and touched up in the field with identical coating materials after installation and in accordance with the coating's manufacturers standard surface preparation and application instructions.

3.02 FIELD PAINTING

A. Follow specified information in the Coating Tabulations and/or coating manufacturer's standard surface preparations and application instructions for field applied coatings.

3.03 PROTECTION OF ADJACENT SURFACES

A. Remove, mask, or otherwise protect items or surfaces not coated from contamination and damage during cleaning and coating operations.

B. Examples include protecting mating and machined surfaces, mechanical and electrical equipment (open or enclosed), instruction and similar plates, and wet and newly coated surfaces.

3.04 SURFACE PREPARATION

A. Remove or repair surface irregularities and impart profile as specified:

1. Welds:
   a. Welds: Smooth and continuous.
   b. Weld spatter, protrusions, laminations, slag, buckshot, and slivers. Remove and grind smooth in accordance with NACE SP 0178.
   c. Undercuts and porosity: Fill with weld material and grind smooth.in accordance with NACE-SP 0178.
   d. Projections, sharp edges, high points, fillets, and corners: Grind smooth to a radius of at least 1/16-inch.
2. Substrate defects:

a. Pitting, gouges, scratches, porosity, and similar:

1) Grind smooth.

2) Defects exceeding 20-percent reduction in wall thickness require weld repairs.

3. Grind full length of edges and corners smooth to a radius of at least 1/16-inch.

B. Surface preparation method:

1. See Coating Tabulations.

2. Compare prepared steel surfaces to following visual reference photographs for allowable visible contaminants and stains:

a. SSPC-VIS1 for abrasive blast cleaning.

b. SSPC-VIS3 for power and hand tool cleaning.

3. Assessment of dust contaminants:

a. Perform clear tape test method in accordance with ISO 8502-3.

b. Test all items prior to coating application.

c. Acceptance Criteria: Degree of cleanliness shall meet Class 3.

C. Surface profile:

1. Prepare as specified in Coating Tabulations.

2. Where not specified, prepare in accordance with manufacturer's instructions for metallic substrates or existing coating surfaces and service environment.

3. Where manufacturer's instructions do not specify a surface profile, prepare blasted surfaces to following profile:

a. Atmospheric Service Environments: 1-mil or greater angular profile and less than specified millage of first applied coat.

4. Inspect surface profile in accordance with NACE SP 0287:

a. Use replica tape suitable for surface profile depth range.

b. Perform at least two tests per 1,000-square feet.

D. Soluble salts:

1. Measure concentration of chlorides, nitrates and sulfates in accordance with SSPC Guide 15.

2. Perform at least two tests per 1,000-square feet of surface area. Include corrosion pit areas.

3. Acceptance criteria: Do not exceed 3-micrograms per square centimeter for chlorides and 5-micrograms per square centimeter for nitrates and sulfates.

E. Re-clean or perform additional surface preparation of contaminated surfaces before coating application.

3.05 COMPRESSED AIR EQUIPMENT

A. Keep air compressor and spray application equipment lines free of oil and moisture during work.

B. Compressed air quality:

1. Perform tests in accordance with ASTM D4285.
2. Perform test at the beginning of every shift.

3.06 FILLERS AND CAULK APPLICATION

A. Caulk areas including crevices, gaps, plate seams, skip welds, and conduit penetrations.

B. Apply in a uniform texture, neatness, and color matched appearance.

C. Apply in accordance with manufacturer's instructions and achieve tight bond to substrate or previous coats.

3.07 COATING APPLICATION

A. Coating shall be done in a workmanlike manner to produce an even film of uniform thickness. The finished surfaces shall be free from runs, drops, ridges, waves, laps, sags, curtains, brush marks, and variations in color, texture, and finish.

B. Shop coated and lined equipment shall be primed and finished in the shop and touched up in the field with identical coating materials after installation and in accordance with the coating manufacturer's application instructions.

C. Follow specified systems in the Coating Tabulations and coating manufacturer's application instructions for applied coatings. In event of a conflict, the more stringent requirement shall apply.

D. Stripe coat:

1. Brush apply stripe coat to each coat applied.
2. Apply stripe coat prior to spray application of the primer, when practical.
3. Apply to edges, corners, interior angles, pits, plate seams, crevices, rivets, nuts, threads, bolts, washers, welds, and similar features.

E. Apply number of coats and coating thickness specified in Coating Tabulations.

1. Alternate coat colors to differentiate between coats.
2. Apply in accordance with manufacturer's instructions.

3. Apply in accordance with SSPC-PA 1.

F. Prevent overspray or dry spray. When such conditions occur, clean surfaces prior to application of subsequent coats.

G. Re-clean contaminated surfaces between coats.

H. Dry Film Thickness (DFT):

1. After each coat, inspect hardened coating system for DFT compliance in accordance with SSPC-PA 2.

2. Acceptance Criteria: no single spot measurement less than 80 percent minimum or 120 percent maximum specified.

I. Discontinuity (Holiday) Testing:

1. Inspect in accordance with NACE SP 0188:

a. Use maximum test voltage for DFT as recommended by coating manufacturer to prevent coating damage.

J. Coating Adhesion:

1. Test in accordance with ASTM D4541 at the direction of the COR.

3.08 CONTRACTOR FIELD QUALITY TESTING

A. Inspection Equipment:

1. Calibrate inspection devices and equipment in accordance with the manufacturer's instructions.

2. Verify calibration prior to every use.

B. Qualified personnel shall conduct tests and sign reports.

1. Perform tests in presence of the COR:

2. Provide rigging for COR to observe inspections.

C. Make daily reports for review by the COR, including:

1. Date of work.

2. Description of areas and work performed.

3. Environmental conditions.

4. Results from the following quality control tests:

a. Soluble salt.

b. Surface profile.

c. Visual comparison of prepared surfaces.

d. Assessment of dust contaminants.

e. Compressed air quality.

f. Dry film thickness (DFT).

g. Discontinuity (Holiday) testing.

h. Coating adhesion testing (when directed by the COR).

D. Final inspection will take place after repairs, but before placing into service.

3.09 REPAIR AND REMEDIAL WORK

A. Repair defective or damaged areas of coatings in accordance with coating manufacturer's recommendations.

PART 4 COATING TABULATIONS

Tabulation No. 01		
Items to be coated – Commercial or manufacturer's product with a standard applied coating system: A. Electrical equipment B. Electrical cabinets C. Motor hoist D. Hoist equipment		
Coating materials	Number and thickness of coats	Surface preparation method
Factory or Shop applied permanent coating system: I. Commercial or manufacturer's standard surface preparation and permanent coating system. II. Items subject to sunlight shall be topcoated with ultraviolet (UV) stable materials. III. Permanent coating system shall have 10-year corrosion-free protection without significant defects stored in atmospheric exposure. IV. Color and gloss: Standard color unless a specific color is otherwise specified in the color schedule. V. Unless otherwise specified, unexposed surfaces that require coatings, such as interior of cabinets, enclosures, and equipment, shall be given the manufacturer's standard permanent coated finish.		
Field Repair: Repair damaged areas of coated surfaces with compatible materials to equal thickness and color match of undamaged areas, unless otherwise tabulated herein.		

Tab AE-05.DOCX

Tabulation No. 02
Items to be coated: a) Bridge crane structural steel members b) Bridge crane handrails c) Bridge crane ladder rails d) Lower block and hook e) Upper block

Tabulation No. 02		
Note: 1. FD versions of the Polysiloxane can be used as substitutes 2. If crane or lifting beams are galvanized steel, exclude the zinc rich primer, use the epoxy as the primer followed by the polysiloxane topcoat (two coat system 8-14 mils DFT) 3. If ladder or ladder rails are galvanized, no coating is necessary		
Coating material – Option 1 Zinc rich epoxy primer/ Epoxy/ Polysiloxane	Number and thickness of coats	Surface preparation method
PPG: Amercoat 68HS or Amerlock 2 or 400/ PSX 700 Sherwin Williams: Zinc Clad III HS or 4100/ Duraplate 235/ Sherloxane 800	1 or more prime coats, apply at 3 to 5 mils DFT per coat, plus stripe coats. 1 or more intermediate coats, apply at 5 to 7 mils DFT per coat. 1 or more finish coats, apply at 3 to 7 mils DFT per coat. Total system excluding stripe coats: 11-mil DFT, minimum 19-mil DFT, maximum	SSPC-SP1 followed by: Uncoated steel surfaces: SSPC-SP10 or SSPC-SP11 where abrasive blasting is impractical Uncoated galvanized steel surfaces: SSPC-SP16 or SSPC-SP11 where abrasive blasting is impractical Follow manufacturer's surface preparation and application instructions to apply subsequent coats
Coating material – Option 2 Zinc rich epoxy primer/ epoxy/ polyurethane	Number and thickness of coats	Surface preparation method

Tabulation No. 02		
Carboline: Carbozinc 859/ Carboguard 691/ Carbothane 134 HB, HG, or VOC International Paint: Interzinc 52/ Intergard 475HS/ Interthane 870 UHS PPG: Amercoat 68HS or 68 VOC/ Amerlock 2 or 400 Amercoat 450H or Amershield VOC Sherwin Williams: Zinc Clad III HS or 100/ Duraplate 235 or Macropoxy 646/ Hi solids polyurethane or 250 Tnemec: Tneme-zinc 90-97/ Epoxoline Series N69 or V69/ Endura-shield 1075 Color and gloss: see color schedule	1 or more prime coats, apply at 3 to 5 mils DFT per coat, plus stripe coats. 1 or more intermediate coats, apply at 6 to 8 mils DFT per coat. 1 or more finish coats, apply at 3 to 5 mils DFT per coat. Total system excluding stripe coats: 12-mil DFT, minimum 18-mil DFT, maximum	SSPC-SP1 followed by: Uncoated surfaces: SSPC-SP10 Damaged coated surfaces: SSPC-SP10 and SSPC-SP11 where abrasive blasting is impractical
Coating materials – Option 3 Alkyd/Silicone Alkyd	Number and thickness of coats	Surface preparation method

Tabulation No. 02		
Carboline: Carbocoat 115 VOC/ Carbocoat 30 International Paint: Devguard 4160/ Devshield 877 PPG: KL6040/ KLF Series Silicone Alkyd Sherwin Williams: Kem Kromik Universal Primer/ Steel Master 9500 Tnemec: Chem-Prime HS Series 37H/ Versatone Series 82HS Color and gloss: see color schedule	1 or more prime coats apply at 2 to 3 mils DFT per coat, plus stripe coats. 2 or more finish coats apply at 2 to 3 mils DFT per coat. Total system excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: New uncoated surfaces: SSPC-SP6 Damaged coated surfaces: SSPC-SP6 and SSPC-SP11 where abrasive blasting is impractical Galvanizing: SSPC-SP7, SSPC-SP3, or manufacturer's chemical treatment
Coating materials – Option 4 Water-borne acrylic	Number and thickness of coats	Surface preparation method
Prime or spot repair Carboline: Carbocrylic 3358/ Carbocrylic 3359 International Paint: Devflex 4020PF DTM/ Devflex 4216HP Sherwin Williams: Pro Industrial Procryl Universal Acrylic Primer series B66-W00310/ Pro Industrial Procryl DTM Acrylic Color and gloss: see color schedule	1 or more prime coats apply at 2 to 3 mils DFT per coat, plus stripe coats. 2 or more finish coats apply at 2 to 3 mils DFT per coat. Total system excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: Uncoated surfaces: SSPC-SP6 Damaged coated surfaces: SSPC-SP6 and SSPC-SP11 where abrasive blasting is impractical Galvanizing: SSPC-SP7, SSPC-SP3, or manufacturer's chemical treatment

Tabulation No. 02	
PERFORMANCE REQUIREMENTS:	
Testing Protocol	Acceptance Criteria
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy/Polysiloxane: 120 milligram loss or less
Direct impact, ASTM D2794:	Epoxy/Polysiloxane: 40 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	Epoxy/Polysiloxane: 1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 5000 hrs.
QUV accelerated weathering test, ASTM D 4587:	Passes 5,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244

Tab AE-08.DOCX

Tabulation No. 03		
Items to be coated: A. Crane ladder rungs B. Crane deck		
Note: 1. FD versions of the Polysiloxane can be used as substitutes. 2. For slip resistance, follow manufacture recommendation for material selection and method to broadcast material into coating. 3. If ladder rungs are galvanized no coating or broadcast sand necessary.		
Coating material – Option 1 Zinc rich epoxy primer/ Epoxy/ Polysiloxane	Number and thickness of coats	Surface preparation method

Tabulation No. 03		
PPG: Amercoat 68HS or Amerlock 2 or 400/ PSX 700 Sherwin Williams: Zinc Clad III HS or 4100/ Duraplate 235/ Sherloxane 800	1 or more prime coats, apply at 3 to 5 mils DFT per coat, plus stripe coats. 1 or more intermediate coats, apply at 5 to 7 mils DFT per coat. 1 or more finish coats, apply at 3 to 7 mils DFT per coat. Total system excluding stripe coats: 11-mil DFT, minimum 19-mil DFT, maximum	SSPC-SP1 followed by: Uncoated steel surfaces: SSPC-SP10 or SSPC-SP11 where abrasive blasting is impractical Uncoated galvanized steel surfaces: SSPC-SP16 or SSPC-SP11 where abrasive blasting is impractical Follow manufacturer's surface preparation and application instructions to apply subsequent coats
Coating material – Option 2 Zinc rich epoxy primer/ epoxy/ polyurethane	Number and thickness of coats	Surface preparation method

Tabulation No. 03		
Carboline: Carbozinc 859/ Carboguard 691/ Carbothane 134 HB, HG, or VOC International Paint: Interzinc 52/ Intergard 475HS/ Interthane 870 UHS PPG: Amercoat 68HS or 68 VOC/ Amerlock 2 or 400 Amercoat 450H or Amershield VOC Sherwin Williams: Zinc Clad III HS or 100/ Duraplate 235 or Macropoxy 646/ Hi solids polyurethane or 250 Tnemec: Tneme-zinc 90-97/ Epoxoline Series N69 or V69/ Endura-shield 1075 Color and gloss: see color schedule	1 or more prime coats, apply at 3 to 5 mils DFT per coat, plus stripe coats. 1 or more intermediate coats, apply at 6 to 8 mils DFT per coat. 1 or more finish coats, apply at 3 to 5 mils DFT per coat. Total system excluding stripe coats: 12-mil DFT, minimum 18-mil DFT, maximum	SSPC-SP1 followed by: Uncoated surfaces: SSPC-SP10 Damaged coated surfaces: SSPC-SP10 and SSPC-SP11 where abrasive blasting is impractical
Coating materials – Option 3 Alkyd/Silicone Alkyd	Number and thickness of coats	Surface preparation method

Tabulation No. 03		
Carboline: Carbocoat 115 VOC/ Carbocoat 30 International Paint: Devguard 4160/ Devshield 877 PPG: KL6040/ KLF Series Silicone Alkyd Sherwin Williams: Kem Kromik Universal Primer/ Steel Master 9500 Tnemec: Chem-Prime HS Series 37H/ Versatone Series 82HS Color and gloss: see color schedule	1 or more prime coats apply at 2 to 3 mils DFT per coat, plus stripe coats. 2 or more finish coats apply at 2 to 3 mils DFT per coat. Total system excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: New uncoated surfaces: SSPC-SP6 Damaged coated surfaces: SSPC-SP6 and SSPC-SP11 where abrasive blasting is impractical Galvanizing: SSPC-SP7, SSPC-SP3, or manufacturer's chemical treatment
Coating materials – Option 4 Water-borne acrylic	Number and thickness of coats	Surface preparation method
Prime or spot repair Carboline: Carbocrylic 3358/ Carbocrylic 3359 International Paint: Devflex 4020PF DTM/ Devflex 4216HP Sherwin Williams: Pro Industrial Procryl Universal Acrylic Primer series B66-W00310/ Pro Industrial Procryl DTM Acrylic Color and gloss: see color schedule	1 or more prime coats apply at 2 to 3 mils DFT per coat, plus stripe coats. 2 or more finish coats apply at 2 to 3 mils DFT per coat. Total system excluding stripe coats: 6-mil DFT, minimum 9-mil DFT, maximum	Undamaged coated surfaces to receive additional coats: SSPC-SP1 followed by: Uncoated surfaces: SSPC-SP6 Damaged coated surfaces: SSPC-SP6 and SSPC-SP11 where abrasive blasting is impractical Galvanizing: SSPC-SP7, SSPC-SP3, or manufacturer's chemical treatment

Tabulation No. 03	
PERFORMANCE REQUIREMENTS:	
Testing Protocol	Acceptance Criteria
Abrasion resistance, ASTM D4060, CS-17 wheel, 1,000 cycles, 1-kg load:	Epoxy/Polysiloxane: 120 milligram loss or less
Direct impact, ASTM D2794:	Epoxy/Polysiloxane: 40 inch-pounds
Pulloff adhesion, ASTM D4541, annex A2, type II tester:	Epoxy/Polysiloxane: 1000 psi or greater
Cyclic testing salt fog/UV, ASTM D5894:	1/4 inch or less undercutting at 5000 hrs.
QUV accelerated weathering test, ASTM D 4587:	Passes 5,000 hour test with no blisters evident on either scribed or unscribed sides, or color difference ASTM D2244

Tab AE-08.DOCX

Tabulation No. 04
Items to be repaired: A. Gratings B. Ladders C. Handrails and safety railings D. Platforms E. Damaged galvanized surfaces not otherwise tabulated
Repair damaged galvanized surfaces in accordance with ASTM A780. Repair materials containing cadmium and lead are not permitted.

Tab AE-11.DOCX

4.01 COLOR SCHEDULE

A. Colors and glosses of finished coats:

1. To be selected and approved by COR.

B. Color and gloss to meet one or more of following:

1. Fed Std 595B.
2. Manufacturer's standard color.

C. Color schedule table:

1. Numbers listed in the "Tabulation No." column correspond to "Items to be coated" listed in Coating Tabulations.

Tabulation No.	Item Surface	Color	Color No.
1	• Electrical equipment • Electrical cabinets • Motor hoist • Hoist equipment	Manufacturer's standard	N/A
2	• Lower Block and hook • Bridge crane handrails	OSHA Safety Yellow	13591 or 13655
2	• Bridge crane structural steel members • Bridge crane ladder rails • Upper block	Color match to existing crane Selected by COR	27886
3	• Crane ladder rungs • Crane deck	Selected by COR	

END OF SECTION

SECTION 25 00 01
AUTOMATION CONTROL SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Furnish, Install, Test and Deliver New Crane Automation Control System:

1. Payment: Lump sum price offered in the Price Schedule.

B. Provide Automation Control System Support:

1. Payment: Lump sum price offered in the Price Schedule.
   a. Includes onsite testing and commissioning support trips for control system startup.

C. Spare Parts for Automation Control System:

1. Payment: Lump sum price offered in the Price Schedule.

1.02 REFERENCE STANDARDS

A. Code of Federal Regulations (CFR)

1.	29 CFR 1910 - 2022	Occupational Safety and Health Standards

B. Facilities Instructions, Standards and Techniques (FIST)

1.	FIST 3-8 - 2021	Facility Instructions and Standard Techniques (FIST) – Operation, Maintenance, and Field Test Procedures for Protective Relays and Associated Circuits.
2.	FIST 4-1b – 2022	Maintenance Scheduling for Electrical Equipment

C. International Electrotechnical Commission (IEC)

1.	IEC 61131-3:2013	Programmable Controllers – Part 3 – Programming Languages
2.	IEC 61000-4-5(2014)	Electromagnetic compatibility (EMC) Part 4-5, Testing and measurement techniques – Surge Immunity Test
3.	IEC 61000-4-11(2005)	Electromagnetic compatibility (EMC) Part 4-11, Testing and measurement techniques – Voltage dips, short interruptions, and voltage variations immunity tests

4.	IEC 62443-2020	Industrial Communication Networks – Network and System Security

D. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE 519-2022	IEEE Recommended Practice and Requirements for Harmonic Control In Electrical Power Systems
2.	IEEE 754-2019	Floating Point Arithmetic
3.	IEEE 802.3-2022	Ethernet
4.	IEEE C37.90-2011	Standard for relays and relay systems associated with electric power apparatus
5.	IEEE 1046-1996	Distribution Digital Control and Monitoring for Power Plants.
6.	IEEE 1249 – 2013	Guide for Computer-Based Control for Hydroelectric Power Plant Automation
7.	IEEE 1613 – 2009	Standard for Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations.
8.	IEEE 1615 – 2019	Recommended Practice for Network Communication in Electric Power Substations
9.	IEEE C37.1-2008	Standard for SCADA and Automation Systems
10.	IEEE C37.2-2022	Electrical Power System Device Function Numbers, Acronyms, and Contact Designation

E. International Society of Automation (ISA)

1.	ISA 101.01-2015	Human Machine Interfaces for Process Automation Systems
2.	ISA 61511-1-(2017)	Functional Safety – Safety Instrumented Systems for the Process Industry Sector Part 1: Framework, Definitions, System, Hardware and Application Programming Requirements
3.	ISA 62381 -2011	Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)

4.	ISA 62382-2012	Automation Systems in the Process Industry – Electrical and Instrumentation Loop Check
5.	ISA 62443-1-1(99.01.01)-2007	Security for Industrial Automation and Control Systems Part 1-1: Terminology, Concepts, and Models

F. National Electrical Manufacturers Association (NEMA)

1.	NEMA ICS 1-2022	Industrial Control and Systems General Requirements
2.	NEMA ICS 5-2017	Control Circuit and Pilot Devices
3.	NEMA ICS 7-2020	Adjustable-Speed Drives
4.	NEMA ICS 8-2019	Application Guide for Industrial Control Systems Crane and Hoist Controllers
5.	NEMA ICS 16 – 2001	Motion/Position Control Motors, Controls, and Feedback Devices

G. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electric Code (NEC)

H. Underwriters Laboratories (UL)

1.	UL 508-2018	Industrial Control Equipment
2.	UL 1449-2021	Transient Voltage Surge Suppressors

1.03 DEFINITIONS

A. Automation Control: Application of technology to monitor and control processes.

B. Class II Controller: controllers intended for use with CMAA crane services class A and B.

C. Control system diagram: conceptual diagram of the functional interrelationship of subsystems, usually in block form.

D. CPU: Central Processing Unit.

E. Dielectric test: tests made to determine ability of insulating materials and spacings to withstand specified overvoltages for a specified time without flashover or puncture.

F. DRAM: Dynamic Random-Access Memory.

G. Drift: as applied to devices such as pressure switches, temperature switches etc., a change in operating characteristics over a specified number of operations or time and specified environmental conditions.

H. Dynamic braking: control function that brakes the drive by dissipating its stored energy in a resistor. A method of controlling speed by using the motor as a generator.

I. Electric motor controller: device or group of devices that serves to govern in some predetermined manner the electric power delivered to the motor.

J. HMI: Human Machine Interface.

K. Hoist: A motor machinery unit that used for lifting and lowering a load.

L. I/O: Input/Output.

M. IP: Internet Protocol.

N. Gbps: Gigabits per second

O. Layer 1: Physical layer of networking. The lowest and most physical layer of the models including physical wires. Data at this layer is bits sent across a wire as 0's and 1's.

P. Layer 2: Data Link Layer. Layer involved in transmitting data from one specific node to another through VLAN, WAN or MAN containing source addresses and destination addresses. Equipment can include switches, bridges and network cards.

Q. Layer 3: Network Transport Layer. Including communication protocols and OSI level models. Coordination of data transfer between end systems and hosts, data rates.

R. OSI: Open Systems Interconnect model

S. PLC: Programmable Logic Controller.

T. RTD: Resistance Temperature Detector

U. SCADA: Supervisory Control and Data Acquisition.

V. SFP: Small Form-factor Pluggable

W. SNMP: Simple Network Management Protocol

X. SPAN: Switch Port Analyzer.

Y. System Integrator: A specialized technician engaged in the detail design, component selection and procurement, fabrication, wiring, assembly, programming and testing process control and communication systems. The System Integrator will provide the programming, licensing and software development for the PLC and HMI automation control system for this project.

Z. VDC: Volts Direct Current

AA. VDAN: Virtual Doubly Attached Node.

BB. VFD: Variable-frequency drive motor controller

CC. VLAN: Virtual Local Area Network.

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data:

B. RSN 25 00 01-1, Qualifications:

1. Documentation of inspector's, engineer's, and technician's experience and certifications.

C. RSN 25 00 01-2, Approval Drawings and Data (Government Format):

1. Includes all items and systems in Part 2 Products, Section 25 12 10 – Programmable Logic Controller.
2. Includes all products in Part 2 Products, Section 41 22 15 – Bridge Crane Electrical Components.
3. Update all facility drawings impacted by modifications.
4. Drawings: Provide 30, 60 and 90 percent design drawings in coordination with Section 41 22 14 – Bridge Crane.
5. Supply layout drawings showing the location of all Contractor supplied equipment for automation, communication, controls and monitoring.
    a. Show device locations, wireway, connection and support points and grounding locations.
6. Supply layout drawings showing the location of all Contractor supplied devices, including, but not limited to PLC assembly, HMI's, Input/Output devices, communication interface, cables, switches, patch panels, network components, power supplies, mounting hardware, connectors, relays, telecommunication cables, surge protection devices and auxiliary devices.
7. Spare parts list.
8. Catalog or product data for equipment and devices furnished.
    a. Model or catalog number.
    b. Manufacturer's technical data.
    c. Equipment capabilities.
    d. Electrical characteristics.
    e. Connection requirements and capabilities.
9. Component lifecycle support information:
    a. Include meantime between failure and any end of life or end of support announcements for the following components:

1) Programmable Logic Controller (PLC).
2) I/O components.
3) HMI.

10. Bill of materials.

D. RSN 25 00 01-3, Installation Plan and Procedures:

1. Provide a narrative including details for installation plan and procedures for new communications equipment.
2. Detailed instructions identifying new and existing cables or wiring runs necessary for installation of new automation equipment.
3. Detailed instructions for initial inspection of new equipment, including wiring, commissioning, and testing plans.
4. Detailed instructions for throughput functional testing of communications and automation devices prior to commissioning.

E. RSN 25 00 01-4, Software Development Documentation: Automation Control Systems:

1. I/O List, including the following minimum information:
   a. Point designation.
   b. Card location.
   c. Type and rating information.
   d. Termination data.
2. Include:
   a. I/O points database.
   b. All variables.
   c. All logic.
   d. Digital processor high-level logic.
   e. Functional block diagrams.
   f. Modbus listing.
   g. Narrative description of software operation.
   h. HMI screen graphics for each screen.
      1) Screen graphics shall be submitted in color.
   i. Description of Alarm Log Reporting.
   j. Description of Trending Capabilities.
3. Master Alarm List, including the minimum following information for each alarm:
   a. Alarm Identifier.

b. Alarm priority.

c. Alarm group.

d. Alarm Setpoints.

4. System Overview:

a. Provide a general description of hardware, software, control functions, interfaces, and general data flow associated with system.

b. Include software block diagram of entire system.

F. RSN 25 00 01-5, Factory Acceptance Test Procedure:

1. Describe mock functional test for Government witness to demonstrate how automation controls meet these specifications.

2. Describe the methods used to simulate I/O feeds to PLCs and VFDs where required for full testing and demonstration purposes.

3. Describe the methods, software, and testing metrics used to demonstrate network connectivity, network packet captures, throughput bandwidth measurements, and network locations where these measurements will take place.

4. Include new network diagrams, in accordance with Section 01 33 26 – Electrical Drawings and Data, showing all network connections and device connections for all equipment.

G. RSN 25 00 01-6, Factory Acceptance Test Report Automation Control System:

1. Certification of performance and result of system control and monitoring testing, including the following:

a. Results for all network communication paths and network failure scenario testing.

b. Results for all tests approved by the Government in the Factory Acceptance Testing Procedure.

c. Results for any other tests performed during the Factory Acceptance Test.

2. Provide the network diagram, in accordance with Section 01 33 26 – Electrical Drawings and Data, showing all network connections and device connections for all equipment, including test equipment not being furnished and installed as a part of this contract.

a. Highlight any changes from the approved network drawings and diagrams.

3. Provide the network packet capture files for all locations for which those captures took place.

a. Uniquely name the files so that the file contents correspond to, and can be identified, using the network diagram provided in this submittal.

H. RSN 25 00 01-7, Pre-Start Checkout Test Procedure Automation Control System:

1. A written procedure for the new automation controls system describing how each device will be tested following the installation at site and prior to final commissioning test to verify proper performance.

I. RSN 25 00 01-8, Pre-Start Checkout Test Report Automation Control System:

1. Certification of performance and result of Pre-Start Checkout Tests.
2. Document any changes that were made during tests to either contractor wiring and equipment or Government wiring and equipment.

J. RSN 25 00 01-9, Check Prints (Government Format):

1. As-shipped drawings.

K. RSN 25 00 01-10, Site Acceptance Test Procedure Automation Control System:

1. Test procedure shall include but not limited to the following:
   a. Detailed written step-by-step procedures of field tests for the Site Acceptance Testing.
   b. Describe the functional test for the Government to witness to demonstrate how the Automation Control System and network devices will meet these specifications.
   c. Describe the methods for I/O verification and PLCs logic verification.
      1) For each I/O point, provide a detailed list of steps to include unique identifiers for each conductor and test point that will be used for I/O verification and PLC logic verification.

L. RSN 25 00 01-11, Site Acceptance Test Report Automation Control System:

1. Certification of performance and throughput results for Automation Control System includes the following:
   a. Results for all tests approved by the Government in the Site Acceptance Testing Procedure.
   b. Results for any other tests performed during the Site Acceptance Test and not covered in other test reports submitted for Government approval.
2. Provide written description of results for each test performed.
3. Include indication of pass, fail or out of range results.
4. Provide updated network diagrams and automation control drawings in accordance with Section 01 33 26 – Electrical Drawings and Data, reflecting the state of the network at the conclusion of acceptance testing.
   a. Show all testing equipment connections prior to their removal from the network.

M. RSN 25 00 01-12, Commissioning of Electrical Equipment – Automation Control System:

1. Provide completed and signed electrical commissioning forms.

N. RSN 25 00 01-13, Final As-Built Drawings (Government Format), Final Software File and Documentation Automation Control System:

1. Full set of user's manuals, guides, and tutorials for software packages.
2. Categorized licensing information to be turned over to the Government for record keeping.
3. Provide a copy of all software files containing final versions of all PLC and HMI programs.
4. Provide copy of all final software files including a record of all setting and logic values installed.
5. Electronic copies of Final As-Built Drawings and diagrams submitted in the O&M Manual in AutoCAD (*.dwg) format.

O. RSN 25 00 01-14, Operation and Maintenance Manual; Crane Automation Control System:

1. Include in main volume of Operation and Maintenance Manual.
2. Comply with requirements in Section 01 78 30 – Project Record Documents.
3. Content:
   a. Network diagrams, schematics and wiring diagrams.
   b. Furnishing software, hardware and communications protocols necessary to modify programming in programmable devices.
      1) Include version numbers for all software and firmware.
   c. Spare parts list corresponding to bill of materials for a complete system.

1.05 AUTOMATION CONTROL SYSTEM DESCRIPTION

A. The Automation Control System includes the complete integration of programmable logic controllers, variable frequency drive motor controllers, human machine interfaces, control enclosures, and related equipment. The automation control system shall include but not limited to power supplies, input modules, output modules, sensors, feedback devices, communications devices and any other required equipment to provide a fully functional system. The PLC automation system will receive discrete input signals, and through the use of control algorithms to coordinate the overall operation of the crane motors.

B. Provide design, labor, equipment, materials and supervision to furnish, install, program, calibrate, adjust, document, test and commission the total system as required herein, as shown on the drawings and required for the complete integration of the Automation Control System.

C. The contractor shall place the completed system in operation, including programming, tuning loops, testing and adjusting parameters, and final adjustments during crane system start-up. The Contractor shall provide the services of trained and qualified technicians for these services.

D. Automation Control and Monitoring.

1. The Automation Control System shall interface with VFDs to enable precise control of motor speed and torque, control all electrically operated equipment, monitor all processes and annunciate statuses and alarms.

2. The system incorporates a range of sensors and feedback devices to monitor and provide real-time information about various parameters such as position, speed, load and safety conditions. These sensors include limit switches, encoders, load cells and proximity sensors. The data from these devices is fed back to the PLC, enabling accurate control and monitoring of the crane motors.

3. Speed and Position Control:

a. A combination of AC static stepless control and VFD vector control using the pendant control station as the primary interface between the operator and crane motor control. The pendant provides precise command input to the controllers, enabling the operator to control the crane's motions.

1.06 RELATED WORK

A. Coordinate features of the automation control system to be compatible with the following Sections:

1. Section 25 12 10 – Programmable Logic Controller

2. Section 41 22 14 – Bridge Crane

3. Section 41 22 15 – Bridge Crane Electrical Components

4. Section 41 22 16 – Crane Motors

1.07 AUTOMATION CONTROL SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. General requirements:

1. Failure of PLC, I/O hardware, power supplies, or network communication link must be fail-safe and alarmed.

2. In accordance with IEEE 802.3 and IEEE 1249.

B. Control System and Network:

1. The Contractor shall provide all equipment, including software and hardware, necessary for testing, installation, communication, troubleshooting all systems provided with the crane.

2. The crane Automation Control System shall be programmed and operate according to the descriptions in this specification. This description indicates minimum system requirements. The Contractor shall provide all required coordination for a complete and functional Automation Control System. Field adjustments or additional features added during startup and commissioning shall be included in the bid price.

3. The Contractor shall provide all crane specific operational software files including ladder logic and functional block programming for their associated systems.

    a. Provide software development and programming including PLC's, instrumentation, VFD's, HMI and crane control system.

    b. Provide additional system accessories as required for a complete and operational control system.

4. Provide complete system startup, configure, program, function test and commission of the complete Automation Control System and other process control equipment.

5. A single common networked design shall not be used for the automation control system. A failure of individual functions shall not affect any other function except as defined for specific safety interlocks.

6. Failure of the monitoring system shall not affect crane functions.

7. All provided hardware and software shall be currently marketed products, not currently scheduled for end of life or obsolescence.

8. Design to ensure there is no remote access capability enabled. Physically disable or remove all network devices not required for operational purposes.

9. Remove all software and services not required for operation or maintenance. If removal is not technically feasible, then disable software not required for the operation of the crane.

    a. The removal of software or services shall not impede the primary function of the control system.

10. The software and services to be removed or disabled shall include, but not limited to:

    a. Unused networking and communications protocols.

    b. All unused data and configuration files.

    c. Unused administrative utilities, diagnostics, network management and system management functions.

    d. Software compilers for programming languages that are not used in the control system.

    e. Messaging services, games and cameras.

    f. Device drivers for components not procured.

C. Application Programmed Logic shall have the following capabilities:

1. Process to upload and download programs.
2. Support for program de-bugging and troubleshooting.
3. Provide support for programming languages in accordance with IEC 61131-3.
4. Provide portability of developed algorithms between devices from the same or different vendors.
5. Performance for data acquisition, processing and delivery in accordance with IEEE C37.2.
6. Provide failure recovery mode.
7. Design with expandability.
8. Self-diagnostics.
9. Design to utilize variables placed in non-volatile memory and the means of creating the non-volatile memory.

D. Design a crane automation control system.

1. Perform the following functions:
   a. Control and monitor hoist and travel motors, circuit breakers, heaters, indicating devices, sensors, VFD's and protective devices.
   b. Acquire operating data from meters, transducers, contact devices, limit switches and proximity switches.
   c. Accept inputs and provide outputs as listed on applicable input/output lists and drawings.
2. Provide future expansion capability of at least 20 percent for inputs, outputs and programming logic.

E. Application Programming Control System:

1. Hoist Motor Control Modes:
   a. Closed-loop speed controlled with torque limiting.
   b. Single-axis positioning.
   c. Master-slave torque control operation.
   d. Synchronous operation.
2. Travel Motor Control Modes:
   a. Open-loop speed control.
   b. Single-axis positioning.
   c. Master-slave torque control operation.
   d. Synchronous operation.

3. Hoist Motor Operation Modes:
    a. Automatic.
    b. Manual.
    c. Jogging.
    d. Speed Controlled
    e. Encoderless emergency mode.
    f. Position sensing.
    g. Limit switch handling.
    h. High-impact load handling.
    i. Anti-Shock.
4. Travel Motor Operation Modes:
    a. Automatic.
    b. Manual.
    c. Jogging.
    d. Speed Controlled
    e. Encoderless emergency mode.
    f. Position sensing.
    g. Limit switch handling.
    h. Anti-Collision.
    i. Anti-Sway.
5. Processor shall be able to be programmed in a high level or block diagram type language.
    a. Programmed in Ladder Logic.
    b. It shall support the following functions at a minimum:
        1) Normally open contact.
        2) Normally closed contact.
        3) Relay coil.
        4) Latching relay with set and reset inputs.
        5) Positive triggered one-shot.
        6) Negative triggered one-shot.
        7) Delay on timer.
        8) Delay off timer.
        9) Pulse timer.

10) Up counter.

11) Down counter.

12) Arithmetic functions including addition, subtraction, multiplication, division, square root, and absolute value.

13) Relational functions including greater than, less than, and equal to.

14) Grouping of programming sections into subroutines.

15) Supports configurable variable names using common text of 8 characters or more.

c. Accessible via Ethernet connection or USB.

d. Software required to view and make program changes shall be provided as a part of the contract including any licenses, dongles, activation keys, etc. as needed.

1) Compatible with Microsoft Windows versions 11.

e. Programing documentation:

1) Sufficiently documented to provide readability for technicians and engineers.

2) Add comments describing program revision level; program sections, modules and functions; variable names and directions to navigate through the code where an external module is called or a jump to another location takes place.

3) Comments written in clear, concise, English using sentence structure and proper case.

4) Comment rate should be 10 percent or more (i.e., one comment line for every 10 program lines).

6. Password protection shall prevent unauthorized changes to application program.

F. PLC ladder logic application programs and HMI screen application files shall become property of the Government and shall not contain proprietary information.

G. I/O connects to the PLC assembly as shown on the drawings and I/O list.

H. Provide the ability to replace PLC I/O cards, power supplies, and hard drives without need to disconnect or disturb plant wiring.

I. Equipment shall not be affected by operation of microwave and mobile VHF radio equipment.

J. Provide password protection for all PLC’s and HMI panels.

1. Configurable passwords.

2. Passwords shall be a minimum of 8 characters long including at least one of each of the following: letter, number, and special character.

K. Operating System:

1. Provide the manufacturer's standard operating system software package.
2. Capable of maintaining a point database in its memory including all parameters, constraints and the latest value or status of all points.
3. Application programs must use the data in memory resident files.
4. Support a full complement of automation control functions.
5. Capability to restart application programming of all connected I/O functions based on detection of power failure.

L. Failure Mode:

1. Upon any failure detection, perform an orderly shutdown.
2. Force all PLC outputs to a predetermined state.

1.08 PROJECT CONDITIONS

A. Plant Layout: See Section 52 00 00 – Drawings, for informational drawings showing general plant layout and work areas.

B. Altitude: 500 feet.

C. Maximum outdoor ambient temperature: 36 degrees Celsius.

D. Relative Humidity Range: 25 to 89 percent.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in shipping containers with labeling in place.

B. Protect equipment from damage, moisture, and dust, free from contact with soil and weather.

1.10 QUALIFICATIONS

A. Qualified Professional Engineers: Demonstrated experience on crane systems on at least two separate contracts.

B. Qualified Electricians: Minimum of one licensed electrician during field wiring and critical aspects of the field work.

C. Specialized in the design, assembly, programming, testing, installation and service of crane control and communication systems for at least the last three years. System Integrator shall be experienced with the programming and commissioning of PLC systems, operator interfaces and VFD's.

1. Minimum of 3 years of experience testing and commissioning crane control systems.
2. In depth knowledge of this particular application and fully capable of troubleshooting and modifying control system hardware and software, including making modifications during on-site testing as necessary.
3. Technically qualified to supervise installation and testing work, meeting with COR approval.
4. Present or represented at work site during installation period.
5. Report, in writing to COR, work not in accordance with manufacturer's recommendations or other conditions possibly resulting in unsatisfactory job.
6. Maintain daily log of accomplished work.

D. Manufacturer:

1. Regularly engaged in manufacture of similar items.

E. Project Designer and Project Programmer:

1. Minimum of 3 years of experience designing crane or similar systems utilizing similar components.

1.11 SPARE PARTS

A. Spare Parts:

1. Deliver spare parts in coordination with COR.
2. Furnish spare parts listed in Table 25 00 01A – Spare Parts for Automation Control System.

Table 25 00 01A – Spare Parts for Automation Control and Monitoring

Item	Description	Quantity
1	Software License for PLC Application Software	1
2	Software License for HMI Application Software	1

PART 2 PRODUCTS

2.01 CONTROL LOGIC & PLC

A. Proportional Integral and Derivative control:

1. Proportional control.
2. Proportional plus integral control.

3. PLC Automation control equipment must be capable of functioning in an ambient temperature ranging from -30 to 70 degrees Celsius, up to 100% relative humidity.

4. Vibration: 2g at 10 to 500 Hertz.

B. Refer to Section 25 12 10 – Programmable Logic Controller.

2.02 PLC APPLICATION PROGRAM

A. General:

1. Crane automation control programming logic shall be based on supplied drawings and descriptions of these specifications.

2. Command Priorities:

   a. A scheme of priority levels must be provided to prevent interaction of a command of low priority with a command of higher priority. Override commands entered by the operator must have the priority than those emanating from the applications programs.

3. Control modes shall be provided with a mode selector control switch with the following positions:

   a. MANUAL – Local manual control mode performed by operator at the crane pendant control station.

      1) When the selector switch is in the MANUAL position, the speed is specified manually from the high-level controller. The hoist and travel motors are accelerated and decelerated to the set speed in such a way that the load sway has been eliminated when the set speed is reached.

      2) Sway control is active in manual mode.

      3) Jogging/inching/micro-speed is active in manual mode.

      4) Approaching zero position for soft landing is active.

   b. SAFE – Disable controls.

4. Anti-Sway, Anti-Skew, Anti-Jerk, and Anti-Collision functions:

   a. Prevent damage.

   b. Prevent accidents.

   c. Implement programming, sensors and proximity switches into crane automation control system.

   d. Continuous load damping.

5. Collision Avoidance/”No-Fly Zone” function:

a. Provide software functionality to create No-Fly Zones within the boundaries of the crane's region of operation with the following characteristics:

1) Software shall utilize provided sensors as described in section 41 22 15 – Bridge Crane Electrical Components, Paragraph 2.18 "Sensors" to determine coordinate definitions.

2) Any crane entry into No-Fly Zones shall be disallowed.

3) No-Fly zones shall have several software-defined boundaries surrounding them with the following characteristics:

a) A full-stop boundary, disabling all further motion.

b) A slow-down and alarm boundary, restricting the crane to runway-end slow speeds and triggering an audible and visible alarm.

c) Boundaries shall be of equal or successively larger width around the No-Fly Zone in the order of full-stop, slow-down.

4) Each No-Fly Zone and its corresponding boundaries shall have separately defined parameters.

5) Boundary widths and No-Fly Zone locations shall be editable by site staff.

6) The software shall include an Override allowing operation in the No-Fly Zone.

a) Override shall include protection against accidental engagement.

B. Relay Function ladder operations shall consist of the following contacts and coils:

1. Normally Open Contact.
2. Normally Closed Contact.
3. Coil.
4. Negated Coil.
5. Retentive Coil.
6. Negated Retentive Coil.
7. Positive Transition Coil.
8. Negative Transition Coil.
9. Set Coil (Latch).
10. Reset Coil (Unlatch)
11. Retentive Set Coil.

12. Retentive Reset Coil.
13. Positive Transition Contact – leading edge one-shot coil.
14. Negative Transition Contact – trailing edge one-shot coil.

C. Adjustable Parameters:

1. Provide parameter input and display directly, in the correct engineering units, through a series of keystrokes on a front panel display with decimal point and polarity indication. Provide display in metric English units.
2. Provide a password protected configuration screen on the HMI to adjust automation control parameters.
3. Include the following items at a minimum:
   a. PLC control timer setpoints.
   b. VFD parameter setpoints.
   c. Acceleration and Deceleration parameters.
   d. No-Fly Zone and Boundary definitions per 2.02.A.5.
   e. Adjustable Analog and Digital input threshold setpoints including but not limited to:
      1) Setpoint calculation for motion control.
      2) Crane controller signaling system.
      3) Closed-loop speed control.
      4) Open-loop speed control.
      5) Coordinate transformation.
      6) Hoist motor RTD.
      7) Travel motor RTD.

D. The PLC shall accept the following functions from the hoist and travel motor controllers:

1. Master Switch Signals:
   a. Setpoint.
   b. Control enable.
2. Ramp-function generator
   a. Series-connected ramp-function generator with adjustable ramps to form the speed setpoint.
3. Speed Controller:
   a. Coordinated with ramp-function to form the control loop.
4. Start Pulse:

a. Start command activates hoisting direction of rotation immediately after power up to prevent the load from dropping on start-up.

5. Sequencer:

a. For switching through rotor stages and activates reversing.

6. Standstill monitoring:

a. Integral zero-speed monitoring with electrical brakes.

E. Inputs and Outputs:

1. Automation controls shall collect electrical power and process data from digital inputs for the following values:

a. Hoist and Travel Motor voltage, current, frequency.

b. Motor field voltage and current.

c. Motor position.

d. Five Speed changer setpoint.

1) First Speed: Microspeed. High or low frequency setting.

2) Second Speed.

3) Third Speed: step frequency setting.

4) Fourth Speed: Step frequency setting.

5) Fifth speed: Auto speed frequency setting. This is used in hoisting only to allow for lifting light and heavy loads.

e. Upper Limit switch #1.

f. Upper Limit switch #2.

g. Lower Limit switch #1.

h. Lower Limit switch #2.

i. End Travel Limit Switch #1.

j. End Travel Limit Switch #2.

F. Control Functions:

1. Proportional, integral, derivative PID controller.

2. Bumpless transfer between control modes.

3. Tracking of set point, process variable and equipment status (LIFT, LOWER, FOREWARD, REVERSE, HOLD).

2.03 HOIST MOTOR CONTROL LOOP

A. Control Logic Description:

1. Monitors load conditions to match motor torque and speed for LIFT and LOWER operation.

B. Process Control Signals:

1. Command output signal sent to the hoist motor from PLC.
2. Feedback for position.
3. Upper and lower limit switches.

C. Operation Sequence:

1. Hoist motor "Start of Run Motor Check":
   a. The start-up check shall check the motor torque at the beginning of each lift.
      1) A "Torque-Proving" function shall be programmed on a power up cycle. The VFD will test the motor at the default torque test value.
      2) Once the first check has successfully completed the VFD will check the motor at the torque required for the suspended load.
      3) If no load is suspended the VFD will check the motor torque at the minimum torque check value. The hoist may rotate slightly in the lift direction due to a buildup of starting torque, this is normal.
      4) During the hoist motor start, the VFD shall check to ensure the motor has produced sufficient torque before releasing the brakes.
      5) If the hoist motor fails to generate sufficient torque during start-up, the VFD will trip with an error. Brakes shall not be released.
      6) The automation controller will use PID control to maintain the level to user defined set point.
2. Hoist motor "Load Float":
   a. The load float utilizes the encoder feedback to hold the load at zero speed without setting the motor brakes. This allows for precise movement of a load.
   b. Once the motor brakes have been released and motion commands have been completely released, the VFD shall decelerate to zero speed. The float load will trigger a timer.
   c. If a motion command is issued before the timer has expired the load float timer will reset.
   d. Once the load float timer has expired, the VFD shall apply the motor brakes and start the "End of Run Motor Brake Check".
   e. Load float timer shall be set to a minimum of 2 seconds, unless otherwise designed by the crane manufacturer.
3. Hoist motor brakes delay:

a. Program a delay for a minimum of 0.3 seconds, unless otherwise designed by the crane manufacturer.

b. Delay shall allow for the motor brakes to fully release before accepting a frequency command as well as allowing for the motor brakes to fully set before starting the "End of Run Motor Brake Check".

c. Design to prevent the hoist motor from running through the brakes or prematurely slip.

4. Hoist motor "End of Run Motor Brake Check":

a. Program to check for motor brake slip and the end of each lift cycle.

b. Once the load float timer expires, the PLC shall lockout the directional commands.

c. The VFD will apply the motor brakes and wait until the delay timer has expired. Once the timer expires, the VFD shall reduce the motor torque to 0 percent.

d. If motion is detected during the "End of Run Motor Brake Check" the VFD shall restore full torque to the motor and trigger the fault condition signal from and output relay.

1) The lift and speed commands shall be locked out.

2) The PLC shall wait until a LOWER command is given and then proceed to lower the load in low speed. If the LOWER command is removed, the VFD will start the "End of Run Motor Brake Check" again.

e. Once the load is safely placed on the ground and the "End of Run Motor Brake Check" passes, the VFD shall restore all motion and speed commands. The fault condition signal shall be deactivated.

5. All operation sequences shall be displayed and alarmed on HMI.

D. MANUAL:

1. Autospeed.

a. After a time delay (setpoint), feedback signal is sent to PLC if there is a fail-to-lift or fail-to-lower condition.

1) Motor brakes will be automatically applied

2) Alarmed to HMI.

b. The autospeed feature shall automatically increase the high speed frequency to the preset value when the lifting torque percentage or current at the high speed frequency is less than the Autospeed output torque threshold.

1) The output current must not exceed the motor full load current or the VFD full load current while in Autospeed.

2) The output torque must not exceed 225 percent.

3) Autospeed frequency shall not be set above 90 Hz.

2. Automation Control with loss of power:

a. Apply mechanical brakes.

b. Display alarm on HMI.

3. Control Loop – Temperature Alarms:

a. Alarms: Motor High Temperature detected.

b. Alarms: Smoke detected in machine room.

c. Display on HMI's.

4. Control Loop – Power:

a. Monitor main power circuit for undervoltage.

b. Operation Sequence:

1) PLC Initiate application of motor brakes.

2) PLC Initiate transfer switch to engine generator (if available).

5. HMI Indication, alarming and operator set points:

a. Hoist control mode selection and status indication.

b. Hoist Position: 0 to 100 percent.

c. In Transition.

d. Hoist Motor Fault/Trouble.

e. Motor overtemperature/overload alarm.

f. Motor disconnect Open.

g. Loss of power alarm.

h. Loss of signal alarm.

E. Inputs to start sequence checks

Table 25 00 01B – Inputs to Start Sequence Checks
C = Control; P = Protection

Input	Name	Position	Function	From	Description
Control mode transfer switch	43CCS	MANUAL	C	Control Panel	Motor control mode selection
Motor disconnect breaker	42CD	Closed	C	Control Panel	Electric motor actuator running circuit breaker
Motor starter contact	6CS	Open		Control Panel	Electric motor actuator starting contact

Table 25 00 01B – Inputs to Start Sequence Checks
C = Control; P = Protection

Input	Name	Position	Function	From	Description
Motor overload relay	50C	Normally Closed	P	Control Panel	Electric motor actuator overload relays
Overtemperature protection relay	38C	Normally Closed	P	Control Panel	Electric motor actuator overtemperature protection device
Limit switch #1	33ULS1		C	Crane	Upper Limit switch for crane operation
Limit switch #2	33LLS2		C	Crane	Lower Limit switch for crane operation
Motor Torque Check Value			C	PLC	Default or preset hoist motor torque check value
Motor Torque Check time			C	PLC	Preset "Start of Run Motor Check" timer.
Output Torque Threshold			C	PLC	Autospeed preset torque and current threshold %
Autospeed Frequency			C	PLC	Autospeed preset frequency threshold

2.04 TRAVEL MOTOR CONTROL LOOP

A. Control Logic Description:

1. Monitors load conditions to match motor torque and speed for FORWARD and REVERSE operation.

B. Process Control Signals:

1. Command output signal sent to the travel motor from PLC.
2. Feedback for position.
3. Laser sensors for anti-collision and anti-sway.
4. End of travel limit switches.

C. Operation Sequence:

1. Travel motor "Start of Run Motor Check":
   a. The start-up check shall check the motor torque at the beginning of each travel.
      1) During the travel motor start, the VFD shall check to ensure the motor has produced sufficient torque.
      2) If the travel motor fails to generate sufficient torque during start-up, the VFD will trip with an error.

3) The automation controller will use PID control to maintain the travel position to user defined set point.

2. Travel motor time delay:

a. Program a delay for a minimum of 2 seconds, unless otherwise designed by the crane manufacturer.

b. Delay shall allow for the travel motor brakes to fully release before accepting a frequency command as well as allowing for the motor brakes to fully set before starting the "End of Run Motor Brake Check".

c. Design to prevent the travel motor from running through the brakes or prematurely slip.

3. Travel motor "End of Run Motor Brake Check":

a. Program to check for motor brake set and the end of each travel cycle.

b. The VFD will apply the motor brakes and wait until the delay timer has expired. Once the timer expires, the VFD shall reduce the motor torque to 0 percent.

c. If motion is detected during the "End of Run Motor Brake Check" the VFD shall restore full torque to the motor and trigger the fault condition signal from and output relay.

1) The FORWARD and speed commands shall be locked out.

2) The PLC shall wait until a REVERSE command is given and then proceed to REVERSE in low speed. If the REVERSE command is removed, the VFD will start the "End of Run Motor Brake Check" again.

d. Once end of travel or target position is reached and the "End of Run Motor Brake Check" passes, the VFD shall restore all motion and speed commands. The fault condition signal shall be deactivated.

4. All operation sequences shall be displayed and alarmed on HMI.

D. MANUAL:

1. Autospeed:

a. After a time delay (setpoint), feedback signal is sent to PLC if there is a fail-to-start condition.

1) Motor brakes will be automatically applied.

2) Alarmed to HMI.

b. The autospeed feature shall automatically increase the high speed frequency to the preset value when the starting torque percentage or current at the high speed frequency is less than the Autospeed output torque threshold.

1) The output current must not exceed the motor full load current or the VFD full load current while in Autospeed.

2) The output torque must not exceed 180 percent.

3) Autospeed frequency shall not be set above 90 Hz.

2. Automation Control with loss of power:

a. Travel motor brakes shall be applied.

b. Display alarm on HMI.

3. Control Loop – Temperature Alarms:

a. Alarms: Motor High Temperature detected.

b. Alarms: Smoke detected in machine room.

c. Display on HMI's.

4. Control Loop – Power:

a. Monitor main power circuit for undervoltage.

b. Operation Sequence:

1) PLC Initiate application of motor brakes.

2) PLC Initiate transfer switch to engine generator (if available).

5. HMI Indication, alarming and operator set points:

a. Travel control mode selection and status indication.

b. Travel Position: 0 to 100 percent.

c. In Transition.

d. Travel Motor Fault/Trouble.

e. Motor overtemperature/overload alarm.

f. Motor disconnect Open.

g. Loss of power alarm.

h. Loss of signal alarm.

E. Inputs to start sequence checks:

Table 25 00 01C – Inputs to Start Sequence Checks
C = Control; P = Protection

Input	Name	Position	Function	From	Description
Control mode transfer switch	43CCS	MANUAL	C	Control Panel	Motor control mode selection
Motor disconnect breaker	42CD	Closed	C	Control Panel	Electric motor actuator running circuit breaker

Table 25 00 01C – Inputs to Start Sequence Checks
C = Control; P = Protection

Input	Name	Position	Function	From	Description
Motor starter contact	6CS	Open		Control Panel	Electric motor actuator starting contact
Motor overload relay	50C	Normally Closed	P	Control Panel	Electric motor actuator overload relays
Overtemperature protection relay	38C	Normally Closed	P	Control Panel	Electric motor actuator overtemperature protection device
Limit switch #5	33TLS5		C	Crane	Travel Limit switch for crane operation
Limit switch #6	33TLS6		C	Crane	Travel Limit switch for crane operation
Motor Torque Check Value			C	PLC	Default or preset hoist motor torque check value
Motor Torque Check time			C	PLC	Preset “Start of Run Motor Check” timer.
Output Torque Threshold			C	PLC	Autospeed preset torque and current threshold %
Autospeed Frequency			C	PLC	Autospeed preset frequency threshold

2.05 PROGRAMMABLE LOGIC CONTROLLER

A. Refer to Section 25 12 10 – Programmable Logic Controller.

2.06 COMMUNICATION MODULES

A. Refer to Section 25 12 10 – Programmable Logic Controller.

2.07 HMI AND GRAPHIC DISPLAYS

A. Refer to Section 25 12 10 – Programmable Logic Controller.

2.08 CONTROL ENCLOSURE

A. Refer to Section 41 22 15 – Bridge Crane Electrical Components.

2.09 FACTORY ACCEPTANCE TESTING

A. Coordinate factory acceptance testing of automation systems with factory testing of Crane Electrical Components and PLC assembly (Section 41 22 15 – Bridge Crane Electrical Components and Section 25 12 10 – Programmable Logic Controller)

B. Notify the Government at least 60 days before witness tests are to be conducted and as agreed by the COR.

C. Prior to Factory Acceptance Test, the Contractor shall perform burn-in test of the equipment for a minimum of 72 hours.

D. The purpose of the Factory Acceptance Test is to demonstrate the functionality, performance and stability of the hardware and software.

E. The test shall verify that hardware and software meet the requirements of the specifications and drawings.

F. Factory Acceptance Tests shall include point to point checks of all connections and application simulation tests that demonstrate automation controls will operate as described in these specifications.

G. Government reserves the right to request additional simulation and control algorithm tests, to demonstrate proper programming sequences.

H. Perform 100 percent I/O checkout, closed loop simulation of binary/modulating logic, and validations of all logic and displays.

1. Display of all alarms and warnings on the HMI shall be demonstrated for each I/O point.

I. Specific tests shall include but not be limited to:

1. Simulation of each discrete data point at the terminal block.
2. Simulation of each analog data signal using current or voltage source.
3. Operation of communication between PLC, Distributed I/O devices, power meters, process meters, network switches and crane automation control network.
   a. Fail-safe shutdown and restart of PLC application programming.
4. HMI display screens and data display.
5. Simulation of crane motor LIFT, LOWER, FORWARD and REVERSE operation sequences in MANUAL mode and AUTOMATIC control modes, including the ability to introduce out of sequence events to test program stability.
6. Simulation of HMI status functions in all control modes.
7. Demonstration of Maintenance Test Mode capability.

J. Government will witness first factory acceptance test and reserves the right to witness subsequent factory tests. Notify COR in writing at least 60 days prior to beginning the Factor Acceptance Tests.

1. Location: Contractor facility.

K. Do not ship equipment until the test reports for the equipment are approved.

1. Approval of factory tests shall in no way relieve the Contractor of the responsibility for furnishing equipment that meets the requirements of these specifications.

2.10 NETWORK ASSET CONFIGURATION MANAGEMENT LIST

A. Spreadsheet format.

a. The Network Asset Configuration Management List includes the following minimum information:

1. List of all equipment located at the facility and connected to the communication networks in the system in separate rows and in the first columns and on the same row for each piece of equipment:
    a. Serial number.
        1) Model number.
    b. Firmware revision numbers.
        1) Communication addresses.
    c. Default passwords.
2. In a separate spreadsheet tab for each device, include a list of all active and inactive electronic access ports in the first column and include the following minimum information in subsequent columns, on each row, for each port:
    a. Enabled or disabled status.
        1) Communication protocol used on this port.
    b. If the port is enabled, list the service, node, device, and/or system requiring this communication port to be enabled.
3. Spreadsheet rows shall be sortable based on any column's contents.

2.11 SECURITY

A. Communication between Automation Controls System:

1. Approved components or systems:
    a. Bridge crane automation control networks.
    b. Crane HMI alarm system.
    c. Intranet communications with approved, internally networked, devices are the only network connections that will be allowed.
2. Unapproved Components:
    a. Components and systems are unapproved unless they are included in the list of approved components or systems.
    b. Anything with a connection to the internet, Reclamation, or Contractor business network, or world wide web are unapproved.

B. All contractor owned devices, and communication paths, not being turned over to the Government, shall be removed from the system within 48 hours following the completion of a system's Site Acceptance Testing.

b. All wireless capability must be fully disabled prior to delivery and will remain disabled prior to, during and following Site Acceptance Testing.

C. Access Control - Provide the following minimum access control capabilities, in

1. accordance with the recommendations in ISA 62443-1-1 and ISA 62443-2-1The Contractor shall provide user accounts with configurable access and permissions associated with one or more organizationally defined user roles, where roles are used to include the following requirements:

   a. Password length.

   b. Minimum required password complexity.

      1) Minimum of eight characters in length.

      2) Support a maximum of 64 characters in length.

      3) At least one special character.

2. Adjustments to the above requirements shall only be with the explicit written approval of the Project Manager upon receipt of a written justification.

3. PLC assemblies, VFD assemblies and Network devices:

   a. Provide individual accounts for each user with customizable access privileges for each account.

   b. Accounts shall be configurable into role-based functions allowing varying levels of interface.

   c. Include account authentication by approved method.

4. The Contractor shall configure each component to operate using the principle of least privilege. This includes operating system permissions, file access, user accounts, application-to-application communications, and system services.

5. The Contractor shall provide a system administration mechanism for changing user's roles.

6. The Contractor shall document options for defining access and security permissions, user accounts, and applications with associated roles.

7. The Contractor shall recommend methods for the user to prevent unauthorized changes to the Basic Input/Output System (BIOS) and other firmware. If it is not technically feasible to protect the BIOS to reduce risk of unauthorized changes, the Contractor shall document this case and provide mitigation recommendations.

D. Patch Management and Updates:

1. The Contractor shall verify that procured products including third-party hardware, software, firmware and services have appropriate updates and patches installed prior to delivery.

E. Physical Security:

1. The Contractor shall provide lockable or locking enclosures for the crane control system and components and for the systems used to manage and control physical access.

2.12 COMPONENTS

A. A standard commercial product/assembly is defined as a commercial item in FAR Part 2, 2.101. The Contractor may utilize standard commercial products/assemblies in the design of the crane automation control system provided such components meet the requirements of this specification. The component selection shall be substantiated by means of manufacturer's published ratings, selection method or prorating.

PART 3 EXECUTION

3.01 GENERAL

A. Install network communication devices and automation control system in accordance with approved submittals.

1. Format detailed instructions and checklists in accordance with Section 01 33 26 – Electrical Drawings and Data.

B. All instructions and checklists submitted and approved in these specifications shall be followed and completed by the Contractor's personnel performing work under this contract. Checklists shall be made available for inspection at the request of the COR.

1. The Contractor representative's signature shall assert that all work performed was completed in compliance with the executed contract.
2. Initials on all checklists and instructions shall be applied by the Contractor's personnel as the steps are completed.
3. The Contractor representative's signature shall be applied no later than one calendar day following the completion of major steps.
4. Completed checklists for work performed shall not require signatures from COR or Government personnel.
5. Completed Electrical Commissioning Forms for work performed shall not require signatures from COR or Government personnel.
6. Completed checklists do not relieve the contractor of any requirements under the executed contract.

3.02 INSTALLATION

A. Install at locations described in these specifications and approved in submittals.

1. Install in accordance with the manufacturer's recommendations, with suitable and secure fasteners.

B. Connections shall be made to place the automation system into operation.

C. Terminal Blocks:

1. Group power and alarm terminations separately and include barriers.

D. Wire unused I/O points from installed modules to terminal blocks.

E. Make grounding and bonding connections in accordance with Section 26 05 20 – Grounding and Bonding and NFPA 70.

F. Provide cables and conductors in accordance with Section 26 05 10 – Conductors and Cables.

G. Software and associated programming/configuration:

1. Current licenses for software in the Government's name and install the latest version, upgrade or service pack for software.
2. Software supplier's Comprehensive Support Contract for software covering a full one-year warranty period following Site Acceptance Testing, including no cost software upgrades, service packs and tech support from the software supplier.
3. Software supplier grants the Government a non-exclusive, perpetual, irrevocable, transferable license to the Contactor furnished and/or installed software and related documentation included as part of, integrated into, or necessary for the proper function of the work, or other equipment purchased, furnished and/or installed, under this contract.
   a. Contractor shall provide to the Government two (2) licensed copies, for the sole use of the Government, of any proprietary software to perform network packet captures.

3.03 SITE ACCEPTANCE TESTING (SAT)

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.04 PRE-START CHECKOUT TESTING

A. Purpose: Demonstrate readiness of system to proceed with Commissioning Tests.

B. Provide field service engineer to perform initial system checkout.

1. Inspection of equipment to verify equipment was not damaged and is properly installed.

2. Applying power to the equipment.
3. Verification of field wire connections.
4. Assist Government in wire checkouts from end devices to new equipment.
5. Adjusting, programming, and or calibrating new equipment and devices.
6. Assist Government in checkout of alarms verifying proper alarm designation on touch screens, and in alarm logs and reports.
7. Verify communication circuits are installed equipment and operational.
8. Government will provide 20 days' notice prior to beginning commissioning tests.
9. Pre-Start Checkout Test duration will not exceed 14 calendar days for the first unit and 7 calendar days for the subsequent units.
    a. Assume 6 ten-hour working days, Monday through Saturday.
10. Government will provide Job Hazard Analysis (JHA) documentation.
11. Contractor to provide Pre-Start Checkout Test Procedure and Test Results documentation.

3.05 COMMISSIONING TESTING

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.06 TRAINING

A. Refer to Section 01 79 20 – Training.

3.07 SOFTWARE LICENCSE TRANSFER

A. Provide copies of software and associated programming/configuration required to meet performance requirements of the Contract Documents.
    1. At substantial completion of the project, turn current licenses for software over to the Government in the Bureau of Reclamation's name and install the latest version, upgrade or service pack for software.
    2. Include the respective software supplier's Comprehensive Support Contract for software covering a full three year warranty period following substantial completion which shall provide no cost software upgrades, service packs and tech support from the software supplier.

B. All final software programs shall become the property of the Government and shall be provided in duplicate on two separate encrypted external hard drives with full access rights.

3.08 FINAL AND AS-BUILT DRAWINGS

A. Final As-built Drawings Government Format: refer to Specification Section 01 78 30 – Project Record Documents and Section 01 33 26 – Electrical Drawings and Data.

1. Marked prints of specifications drawings indicating "Final As-Built" changes made to automation control system during construction and testing.

END OF SECTION

SECTION 25 12 10
PROGRAMMABLE LOGIC CONTROLLER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of the following in the lump sum price offered in the Price Schedule for Furnish, Install, Test and Deliver New Crane Automation Control System:
   a. Programmable Logic Controllers.
   b. Human Machine Interface and Graphic Displays.
   c. AC Power Supply.
2. Include cost of spare parts in price offered in the Price Schedule for Spare Parts for Automation Control System.

1.02 DEFINITIONS AND ACRONYMS

A. A: Amps

B. AI: Analog Input

C. AO: Analog Output

D. DI: Digital Input

E. DO: Digital Output

F. FAT: Factory Acceptance Testing

G. GB: Giga Byte

H. HMI: Human Machine Interface

I. I/O: Input/Output

J. IP: Internet Protocol

K. LA Power: Local Actuator Power

L. mA: Milliamps

M. MOD Power: Modular Power

N. ms: Milliseconds

O. MB: Mega Byte

P. PLC: Programmable Logic Controller

Q. SA Power: Sensor/Actuator Power

R. SAT: Site Acceptance Testing

S. SCADA: Supervisory Control and Data Acquisition

T. SPD: Surge Protection Device

U. VAC: Voltage Alternating Current

V. VDC: Voltage Direct Current

W. W: Watts

X. Automation Control: Application of technology to monitor and control processes.

Y. Communications: A network of communication equipment and associated protocols

Z. Control system diagram: conceptual diagram of the functional interrelationship of subsystems, usually in block form.

AA. CPU: Central Processing Unit.

BB. Dielectric test: tests made to determine ability of insulating materials and spacings to withstand specified overvoltages for a specified time without flashover or puncture.

CC. DRAM: Dynamic Random-Access Memory.

DD. Drift: as applied to devices such as pressure switches, temperature switches etc., a change in operating characteristics over a specified number of operations or time and specified environmental conditions.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B30.2-2022	Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

B. Code of Federal Regulations (CFR)

1.	29 CFR 1910 – 2022	Occupational Safety and Health Standards

2.	47 CFR Part 15 – 2023	Radio Frequency Devices

C. Facilities Instructions, Standards and Techniques (FIST)

1.	FIST 4-1b – 2022	Maintenance Scheduling for Electrical Equipment

D. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE 754-2019	Floating-Point Arithmetic
2.	IEEE 802.3 – 2018	Standard for Ethernet
3.	IEEE 802C – 2017	Local and Metropolitan Area Networks: Overview and Architecture – Amendment 2: Local Medium Access Control (MAC) Address Usage
4.	IEEE 1010 – 2006	Guide for Control of Hydroelectric Power Plants
5.	IEEE 1046-1996	Distribution Digital Control and Monitoring for Power Plants.
6.	IEEE 1249 – 2013	Guide for Computer-Based Control for Hydroelectric Power Plant Automation
7.	IEEE 1379 – 2000(R2006)	Data Communications Between Remote Terminal Units and Intelligent Electronic Devices in a Substation
8.	IEEE 1613 – 2009	Standard for Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations.
9.	IEEE 3003.2-2014	IEEE Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems
10.	IEEE C37.90.1	Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
11.	IEEE C37.90.2	Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers
12.	IEEE C62.41.1-2008	Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits

E. International Electrotechnical Commission (IEC)

1.	IEC 60068-2-1:2007	Environmental testing – Part 2-1: Tests – Test A: Cold
2.	IEC 60068-2-2:2007	Environmental testing – Part 2-2: Tests – Test B: Dry Heat
3.	IEC 60068-2-14:2007	Environmental testing – Part 2-14: Tests – Test N: Change of Temperature
4.	IEC 60068-2-30:2007	Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
5.	IEC 60870-3-(1989)	Telecontrol equipment and systems Part 3: Interfaces (Electrical Characteristics)
6.	IEC 61000-4-5-(2005)	Electromagnetic Compatibility (EMC) – Testing and Measurement Techniques – Surge Immunity Test
7.	IEC 61131-1-(2003)	Programmable Controllers – Part 1: General Information
8.	IEC 61131-3-(2013)	Programmable controllers – Part 3: Programming Languages
9.	IEC 61131-2-(2007)	Programmable Controllers – Part 2: Equipment Requirements and Tests
10.	IEC 61508-3-(2010)	Functional Safety of Electrical/Electronic/Programmable Safety-Related Systems – Part 3: Software Requirements
11.	IEC 62443-2020	Industrial Communication Networks – Network and System Security

F. International Society of Automation (ISA)

1.	ISA 101.01	Human Machine Interfaces for Process Automation Systems
2.	ISA 61511-1-(2017)	Functional Safety – Safety Instrumented Systems for the Process Industry Sector Part 1: Framework, Definitions, System, Hardware and Application Programming Requirements
3.	ISA 62381-2011	Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)

G. National Fire Protection Association, Inc. (NFPA)

1. NFPA 70-2023 National Electrical Code (NEC)

H. National Institute of Standards and Technology (NIST)

1. NIST SP 800-82 Rev. 2 (2015) Guide to Industrial Control Systems (ICS) Security

1.04 SUBMITTALS

A. Refer to Section 25 00 01 – Automation Control System.

1.05 DESIGN REQUIREMENTS

A. General Requirements:

1. Provide two crane control PLC assemblies. The PLC equipment shall utilize logic functions, memory, timing functions, software, I/O points and communication capabilities for the control and monitoring functions of the system described.

   a. The Crane Control PLC shall provide accurate and reliable control of the hoist motors, travel motors and variable frequency drives.

2. Coordinate PLC assembly and HMI screen application programming in accordance to Section 25 00 01 – Automation Control System.

3. In accordance with IEEE 802.3, IEEE 802C, IEEE 1249, and IEEE 1379.

4. Failure of PLC and HMI screens shall be fail-safe and alarmed.

B. PLC assembly shall be micro-processor based, capable of the following:

1. Receiving binary and analog inputs.

2. Controlling binary and analog output functions.

3. Capable of accomplishing the control requirements of the specifications.

4. Perform data handling operations and communicate with external network devices.

5. Withstand susceptibility tests in accordance with NEMA ICS 1, NEMA ICS 2, IEC 61131-2, IEEE C37.90.1 and IEEE C37.90.2.

C. PLCs must be labeled as Class A, digital device, under 47 Code of Federal Regulations Part 15.

D. Provide PLC assembly with multiple loop controllers with a scalable process variable for each loop.

E. Design PLC assembly to provide proportional, integral and derivative (PID) control logic.

1. Analog outputs shall be configured as direct acting or reverse acting.

F. Modular PLC

1. Expandable through additional hardware and/or software.
2. Modules grouped together in a mounting rack or cabinet.
3. Mounting rack backplane shall provide the communications mechanism integrating individual modules.
    a. The use of wires connectors between modules will not be accepted.

G. PLCs, I/O modules, communication modules, backplanes, and other components furnished shall be of the same manufacturer. Minimize number of different types and models utilized.

H. PLC assemblies shall be located in control enclosures as shown on drawings and as outlined in Section 41 22 15 – Bridge Crane Electrical Components.

I. Environmental:

1. PLC automation control equipment shall be suitable for indoor and outdoor use.
2. PLC Automation control equipment shall be capable of functioning in an ambient temperature ranging from -20 to 70 degrees Celsius, up to 100% relative humidity.
3. Vibration: 2g at 10 to 500 Hertz.

J. Automation Controls Digital Central Processing Unit:

1. CPU shall be a microprocessor based unit that provides the following:
    a. Self-contained.
    b. Scanning.
    c. Application program execution.
    d. Storage of application programs.
    e. Storage of numerical values related to the application process and logic.
    f. I/O bus traffic control.
2. Speed:
    a. Processor shall be able to simultaneously run all tasks with a scan time equal to or greater than the time taken for the controller to complete a control loop.
        1) The processor loading shall be less than 60 percent while running all specified tasks.
3. Processor program stored in non-volatile memory, so that the program will be saved indefinitely with no external power applied to the processor board.

4. Communications:
   a. Ability to communicate with the Crane Automation Control System and components as shown on network diagrams.
   b. Communication module shall allow programming of the PLC's locally.
5. Indications:
   a. Colored LED indications shall display the operating mode of the processor, i.e. running, programming mode, failure condition, communications active, etc.

K. The PLC assembly shall be capable of the following minimum safety measures:
1. Watchdog function to monitor:
   a. Internal processor clock failure.
   b. Processor memory failure.
   c. Loss of communication between processor and I/O modules.
   d. Processor ceases to execute logic program.
2. Safety conditions:
   a. Utilize program module to dictate output states in a known and safe manner prior to running of control program.
3. Security:
   a. Password protection with lockable key operated selector switches.
4. Provide high noise immunity to prevent occurrence of false logic signals resulting from switching transients, relay and circuit breaker noise or radiated radio frequency interference.

L. Human Machine Interface (HMI) Touch Screen:
1. General Requirements:
   a. Provide a series of screens for the control and monitoring of crane electrical components, crane motors, VFD's and control network components.
   b. Design a menu system that provides an easy mechanism to move between different windows with no more than three movements.
   c. Logging functionality allowing operators to leave notes.
   d. In accordance with IEEE C37.1 and ISA 101.01.
   e. Provide a common way to define and authorize secured actions for a set of users.
   f. Provide support for embedded variables to display values that change dynamically at run time.

2. Design alarm annunciator screen displaying real-time alarms that can be sorted, filtered, individually disabled/enabled and silenced based upon multiple criteria such as alarm name, group and time. Provide the following annunciation display:
   a. Historical alarm display functioning similarly to an annunciator window.
3. Design automation control system single-line diagram of the crane system that overlays a summary of the status and analog points.
   a. Control shall not be possible from the single-line window.
4. Provide capability to display the following:
   a. Layout of physical equipment.
   b. Status and analog data.
   c. Control of electrical devices.
   d. Voltage levels.
5. Variable tags shall show a sequence of characters not to be confused with the actual reading when data is not updating.
6. Use of Colors:
   a. Green for open, de-energized or stopped status.
   b. Red for closed, energized or running status.
   c. Yellow for alert or condition out of normal.

M. Provide a surge protection device in accordance with IEEE C62.41.1.
   1. Refer to Section 26 43 13 – Surge Protective Devices for Electrical Circuits.

1.06 PERFORMANCE REQUIREMENTS

A. Crane Control PLC: Provide control and monitoring for the following:
   1. Operation and monitoring of the hoist motors, travel motors and VFD's as outlined in Section 25 00 01 – Automation Control System.
   2. Provide control and monitoring of physical switches, sensors, meters, indicating lights and horns as outlined in Section 25 00 01 – Automation Control System.
   3. Perform configuration and programming activities required for a complete and functional system.
   4. Provide operator interface, engineering/programming interface, data communication, historization, trending, and I/O processing.
   5. Fully integrated PLC and microprocessor-based system, and have the following minimum features:
      a. PLCs, digital processing units, I/O cards, network switches, backplanes, power supplies and other peripheral control components.

6. Provide latest hardware, software, and firmware, offered by respective manufacturers at time of award, including:
    a. Automation Control, data and monitoring identified in these Specifications and supplied drawings.
    b. Automation Control, data and monitoring to render a complete, and functional, system which meets, at a minimum the functional intent and requirements stated here-in and provides safe and reliable operation of the facility components under all conditions.
    c. Fully integrated startup, shutdown, and online control system.

B. HMI Philosophy development:
1. Analog indicators.
    a. Display the range of the instrument being displayed, and in that range will be an indicator of the normal process limits.
    b. Above and below the indicator shall be white bands indicating abnormally high and low process values respectively.
    c. Above and below the white bands are dark gray bands which indicate High and Low process values.
2. HMI Trends.
    a. Make trends available and accessible in all HMI applications.
    b. All available information shall be easy to access for operators.
        1) The Y-axis and X-axis of trends shall be automatically ranged to a predetermined scale.
        2) Provide capability to alter the timebase and ranges without the requirement of keystrokes, making use of dragging the cursor to re-range.
3. HMI Colors
    a. Develop a high-performance HMI with colors used and applied consistently.
    b. Background color light gray to mitigate glare, contrast, color interference and operator fatigue.
    c. Foreground colors shall be kept to a minimum with attention to line thickness.
    d. Colors shall be used to indicate abnormal conditions to draw the operator’s attention quickly.

C. HMI Style development:
1. High-performance design in accordance with ISA 101-01 and ISA TR101.02.

2. Pop-up information-driven display:
   a. Information about each alarm shall be visible to operators.
3. Develop at a minimum four display hierarchies:
   a. Level 1, Overview.
      1) Design to give operators the broadest view of the crane system.
      2) Clear information of the current state.
      3) Key performance indicators.
      4) Ease of navigation to Level 2 displays.
      5) Abnormal conditions and alarms.
   b. Level 2, System Control.
      1) Operators shall have ability to select a Level 2 display with a one-click operation.
      2) Include information and controls required to perform tasks called from Level 1.
      3) Provide a clear picture of the system selected from Level 1.
      4) Ability to operate equipment and auxiliary circuits.
   c. Level 3, Equipment and device detail.
      1) Operators shall have ability to select a Level 3 display with a one-click operation.
      2) Level 3 shall display advanced control capabilities, and complete view of equipment not available on Level 1 or Level 2.
      3) Information from the Level 2 displays information such as, but not limited to, runtime, faults, alarms, speed or feedback variables.
      4) Custom trends such as load, temperature or torque.
      5) Detailed diagnostic displays and interlocks.
   d. Level 4, Process level support and configuration.
      1) Operators shall have ability to select a Level 4 display with a one-click operation.
      2) Display the highest detail for subsystems, sensors, field devices and individual components.
      3) Provide information on PLC processor performance and status of Input and Output channels.
      4) Level 4 shall display advanced troubleshooting, programming and setpoint adjustments.

5) Provide viewable operating procedures, alarm response instructions and abnormal condition response guidance.

4. Process lines.

a. Process lines for static equipment shall be dark gray or black, with line thickness used to differentiate significance.

b. When using different line styles for solid, dotted and dashed.

1) Limited to a maximum of three styles with the same line thickness.

c. Process lines shall enter and exit the screen consistently.

D. HMI interface development:

1. Process flow and navigation:

a. The process flow development shall be consistent in layout across all screens.

2. Static texts and live data:

a. Utilize simple font and color that is easily displayed on screen.

b. Abbreviations must be consistent across the entirety of all systems.

c. Use larger texts to identify duplicated equipment such as multiple motors.

d. Isolated words, titles, device and equipment designations shall all be uppercase.

e. Live data shall be depicted distinctly from static text.

f. If live data is shown in a table, align the numbers on the decimal point and do not display leading zeros.

g. When required, the units of measurement are displayed in lower contrast and adjacent to the live data value.

E. Control Logic Description: Reference Section 25 00 01 – Automation Control System.

F. Operating System: Reference Section 25 00 01 – Automation Control System.

1.07 EXTRA MATERIALS

A. Spare Parts:

1. Deliver spare parts to locations as determined by COR.

2. Deliver spare parts within seven days prior to installation of those parts for which spares are required.

3. Furnish spare parts listed in Table 25 12 10A – Spare Parts.

Table 25 12 10A - Spare Parts

Item	Description	Quantity
1	PLC	1 of each type
2	AC Power Supply	1 of each type
3	I/O Modules	1 of each type
4	Communication Modules	1 of each type
5	HMI	1 of each type
7	Control Power Transformer	1 of each type

PART 2 PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLER

A. Location:

1. Folsom Dam Warehouse, accessible from floor level, nearby to the designated crane area.

B. Provide PLC assembly, process modules, peripherals and accessories as required to provide specified functionality.

C. Supports both local I/O on common backplane.

D. Communication Capability:

1. In accordance with:
   a. IEEE 754, 802.3, and 1815.
   b. TIA/EIA 485 and 598.
2. Ethernet/IP.
3. Modbus TCP.
4. RJ-45 Ethernet 10baseT connection for technician to monitor, download, and upload application programs.
5. Modbus RTU mode protocol over RS-232 via TIA/EIA 485 connection.

E. Empty slots in the chassis shall include cover plates.

F. PLC: Model Opto 22 groov EPIC, GRV-EPIC-PR1, manufactured by Opto 22, 43044 Business Park Drive, Temecula CA 92590; or equal, having the following essential characteristics:

1. One or more USB Ports
2. 2 or More Ethernet Ports

3. Memory Storage: 2 megabytes, minimum.
4. Provided with adequate I/O modules as to provide 44 base I/O ports, minimum, split appropriately between analogue and digital.
5. Power Voltage: 110-240 VAC
6. Provide capability of programming control logic using the following programming languages in accordance with IEC 61131-3:
   a. Ladder diagram.
   b. Function block diagram.
   c. Structured text.
7. Certified in accordance with IEC 60068-2-1 and IEC 60068-2-2.
8. Certified in accordance with IEC 60068-2-14 for Operating and Storage Temperature as follows:
   a. Operating Temperature: Minus -20 to Plus 140 degrees F.
   b. Storage Temperature: Minus 40 to Plus 185 degrees F.
9. Certified in accordance with IEC 60068-2-30 for relative humidity of 5 to 95 percent, non-condensing.
10. Surge Immunity: 1kV line to line; 2kV line to earth as defined by IEC 61000-4-5.

G. PLC Digital Input Module: Model GRV-IDCI-12, manufactured by Opto 22, 43044 Business Park Drive, Temecula CA 92590; or equal, having the following essential characteristics:
1. DC Input Module
2. Inputs: 12 Channel (1 group of 12), sinking
3. Voltage Category: 24 VDC.
4. Voltage Rating:
   a. Input Ratings: 15-30 VDC
5. Certified in accordance with IEC 60068-2-1 and IEC 60068-2-2.
6. Certified in accordance with IEC 60068-2-14 for Operating and Storage Temperature as follows:
   a. Operating Temperature: Plus 32 to Plus 140 degrees F.
   b. Storage Temperature: Minus 40 to Plus 185 degrees F.
7. Certified in accordance with IEC 60068-2-30 for relative humidity of 5 to 95 percent, non-condensing.

H. PLC Digital Output Module: Model GRV-ODCI-12, manufactured by Opto 22, 43044 Business Park Drive, Temecula CA 92590; or equal, having the following essential characteristics:

1. Outputs: 12 Channel (1 group of 12).
   a. Hold Last State.
2. Voltage and Current Ratings:
   a. Output Voltage range: 5-60 VAC.
3. Certified in accordance with IEC 60068-2-1 and IEC 60068-2-2.
4. Certified in accordance with IEC 60068-2-14 for Operating and Storage Temperature as follows:
   a. Operating Temperature: Plus 32 to Plus 140 degrees F.
   b. Storage Temperature: Minus 40 to Plus 185 degrees F.
5. Certified in accordance with IEC 60068-2-30 for relative humidity of 5 to 95 percent, non-condensing.

I. PLC Analog Input and Output Module: Model GRV-MM1001-10, manufactured by Opto 22, 43044 Business Park Drive, Temecula CA 92590; or equal, having the following essential characteristics:

1. Inputs and Outputs: 8 multifunction, 2 Form C electromechanical relay
2. Input Range, Voltage: 5-30 VDC.
3. Input Range, Current 0-20 mA.
4. Output Range, Voltage: 0-10V ± .035 percent of full range or better and 0-250 VAC or 5-30 VDC Relayed.
5. Output Range, Current: 0-20mA ± .04 percent of full range or better.
6. Certified in accordance with IEC 60068-2-1 and IEC 60068-2-2.
7. Certified in accordance with IEC 60068-2-14 for Operating and Storage Temperature as follows:
   a. Operating Temperature: Plus 32 to Plus 140 degrees F.
   b. Storage Temperature: Minus 40 to Plus 185 degrees F.
8. Certified in accordance with IEC 60068-2-30 for relative humidity of 5 to 95 percent, non-condensing.
9. Self-diagnostics that can detect open circuit or value out of range.
10. Self-protecting limiters for overload.

2.02 POWER

A. Provide power distribution system to all supplied components, including overcurrent and surge protection, to support full operation of the system. This distribution system shall include analog loop power supplies and contact interrogation voltages for dry contact inputs where required.

B. Control power shall be 120 VAC.

C. Self-diagnostic capability to determine internal faults and annunciate alarms.

D. Redundant AC and DC power supplies with sufficient capacity to operate on a single power supply in case of failure.

E. Failure of any power supply or power feed shall result in a system alarm.

F. Surge Immunity: 1kV line to line; 2kV line to earth as defined by IEC 61000-4-5.

G. Voltage Variation: +/- 20 percent as defined by IEC 61000-4-11.

H. AC Power Supply:

1. Type: Din-Rail mountable.
2. Input Voltage: 100-240 VAC.
3. Connection Type: Screw.
4. Operating Temperature Range: Minus 25 degrees C to 70 degrees C.

I. DC Power Supply:

1. Type: Din-Rail mountable.
2. Input Voltage: 100-240 VAC.
3. Output Voltage: 24 VDC plus-and-minus 1 percent.
4. Output Current: 10 amps, minimum.
5. Power Dissipation, Max: 4.0 Watts.
6. Connection Type: Screw.
7. Operating Temperature Range: Minus 25 degrees C to 70 degrees C.

J. Fuse Holder and Fuses:

1. DIN-Rail mountable.
2. Fuse:
   a. Rated for size required.
   b. Class CC.

K. Uninterruptable Power Supply (UPS)

1. Type: Din-Rail Mountable
2. Characteristics matching selected AC and DC power supplies for respective type of UPS.
3. Sufficient battery capacity to allow 90 minutes of operation for connected equipment.

2.03 COMMUNICATION MODULES

A. As necessary to communicate to HMI.

2.04 PLC APPLICATION PROGRAM

A. Refer to Section 25 00 01 – Automation Control System.

2.05 HMI GRAPHIC DISPLAYS

A. Locations:

1. Crane Automation Control Enclosure.

B. HMI:

1. Power: 120 VAC.
2. Display Dimensions:
   a. 19”, minimum.
3. Touch Screen Control.
4. Host Port: One USB 2.0 high-speed (type A).
5. Device Port: One USB 2.0 high-speed (type B).
6. Capable for flush panel mounting.
7. Compatible with Opto Controller.

2.06 CONTROL ENCLOSURE

A. Refer to Section 41 22 15 – Bridge Crane Electrical Components.

2.07 SURGE PROTECTION DEVICE

A. Refer to Section 26 43 13 – Surge Protective Devices for Electrical Circuits.

2.08 SOURCE QUALITY CONTROL

A. Government reserves the right to inspect equipment at supplier’s manufacturing plant prior to final testing.

2.09 FACTORY ACCEPTANCE TEST

A. FAT will be completed in accordance with requirements outlined in Specification Section 25 00 01 – Automation Control System.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform installation in accordance with requirements in NFPA 70 and reference standard drawing 40-D-60001.

B. Provide grounding in accordance with Section 26 05 20 – Grounding and Bonding, NFPA 70, and IEEE 3003.2.

C. Cable and Wiring: Provide cable and wiring in accordance with Sections 26 05 02 – Basic Electrical Materials and Methods and 26 05 10 – Conductors and Cables.

D. Installation shall be completed in a neat and workmanlike manner in accordance with NFPA 70.

3.02 SITE ACCEPTACE TEST

A. SAT will be completed in accordance with requirements outlined in Section 25 00 01 – Automation Control System.

END OF SECTION

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SECTION 26 05 02
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include the cost of basic electrical materials and methods in prices offered in the Price Schedule for applicable items of work.

   a. Includes but not limited to the following:

      1) Furnishing, handling, and storing spare parts for electrical equipment.

      2) Furnishing special tools and appliances for maintenance and adjustment of equipment

      3) Making electrical connections.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME BPVC-IX 2019 — Boiler and Pressure Vessel Code, Section IX – Welding and Brazing Qualifications

B. ASTM International (ASTM)

1. ASTM A 123/A 123M-2020 — Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. ASTM A 153/A 153M-2015 — Zinc Coatings (Hot-Dip) on Iron and Steel Hardware

C. International Electrical Testing Association, Inc. (NETA)

1. NETA ATS-2021 — Acceptance Testing Specifications for Electrical Power Equipment and Systems

D. International Organization for Standardization (ISO)

1. ISO 9001 – 2015 — Quality Management Systems - Requirements

E. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2023 — National Electrical Safety Code (NESC)

F. National Fire Protection Association (NFPA)

1. NFPA 70-2023 National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 02-1, Equipment Layout Plan and Coordination Approval Drawings:

1. Provide dimensioned drawing showing actual equipment being supplied. Show equipment sizes, location centerline dimensions, equipment maintenance clearance required, and bus supports in accordance with the following Sections:

a. 25 00 01 – Automation Control Systems

b. 26 24 42 – Distribution Panelboards

c. 41 22 15 – Bridge Crane Electrical Components

d. 41 22 16 – Crane Motors

C. RSN 26 05 02-2, Resumes:

1. Technical installation supervisor's or CO's resume.

2. Registered Engineer's resume.

3. Electrician's resume.

1.04 QUALIFICATIONS

A. Welder Qualifications: In accordance with ASME BPVC-IX.

B. Field testing personnel: As specified in NETA ATS, Section 3, except may be accredited by other than NETA.

1.05 DESIGN REQUIREMENTS

A. Contractor is responsible for providing a complete integral system and proper coordination between equipment manufacturers to ensure equipment is properly designed for connection to each other.

1.06 QUALITY

A. Certifications:

1. Equipment manufacturing facilities to be ISO-9001 certified.

B. Qualifications and Responsibilities:

1. Field testing organization and personnel: As specified in NETA ATS, Section 3, except may be accredited by other than NETA.

a. Technically qualified to supervise installation and testing work, with experience of similar work, and meets Government approval.

b. Responsible for installation and testing/commissioning of each new crane electrical system, interface circuits and its corresponding distribution circuits.

c. May have multiple responsibilities at work site.

d. Present or represented at work site for all shifts during entire removal, installation and testing period.

e. Report immediately, in writing to Government, work not in accordance with manufacturer's recommendation or other conditions which may result in an unsatisfactory job.

f. Maintain daily log of accomplished work.

2. Welder Qualifications: in accordance with ASME BPVC-IX.

1.07 SITE CONDITIONS

A. These facilities are over 50 years old and as such the drawings, especially layout drawings, included in these specifications, shall be field verified by the contractor.

1.08 MAINTENANCE

A. Provide special tools and accessories required for installation or normal operation and maintenance of equipment and installations. Studs, bolts, and nuts other than United States Standard provided anywhere in the equipment or installation will be considered as requiring special tools.

B. Deliver special tools and spare parts for equipment to Folsom Dam, Central California Area Office. Provide shipments with item list(s).

C. Special tools and spare parts must be onsite prior to commissioning of newly installed equipment.

1.09 EXTRA MATERIALS

A. Provide to Government special tools and equipment necessary to properly install, adjust, test, and check operation of electrical equipment.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Conform to NFPA 70 and IEEE C2.

B. Galvanize mounting brackets, bolts, nuts, and washers for major items of electrical equipment such as crane electrical components, transformers, circuit breakers, instrument transformers, instrumentation cable and conductors, control cable, power cable, cable trays, disconnecting switches, resistors, capacitors, in accordance with ASTM A 123 and A 153.

C. Provide galvanized steel or non-corrosive metal for mounting bolts, nuts, and washers for minor items of electrical equipment and lighter weight items. Do not use cadmium-plated mounting hardware.

D. Change designs as required where Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. COR will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.

E. Contractor shall provide all testing equipment for testing/commissioning each new crane electrical system which includes calibrating and programming corresponding meters and relays.

F. Provide anchors and mounting hardware for busway, conduit, and other major equipment.

G. Provide pad-lockable circuit breakers, disconnect switches, and energy isolating devices.

2.02 SOURCE QUALITY ASSURANCE

A. Government reserves the right to inspect equipment, hardware and components at supplier's manufacturing plant during fabrication and testing. Final acceptance will not be made until the complete electrical system has been installed and is operational.

B. Notify COR in writing prior to beginning the Factory Checkout Test:

1. United States: At least 45 days prior to testing.
2. International: At least 60 days prior to testing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by the Government.

B. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70 and IEEE C2.

C. Make electrical installations complete and ready for service.

D. Install electrical equipment in accordance with directions furnished by manufacturer's instruction books and manufacturer's expert engineer.

E. Assemble, checkout, adjust, and prepare following equipment for service under direction of manufacturer's expert engineer.

F. Coordinate with manufacturer for obtaining services of manufacturer's expert engineer for Contractor-furnished equipment. Provide CO 30 days advance notice of date when manufacturer's expert engineer will be needed on site, during testing/commissioning of each crane.

G. Calibrate and program each crane electrical system and their corresponding devices.

H. Tighten nuts used in electrical equipment assembly with torque wrenches to torque values recommended by equipment manufacturers.

I. Drill holes in bolted steel structures and provide fastenings required for mounting or installing electrical equipment and materials.

J. Installation of electrical equipment includes:

1. Leveling and grouting channel bases.
2. Drilling holes, furnishing hardware, and assembling components to each other.
3. Furnishing materials for and making all connections correctly in accordance with final wiring diagrams.
4. Tagging wires and cables at each end.
5. Correcting any errors made by the Contractor in the installation at no expense to the Government.

K. Grout electrical equipment installed on concrete foundations to fill voids. Use adjusting nuts to bear weight of electrical equipment.

3.02 REPAIR

A. Repair damaged painted surfaces of equipment to match original finish.

B. Correct by repair or replacement, at the Contractor's expense, damage to or failure of any part of the items of material and equipment which in the opinion of the COR was caused by faulty installation, faulty mechanical assembly, or mishandling.

3.03 FINAL AND AS-BUILT DRAWINGS

A. Final and As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents.

1. Marked prints of specification drawings indicating "Final As-Built" changes made to electrical conduit during construction.

3.04 FIELD QUALITY CONTROL

A. Coordinate with manufacturers and sub-contractors for obtaining services of an installation supervisor as well as expert engineers for Contractor-furnished equipment. Follow instruction of the installation supervisor.

B. Assemble, checkout, adjust and prepare new equipment for service under direction of the Contractor's or manufacturer's installation supervisor.

3.05 FIELD QUALITY ASSURANCE

A. Coordinate with manufacturers and sub-contractors for obtaining services of an installation supervisor as well as expert engineers for Contractor-furnished equipment. Follow instructions of installation supervisor.

B. Field test, (static & functional), installed equipment to ensure proper operation as well as sequencing of control and protection system.

C. The Government will inspect major electrical equipment and complete electrical system during construction. Acceptance of equipment will be made after equipment is operational.

END OF SECTION

SECTION 26 05 10
CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Conductors and Cables:

1. Payment: Lump sum price offered in the Price Schedule.
   a. Includes cost of work and materials for conductors and cables except as specified.
   b. Includes cost of making electrical connections to equipment and devices.
   c. Includes cost for items requiring conductors and cables.

1.02 DEFINITIONS

A. Cable: Cable, cables, wire, or wires of one or more insulated conductors.

B. Power Cable: For power loads operating at less than 600 volts including power potential transformers, power circuit breakers, and other items associated with the excitation equipment; receptacle outlets, motors, alternating- and direct-current distribution circuits; and lighting circuits.

C. Multi-conductor Control Cable: For control, metering, indication, annunciation, and relaying circuits; and circuits not identified as power circuits.

D. Instrumentation Cable: For Resistance Temperature Detector (RTD), thermocouple, and transducer circuits and can be used for serial communication (RS-232 & RS-485)

E. Telecommunications Cable: For supervisory computer control, voice communication, and logic level signals (fiber, Ethernet, coax, etc.).

1.03 REFERENCE STANDARDS

A. ASTM International (ASTM)

1. ASTM B8 -2011(2018) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-, or Soft
2. ASTM B496M-2019 Compact Round Concentric-Lay-Stranded Copper Conductors

B. Insulated Cable Engineer Association (ICEA)

1. ICEA S-104-696-2019 Indoor-Outdoor Optical Fiber Cable

2.	ICEA S-116-732-2016	Standard Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (with or Without An Overall Shield) for Use in LAN Communication Systems

C. Code of Federal Regulations (CFR)

1.	7 CFR 1755.390	RUS Specification for Filled Telephone Cable

D. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE 95-2012	Recommended Practice for Insulation Testing of AC Electric Machinery (2300V and Above) With High Direct Voltage
2.	IEEE 383-2023	Qualifying Electric Cables and Splices for Nuclear Facilities
3.	IEEE 1202-2020	Standard for Flame – Propagation Testing of Wire and Cable
4.	IEEE C2-2023	National Electrical Safety Code (NESC)

E. National Electric Manufacturers Association (NEMA)

1.	NEMA WC 57-2-2021	Control, Thermocouple Extension, and Instrumentation Cables
2.	NEMA WC 66-2019	Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables for Use in LAN Communication Wiring Systems
3.	NEMA WC 70-2021	Power Cables, Rated 2000 Volts or Less for the Distribution of Electrical Energy.

F. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electrical Code (NEC)
		Article 430
		Article 610
		Article 725
		Article 805

G. Telecommunications Industry Association (TIA)

1.	TIA 568.0-D-2017	Generic Telecommunications Cabling for Customer Premises
2.	TIA 568-C.2-2017	Balanced Twisted-Pair Telecommunications Cabling and Components Standards

H. Underwriters Laboratories, Inc. (UL)

1.	UL 444-2017	Communications Cables
2.	UL 486A-486B-2021	Wire Connectors
3.	UL 1581-2023	Std. for Electrical Wires, Cables and Flex. Cords
4.	UL 1650-2023	Portable Power Cable
5.	UL 1666-2021	Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
6.	UL 1685-2020	Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
7.	UL 758-2022	Appliance Wiring Material

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 10-1, Approval Data:

1. Manufacturer's data.

C. RSN 26 05 10-2, Notification of Field Tests:

1. See 3.02 Contractor Field Quality Testing.

D. RSN 26 05 10-3, Field Test Reports.

1. See 3.02 Contractor Field Quality Testing.
2. Provide completed, signed, and approved electrical commissioning forms.

1.05 DESIGN REQUIREMENTS

A. Determine conductor sizes, except where shown or specified, in accordance with NFPA 70. In the event of conflict between design requirements and NFPA 70, the more stringent requirement applies.

B. Determine actual cable lengths, and cable termination configurations.

C. Provide serial cable for motor controller connections to programmable logic controller, except where indicated otherwise on these drawings or specifications.

D. Provide new cables where required due to project modifications.

E. Replace cables as required and in accordance with Contractor's approved submittals.

F. Provide new cables to control enclosures.

1.06 PROJECT CONDITIONS

A. Locations of existing cables indicated on drawings are approximate.

B. Contractor is responsible for locating all crane power and control cables entering the new equipment, taking field measurements, and replacing these cables per specification requirements.

PART 2 PRODUCTS

2.01 CABLE, GENERAL

A. Manufactured no more than 24 months prior to Notice to Proceed.

B. UL Listed.

C. AWG or kcmil designation.

D. Coverings or insulation: Suitable for installation in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70.

E. Round shape.

F. Conductors:

1. Copper conductor: ASTM B8, class B or C.
2. Stranded conductors.
3. Size: 14 AWG, minimum.

2.02 PHASE INDENTIFICATION

A. Power Cable Phase Conductors:

1. 120/240, single-phase: Black.
2. 120/208- or 240-volt, 3-phase: Black, red, blue.
3. 277/480-volt, 3-phase: Black with brown, orange, yellow phase tape.

B. Neutral (Grounded) Conductors: In accordance with NFPA 70.

C. Direct Current (Ungrounded) Conductors:

1. DC positive bus: Red.
2. DC negative bus: Black.

D. Equipment Grounding Conductors:

1. 6 AWG and smaller: Green insulation.

2. Larger than 6 AWG: Green tape at both ends and visible points including junction boxes.

E. Control Cable:

1. In accordance with NEMA WC 57, Table E-2.

F. Instrumentation Cable:

1. Sequentially number each pair/triad for identification.

G. Telecommunications Cable

1. Category 6A Cable: In accordance with TIA 568.

2.03 COLOR CODING

A. Multi-conductor Control and Instrumentation Cable:

1. In accordance with NEMA WC 57, Table E-2.
2. Colored insulation or jacket compound. Do not apply color coatings to insulation or jacket surface.
3. Indoor telemetering cable: In accordance with 7 CFR 1755.390.

2.04 POWER CABLE

A. Minimum 600-volt rated insulation.

B. Single-conductor power cable in accordance with NEMA WC 70.

C. Multi-conductor cable in accordance with NEMA WC 57.

D. UL listed and labeled.

E. Conductors:

1. Copper in accordance with ASTM or B496, Class B or C.
2. Stranded conductors.
3. Minimum Conductor Size:
   a. Single conductor cable: 14 AWG.
   b. Multi-Conductor Cable: 14 AWG.

F. Type:

1. Single-conductor or multi-conductor, non-shielded.
   a. Ground cable ground shield (drain) wire at both ends.
2. Minimum Requirements:

a. Suitable for wet or dry locations, indoors or outdoors.

b. Suitable for installation in cable trays, in conduits, and for general use.

c. UL listed type TC.

d. UL labeled on outer surface in accordance with NFPA 70.

3. Rated in accordance with the NFPA 70 for the location where installed, including plenum rated cables where applicable.

4. Rated in accordance with the NFPA 70 for the location where installed.

G. Temperature

1. Minimum 90 degrees Celsius continuous operating temperature rating wet or dry application.

H. Insulation Type:

1. THWN-2, XHHW-2, or equal.

I. Overall Jacket:

1. Type: Polyvinyl Chloride (PVC) or Chlorinated Polyethylene (CPE) or better.

a. Flame-retardant.

2. UV Resistant.

3. Includes rip-cord for single conductor cables.

J. Flame Test Rating:

1. In accordance with IEEE 383.

2. In accordance with IEEE 1202 and UL 1581 VW-1.

K. If using multi-conductor power cable, provide with integral ground conductor. Size ground conductor in accordance with NEMA WC 70 and NFPA 70.

L. Round conductors, except for 2-conductor cable with parallel conductors.

M. Group small diameter conductors (1/0 AWG and smaller) into multi-conductor cable assemblies where available and where such groupings are permitted by the NEC.

2.05 CONTROL CABLE

A. Minimum 600 Volt rated insulation.

B. Multi-conductor cable in accordance with NEMA WC 57.

C. UL listed and labeled.

D. Conductors:

1. Copper in accordance with ASTM or B496, Class B or C.
2. Stranded conductors.
3. Minimum Conductor Size:
   a. Single conductor cable: 14 AWG.
   b. Multi-Conductor Cable: 14 AWG.

E. Type: Single-conductor or multi-conductor Control Cable, shield type.
1. Cable ground shield (drain) wire shall be grounded at both ends.
2. Minimum Requirements:
   a. Suitable for wet or dry locations, indoors or outdoors.
   b. Suitable for installation in cable trays, in conduits, and for general use.
   c. UL listed type TC.
   d. UL labeled on outer surface in accordance with NFPA 70.
3. Rated in accordance with the NFPA 70 for the location where installed, including plenum rated cables where applicable.
4. Rated in accordance with the NEC for the location where installed.

F. Temperature:
1. Minimum 90 degrees Celsius continuous operating temperature rating wet or dry application.

G. Insulation Type:
1. EPR, XLPE or equal. Halogen free containing less than 0.2% halogen content by weight.

H. Overall Jacket:
1. Type: Halogen free flame retardant. Containing less than 0.2% halogen content by weight.
2. UV Resistant.
3. Includes rip-cord for single conductor cables.

I. Flame Test Rating:
1. In accordance with IEEE 383.
2. In accordance with IEEE 1202 and UL 1581 VW-1.

J. Round conductors, except for 2-conductor cable with parallel conductors.

K. Group small diameter conductors (1/0 AWG and smaller) into multi-conductor cable assemblies where available and where such groupings are permitted by the NEC

2.06 CRANE FEEDER CABLE:

A. 2000-volt rated insulation unless specified otherwise.

B. Single or multi-conductor, non-shielded type.

C. Suitable for installation in conduits and for general use.

D. Minimum conductor size: 4 AWG.

E. Portable Power Cable:

1. Single conductor: NFPA 70 Type W.
   a. Insulation: Ethylene-Propylene Rubber.
2. Multi-conductor cable:
   a. NFPA 70 Type W.
   b. Number of conductors: Four.
   c. Insulation: Ethylene-Propylene Rubber.

F. UL 1650 listed and labeled on outer surface per NFPA 70.

G. Single-conductor power cable: In accordance with NEMA WC 70.

H. Multi-conductor power cable: In accordance with NEMA WC 57, with integral ground conductor sized in accordance with NEMA WC 70.

I. Jacket:

1. Black heavy duty CPE thermoset compound.
2. Ozone, sunlight, oil, flame, weather, impact and abrasion resistant
3. Sunlight resistant 90 degrees C, wet or dry.

J. Overall flame-retardant covering (jacket) of thermoplastic or neoprene.

2.07 PREMISES WIRE

A. Single, solid conductor THHN/THWN rated for 600 volts.

B. Size:

1. 14 AWG for 15 ampere branch circuits.
2. 12 AWG for 20 ampere branch circuits, or as shown.

C. Suitable for installation in raceways.

D. In accordance with NEMA WC 70. UL listed and labeled.

E. Plated to resist corrosion.

2.08 INSTRUMENTATION CABLE

A. Type:

1. Single-pair or triad shielded or multiple individual shielded pairs or triads with overall shield.
2. Twisted pair for transducer circuits and twisted triad for RTD circuits.
3. Cable shield: Aluminum-mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire. Grounded only at one end.
4. Suitable for installation in above grade or underground raceways.
5. UL listed and labeled.
6. Suitable for installation in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70.
7. Rated for installed configuration in installation locations, including plenums or NFPA 70 Class 1, Class 2 and Class 3 hazardous areas, where applicable.
8. Each pair or triad sequentially numbered for identification.

B. Suitable for installation in raceways, cable trays, conduit, and for general use.

C. Conductors:

1. Size: No. 16 or 18 AWG, minimum.
2. Copper in accordance with ASTM 8, class B or C.
3. Stranded conductors.
4. Conductor sized according to application requirements, and in accordance with the requirements and recommendation in the NEC.

D. Rated for a minimum of 90° C continuous operating temperature, Wet or Dry.

E. Insulation:

1. 600 volt 90 degrees Celsius, minimum.
2. Type: EPR or XLPE

F. Flame Test Rating:

1. IEEE 383.
2. IEEE 1202 or UL 1685.

G. Jacket:

1. Halogen free, Smoke free and flame retardant:

a. LSHF, CPE (Chlorinated Polyethylene) or better, flame-retardant with rip-cord.

2. UV resistant.

3. Moisture resistant.

H. UL Listed and labeled.

2.09 MULTICONDUCTOR INDOOR CABLE

A. Twisted pair, individually insulated, having varying lengths of lay to minimize crosstalk.

B. Insulation: Extruded high-density polyethylene or crystalline propylene/ethylene copolymer insulating compound.

C. Core that is completely covered with a layer of nonhygroscopic dielectric material. Apply covering with an overlap.

D. Shield: 0.006-inch-thick copper or 0.0008-inch plastic-coated aluminum.

E. Cable jacket: High-molecular-weight polyethylene, resistant to abrasion, moisture, weather, and environmental cracking.

2.10 TELECOMMUNCIATIONS CABLE

A. Cable performance shall not be impacted by immersion in water.

B. UL listed, where available.

C. Approved Types of Telecommunications Cable:

1. Category 6A (CAT 6A) cable with RJ45 connections:

a. Provide in accordance with TIA 568.

1) Type:

2) UL listed CMR cable, unless otherwise required for installation conditions.

3) Single twisted pair, or multiple individual twisted pairs. Quantity of pairs as required for application.

4) Suitable for installation in above grade or underground raceways.

b. Rated for a minimum of 60° C continuous operating temperature, Wet or Dry.

c. Insulation:

1) Halogen free.

d. Jacket:

1) Halogen free, resistant to abrasion, moisture, weather, and environmental cracking.

2) Rip-cord

3) Moisture resistant.

e. Flame Test Rating:

1) UL 1666 Riser.

f. Provide communications rated cabling for the installation purpose it is installed (plenum, riser, etc.) in accordance with NFPA 70.

2. Coaxial Cable rated for use in plenum spaces.

3. Special Purpose Cable

a. With the approval of the Project Manager.

2.11 ENCLOSURE WIRING

A. Wiring inside switchboards, control panels, etc., not intended for use extending outside of the enclosure. Enclosure wiring for instrumentation or telecommunications shall maintain characteristics of those cable types.

B. Minimum 600-volt rated insulation.

C. Type:

1. NEC type SIS.

D. Minimum Conductor Size:

1. 14 AWG

2. Conductor sized according to application requirements, and in accordance with the requirements and recommendation in the NEC.

E. Insulation Type

1. 600 volt 90 degrees Celsius, minimum.

2. XLPE, or equal.

F. Insulation Color:

1. Gray, unless special purpose application.

G. Flame Test Rating:

1. UL 1581 VW-1

2.12 DUAL ELEMENT RTD WIRE

A. 6/C 16 AWG.

B. Shielded PTFE – Hook up wire.

2.13 ACCESSORIES

A. Conductor markers:

1. Type: Heat-shrink or Self-laminating-vinyl type, machine printable sleeve.
2. Color: White with black text.
3. Text Size: As large as practical but at least 7 point, (0.06-inch).
4. Text Type: Computer generated.
5. Length: 1-inch, minimum.
6. Diameter: Suitable for installation on the intended conductor.

B. Cable tags.

1. Type: Cross-laminated polyethylene film or Nomex. Be resistant to water, oil, solvent, abrasion, and tearing.
2. Rectangular shape and have minimum dimensions of 2 by 0.5-inches.
3. Color: White with black text.
4. Text size: As large as practical but at least 16 point (0.16-inch).
5. Attach to cable with standard nylon self-locking tie wraps or cable ties.
6. Suitable for outdoor use.
7. Shape: Rectangular.
8. Color: white.

C. Terminal connectors for power, control and instrumentation cable:

1. Heavy-duty, nylon insulated sleeve, pressure-crimp-type with ring tongues.
   a. Fork tongue terminals are not permitted.
   b. 600-volt insulated pin connectors may be used where ring tongue terminal connectors are not practical (i.e., control switches, indicating lights, etc.).
2. Tin-plated copper.
3. Serrated inner barrel.
4. UL listed.
5. Compatible with conductor size and type of cable for which it is used.

D. Cable Ties:

1. General purpose black Nylon 6/6.
2. UV Resistant.
3. Self-locking.
4. Stainless Steel tab.

E. Telecommunications Cable Faceplates and Connectors:

1. Terminate unshielded twisted pair (UTP) cables in accordance with TIA-568-C.1 and TIA-568-C.2 with T-568A color configuration.
2. Use registered jack (RJ) 45 modular connector.
3. Use punch-down keystone jacks for termination connections.
4. Provide each location with 2 port RJ-45 faceplates unless otherwise noted on drawings.
5. Faceplate color shall be white.

F. Crimps to be made with hydraulic or ratcheting high leverage crimping tools. Interface Terminal Blocks: Type EB-25 manufactured by General Electric Company, 41 Woodford Avenue, Plainville, CT 06062; Buchanan catalog Nos. B104 through B112 manufactured by Tyco Electronics, P.O. Box 3608, Harrisburg, PA 17105-3608; Marathon catalog Nos. 1604 through 1612 manufacturer by Marathon Electric Manufacturing Corporation, 13300 Van Camp Road, Bowling Green, OH 43402; or equal having following essential characteristics:

1. Type: One piece, molded-block with molded-insulating barrier between terminals. Sectional type or DIN rail mounted terminal blocks are not acceptable.
2. Rating: 600 Volts, 30 Amperes, minimum.
3. Terminals: Binding-head or washer-head screws with serrated or grooved-contact surfaces suitable for use with ring-tongue type terminal connectors.
4. Arranged and located such that incoming and outgoing cables can be supported.
5. Provide 25 percent spare terminals.
6. Furnish with removable covers and full-size marking strips.
7. Provide shorting-block type terminal blocks for current transformer circuits.

G. Wire Connectors: UL 486A-486B.

2.14 SOURCE QUALITY TESTING

A. Government reserves the right to inspect cable at supplier's manufacturing plant prior to shipment.

B. Cables shall be tested at the supplier in accordance with the requirements of ICEA S-104-696 and NEMA WC 66, as appropriate.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70, IEEE C2, TIA 568 and manufacturer's requirements and recommendation.

B. Install cable in conduits.

C. Maintain manufacturer recommended minimum bending radius for cables.

D. Install all telecommunications cables in raceway, cable tray or similar protected installation.

E. Do not combine power and control circuits in the same multi-conductor cable.

F. Install cable without exceeding allowable pulling tensions and sidewall pressures recommended by cable manufacturer.

G. When using cable ties, do not over tighten, to ensure tie does not cut conductor insulation or cable outer jacket. Do not use cable ties to support cables.

H. Seal cable penetrations into equipment or passing through block-outs, with silicone-foam, fire-retardant type material.

I. Block cable opening in sleeves under equipment or passing through block-outs with silicone-foam, fire-retardant material in accordance with NFPA 70.

J. Install cable in a neat and workmanlike manner in accordance with industry standards and manufacturer requirements.

K. Retain spare single conductors at each end of a multi-conductor cable in a length equal to the longest single conductor of multi-conductor cable. Land and ground the spare conductors.

L. Retain sufficient length of conductors in current transformer cable length to reach farthest terminal used to select current transformer ratios. No splices will be allowed in current transformer circuits or any circuits.

M. Run both positive and negative leads of a circuit in same cable.

N. Do not combine alternating- and direct-current circuits, or current and potential transformer circuits in the same multi-conductor cable.

O. Cable Splicing:

1. Do not splice cables.

P. Cable Separation

1. Install cables to provide separation of voltage levels, defined below, except with approval of the COR.
2. Voltage Levels
   a. Medium Voltage: Above 600V operating voltage.
   b. Single-Conductor Power Cable: 64V operating voltage and above.
   c. Power & Control: 64V operating voltage and above.
   d. Instrument Level: Below 64V operating voltage.
3. Do not mix voltages within a cable.
4. Do not install cables of different voltage levels in the same raceway.

Q. Cable Installed in New and Existing Conduit:

1. Do not pull cable into conduits until conduit runs have been cleaned and are free from obstructions and sharp corners.
2. Draw a clean, dry, tight-fitting rag through conduit immediately before installing cable.
3. Install cable using gradual and uniform pulling stresses.
4. Install cable without exceeding allowable pulling tensions and sidewall pressures recommended by cable manufacturer.
5. Install cable to prevent cuts or abrasions in insulation or protective covering, or kinks in cable.
6. When a lubricant is needed as an aid to pulling, use only soapstone or other suitable lubricant that is not injurious to cable insulation.
7. When mechanical cable pulling equipment is used, use a tension meter release mechanism to ensure pulling tension remains below tensile strength of the cable.
8. Remove and replace cable that is damaged during installation with new cable.

R. Cable Installed in Vertical or Inclined Plane:

1. Install in locations shown. If not shown, install in accordance with NFPA 70.
2. Support with cable grips leaving slack spans between supports.
3. Clamp cable entering enclosures, junction boxes, or equipment with commercial cable clamps.

S. Cable in Boxes and Enclosures

1. Provide slack in the cable in all boxes, and enclosures. The cable should not be pulled tight against any edge or component in the enclosures and boxes.
2. If a cable is terminated in the box or enclosure include enough spare length in the terminated conductor to reach any other terminal in the enclosure. In multi-panel control cabinets the conductor should be able to reach any other terminal within that panel of the enclosure.

T. CAT6A cables:

1. Install in accordance with BICSI-TDMM, TIA-568-C.2, NFPA 70, and UL standards as applicable.
2. Install per manufacturer's instructions and do not exceed manufacturers' cable pull tensions for copper cables.
3. Install back boxes for RJ-45 connectors.
4. Do not install power and communication cable in same conduit.
5. No cable shall contain unterminated elements.
6. Do not untwist Category 6A cables more than 1/2-inch from point of termination to maintain cable geometry.
7. Terminate networking cables in T568A configuration per TIA-568-C.2.
8. Provide termination punch-down keystone jacks as required.

U. Form conductors into neat packs, or lace conductors, or tie conductors with self-locking cable ties at termination point of multi-conductor cable.

V. Cabinet and Enclosure Wiring:

1. Bind wires together into compact groups.
2. Support firmly.
3. Run straight, horizontally or vertically with short-radius, right-angle bends.
4. Twist hinge wiring around longitudinal axis of wire wherever possible instead of being bent laterally.
5. Protect each wire from abrasion where it leaves a channel or duct.
6. Make connections only at device studs or terminal blocks.
7. Do not terminate more than two wires at each terminal point.

W. Terminal Blocks:

1. Arranged and located such that incoming and outgoing cables can be supported.
2. Separate adjacent rows by at least 6 inches edge to edge.
3. Provide 6 inches from the sides, top, or bottom of control cabinet for wiring that will be made in the field.

4. Machine letter circuit designations, as shown on drawings, on white marking strips. Mount marking strip on terminal block.
5. Separate AC and DC blocks.
6. Provide 25 percent spare terminals.

X. Conduit Installation:

1. Install cable to prevent cuts or abrasions in insulation or protective covering, or kinks in cable.
2. Block cable opening in sleeves under equipment or passing through blockouts, with silicone-foam, fire-retardant type material in accordance with NFPA 70.

Y. Tagging:

1. Tag multi-conductor cables at each end.
2. Attach tags to cable by self-locking cable ties.
3. Mark tags with cable designation as indicated on approved wiring diagrams. Where not shown, develop and provide to include a sequential cable number followed by originating equipment designation and destination equipment destination, separated by a dash (-). Examples:
   a. 1A1A-C1A3R//12/C – 12 AWG – First cable from governor actuator cabinet A1A to unit control cabinet C1A, panel 3, rear.
   b. 4G2-C2E1F//3/C – 10 AWG – 4th cable from unit air housing terminal box U2 to unit 2 exciter cabinet C2E, panel 1, front.

Z. Conductor Marking:

1. Mark all conductors, whether single-conductor cables or individual conductors of multi-conductor control, instrumentation, and power cables at each end with conductor designation on first line followed by cable designation on second line as indicated on approved wiring diagrams.
2. Do not shrink sleeves on conductor labels for 10 AWG or smaller. Size for limiting movement along the conductor or cable and permitting rotation.
3. Mark spare conductors of multi-conductor cables with cable designation and word “SPARE”.
4. Numerically sequence markings (e.g. 2CSA-CSB-SPARE1).
5. Conductor (wire) Designations:
   a. Show and label each conductor (wire) with a designation consisting of the unit number (1,2,3, 18), and device designation or function letters as described on standard drawing 104-D-1150, followed by sequential numbers and or letters.

AA. Grounding.

1. Provide 1 nonactive conductor grounded at both ends in each multi-conductor control cable.
2. Ground shielding of twisted pair shielded cables only to source equipment ground bus using pressure crimp type connectors with ring tongues on drain wire.
3. Ground spare conductors by wire jumpers from equipment terminal block points to equipment ground bus.
4. Ground shielding of instrumentation and telecommunications cable only to source equipment ground bus.

BB. Marking:

1. Mark conductors, whether single-conductor cables or individual conductors of multi-conductor control, instrumentation, and power cables at each end with conductor designation on first line followed by cable designation on second line as indicated on approved wiring diagrams.
2. Mark spare conductors of multi-conductor cables with cable designation and word "SPARE".
3. Numerically sequence markings (e.g., 2CSA-CSB-SPARE1).

CC. Spare conductors:

1. Provide spare conductors in accordance with Government-furnished information marked on Contractor's approval wiring diagram drawings.

DD. Terminate control and instrumentation wire with heavy duty, pre-insulated, pressure-crimp-type terminal connectors with ring tongues.

EE. Wiring methods:

1. Form conductors into neat packs, or lace conductors, or tie conductors with self-locking cable ties at termination point of multi-conductor cable.
2. Do not combine alternating- and direct-current circuits, or current and potential transformer circuits in same multi-conductor cable.
3. Support cable installed in a vertical or inclined plane by cable grips (including hooks). Installed cable with slack spans between supports.
4. Clamp cable entering equipment with commercial type cable clamps.
5. Leave sufficient length cable ends to make connections conveniently to equipment, fixtures, and devices.
6. Provide 5-conductor cable for each three-phase current and each potential transformer circuit.
7. Retain sufficient length of conductors in a current transformer cable length to reach farthest terminal used to select current transformer ratios.

8. Retain spare single conductors at each end of a multi-conductor cable in a length equal to longest single conductor of multi-conductor cable.

9. Run direct-current circuits connected to a device radially.

10. Run both positive and negative leads of a circuit in same cable.

11. Tie cables that are installed under a raised floor system and are not in conduit, and that consist of two or more single conductors, together at 10-foot intervals by self-locking cable ties.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Perform testing after installation, but before connection to equipment.

B. Test cables in large groups to minimize number of testing sessions.

C. Notify COR, in writing, of date, time, and cables to be tested at least 5 working days before testing.

1. Testing dates shall be approved by COR.

D. Perform following tests:

1. Continuity test: Test continuity of each conductor prior to performing insulation resistance test.

2. Insulation resistance tests for power, control, and instrumentation cables:

a. Measure insulation resistance between each conductor and station ground with all other conductors in same cable or conduit grounded.

b. Test voltage: 1,000 volts direct-current, minimum.

c. Minimum acceptable insulation resistance: R in MΩ = (rated voltage in kV + 1) x 1000/length in ft.

d. Duration: 1-minute.

3. Record following test data on test report for each conductor tested:

a. Date of test.

b. Name or names of Contractor's personnel who performed test.

c. Name of COR or inspector who witnessed test.

d. Conductor identification.

e. Megohms between conductor and ground.

f. Total length of conductor.

g. Duration each conductor was tested.

4. Insulation resistance test for telemetry cables:

a. Measure insulation resistance between each conductor and each of remaining conductors, and between each conductor and shield for telemetry cable. Conduct test after cable sheath has been floated at transducer end but prior to connecting any ground conductors.

5. AC dielectric test in accordance with NEMA WC 70 for the DLO cable:

a. Test voltage:

1) 1,500 V, (75 per cent of 2 kV, factory test level)

b. Test voltage shall be applied for 5-minutes.

c. Test frequency nominally between 49 and 61 hertz.

d. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric test, the cable is considered to have passed the test.

E. Perform the following tests – CAT 6A cable:

1. Test equipment shall conform to TIA-1152.

2. Inspect network cabling terminations for T568A color configuration.

3. Perform testing for each outlet.

4. Performance test:

a. Perform Category 6A link tests in accordance with TIA-568-C.1 and TIA-568-C.2.

b. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

F. If any cable or conductor fails testing, remove and replace cable.

3.03 COMMISSIONING VERIFICATION

A. Document changes and update Government copies final drawings.

B. Contractor shall provide the following:

1. Labor for adjustments and modifications during commissioning tests.

2. Demonstrate continuity and proper function of field devices and systems impacted by the removal and installation of cables and conductors.

3. Submit completed, signed, and approved Electrical Commissioning Forms.

C. Government will review Contractor's field test reports and if found acceptable will respond accordingly. Refer to Section 01 46 00 – Quality Procedures.

END OF SECTION

SECTION 26 05 20
GROUNDING AND BONDING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for items of work requiring grounding and bonding and ground cable.
   a. Include cost of furnishing and installing ground cable, associated materials and of connecting new equipment and associated metal conduit to existing grounding system.
   b. Includes cost of Electrical Ground Resistance Test.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B3 -2011(2018)	Soft or Annealed Copper Wire
2.	ASTM B8 -2011(2018)	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-, or Soft
3.	ASTM B 228-2021	Concentric-Lay-Stranded Copper-Clad Steel Conductors

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 80-2013	Safety in AC Substation Grounding
2.	IEEE 81-2012	Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
3.	IEEE 142-2007	Grounding of Industrial and Commercial Power Systems
4.	IEEE 837-2014	Qualifying Permanent Connections Used in Substation Grounding
5.	IEEE C2-2023	National Electric Safety Code (NESC)

C. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electric Code (NEC)

1.03 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 - Submittals and 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 20-1, Approval Drawings and Data:

1. Manufacturer's catalog data.
2. Layout drawing showing all ground connections between components. Provide all sizes of individual ground wires and methods for bonding.
3. Layout drawing showing all ground connections between components. Provide all sizes of individual ground wires and methods for bonding.

C. RSN 26 05 20-2, Field Test Reports.

1. Test report shall include date of test,
2. Name or names of Contractor's personnel who performed test,
3. Name of Government inspector who witnessed test.
4. Provide completed, signed, and approved electrical commissioning forms.

1.04 PROJECT CONDITIONS

A. Verify size and location of grounding system.

B. Verify size of existing plant grounding system risers.

1.05 DESIGN REQUIREMENTS

A. Design concrete-encased grounding system for vault structures with ground rod electrodes.

B. Design grounding system for vault structures, panelboards, enclosures and control systems.

C. Construct and testing grounding system.

D. Grounding system conductor sizes: In accordance with NFPA 70 unless shown otherwise.

E. Provide lightning ground protection for crane structures.

1.06 PERFORMANCE REQUIREMENTS

A. Ground system impedance to ground: Less than 10 ohms.

PART 2 PRODUCTS

2.01 MATERIALS

A. In accordance with standard Drawings 40-D-4334 and 40-D-4335, and as listed below.

B. Connect each new crane system to the existing ground system at one location. This location shall be identified on the final as-built drawings.

C. Connect each new electrical enclosure to the existing ground system at one location. This location shall be identified on the final as-built drawings.

D. Connect to existing railways for lightning ground path.

E. Ground Cable:

1. Annealed bare-copper cable:
   a. ASTM B8, class B.
   b. Solid wires used in forming the copper cable: ASTM B3.
2. Concentric stranded.
3. Sizes:
   a. As indicated on drawings.
   b. Where not shown:
      1) Ground risers and electrode conductors: 4/0 AWG.
      2) Equipment grounding conductors:
         a) Major equipment: Equal in size to electrode conductors.
         b) Minor equipment: In accordance with NFPA 70.
      3) Electrode interconnecting conductors: Equal in size to electrode conductors.
      4) Equipment ground ring bus: Equal in size to largest riser.
      5) A separate ground conductor shall be installed in all new conduit runs. Refer to Section 26 05 33 – Raceways and Boxes.

F. Ground Plates:

1. Cast copper or copper-alloy.
2. Four-holes type unless shown otherwise.
3. Designed for installation in concrete walls or floors.
4. Use exothermic process for connection to grounding system. Use of compression type ground plates is not acceptable.

2.02 ACCESSORIES

A. Cable Connectors:

1. Welded (isothermic), bolted solderless or compression type.
2. Current-carrying capacity: Equal to cable with which they are used.
3. Connectors for ground cables, including fittings, lugs, bolts, nuts, and washers: Copper alloy containing not more than 4 percent zinc.
4. Bolted solderless or compression type connectors: IEEE 837.

B. Provide to connect equipment, metal conduit, steel structures, metal pull box covers, exposed metal surfaces, fences, and other miscellaneous metalwork to grounding system as indicated on Standard Drawings 40-D-4334, 4-D-4335, 40-D-4753, 40-D-4874 and 40-D-6376.

2.03 WELDING PROCESS

A. Use Cadweld, Thermoweld, or equivalent exothermic process.

B. Molds and weld metal:

1. Use fresh stock from same manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70, IEEE C2, IEEE 142, and this Section.

B. Connect equipment, metal conduit, steel structures, metal pull box covers, exposed metal surfaces, and other miscellaneous metalwork to grounding system as indicated on Standard Drawings 40-D-4334, 40-D-4335; and as shown on specification drawings.

C. Ground equipment and miscellaneous metalwork that is required to be grounded, but is not indicated on drawings to grounding system.

1. Located ground bars at bottom of enclosures.

D. Exposed connections shall be bolted.

E. Ground or Bond as Applicable:

1. Steel structural components.
2. Metal enclosures for electrical equipment.
3. Electrical raceway.
4. Shielding and armor on insulating conductors.

5. Make ground connections that will be direct buried or embedded in concrete:
   a. Exothermic process.

F. In accordance with manufacturer's instructions.

G. Concrete Encased Grounding Electrodes:
1. Ground risers:
   a. Connect grounding electrodes to ground bus.
   b. Install at least four ground risers for connection to grounding electrodes.
2. Ground plates and ground bus:
   a. Connect equipment grounding conductors to ground plates.

H. Ground Electrode Interconnections:
1. Install minimum of two physically separate grounding electrode tie conductors as interconnections between ground electrodes of grounding system.
2. Installation depth: At least 2-1/2 feet.

I. Connections:
1. Make all ground connections between equipment and miscellaneous metalwork, and ground plates of grounding system whether or not such grounding connections are indicated on drawings.
2. Number of grounding connections for equipment may be one, two, or more in some cases.
3. Remove paint, enamel, scale, oil, grease, or other foreign nonconductive material from point of contact on metal surfaces before making ground connections.
4. Repair damaged or removed paint or galvanizing material on metal finishes.
5. Make ground connections that will be direct buried or embedded in concrete:
   a. Exothermic process.
   b. In accordance with manufacturer's instructions.
6. Electrical distribution equipment, transformers, disconnects, control enclosures and distribution panelboards shall be grounded to ground conductors extending to the existing underground system, and shall not utilize steel, or any other structural component for the grounding system.
   a. Grounding connections for the electrical distribution equipment shall utilize minimum 4/0 AWG copper grounding conductors.
7. All connection shall be approved by the Government.

J. Furnish and install ground cable and all associated materials.

K. Connect new crane structures to the ground system at one location.

L. Connect new electrical enclosure to the ground system at one location.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test resistance of grounding system:

1. Notify COR at least 24 hours in advance of time of test in order that test may be witnessed by COR.
2. Measured resistance: Less than 1 ohm.
3. Use fall of potential method in accordance with section 8.2.1.5 of IEEE 81.
4. Testing device:
   a. Earth resistance tester.
      1) Heavy-duty, low-resistance type with direct-reading and direct-current ohmmeter as described in bulletin No. 25 and any one of bulletins Nos. 25J, 25J-2, and 25T, all by James G. Biddle Co.; the 3 point electronic Vibroground7 by Associated Research, Inc.; or equal.
      2) Capable of measuring ground resistance to an accuracy of 0.5 ohms or better.
5. Test Performance:
   a. Initial distance between remote current electrode (C) and grounding system under test (X): at least six times longest diagonal dimension of grounding system.
   b. Beginning at electrode X, drive potential-reference electrode (P) into ground at a number of test points on a straight line between electrode X and electrode C.
   c. Distance between test points: Approximately 5 percent of actual distance between electrodes X and C.
   d. Continuously log apparent resistance readings for each test point and plot curve of resistance versus distance to ensure that the electrode C location is yielding acceptable results as indicated in IEEE 81.
   e. Measure and record test points until reaching electrode C or as approved by COR. If plot of resistance vs. distance curve indicates remote current electrode is in area of influence of grounding system, increase distance between electrode C and grounding system, and measure and record a new set of test data.

3.03 FINAL AND AS-BUILT DRAWINGS

A. Final and As-Built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents.

1. Marked prints of drawings indicating "Final As-Built" changes made to electrical conduit during construction.

3.04 COMMISSIONING AND VERIFICATION

A. Document changes and update Government copies final drawings in accordance with Section 01 78 30 – Project Record Documents.

B. Contractor shall provide the following:

1. Labor for adjustments and modifications during Grounding and Bonding tests.
2. Submit completed, signed, and approved Electrical Commissioning Forms.

C. Government will review Contractor's field test reports and if found acceptable will respond accordingly. Refer to Section 01 46 00 – Quality Procedures.

END OF SECTION

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SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Raceways and Boxes:

1. Payment: Lump sum price offered in the Price Schedule.
   a. Includes the following:
      1) Work requiring Electrical conduit.
      2) Work requiring wall penetration seals.
      3) Work requiring core hole drilling in concrete.
      4) Work requiring junction boxes.
      5) Work requiring wire ways.
      6) Work requiring expansion and expansion-deflection couplings.

B. Cost:

1. Include cost of as-built and final drawings in lump sum price offered in the Price Schedule for As-built and Final Drawings, and Operations & Maintenance (O&M) Manuals.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1. ANSI C80.1-2020 — Electric Rigid Steel Conduit

B. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2023 — National Electrical Safety Code (NESC)

C. National Electrical Manufacturers Association (NEMA)

1. NEMA FB 1 - 2014 — Fittings, Cast Metal Boxes, And Conduit Bodies For Conduit, Electrical Metallic Tubing And Cable

D. National Fire Protection Association (NFPA)

1. NFPA 70-2023 — National Electric Code (NEC)

E. Underwriters Laboratories, Inc (UL)

1.	UL 360-2013	Liquid-Tight Flexible Steel Conduit (LTFC)
2.	UL 2024-2015	Safety Cable Routing Assemblies and Communications Raceways
3.	UL 6-2022	Electrical Rigid Metal Conduit - Steel

1.03 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 33-1, Approval Drawings and Product Data:

1. Provide manufacturer's standard catalog pages and data sheets for conduits, wall penetration seals, junction boxes, wire ways, expansion and expansion-deflection couplings and fittings.
2. Conduit Layout Drawings: drawings include, but not be limited to the contractor visiting the site, designing the layout of the conduits to crane motor controller system and the remaining conduits required for this project. The contractor will provide these drawings (in this submittal) to the Government, which illustrates:
   a. Layout of the new conduits to be installed by the contractor.
   b. List the sizes and types of conduit.
   c. Identifies which cables will be in each conduit.
   d. Include proposed location of wall penetrations and proposed methods of sealing.

C. RSN 26 05 33-2, Site Acceptance Test Reports.

1. Completed and approved commissioning forms.

1.04 DESIGN REQUIREMENTS

A. The new dynamic breaking resistors cabling shall be located in new LTFC conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

B. The new crane rail cables shall be located in new RMC conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

C. The new pendant control station feeder cables shall be located in new conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

D. The new disconnect switch or circuit breaker feeder cables shall be located in new conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

E. The new low voltage dry-type transformer feeder cables shall be located in new LTFC conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

F. The new hoist motor and travel motor feeder cables shall be located in new LTFC conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

G. The new exterior lighting fixtures cabling shall be located in new RMC conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

H. The new heater disconnect switches cabling shall be located in new conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

I. The new heavy-duty fused disconnect switch feeder cables shall be located in new RMC conduit. The contractor shall furnish both cable and conduit for crane motor controller system.

J. Provide conduit for the new Automation Control System equipment to all devices.

K. Provide new conduits where other new electrical components will be furnished.

1. The conduits shall be rated appropriately for routing the electrical equipment to its corresponding safety interface and control devices and distribution panelboards.

L. Determine conduit sizes in accordance with NFPA 70. In the event of conflict between design requirements and NFPA 70, the more stringent requirement applies.

M. Rated for intended purposes or labeled by nationally recognized testing laboratory (NRTL) accredited by Federal Occupational Safety and Health Administration (OSHA) when applicable.

N. Fittings: In accordance with NEMA FB 1, required to complete electrical conduit systems and to fasten, clamp, attach, and support each conduit in place:

O. Includes threaded joint compound; protective sealant; materials for sealing ends of conduits terminating at outdoor boxes, panelboards or cabinets; supports and clamps.

P. Determine actual conduit lengths, and conduit fitting configurations.

Q. Existing conduit drawings are not complete. The contractor is responsible for field verifying the location of existing conduit routes and proposing use of new conduit routes, lengths and sizes of conduit.

1.05 PROJECT CONDITIONS

A. Contractor is responsible for taking field measurements and replacing these conduits per specification requirements.

PART 2 PRODUCTS

2.01 CONDUIT

A. General:

1. UL listed.
2. Steel materials and hardware: Galvanized.

B. Rate for intended purposes or labeled by nationally recognized testing laboratory (NRTL) accredited by Federal Occupational Safety and Health Administration (OSHA) when applicable.

C. Rigid Steel conduit and attached fittings:

1. Zinc-coated and in accordance with ANSI C 80.1

D. Liquid Tight Flexible Metal Conduit for Outdoor Use:

1. Galvanized steel core conduit no longer than 3 feet.
2. Copper bonding conductor between spiral segments.
3. Extruded synthetic jacket overall to ensure water tightness.
4. Grounding-type fittings.

E. Interlocked steel construction with flame-retardant PVC jacket.

F. Drill holes in concrete per approved "Conduit Layout Drawings" for installation of conduit. Grout conduit in place in accordance with Section 03 62 20 – Non-shrink Grout for Equipment and Metalwork.

2.02 CONDUIT ACCESSORIES

A. General:

1. UL listed.
2. Conform to NEMA FB 1 as applicable.
3. Steel materials and hardware: Galvanized

B. Size: Contractor to determine for each application in accordance with NFPA 70.

C. Outdoor rated fittings required to complete electrical conduit systems. Includes, caps, connectors, couplings (excluding expansion and expansion-deflection couplings), nipples, reducers, elbows, pipe plugs, locknuts, bondnuts, bushings, seals (excluding wall penetration seals), and any other fittings.

D. Devices required to complete electrical conduit systems and to fasten, clamp, attach, and support each conduit in place.

1. Includes threaded joint compound; protective sealant; materials for sealing ends of conduits terminating at outdoor boxes, panelboards or cabinets; supports and clamps.
2. Complete with bolts, washers, and nuts.

E. Conduit Sealing Bushings:

1. Non-Toxic.
2. Non-shrinking.
3. Fire-retardant type.
4. Seals against liquid, gas, and vapor seepage.

F. Conduit Wall Penetration Seals:

1. Elastomeric material to prevent liquid and gas seepage.
2. Dust tight.
3. Fire retardant.

G. Protective Sealant:

1. Water repellant.
2. Resistant to peeling and cracking.

H. Exposed Outlet Bodies and Boxes: Cast iron, malleable iron, or cast aluminum.

1. Weatherproof.

I. Junction Box, Junction Box Extensions, and Junction Box Covers: Steel, cadmium, or zinc coated.

1. Weatherproof.

J. Expansion Couplings:

1. Furnish for longitudinal movement only.
2. Zinc coated, watertight type.
3. Capable of at least 4-inch expansion/contraction.
4. Expansion couplings for plastic conduit shall expand at least 4 inches for each 100 feet of run and for each 100 degrees F temperature change.

K. Expansion-deflection Couplings:

1. Furnish for movement in any direction.
2. Watertight.
3. Deflection and expansion: 3/4-inch, minimum.

4. Angular misalignment: 30 degrees, minimum.

L. Embedded Cast or Malleable Metal Outlet Boxes:

1. Type FD1 (Single-gang with extension):

a. Rectangular, single-gang, deep-wiring device outlet boxes with threaded hub connections for rigid steel conduit.

b. Equip with:

1) Four 1-inch threaded hubs.

2) 1-inch-deep cast or malleable metal extension ring.

3) 1-inch bushed elbows where indicated on drawings.

4) Plugs for any unused openings.

5) Reducers as required.

c. Boxes and extension rings: Iron alloy with corrosion-resistant finish.

2. Type FD2 (Two-gang with extension):

a. Rectangular, two-gang, deep-wiring device outlet boxes with threaded hub connections for rigid steel conduit.

b. Equip with:

1) Four 1-inch threaded hubs.

2) 1-inch-deep cast or malleable metal extension ring.

3) 1-inch bushed elbows where indicated on drawings.

4) Plugs for any unused openings.

c. Boxes and extension rings: Iron alloy with corrosion-resistant finish.

3. Type GRF:

a. 4-inch-round outlet boxes approximately 3-1/8 inches deep, with threaded-hub connections for rigid steel conduit.

b. Equip with:

1) Four 1-inch threaded hubs.

2) Plugs for any unused openings.

3) Reducers as required.

4) Tap for 3/8-inch fixture stud as required.

c. Boxes: Iron alloy with corrosion-resistant finish.

M. Pull and Junction Boxes:

1. Thickness: No. 10 United States Standard gauge, minimum.

2. Finish Paint:
   a. Prime coat: Red vinyl-resin.
   b. Final coat: Gray vinyl-resin.

N. Wire ways:
1. Fabricate of gauge steel in conformance with applicable codes.
2. Galvanize after fabrication.
3. Covers: Hinged or screw type as indicated on drawings.
4. Secure screw-type covers with rustproof screws.
5. Furnish wire ways without knockouts unless otherwise indicated on drawings.
6. Drill and punch onsite as required.

O. Sealing Materials:
1. General use:
   a. Non-toxic.
   b. Non-shrinking.
   c. Fire retardant type.
   d. Seal ends of conduit against liquid, gas, and vapor seepage.
2. Hazardous locations:
   a. Melting point of not less than 200 degrees F.
   b. Meet UL standards for hazardous locations.
   c. Prevent passage of gas or vapor.

P. Adhesive: In accordance with conduit manufacturer's recommendations.

Q. Ground Conductor: Furnish and install a separate grounding conductor in each new conduit run. Refer to Section 26 05 20 – Grounding and Bonding.

2.03 OUTLET BODIES, DEVICE BOXES, JUNCTION AND PULL BOXES

A. Outlet Bodies and Fittings:
1. Material: Cast iron or malleable iron.
2. Covers: Cast or sheet metal.

B. Cast Devices Boxes: Type FD and GRF manufactured by Cooper Crouse-Hinds; or equal, having the following essential characteristics:
1. Rectangular or round, deep-wiring device outlet boxes with threaded hub connections for rigid steel conduit.

2. Material: Iron alloy.
3. Number of Gangs: As required.
4. Provide plugs for unused openings.
5. Extension Rings: Iron alloy with corrosion-resistant finish.

C. Fabricated Sheet Steel Boxes:

1. Used as junction and pull boxes.
2. Sheet Steel Thickness: No. 14 United States Standard gauge, minimum.
3. Boxes installed outdoors shall be NEMA type 4X.
4. Hinged cover with oil-resistant gasket.
5. Finish: Manufacturer's standard grey coating.
6. Conform to NEMA 250.

D. Large, fabricated sheet steel, free standing, Type 4X enclosures as manufactured by Hoffman Engineering Company, Anoka, Minnesota; or equal, with the following essential characteristics:

1. Large, free standing pull box, NEMA 250, Type 4X.
2. Sheet Steel: 12-gauge, minimum.
3. Seams: Continuously welded and ground smooth.
4. Coating: Polyester powder coating over phosphatized surface, inside and out, Munsell ANSI #61 gray semi-gloss.
5. Mounting channels welded horizontally to interior body sides at top, center, and bottom.
6. Stainless steel door clamps and heavy gauge continuous hinge with stainless steel pin.
7. Includes lifting eyes, document pocket, and oil resistant door gasket.
8. Size in accordance with NFPA 70 or as indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to NFPA 70 and IEEE C2.

B. Determine routing of exposed conduit when not indicated on drawings.

C. Determine exact locations of embedded conduit stub-ups based on equipment being furnished.

D. Install conduit as required for new cable installation.

E. Install conduit with necessary fittings and supports.

F. Ensure that conduit runs and bends are free from kinks, indentations, or flattened surfaces.

G. Bends:

1. Install smooth, gradual bends to permit pulling insulated conductors without undue stress or damage to conductors or conduit.
2. Make metal conduit bends onsite with more than minimum radii required by NFPA 70.
3. Bend conduit cold to prevent damage to protective coating.

H. Remove burrs and sharp corners at ends of metal conduit.

I. Coat male threads of rigid metal conduit joints with suitable graphite or zinc sealing material before making joints.

J. Tighten conduit joints securely to ensure electrical continuity and to prevent entrance of moisture or foreign material.

K. Install bushings or Chase-type nipples on ends of conduit to protect insulation of insulated conductors from abrasion.

L. Install locknuts and bondnuts to provide tight ground connections between conduit and boxes, panelboards, and cabinets.

M. Seal ends of conduits that terminate at boxes, panelboards, or cabinets with sealing material or sealing bushings to prevent air circulation through conduits into boxes, panelboards, or cabinets. Install seals in accordance with manufacturer's instructions.

N. Stub conduit that terminates at horizontal surfaces 2 inches above finished floor level and terminate with coupling and plug. Replace plug with bushing or Chase-type nipple before installing insulated conductors.

O. Tighten conduit to electrical equipment mounted on tubular metal structures securely and support rigidly in place by conduit clamps, hex head nuts, and threaded 3/8-inch stud fasteners driven by powder-actuated tools.

P. Install expansion couplings where exposed or embedded conduits cross building expansion or contraction joints. Install expansion couplings and expansion-deflection couplings in accordance with manufacturer’s instructions.

Q. Furnish and install wall penetration seals for conduits entering structures below grade. Install seals in accordance with manufacturer's instructions.

R. Exposed conduit runs:

1. Straight and parallel with each other and with centerlines of room or structure.
2. Support conduit rigidly from wall or ceiling within 3 feet of each outlet box, junction box, cabinet, or fitting; and at intervals of not more than 5 feet.
3. Installation includes, where required, drilling holes in bottom, side, or top of enclosures or plates of other electrical equipment.
4. Tighten conduit securely.
5. Support conduit rigidly in place.
6. Minimize conduit runs in walkways to minimize trip hazards.

S. Drill specified holes in concrete per approved Conduit Layout Drawing(s) specified in this section for installation of conduit. Grout conduit in place in accordance with Section 03 62 20 – Non-shrink Grout for Equipment and Metalwork.

T. Use flexible conduit (no longer than 3 feet) for conduit connections to lighting fixtures and to other outdoor electrical equipment.

U. Conduit Tags:

1. Stamp or engrave tag with conduit number on "As Built" cable and conduit schedule.
2. Permanently attach tag to conduit with non-corrosive wire and crimp-type connector.

3.02 SITE ACCEPTANCE TESTING

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.03 COMMISSIONING VERIFICATION

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.04 FINAL AND AS-BUILT DRAWINGS

A. Final and As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents.

1. Marked prints of contractor drawings indicating "Final As-Built" changes made to electrical conduit during construction.

END OF SECTION

SECTION 26 05 90
WIRING CHECKOUT AND TESTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the Price Schedule for equipment and devices that require wiring checkout and tests.

1.02 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2023 National Electrical Safety Code

B. International Electrical Testing Association (NETA)

1. NETA ATS -2017 Acceptance Testing Specifications for Electrical Power Equipment and Systems

C. National Fire Protection Association (NFPA)

1. NFPA 70-2023 National Electrical Code (NEC)

1.03 DEFINITIONS

A. Qualified Person: In accordance with Article 100 of NFPA 70.

1.04 PERFORMANCE REQUIREMENTS

A. These tests are in addition to tests required by Section 26 05 10 – Conductors and Cables. These tests are focused on the testing/commissioning of new distribution system and crane automation control system as it interfaces to its corresponding associated circuits.

B. Furnish materials, including test instruments, required for checkout and testing.

C. Make wiring changes and drawing revisions to ensure there are no discrepancies between check prints and internal equipment wiring and external cabling.

D. Replace defective equipment and make device setting adjustments as required for operation of electrical systems in accordance with specifications and manufacturer's instructions.

E. Make meter and relay settings, timers, limit switches, circuit breakers, motor starters, contacts, variable frequency drives, sensors and programmable logic controller setting

calibrations and/or programming as required for operation of electrical systems in accordance with specification requirements.

F. If required during testing, remove and replace wire connections.

G. Make wiring changes, wire tag revisions and other repairs or revisions during the testing session the discrepancy is discovered.

H. Perform wiring checkout and operational and functional test in presence of Contracting Officer representatives.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 26 05 90-1, Test Notifications.

1. Names and qualifications of personnel performing checkout and testing, test methods, and schedule.

C. RSN 26 05 90-2, Test Reports.

1. For each new distribution system, automation control system and medium voltage equipment.

1.06 QUALIFICATIONS

A. Testing Personnel:

1. Competent and qualified person(s) to perform wiring checkout, and operational and functional testing. These person(s)/entities performing this work, shall have performed similar services for at least three installations of similar type in the past five years.
2. Have a thorough knowledge of the electrical equipment, installation and drawings. These person(s)/entities performing this work, shall have performed similar services for at least three installations of similar type in the past five years.
3. Qualified to operate equipment being tested. These person(s)/entities performing this work, shall have performed similar services for at least three installations of similar type in the past five years.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR FIELD QUALITY TESTING

A. General requirements:

1. Test in accordance with IEEE C2, requirements of the clause at FAR 52.246-12 "Inspection of Construction", and as specified below.
2. Perform tests in presence of Contracting Officer.
   a. Perform tests at time agreed to by Contractor and Contracting Officer.
3. Provide competent personnel who have personal knowledge of electrical installation at jobsite for processing checkout.
4. Provide labor and materials as required.

B. Check electrical equipment wiring prior to site testing.

C. Test wiring continuity and verify schematic functionality for wiring and terminations to facilitate functional electrical equipment installation.

D. Conform to NFPA 70, IEEE C2, and NETA ATS.

E. Site Testing (Prior to final Testing/Commissioning):

1. Date: After complete installation and wiring of all equipment, and during a period of time agreed to by Contractor and Contracting Officer.
2. Perform tests on individual items of equipment in advance of completion of electrical installation if desired by Contractor or by Contracting Officer.
3. Contracting Officer will not request tests on individual items that will require power in excess of that available for construction purposes.
4. The Government will pay cost of electric power for operational tests of electrical equipment.
5. Furnish all materials, including test instruments beyond those furnished under these specifications that are required for checkout and tests.
6. Notify the Government in writing at least 72 hours in advance of time each test on individual items of equipment is to be made in order that tests may be witnessed by Contracting Officer.
7. Check wiring of entire installation including all equipment supplied by Contractor.
8. Perform wiring checkout and tests in accordance with approved testing plan.
9. Use electrical schematic and wiring diagram check prints to perform internal wiring check of equipment and of external cabling.
10. Insure there are no discrepancies in drawings, equipment or wiring.
11. Include wire-by-wire, terminal-by-terminal (point-to-point) check for following:

a. Continuity.

b. Insulation resistance: Perform in accordance with Section 26 05 10 – Conductors and Cables.

c. Proper wire tagging at each end of insulated conductors.

d. Verify contact configuration and contact numbering.

e. Check conductors for insulation damage. Perform additional insulation resistance test of damaged conductors.

12. When necessary, make wiring changes, adjust settings, make equipment replacements, etc., required for proper functioning of installation to conform to requirements of specifications.

13. Examine and check all protective devices and sequence of operation of all controls for all electrical equipment for proper functioning and settings.

14. Provide drawings at jobsite for use by Contracting Officer that show electrical installation at time of examination; and instruction books, test reports, coordination curves, and manufacturer's data for electrical equipment installed.

    a. Provide the following drawings prior performing wiring checkouts and tests:

        1) Two complete sets of full-size (D-size) electrical schematic and wiring diagram check prints for equipment being tested.

            a) One set to be used and maintained by the Government.

            b) One set to be maintained by Contractor and used to produce final drawings.

15. While performing functions of testing and checkout, remove and replace wiring connections that may be required in processing of checkout; and make wiring changes, setting adjustments, equipment replacements, or other revisions which are necessary for proper functioning of installation.

16. Operational and Functional Testing:

    a. Perform after completion of wiring checkout of equipment being tested.

    b. If required, adjust and calibrate protective devices in accordance with specifications, and manufacturer's instructions and recommendations.

    c. Check electrical systems and controls for proper sequence of operation, correct adjustments and settings, and agreement with schematic diagram.

    d. Testing, calibration and programing of automation control equipment.

17. Furnish all materials, including test instruments beyond those furnished under these specifications that are required for checkout and tests.

18. Ensure there are no discrepancies in drawings, equipment or wiring.

19. When necessary, make final wiring changes, final adjustment settings, make equipment replacements, etc., required for proper functioning of installation to conform to requirements of specifications.

20. Provide drawings from the Site Testing for use by Reclamation that show final electrical installation at time of examination; and instruction books, test reports, coordination curves, and manufacturer's data for electrical equipment installed.

21. While performing testing/commissioning, remove and replace wiring connections that may be required in processing of checkout; and make wiring changes, setting adjustments, equipment replacements, or other revisions which are necessary for proper functioning of installation.

22. Operational and Functional Testing:

    a. If required, adjust and calibrate protective devices in accordance with specifications, and manufacturer's instructions and recommendations.

    b. Check electrical systems and controls for proper sequence of operation, correct adjustments and settings, and agreement with schematic diagram.

23. Replace wiring, instruments, or equipment that is damaged during final testing/commissioning.

END OF SECTION

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SECTION 26 08 00
COMMISSIONING OF ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of commissioning of electrical equipment in prices offered in the Price Schedule for other items of work.

1.02 SCOPE

A. Construction verification, field tests and functional performance testing as well as requirements for commissioning of the overall respective electrical systems, related subsystems and related equipment.

B. Division 25, Division 26, and Section 41 22 15 – Bridge Crane Electrical Components responsibilities and participation in the commissioning process.

1.03 DEFINITIONS

A. Construction Testing: Government Contract Quality Assurance, Contractor Quality Assurance / Quality Control, Contractor Field Quality Tests, and functional checkout at the equipment and device level. Refer to Section 01 46 00 – Quality Procedures.

B. Contractor Tests: Tests as required by other sections.

C. Factory Acceptance Test (FAT): Activity, including inspection and testing, to demonstrate that the system, subsystem, electrical equipment or component is in accordance with the specification and is typically conducted at the manufacturer's facility.

D. I/O: Input/Output.

E. Operational Commissioning: Functional tests including verification of electrical and mechanical systems, electrical metering, instrumentation readings, motors, drives, automation control, network devices and protective relay functional tests.

F. PLC: Programmable Logic Controller.

G. Pre-Check Out Tests: Functional, static checkout at the system level performed prior to energizing the unit, the equipment, and the incoming line. Includes system verification of electrical and mechanical systems, systematic functional testing, and verification of completion of required Construction Testing. Refer to Section 26 05 90 – Wiring Checkout and Tests.

H. Site Acceptance Test (SAT): Activity, including inspection and testing, conducted at the site of the site of installation, to demonstrate that the installation of system, subsystem, electrical equipment or component is in accordance with the applicable standards, codes, specifications and installation instruction. Test is performed to demonstrate proper functionality after delivery and installation.

I. SPD: Surge Protective Device.

J. VFD: Variable-Frequency Drive Motor Controller.

1.04 REFERENCE STANDARDS

A. Bureau of Reclamation (Reclamation)

1.	FIST 3-1-1991	Testing Solid Insulation of Electrical Equipment
2.	FIST 3-3-1991	Electrical Connections for Power Circuits
3.	FIST 3-8-2021	Operations, Maintenance, and Field Test Procedures for Protective Relays and Associated Circuits
4.	FIST 4-13-2011	Thermal Analysis

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 115 - 2019	Test Procedures for Synchronous Machines including Acceptance and Performance Testing and Parameter Determination for Dynamic Analysis
2.	IEEE 1248-2020	Guide for Commissioning of Electrical Systems in Hydroelectric Power Plants
3.	IEEE C2-2023	National Electrical Safety Code
4.	IEEE C62.34-2017	Test Methods and Performance of Low-Voltage Surge Protective Devices Used on Secondary Distribution Systems
5.	IEEE C62.62-2018	Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

C. International Society of Automation (ISA)

1.	ISA 62381-2011	Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)

D. International Electrical Testing Association, Inc. (NETA)

1.	NETA ATS-2021	Acceptance Testing Specifications

E. National Electrical Manufacturers Association (NEMA)

2. NEMA ICS 2.9-2002 — AC Vacuum-Break Magnetic Controllers Rated 1500 Volts AC

F. National Fire Protection Association (NFPA)

1. NFPA 70-2023 — National Electrical Code (NEC)

G. Underwriters Laboratories (UL)

1. UL 508-2018 — Industrial Control Equipment
3. UL 60947-4-1 - 2022 — Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters

1.05 DESIGN REQUIREMENTS

A. Commissioning forms shall be filled in as work progresses by the individuals responsible for installation and are included in the respective submittals per the Submittal Table 01 33 00A.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. Reference the following specifications for submittal requirements and submit in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data:

1. Section 25 00 01 – Automation Control System.
2. Section 25 12 10 – Programmable Logic Controller.
3. Section 26 05 10 – Conductors and Cables.
4. Section 26 05 20 – Grounding and Bonding.
5. Section 26 05 33 – Raceways and Boxes.
6. Section 26 05 90 – Wiring Checkout and Tests.
7. Section 26 24 42 – Distribution Panelboards.
8. Section 26 43 13 – Surge Protection Devices for Electrical Circuits.
9. Section 41 22 15 – Bridge Crane Electrical Components.
10. Section 41 22 16 – Crane Motors.

C. RSN 26 08 00-1, Schedule for Commissioning Tests:

1. See 1.08.A.6 for requirements.

1.07 PERFORMANCE REQUIREMENTS

A. Crane automation control systems are to be tested in their implementation to verify proper operation in accordance with contract specifications.

B. The SAT shall be performed after the delivery and installation of the system, equipment or components at the site.

C. Commissioning checks and tests are in addition to tests required by other sections.

D. Furnish materials, including test equipment, required for commissioning.

E. Replace defective equipment and make device setting adjustments as required for operation of electrical systems in accordance with Specifications and manufacturer's instructions.

F. If required during testing, remove and replace wire connections.

G. Make wiring changes, wire tag revisions, and other repairs or revisions during testing session if a discrepancy is discovered.

H. Perform commissioning in presence of Government.

I. Work shall be performed during an outage in accordance with Section 01 14 30 – Interruption of Service.

J. While performing testing/commissioning, remove and replace wiring connections that may be required in processing of checkout; and make wiring changes, setting adjustments, equipment replacements, or other revisions which are necessary for proper functioning of installation.

K. Replace wiring, instruments, or equipment that is damaged during final testing/commissioning.

L. Provide spare parts and extra materials prior to the commissioning of the crane.

M. Provide a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems.

N. The equipment provided and installed requires pre-check out tests and operational commissioning. Government may require commissioning and survey of additional equipment.

O. System components which will not be functionally performance tested but will be included in the commissioning scope for conformance to the design documents, verification of installation, and Contractor testing shall include:

1. Crane electrical components.
2. Distribution panelboards.
3. Control enclosures.
4. Surge protective devices.

5. Conductors, cables, raceways, and boxes.

P. Grounding system. Commissioning of automation controls system:

1. Perform proper configuration and tuning of controllers, programmable logic controllers and network components to ensure requirements are met and facility personnel is well prepared for operation and maintenance.
2. Verify each control device is installed and connected according to approved drawings. Each connection shall be verified and all safeties and sequences tested.
3. Controllers and PLCs shall be verified for the following:
   a. Steady-state errors minimized for set points.
   b. Responds with appropriate timing to disturbances.
   c. Remains stable under all operating conditions.
4. Proportional, PI and PID controller tuning parameters shall be verified using ultimate oscillation or first-order-plus-dead-time.

1.08 ROLES AND RESPONSIBILITIES

A. Contractor

1. Ensure cooperation and participation of specialty sub-contractors.
2. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
3. Attend Construction Phase coordination meetings.
4. Complete Commissioning Forms for all equipment.
5. Remedy any deficiencies identified in Commissioning Tests and notify COR in writing that deficiencies have been addressed.
6. Prepare preliminary schedule for inspection, SAT, Commissioning Tests, and update schedule as appropriate throughout the construction phase.
7. Provide a complete set of Final As-Built drawings to the COR.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. The Contractor(s) shall furnish all special tools and equipment required for testing and commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the COR for approval. Government will furnish necessary utilities for the commissioning process.

B. Proprietary Test Equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the

equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed.

PART 3 EXECUTION

3.01 METHOD AND ACCEPTANCE

A. Provide skilled technicians to start-up and debug all systems. These same technicians shall be made available to assist the Government in completing the tests. Work schedules, time required for testing, etc., shall be requested by the Contractor. Ensure that the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. Provide templates of copies of each commissioning form that will be used to perform tests to the Government 7 days prior to construction progress meetings.

C. Commissioning forms shall be completed for each installation phase and each electrical equipment, system and subsystem in accordance with contract specifications.

1. Provide a description of the work completed since the last entry.
2. Provide the percentage of the total work completed for each electrical system and finalization.
3. Circle “YES” or “NO” for each commissioning form item. Should the information requested for a device or component not apply to the phase of installation for the system, list it as “N/A”.
4. Provide explanation for all discrepancies, critical responses or “N/A” responses.
5. Upon one hundred percent completion of each installation is finalized and responses are filled out, document the following:
   a. Complete.
   b. Initials.
   c. Date timestamp.

D. Conform to FIST 3-1, FIST 3-3, FIST 3-8, NFPA 70, NETA ATS, IEEE C2, and IEEE 1248.

E. Government approval of commissioning dates is required prior to scheduling commissioning activities.

1. Notify COR in writing 28 days in advance of first commissioning activity.
2. Notify COR in writing 14 days in advance of each commissioning session.

F. Contractor shall have the following onsite at time tests and commissioning are performed:

1. Two sets of the Contractor's Record Drawings full-size (ANSI D) electrical schematic and wiring diagrams with field markups for equipment being tested. Sets to be maintained by Contractor and used to produce final as-built drawings.
2. Operation and maintenance instruction books and test reports for equipment being tested.
3. Field copy of approved Commissioning Test Plan and Procedures.

G. Perform wiring checkout and operational and function testing in accordance with Section 26 05 90 – Wiring Checkout and Tests prior to commissioning.

H. Government may verify any tests or retest.

I. Government may perform additional tests prior to energizing equipment, including be not limited to:

1. Crane Motors commissioning tests.
2. Bridge Crane Electrical Components tests.
3. Distribution Panelboards tests
4. Automation Control System function testing.
5. PLC and HMI testing.
6. Operational testing of any furnished equipment.

J. Document changes and update Final and As-Built drawings in accordance with Section 01 78 30 – Project Record Documents.

3.02 SITE ACCEPTANCE TEST

A. The SAT shall be performed after the delivery and installation of equipment, system, and sub-systems at the site. The SAT is performed to demonstrate the proper functionality.

B. Pre-SAT Activities:

1. Prior to conducting the SAT the relevant hardware or software components shall be delivered to the site and properly installed. The following items shall be completed during the installation of the automation system/subsystem/components before the SAT can be carried out:
   a. Hardware installation: all system components.
   b. Grounding system installed for the relevant equipment or device being tested.
   c. Review of software revisions, updates or modifications from FAT to date.
   d. System or equipment energization.
   e. Correct software or firmware installation.

C. Test Plan:

1. A written test plan and specification, developed and agreed to by owner and vendor in advance of testing, documenting:
   a. The tests to be conducted to ensure the relevant systems meet technical, operational, and performance requirements,
   b. The applicable acceptance criteria to be used for each test,
   c. Safety instructions,
   d. Necessary facilities/tools/hardware/software,
   e. Necessary manpower and support personnel,
   f. Who (owner or the vendor) is to perform each test.
2. The test plan shall address all of the following areas applicable to the specific project:
   a. Overall scope of the tests, including hardware, software, configuration/programming and documentation.
   b. Hardware, including installation, Check Prints, wiring/cabling, terminations.
   c. Software, including the loaded custom configuration, programs and graphics.
   d. FAT functional tests to be re-performed after installation.
   e. Security of the plant SCADA network.
   f. Tests to be performed after loop checks, such as interlock checks, complex functionality checks and sequence or batch checks.

D. Site Test Notification:

1. Government reserves the right to witness SAT. Notify Government at least 60 days in advance when tests are to be performed.

E. SAT Punch List

1. Reference to specification or SAT test plan requirement.
2. Description of the issue.
3. Person(s) responsible for resolution.
4. Description of the resolution and date completed.
5. Sign-off area for owner and the vendor for acceptance, if not recorded otherwise.

F. SAT Reports

1. Attendees.
2. Tests performed.
3. Results of all testing.
4. Open issues and agreements for resolution.
5. Acceptance as approved by COR.

6. Provided to Government within 21 days.

G. SAT Documentation

1. Copies of test plans.
2. Punch List with updated status of each item.
3. Documentation of hardware and software, including versions, tested.
4. Documentation of configurable parameters used.
5. Final complete system and application software.

3.03 COMMISSIONING

A. Work shall include, but not be limited to:

1. Crane motors, drives, automation control system, power distribution system, and control enclosures.
2. Operating breakers locally and remotely, confirming operation of protective relays, monitoring and alarm signals for proper operation, operating crane motors, variable frequency drives, operating switches and automation components to establish various crane configurations and operation of crane automation control system.
3. Date: After completion of Commissioning, and during a period of time agreed to by Contractor and COR.
   a. During each test of electrical system and equipment, the contractor's manufacturer's expert will be onsite and complete the commissioning tests.
4. Furnish all materials, including test instruments beyond those furnished under these specifications that are required for commissioning tests.
5. Use electrical schematic and wiring diagrams from the Record Documents for that particular electrical system, to perform any additional internal wiring check of equipment and of external cabling.
6. Ensure there are no discrepancies in drawings, equipment or wiring.
7. When necessary, make final wiring changes, final adjustment settings, make equipment replacements, etc., required for proper functioning of installation to conform to requirements of specifications.
8. Re-examine and check all protective devices and sequence of operation of all controls for all electrical equipment for proper functioning and settings.
9. Provide drawings from the Record Documents (for that particular electrical system or sub-system) for use by Reclamation that show final electrical installation at time of examination; and instruction books, test reports, coordination curves, and manufacturer's data for electrical equipment installed.
10. While performing testing/commissioning, remove and replace wiring connections that may be required in processing of checkout; and make wiring changes, setting adjustments,

equipment replacements, or other revisions which are necessary for proper functioning of installation.

11. Operational and Functional Testing:

    a. If required, adjust and calibrate protective devices in accordance with specifications, and manufacturer's instructions and recommendations.

    b. Check electrical systems and controls for proper sequence of operation, correct adjustments and settings, and agreement with schematic diagram.

    c. Testing, calibrating and programming shall be in conjunction with Government.

    d. Test the overall crane control system in manual mode, automatic mode and maintenance mode.

12. Replace wiring, instruments, or equipment that is damaged during final testing/commissioning.

B. Complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, conduits, duct, wire, insulation, controls, etc., per the contract specifications and related directives, clarifications, and change orders.

C. A Commissioning Plan shall be developed. The Contractor shall provide all necessary information pertaining to the actual equipment and installation. If contractor-initiated system changes have been made that alter the commissioning process, notify the COR.

D. Perform hot-phasing verification at various locations and stages of the process to verify proper operation and configuration of the system.

E. Document commissioning results on Government approved, Contractor supplied checklists and data logs.

F. Document changes and update operation and maintenance manuals to reflect final as-built conditions after commissioning.

G. Document changes to as-built schematic and wiring diagram drawings. If discrepancies are found in wire or cable tags, modify in accordance with Section 26 05 10 – Conductors and Cables and with approval from COR.

H. Contractor Lead Test Engineer:

1. Provide checklists and data logs for verification of test performed and passed.

2. Provide overall checklist and data log document.

3. Provide written procedures for testing and commissioning of Contractor provided equipment. Incorporate Manufacturer's recommended tests into the procedures. Government may dictate the order of the tests performed on equipment and systems.

4. Direct Contractor's personnel to perform tasks as outlined in the commissioning procedures.

5. Communicate directly with the COR designated Lead Test Engineer during onsite commissioning.

I. Complete, as determined by the Government, all required Construction Testing prior to Pre-Checkout Tests.

J. Notify Government, of time for each SAT/commissioning for each system, sub-system, electrical equipment and components. This will allow Government to get the appropriate personnel onsite to witness each test.

K. Use electrical schematic and wiring diagrams from the Record Documents for that particular electrical system, to perform any additional internal wiring check of equipment and of external cabling.

L. Insure there are no discrepancies in drawings, equipment, or wiring.

M. When necessary, make final wiring changes, final adjustment settings, make equipment replacements, etc., required for proper functioning of installation to conform to requirements of specifications.

N. Assist Government with commissioning and operational commissioning.

1. Pre-Checkout Tests: Testing responsibilities for the Contractor shall be assigned in accordance with approved Test Plan and Procedure report.

2. Operational Commissioning: Offline and online testing responsibilities for the Government and the Contractor will be assigned in accordance with approved Test Plan and Procedure report.

O. Contractor shall perform test activities as required by the Government to verify proper operation after corrections have been made.

1. Any changes made including, but not limited to programming changes shall require re-testing of all impacted control logic functions, devices, components and associated equipment.

P. Performance:

1. Commissioning tests shall ensure that interconnected systems function together to demonstrate the crane control philosophy and contract specification requirements.

2. Verification of the communication and interaction between subsystems or with other systems to ensure desired functional performance.

3.04 BRIDGE CRANE ELECTRICAL COMPONENTS

A. Site Acceptance Testing

1. Perform SAT for control panel, including a functional test of all equipment and affiliated I/O interfaced to the Automation Control System.

2. Full system test verifying functionality as outlined in Section 25 12 10 – Programmable Logic Controller.
3. Site acceptance testing in accordance with NETA ATS.
4. Site acceptance testing of unit shall be conducted after complete installation of equipment.
5. Site Test Procedures:
    a. Following completion of Government inspection, a performance test shall be satisfactorily performed for each crane control system. One copy of all final crane drawings and a preliminary operation and maintenance manual shall be made available at the test site.
    b. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify the Government before starting the motors.
    c. Test each motor for proper phase rotation.
    d. Perform each electrical test and visual and mechanical inspection stated in NETA ATS.
    e. Perform the following infrared (thermographic) scan tests and prepare reports:
        1) Perform infrared scan of each VFD. Remove front panels so joints and connections are accessible to scanner.
        2) Instruments and Equipment: Use an infrared scanning device designed to measure temperature to detect significant deviations from normal values.
    f. Test and adjust controls, monitoring and safeties. Replace damaged and malfunctioning controls and equipment.
    g. Where applicable, test VFD operation with Hoist Motor under lightly loaded conditions, low-speed operation and high-impact load testing.
    h. Test procedures shall define the tests required to ensure that the system meets technical, operational, and performance requirements.
    i. Support personnel provided during testing shall be familiar with the project and be capable of fixing problems identified during testing.
    j. Perform Site Acceptance Testing for PLCs and VFDs in accordance with requirements in ISA 62381.
    k. Perform 100 percent I/O checkout.
    l. Verify all validated software and hardware updates and patches are installed prior to start of functional testing.
    m. Test procedures shall define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, and supplies required.
        1) Any simulation programs, equipment, personnel, and supplies required shall be provided by the Contractor.

n. Provide test procedures for testing all process control system capabilities and functions specified.

o. Test Procedures shall cover actual equipment and sequences to be used for the specified project and include detailed instructions for test setup, execution, and evaluation of test results.

6. Conduct testing for acceptance after the erection work has completed.

7. Allow inspection of all parts of the crane containing electrical parts or moving mechanical parts.

8. Site Acceptance Test Reports:

a. With test results, include final calibrated engineering unit values and corresponding amperage for each endpoint of calibrated analog devices.

9. Perform field wiring checkout and test in accordance with Section 26 05 90 – Wiring Checkout and Tests.

10. Motor controllers and VFD shall be tested in accordance with IEEE 115, UL 508 and UL 60947-4-1:

a. Vacuum-break controllers:

1) Temperature-rise limits.

2) Dielectric properties tests.

3) Rated making and breaking capacity.

4) Endurance performance test.

5) Performance under short-circuit conditions.

6) Terminal performance test.

7) Short-time operating capability

8) Operation and operating limit tests.

9) Tests to be performed in accordance with NEMA ICS 2.9.

11. Acceptance Testing Preparation:

a. Test insulation resistance for each VFD element, bus, component, supply, feeder and control circuit.

b. Test continuity of each circuit.

12. Contractor's Self-Test:

a. The Contractor, at the Contractor's facility prior to Government witnessed factory acceptance test, shall test each major component. Testing and inspection shall include motors, motor controls, brakes, lights, speeds, limit switches, interlocks and wiring. Operationally test all drives. Once tests are completed, the Contractor shall notify the COR to schedule the Government representative witnessed factory acceptance test.

b. Test insulation resistance for each VFD element, component, motor supply and control circuits.

13. Inspections:

a. All test deficient items shall be resolved prior to shipment of the crane. The government reserves the right to inspect all equipment and Contractor's corrective actions performed.

b. The Contractor shall perform an inspection and complete no load operational tests. The Contractor shall ensure the crane controls meets this specification and systems are properly adjusted, operational and can be safely load tested.

c. Inspect VFD, wiring, components, connections and equipment installation. Test and adjust controllers, devices and equipment.

d. The Failure of the crane to pass any of the inspections shall be cause for rejection.

B. Commissioning

1. Program microprocessors and variable frequency drives for required operational sequences, status indications, alarms, event recording and display features. Clear events memory after final acceptance testing and commissioning tests.

2. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

3. Adjust the trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes. Where these maximum settings do not allow for starting of a motor, notify Government.

4. Performance Test with Characteristic Curve:

a. Test with 110 percent of the hoist capacity load.

b. Submit certificate of load test and compliance with OSHA requirements.

5. No Load Free Run Test.

6. Static and Dynamic Balancing Test.

7. Contractor is responsible for utilizing the ECF verification checklists supplied under Section 26 08 00 – Commissioning of Electrical Equipment in accordance with the procedures defined.

8. Government will review Contractor's test reports and if found acceptable will respond accordingly. Refer to Section 01 46 00 – Quality Procedures.

3.05 DISTRIBUTION PANELBOARDS

A. Site Acceptance Testing

1. Perform panelboards continuity and insulation tests after installation and before the panelboard is energized.
   a. Continuity tests using a DC device with buzzer.
   b. Insulation test using a 500-volt minimum insulation-resistance test set.
      1) Record readings after 1 minute and until readings are constant for 15 seconds.
      2) Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.
   c. Record test data. Include identification of panelboard and megohms readings verses time.

B. Commissioning

1. Adjust the trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes. Where these maximum settings do not allow for starting of a motor, notify Government.

3.06 SURGE PROTECTION DEVICES FOR ELECTRICAL CIRCUITS

A. Site Acceptance Testing

1. Contractor shall not perform insulation resistance tests with SPDs connected. Disconnect SPDs before conducting test, and reconnect immediately after tests are complete.
2. General:
   a. Perform SAT in accordance with manufacturer's recommendations. In addition, include the following:
      1) Visual Inspection and Tests:
         a) Compare equipment nameplate data with specifications and approved drawings.
         b) Verify that disconnecting means and feeder size and maximum length to SPD corresponds to approved drawings.
         c) Verify tightness of accessible bolted electrical connections via calibrated torque-wrench.
         d) Vacuum-clean enclosure interior.
         e) Verify the correct operation of all sensing devices, alarm outputs and status indicators.
   b. Wiring checkout and tests in accordance with Section 26 05 90 – Wiring Checkout and Tests.

c. Site acceptance testing in accordance with IEEE C62.34 and IEEE C62.62.

d. Site acceptance testing of unit shall be conducted after complete installation of equipment.

3.07 RACEWAYS AND BOXES

A. Site Acceptance Testing

1. After delivery, with Contracting Officer witness:

   a. Inspect physical and mechanical condition.

   b. Verify conduit types, sizes and quantities match approved data.

2. Acceptance at discretion of Contracting Officer.

3.08 CONDUCTORS AND CABLES

A. Commissioning:

1. Demonstrate continuity and proper function of field devices and systems impacted by the removal and installation of cables and conductors.

3.09 AUTOMATION CONTROL SYSTEM

A. Site Acceptance Testing:

1. Government will witness test. Notify COR in writing at least 28 days prior to test.

2. SAT shall be completed concurrently and in accordance with requirements outlined in Section 41 22 15 – Bridge Crane Electrical Components, Section 41 22 16 – Crane Motors, Section 25 12 10 – Programmable Logic Controller and as specified herein.

3. Demonstrate the functionality, performance and stability of the hardware and software before turning over the system.

4. A witnessed Site Acceptance Test shall be performed on the completed Automation Control System.

   a. The System Integrator standard test forms shall be submitted for review by the Government, including complete test procedure and forms.

   b. Each feature and function of the control system shall be documented on the test forms and shall be tested and demonstrated to the satisfaction of the Government. All revisions made to the crane control system operation shall be approved by the Government prior to final acceptance.

   c. The testing program shall be conducted in accordance with the prior approved procedures and shall be witnessed and signed off by both the System Integrator and COR upon satisfactory completion.

5. All special testing materials and equipment required to demonstrate compliance with the specification shall be provided under the scope of this Section. Where it is not practical to

test with real process variables, provide suitable means of simulation. These simulation techniques shall be subject to the approval of the COR.

6. Coordinate all testing with other associated suppliers and subcontractors.
7. The Government will furnish a discrepancy list to the Contractor 45 days after the test.
8. Contractor shall resolve discrepancy, deliver required documentation and complete other contract requirements associated with the equipment.
9. Perform bench and throughput testing of all installed systems and equipment.
10. Perform field wiring checkout and functional test in accordance with Section 26 05 90 – Wiring Checkout and Tests.
11. Communication Links:
    a. Verify communication links between devices.

B. Commissioning:

1. Commissioning tests shall be completed concurrently and in accordance with requirements outlined in Section 41 22 15 – Bridge Crane Electrical Components, Section 41 22 16 – Crane Motors, Section 25 12 10 – Programmable Logic Controller and as specified herein.
2. Commissioning testing shall be a joint effort between the Contractor and Government personnel.
    a. Contractor to verify that commissioning tests are sufficient to safely and adequately test the new panels and automation controls.
    b. Contractor to suggest modifications to test routines or additional test routines based on contractor's experience.
    c. Provide field service engineer for testing; and to make programming adjustments and modifications, wiring changes, and equipment or device replacements required for successful commissioning of new equipment.
    d. Provide 30 days notice prior to beginning commissioning tests.
    e. Commissioning test duration will not exceed 28 calendar days for the first crane and 14 calendar days for the subsequent units.
    f. Government will provide Job Hazard Analysis.
    g. Contractor will provide commissioning test procedure.
3. Contractor to demonstrate that the system was fully tested during assembly and installation and is a functioning, integrated and reliable control system.
4. Provide crane operators with initial system training.
    a. Purpose: Instruct operators in the basic knowledge needed to operate the equipment during the time period following commissioning and before the formal training session takes place.
    b. Demonstrate operational sequences and answer questions about the new equipment.

c. Ensure operators are familiar and comfortable with standard operational sequences.

d. Provide written operations checklists and or procedures as necessary.

e. Verify completion of this testing with the COR.

5. Document changes and update Government copies of operation and maintenance manuals and software to reflect final as-left conditions after commissioning.

6. Submit completed, signed and approved Electrical Commissioning Forms to the COR and Reclamation.

7. The Government and COR will provide written acceptance after commissioning testing, Electrical Commissioning Forms submitted, and all discrepancies have been resolved.

8. Provide labor for adjustments and modifications during commissioning tests.

9. Demonstrate continuity and proper function of field devices and systems impacted.

10. Demonstrate operation of graphic displays and HMIs.

11. Check process timing sequences and make adjustments where necessary to improve systems operation.

12. Adjust logic, settings, and HMIs.

13. Verify logic and operation of the system.

END OF SECTION

SECTION 26 24 42
DISTRIBUTION PANELBOARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Distribution Panelboards:

1. Payment: Lump-sum price offered in the Price Schedule.

1.02 REFERENCE STANDARDS

A. Federal Specifications (FS)

1.	FS W-C-375D	Circuit Breakers, Molded Case; Branch Circuit and Service

B. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C37.16-2009	Low-Voltage Power Circuit Breakers—Preferred Ratings, Related Requirements, and Application Recommendations
2.	IEEE C62.41.1-2008	Surge Environment in Low-Voltage (1000V and less) AC Power Circuits

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2020	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA AB 3-2013	Molded Case Circuit Breakers and Their Application
3.	NEMA ATS-2021	Standard for Acceptance Testing Specifications for Electric Power Equipment and Systems
4.	NEMA PB 1-2011	Panelboards

D. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL)

1.	UL 50-2015	Enclosures for Electrical Equipment, Non-Environmental Considerations
2.	UL 67-2018	Panelboards

3.	UL 489-2016	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
4.	UL 1449-2021	Surge Protective Devices

1.03 SCOPE

A. Provide new distribution panelboards to be surface mounted in appropriate areas nearby new crane installation.

1.04 DESIGN REQUIREMENTS

A. Design distribution panelboard to replace existing panelboards and for new equipment.

B. The Contractor shall design and verify the correct type of circuit breakers are provided and sized properly for the circuits being served.

C. The Contractor shall verify that all equipment will fit physically within the space allotted.

D. Equip the panelboard assembly with all appurtenances and accessories as required for interface with the crane automation control system to provide a totally integrated and operable system.

E. Design Distribution Panelboards:

1. Include Main Supply Disconnect Circuit Breaker.

F. Design distribution panelboards to facilitate use of new branch circuit cables, raceways and conduits.

G. Provide a surge protective device served from an overcurrent protective device.

H. The panelboard and overcurrent devices contained within shall be fully-rated.

I. Panelboards installed shall utilize a standard dead front cover.

J. Conform to IEEE, NEMA and NFPA 70.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 26 24 42-1, Approval Drawings and Data (Government Format):

1. Manufacturer’s technical catalog data.

2. Layout drawings: scaled arrangement drawings of all panel front and internal-mounted devices. Show all mounting details required. Deviations from approved arrangements require resubmittal and approval prior to installation.

3. Wiring diagram for crane including but not limited to: switches, lights, breakers, terminals, transformers and surge protection devices. Diagrams shall indicate the terminals for remote devices. Wire and terminal numbers shall be included.

4. Bills of material for each device or component of equipment.

5. Circuit directory for each distribution panelboard.

6. Installation and maintenance instructions.

7. Include outline and support point dimensions, voltage, main bus ampacity, circuit breaker arrangement and sizes, and interrupting ratings confirming a fully-rated system for all equipment and components.

C. RSN 26 24 42-2, Factory Test Report.

D. RSN 26 24 42-3, Site Acceptance Test Report.

E. RSN 26 24 42-4, Commissioning Test Reports for Distribution Panelboards:

1. Certification of commissioning test results of Distribution Panelboards including the following:

a. Provide records of clearances, measurements, test results and position or state of all components at conclusion of commissioning activities.

b. List of Contractor and Government personnel performing and witnessing the commissioning.

c. Summary narrative of the commissioning of each set of tests shall be separated by equipment and systems.

d. Results for all tests approved by the Government.

e. Results for any other tests performed during commissioning.

1.06 EXTRA MATERIALS

A. Spare Parts:

1. Deliver spare parts within seven days after the installation of those parts for which spares are required.

a. Furnish spare parts listed in Table 26 24 42A – Spare Parts

Table 26 24 42A – Spare Parts

Item	Description	Quantity
1	Handle lock-off	2
2	Circuit breakers	2 of each type

PART 2 PRODUCTS

2.01 DISTRIBUTION PANELBOARD

A. Conform to NEMA PB 1, NFPA 70, UL 50, and UL 67.

B. Pow-R-Line 4 manufactured by Eaton Corp, 1000 Cherington Parkway, Moon Township, PA, 15108; or equal, having following salient characteristics:

1. Enclosure:
   a. Type 12 in accordance with NEMA 250 with hinged door.
   b. Conduit entry: Top, bottom and rear entry via conduit knockouts.
   c. No. 14 gage steel, minimum.
   d. Flange formed doors. Doors shall include provisions for padlocking all breakers in the open position.
2. Panel finish shall conform to Section 09 96 20 – Coatings.
3. Voltage and System:
   a. 480 Volt, 3φ, 4 wire, 60 Hz.
   b. 120 Volt, 1φ, 3 wire, 60 Hz.
4. Main Bus:
   a. Material: Tin plated Copper. Access for tightening connections shall be from the front, without the need for tools on the rear of the connection.
   b. Continuous current: 225 amperes, minimum.
   c. Momentary current: 8,000 amperes, symmetrical, minimum.
5. Mounting: Surface-mounted, on crane walkway.
6. Provide Distribution Panelboards as required for all loads.
7. Circuit Directory:
   a. Show breaker number and connected load.
   b. Use computer generated lettering in capital letters for directory entries. Handwritten directory entries are not acceptable.

c. Directory to provide the following information:

1) Panel name.

2) AIC rating.

3) Supply circuit number and panel name.

4) Volts, amps, phase, wire, and date printed.

8. Nameplate:

a. As indicated on Standard Drawing No. 40-D-6234 and 40-D-5324.

b. Engraved Nameplates:

c. Text: "DGA".

1) Material: Laminated Plastic

2) Color: Black, engraved to white core.

d. Provide nameplates for all circuit breakers.

9. Ground Bus:

a. Copper.

b. Sufficient length for attaching equipment ground conductors.

10. Conform to NEMA PB 1, NFPA 70, UL 50, and UL 67.

11. The circuit breakers are to be front accessible and mounted in the panelboard to permit installation, maintenance and testing without reaching over line side bussing. The circuit breakers are to be removable by the disconnection of only the load side terminations.

12. Line and load side connections are to be individual to each circuit breaker.

13. A minimum of 25 percent future circuit breaker spaces shall be included.

a. Spaces for future circuit breakers shall be "prepared" spaces.

b. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future breakers are added, only the breaker itself needs to be purchased by the installer.

14. Provide panelboard front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim.

15. Incoming conductors shall terminate at lug landing pads rated for the panelboard.

16. Provide compression type lugs to accommodate conductors.

17. All panelboards provided under this section shall be by the same manufacturer.

2.02 CIRCUIT BREAKERS

A. Refer to Section 41 22 15 – Bridge Crane Electrical Components.

2.03 SURGE PROTECTION DEVICE

A. Refer to Section 26 43 13 – Surge Protection Devices for Electrical Circuits for requirements.

2.04 WIRING

A. Refer to Section 26 05 10 – Conductors and Cables.

2.05 FABRICATION

A. Mount ground bus at bottom of panelboard enclosure. Bond bus to enclosure.

B. Mount circuit directory on inside of door.

C. Dimensions: Contractor to determine.

D. Provide boards with easily removable or hinged front panels so incoming cables may be easily connected or disconnected and inspected.

E. Equip door with locks, latches, and concealed hinges to allow doors to open 105 degrees, minimum, from fully closed position. Key all locks alike with identifying number stamped on each key. Provide five keys.

F. Circuit Directory:

1. Prepare circuit directory for each board, indicating "as-built" conditions.
2. Include board designation, breaker numbers and descriptions of connected loads indicated in their relative physical location.
3. Show breaker number and connected load.
4. Use machine lettering for directory entries. Do not provide pencil or handwritten directory entries.
5. Mount directory in transparent plastic front on inside surface of access doors for each board.
6. Fabricate circuit directory frame such that directory need not be folded when placed in frame, and such that all information on directory is clearly visible and legible.

G. Fabricate frames and enclosures of sheet steel with sufficient weight and strength to ensure permanent rigidity and alignment.

H. Hide butt joints on outside surfaces.

I. Hide holes or fasteners be from front of boards for rear-of- board-mounted equipment.

J. Support bus bars by structural frames. Do not depend on breakers for support.

2.06 CONTRACTOR SOURCE QUALITY TESTING

A. Dielectric test in factory in compliance with NEMA PB 1, as applicable.

B. Test circuits before shipment to demonstrate correctness of completed wiring connections and proper functioning of devices.

PART 3 EXECUTION

3.01 FIELD ACCEPTANCE

A. After delivery, coordinate with COR as witness:

1. Inspect physical and mechanical condition.
2. Inspect anchorage and alignment.
3. Verify equipment sizes, ratings, and quantities match approved drawings and data.
4. Operate circuit breakers to ensure smooth operation.
5. Verify wring connections are tight and secure.
6. Verify equipment is clean and has no loose parts or debris.

B. Acceptance at discretion of Project Manager and COR.

3.02 INSTALLATION

A. Install per manufacturer's instructions.

B. Flush mount panelboard so that no operating handle is less than 30-inches or more than 72 inches above finished floor.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed circuit directory for each panelboard per NFPA 70 408.4(A).

E. Ground and bond in accordance with NFPS 70.

F. Make conduit and cable connections in knockout locations.

3.03 SITE ACCEPTANCE TESTING

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.04 COMMISSIONING VERIFICATION

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.05 FINAL AS-BUILTS

A. Final As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents.

B. Marked prints of specifications drawings indicating "Final As-Built" changes made to electrical conduit during construction.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION DEVICES FOR ELECTRICAL CIRCUITS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Surge Protection Devices for Electrical Circuits:

1. Payment: Lump sum price offered in the Price Schedule.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM D638-2022	Standard Test Method for Tensile Properties of Plastics
2.	ASTM D790-2017	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

B. Code of Federal Regulations (CFR)

1.	29 CFR 1910	Occupational Safety and Health Standards

C. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE C62.34-2017	Test Methods and Performance of Low-Voltage Surge Protective Devices Used on Secondary Distribution Systems
2.	IEEE C62.41.1-2008	Guide on the Surge Environment in Low-Voltage AC Power Circuits.
3.	IEEE C62.41.2-2002	Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
4.	IEEE C62.45-2008	Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
5.	IEEE C62.62-2018	Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

D. National Electrical Manufacturers Association (NEMA)

1. NEMA SPD 1.1-2019 — Part 1 – Surge Protective Device Specification Guide for Low Voltage Power Distribution Systems

E. National Fire Protection Association, Inc. (NFPA)

1. NFPA 70-2023 — National Electrical Code (NEC), Article 285

F. Underwriters Laboratories, Inc. (UL)

1. UL 1283-2017 — Electromagnetic Interference Filters
2. ANSI/UL 1449-2021-5th Ed. — Standard for Safety Surge Protective Devices

1.03 SUBMITTALS

A. In accordance with Sections 01 33 00 – Submittals, 01 33 26 – Electrical Drawings and Data, and 01 78 30 – Project Record Documents.

B. RSN 26 43 13-1, Product Data:

1. Provide all SPD data necessary to show device compliance with all product specifications.
2. Manufacturer's technical catalog data, including indication of which part or model is being supplied.
3. Include data sheet sheets demonstrating SPD performance, weight, dimensions, connections and mounting requirements along with installation instructions.

C. RSN 26 43 13-2, Approval Drawings and Data (Government Format):

1. Provide schematic diagrams which are specific to the installation. Do not use "typical" schematic diagrams to cover multiple installations or pieces of equipment.
2. Schematic diagram to show all portions of the actual circuitry, regardless of whether the circuitry is located within the enclosure or at another location.
3. Provide wiring diagrams for the installation.
4. Provide equipment layout drawing for the installation.
5. Bill of Material.
6. Provide nameplate list for all nameplates.
7. Certification by the manufacturer that the SPDs conform to the requirements of contract specifications.
8. Certification by the contractor that the SPDs have been correctly installed.
    a. Include Electrical Commissioning Form ECF-26 43 13 – Surge Protection Devices.

D. RSN 26 43 13-3, Final Schematics and Wiring Diagrams (Government Format):

1. Provide schematic diagrams specific to the installation for all items and systems in Part 2 Products of the following Sections:

   a. Section 25 12 10 – Programmable Logic Controller.

   b. Section 41 22 15 – Bridge Crane Electrical Components.

   c. Section 26 24 42 –Distribution Panelboards.

2. Generic "typical" schematic diagrams to cover multiple installations or pieces of equipment will not be accepted.

3. Schematic diagram to show all portions of the actual circuitry, regardless of whether the circuitry is located within the enclosure or at another location.

4. Provide wiring diagrams for the installation in accordance with 104-D-1165.

E. RSN 26 43 13-4, Operations and Maintenance Manual.

1. Include data sheets for all products.

2. Include instruction manuals for all products.

3. Include installation manuals for all products.

4. Include approved final schematics, wiring diagrams, and layout drawings submitted and approved in RSN 26 43 13-3.

1.04 DEFINITIONS

A. Clamping Voltage: Voltage measured at the end of the output leads and from the zero voltage reference to the peak of the surge when the applied surge is induced at the 90 degree phase angle of the applied system frequency voltage.

B. SPD: Surge Protective Device.

C. I/O: Input/Output.

D. Maximum Surge Current: Maximum microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage.

E. MCOV: Maximum Continuous Operating Voltage, maximum steady-state voltage at which the SPD device can operate within its rated temperature.

F. PLC: Programmable Logic Controller.

G. VAC: Volts Alternating Current.

H. VPR: Voltage Protection Rating

1.05 DESIGN REQUIREMENTS

A. Modular design with field-replaceable modules.

B. Provide redundant suppression circuits.

C. In compliance with 29 Code of Federal Regulations 1910.7.

D. The surge protective device (SPD) shall be designated a location Type 1 or Type 2 device for intended installation on the load side of the service equipment overcurrent device, including SPDs located at each panelboard and control enclosure.

1. Type 5 Component for automation control system devices.

E. SPD's shall be connected in parallel with the new distribution system.

F. SPD's shall be designed for each unique circuit they will be utilized in.

G. The SPD's shall have Protection Modes for the following:

1. Three-phase grounded wye configured system:
   a. Line to neutral (L-N).
   b. Line to ground (L-G).
   c. Line to line (L-L)
2. Three-phase delta configured system:
   a. Line to Line (L-L).
   b. Line to Ground (L-G).

H. SPD's installed within enclosures shall have adequate spacing to allow for air flow in accordance with each enclosure's manufacturer recommended installation instructions.

I. SPDs shall be connected through a multi-pole circuit breaker or fused disconnect switch:

1. Distribution panelboard: 60 Amperes, minimum.
2. Control enclosure: 30 Amperes, minimum.

1.06 QUALITY ASSURANCE

A. Manufacturer:

1. Have been in the Surge Protective Device industry for a minimum of 5 years.
2. Regularly engaged in manufacture of similar items.

1.07 WARRANTY

A. The manufacturer shall provide a minimum 5 years warranty from the date of shipment of the SPD.

PART 2 PRODUCTS

2.01 SURGE PROTECTIVE DEVICE

A. Type 1 or Type 2, SPD.

B. VPR, UL 1449 listed and shall not exceed the following:

1. 208Y/120 Volt applications: 600V L-N, 700V L-G; 1200V L-L.
2. 480Y/277 Volt applications: 1200V L-N, L-G, N-G; 1800V L-L.
3. 480 Volt delta applications: 2000V L-G, 2000V L-L.

C. Nominal Discharge Current in accordance with UL 1449 and IEEE C62.62 for the following applications:

1. Distribution panelboards: 20 kAIC, minimum.
2. Control enclosures: 10 kAIC, minimum.

D. Short Circuit Current Rating: In accordance with UL 1449.

E. Surge Current Ratings as specified in IEEE C62.41 for the following applications:

1. Distribution panelboards: 100 kA per mode, 200 kA per phase.
2. Control enclosures and Type 2 locations: 50 kA per mode, 100 kA per phase.

F. Visual Status Indicators:

1. LED.
2. Externally visible.
3. Indicate online status for each phase.
4. Protection status.

G. Alarm outputs:

1. Audible diagnostic monitoring.
   a. Silencing switch.
2. Two sets of normally open and normally closed Form-C contacts compatible with I/O modules as defined in Section 25 12 10 – Programmable Logic Controller.
   a. For remote monitoring

b. Audible alarm silencing.

c. Contacts shall reverse on failure of any surge or opening of any current-limiting device.

H. Provide Four-digit transient event monitor inputs into valve automations control system PLC.

I. Bolted compression lugs for internal wiring.

2.02 SPD FOR INSTRUMENTATION AND CONTROL CIRCUITS

A. Type: 4, SPD.

B. UL 1449 and 183 Listed.

C. Application:

1. Incoming 120 Volts power to all control enclosures.
2. Line side of 120 Volts power terminals to PLCs, Remote I/O, and networking devices.

D. Design:

1. Mounted internally to control enclosures for point-of-use loads.
2. MOV based or multi-stage hybrid solid state high performance suppression system.
3. Designed for series connection.
4. C Sinewave tracking to provide EMI/RFI filtering
5. Visual or audible alarms upon failure.
6. Dry contacts for remote monitoring.

E. Operating Voltage: 120 VAC.

F. Operating Current: 5 to 15 Amperes, minimum.

G. Operating Frequency: 45 to 65 Hz.

H. Enclosure: Metallic or plastic, flange or DIN rail mounting.

I. Modes of Protection: All modes, L-N, L-G, L-L and N-G.

J. Short Circuit Current Rating: 5000 Amperes.

K. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.

L. Maximum Discharge Current in accordance with UL 1449 and IEEE C62.62:

1. 52,000 Amperes.

M. Minimum repetitive surge current capacity: 1000 impulses with no degradation of more than 10 percent deviation of clamping voltage.

N. Noise Filtering: -20 dB to -40 dB at 100 Mhz.

O. Fusing: Integral component level short circuit thermal overload protection.

P. Maximum clamping voltage in accordance with IEEE C62.41 and IEEE B3 combination wave of 250 percent of system voltage.

Q. Environmental:

1. Operating Temperature: -10 degrees C to 60 degrees C.
2. Relative Humidity: 5 to 95 percent, non-condensing.

2.03 LOW VOLTAGE SIGNAL LINE

A. General:

1. Mounted internally to control panels for protection of equipment connected to data lines (RS-485, RS-232, telephone line).
2. Multi-stage hybrid solid state high performance suppression system.
3. Designed for series connection.
4. DIN rail mounting.

B. Application:

1. On both ends of data lines that interconnect devices that are locked outdoors or in remote buildings or vault structures where the conductors are routed above grade or underground.

C. UL 497B Listed.

D. Maximum continuous operating voltage: Less than 130 percent of system peak voltage.

E. Maximum surge current: 10,000 Amperes.

F. Minimum repetitive surge current capacity:

1. The SPD shall meet one of the following:
   a. 1000 occurrences of 200A, 10 x 1000 microsecond waveform.
   b. 400 occurrences of 500A, 10 x 1000 microsecond waveform.
   c. 100 occurrences of 400A, 10 x 7000 microsecond waveform.
   d. 100 occurrences of 2000A, 8 x 20 microsecond waveform.

e. 100 occurrences of 10,000A, 8 x 20 microsecond waveform.

G. Maximum clamping voltages for all modes of protection:

1. The SPD shall meet one of the following:

a. 400A, 10 x 700 microsecond waveform: 400 percent of system voltage.

b. 10,000A, 8 x 20 microsecond waveform: 400 percent of system voltage.

c. IEEE B3 combination wave: 250 percent of system voltage.

2.04 NAMEPLATES

A. Nameplates:

1. Provide nameplates in accordance with Standard Drawing 40-D-6234 for each SPD.

2.05 SOURCE QUALITY CONTROL

A. Government reserves the right to inspect device at supplier's manufacturing plant prior to final testing.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with requirements in NFPA 70.

B. Installation shall be completed in a neat and workmanlike manner in accordance with NFPA 70.

1. All damage to SPDs shall be replaced.

2. All damage to enclosures or installation area shall be repaired and left in a finished condition.

C. Provide conductors where necessary for a complete functional system.

D. Install SPD's in accordance with manufacturer's written instructions, NEMA SPD 1.1 and IEEE C62.62.

E. Assemble, level, and secure devices in position parallel-connected to panelboard or control enclosure being protected.

F. Keep lead length as short as practicable and shall not exceed manufacturer's recommended lead length.

1. Contractor shall not bond neutral to ground.

G. Nameplates and Labels: In accordance with Standard Drawing 40-D-6234.

H. Type 1 SPD:

1. Provide on the following applications:

a. 120 VAC power to all control enclosures.

b. Line side of 120 VAC power terminals to equipment.

2. Connected in series with the panel or branch circuit.

3. Provide fuse protection as recommended by manufacturer.

4. Connect all SPDs in the panel to the same grounding point.

I. Type 4 SPD:

1. Provide on the following applications:

a. On both ends of data lines that interconnect devices that are locked outdoors or in remote buildings or structures where the conductors are routed above grade or underground.

2. Connected in series with the equipment.

3. Verify SPDs in series resistance and capacitance does not interfere with the data line signal.

J. Cable and Wire Identification: In accordance with Section 26 05 10 – Conductors and Cables.

K. Conduit connections in accordance with Section 26 05 33 – Raceways and Boxes.

L. Cable connections in accordance with Section 26 05 10 – Conductors and Cables.

3.02 SITE ACCEPTANCE TEST

A. Contractor shall not perform insulation resistance tests with SPDs connected. Disconnect SPDs before conducting test, and reconnect immediately after tests are complete.

B. General:

1. Perform SAT in accordance with manufacturer's recommendations. In addition, include the following:

a. Visual Inspection and Tests:

1) Compare equipment nameplate data with specifications and approved drawings.

2) Verify that disconnecting means and feeder size and maximum length to SPD corresponds to approved drawings.

3) Verify tightness of accessible bolted electrical connections via calibrated torque-wrench.

4) Vacuum-clean enclosure interior.

5) Verify the correct operation of all sensing devices, alarm outputs and status indicators.

2. Wiring checkout and tests in accordance with Section 26 05 90 – Wiring Checkout and Tests.

3. Site acceptance testing in accordance with IEEE C62.34 and IEEE C62.62.

4. Site acceptance testing of unit shall be conducted after complete installation of equipment.

C. Site Test Procedures:

1. Test procedures must define the tests required to ensure that the system meets technical, operational, and performance requirements.

2. Support personnel provided during testing shall be familiar with the project and be capable of fixing problems identified during testing.

D. Site Test Notification:

1. Government reserves the right to witness SAT. Notify government at least 60 days in advance when tests are to be performed.

E. Site Acceptance Test Reports:

1. Provided to the Government within 21 days.

2. List of all SPDs tested and results of each test.

3.03 COMMISSIONING VERIFICATION

A. Document changes and update Government copies final as-built drawings.

B. Submit completed and approved commissioning forms.

3.04 FINAL AND AS-BUILT DRAWINGS

A. Final and As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents.

1. Marked prints of specifications drawings indicating “Final As-Built” changes made to electrical conduit during construction.

3.05 END OF TRAINING

A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of each SPD, on the date requested by the COR.

END OF SECTION

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SECTION 41 22 13
REMOVAL OF EXISTING CRANE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Remove Existing 30 Ton Bridge Crane:

1. Payment: Lump sum price offered in the Price Schedule.
   a. Includes, but not limited to the following:
      1) Removal and disposal of used oil.
      2) Coatings and Equipment with coatings Containing Regulated Metals.
      3) Crane access ladder cage.
      4) Removal and disposal of existing electrical equipment.

B. Remove and Dispose 30 Ton Bridge Crane Runway Rails:

1. Payment: Lump-sum price offered in Optional Price Schedule 2.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals.

B. RSN 41 22 13-1, Report and Plan:

1. Report of Conditions:
   a. Report items not designated for replacement that require repair or replacement to ensure safe and trouble-free operation of the crane.
   b. Include proposed recommendations to remedy problems found with the items not designated for replacement.
2. Plan for Equipment Removal:
   a. Describe equipment required for removal of crane equipment.
   b. Include estimated crane equipment weights and removal equipment weights.
   c. Provide a procedure including the methods and step by step instructions on removal of crane and crane equipment.
   d. Submit a removal schedule.

C. RSN 41 22 13-2, Existing Condition As-Built Drawings:

1. Submit in accordance with 01 33 26 – Electrical Drawings and Data.
2. As-built drawings for existing panelboards, distribution equipment, wiring and connections within the Contractor's scope of work.

1.03 GENERAL

A. In accordance with Section 26 05 02 – Basic Electrical Materials and Methods.

B. Remove and dispose of existing crane equipment, distribution equipment, conductors and cables.

C. Existing Condition As-Built Drawings

1. Contractor shall develop as-built drawings based on site investigation of existing wiring and existing drawings for crane system.
2. Contractor shall request the necessary outages for as-built data gathering in accordance with Specifications Section 01 14 30 – Interruption of Service.
   a. A single site investigation for data gathering is permissible for crane.
   b. Contractor shall define scope of investigation and provide this information with the outage request.
      1) List all cabinets, areas and equipment that require Contractor access.
3. Demolition, installation or modification activities are prohibited until the associated Existing Condition As-Built Drawings, and other RSN approval requirements in this executed contract, are submitted by the Contractor and approved by the Government.

1.04 PROJECT CONDITIONS

A. Hazardous materials:

1. Asbestos: See Table 51 02 82-A for a listing of equipment with materials containing non-friable asbestos.
2. Equipment with coatings contain regulated metals. See Table 51 02 82-A.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Provide equipment, materials, and containers required for disassembly and removal of equipment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Perform survey and inspection in advance of other on-site work.

B. Notify the COR immediately upon finding defective or damaged equipment so that corrective actions can be started quickly.

3.02 REMOVAL AND DISPOSAL OF MATERIALS

A. Comply with requirements of:

1. Section 02 82 20 – Removal and Disposal of Asbestos Containing Materials.
2. Section 02 83 33 – Recycling of Scrap Metal with Coatings Containing Hazardous Materials.
3. Section 02 87 20 – Removal and Disposal of Used Oil.

B. Obtain electrical outage in accordance with Section 01 14 30 – Interruption of Service.

1. Government will establish clearance and lock-out, tag-out of equipment in accordance with RSHS.

C. Remove and dispose the following existing equipment:

1. Perform asbestos abatement for crane per Section 02 80 10 – General Requirements for Hazardous Materials and Section 02 82 20 - Removal and Disposal of Asbestos Containing Materials.
2. Drain and dispose of oil and brake fluid in accordance with Section 02 87 20 – Disposal of Used Oil.
3. Dispose of coated metal equipment in accordance with Section 02 83 33 – Recycling of Scrap Metal with Coatings Containing Hazardous Materials.
4. 30-Ton capacity bridge crane in the Folsom Dam Warehouse. Include ancillary materials.
   a. Includes the cage on the crane access ladder mounted on the North wall of the Pump-Generating Plant.
5. Conductor rail electrification system up to and including their main power disconnect switches on the South wall of the Warehouse.
6. If deemed necessary by the rail survey, see Sections 41 22 14 – Bridge Crane, remove and dispose of the existing runway rails.
   a. Includes rail clips, nuts, bolts, sole plates, splice bars and other associated hardware.
   b. Dispose of removed equipment in accordance with Section 02 83 33 – Recycling of Scrap Metal with Coatings Containing Hazardous Materials.

c. Reuse existing mounting bolts where possible.

D. Preserve the following existing equipment for historical purposes:

1. Manufacturer identification markings.
2. Rated load markings.
3. Coordinate with COR on storage location.

E. Following removal of existing equipment, thoroughly clean and degrease areas by steam vapor or pressure washing:

1. Protect remaining equipment from fouling damage during cleaning.
2. Contain, collect, and dispose of non-hazardous waste from cleaning operations in accordance with Section 01 74 00 – Cleaning and Waste Management.

3.03 EXISTING CONDITION AS-BUILT DRAWINGS

A. Generate Existing Condition As-Built Drawings documenting the following, minimum, information for all equipment, components, or connections that the Contractor will modify or demolish. Where existing Government drawings are available.

1. Contractor shall verify all external cable and conductors connections to and from the existing crane. Include the following information:
   a. For multi-conductor cables and single conductors:
      1) The cable tag or label. Tags and labels shall be legible.
      2) The cable jacket color and type.
      3) The number of conductors in the cable.
      4) The AWG or kcmil size for all conductors.
      5) The insulation color and type for each conductor in the cable.
      6) The termination location for each conductor in the cable.
         a) Note the terminal block designator and specific terminal number for all conductors terminated on a terminal block.
         b) Note the specific termination points for all other equipment.
2. Contractor shall, at a minimum, update the following drawings where they are impacted by the Contractor's activities during the performance of work related to this contract:
   a. Wiring diagrams.
   b. Where existing drawings or diagrams for cabinets, equipment, or connections do not exist, notify the COR to modify existing drawings or

create new drawings in compliance with the as-built drawing requirements of these specifications.

3. A list of existing drawings can be found in Section 52 00 00 – Drawings.

B. Existing Condition As-Built Drawings provided by the Contractor shall meet the requirements of Section 01 33 26 – Electrical Drawings and Data as well as section 01 78 30 – Project Record Documents. Where conflict exists, the most stringent requirements apply.

END OF SECTION

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SECTION 41 22 14
BRIDGE CRANE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Design, Furnish, Install, and Test 30 Ton Bridge Crane:

1. Payment: Lump-sum price offered in the Price Schedule.

   a. Includes cost of crane motors.

B. Conduct Rail Survey of 30 Ton Bridge Crane Runway Rails:

1. Payment: Lump-sum price offered in Price Schedule.

C. Furnish and Install Access Ladder Fall Arrest System:

1. Payment: Lump-sum price offered in Price Schedule.

D. Adjust and Repair 30 Ton Bridge Crane Runway Rails:

1. Payment: Lump-sum price offered in Optional Price Schedule 1.

E. Furnish and Install 30 Ton Bridge Crane Runway Rails:

1. Payment: Lump-sum price offered in Optional Price Schedule 2.

1.02 REFERENCE STANDARDS

A. American Gear Manufacturers Association (AGMA)

1.	AGMA 2001 - C95	Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
2.	AGMA 6013 - A06	Industrial Enclosed Gear Drives

B. American Institute of Steel Construction (AISC)

1.	AISC 360 - 2022	Specification for Structural Steel Buildings

C. American Society of Mechanical Engineers (ASME)

1.	ASME B30.2 - 2022	Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

D. ASTM International (ASTM)

1.	ASTM A1 - 00(2018)	Standard Specification for Carbon Steel Tee Rails
2.	ASTM A29/A29M – 23	General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
3.	ASTM A992/A992M - 22	Structural Steel Shapes
4.	ASTM A1023/A1023M - 21	Carbon Steel Wire Ropes for General Purposes
5.	ASTM D229-19e01	Rigid Sheet and Plate materials Used for Electrical Insulation

E. American Welding Society (AWS)

1.	AWS D1.1/D1.1M - 2020	Structural Welding Code - Steel
2.	AWS D14.1/D14.1M - 2005	Welding of Industrial and Mill Cranes and Other Material Handling Equipment

F. Code of Federal Regulations (CFR)

1.	29 CFR Part 1910	Occupational Safety and Health Standards
2.	29 CFR Part 1910.179	Overhead and Gantry Cranes

G. Crane Manufacturers Association of America, Inc. (CMAA)

1.	CMAA 70 - 2020	Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

H. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE 841 – 2021	Standard for Petroleum and Chemical Industry – Premium Efficiency, Severe Duty, Totally Enclosed Squirrel Cage Induction Motors from 0.75 kW to 370 kW
2.	IEEE C37.2-2022	Electrical Power System Device Function Numbers, Acronyms, and Contact Designation
3.	IEEE C37.13-2015	Low-Voltage AC Power Circuit Breakers Used In Enclosures
4.	IEEE C37.21-2017	Control Swithboards

I. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250 - 2020	Enclosures for Electrical Equipment (1000
2.	NEMA MG 1 - 2021	Motors and Generators

3. NEMA ATS-2021 Standard for Acceptance Testing Specifications for Electric Power Equipment and Systems

J. National Fire Protection Association (NFPA)

1. NFPA 70 – 2023 National Electrical Code

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 26 – Electrical Drawings and Data.

B. RSN 41 22 14-1, Qualifications:

1. Qualifications of designer/engineer, inspector, technician, electrician, and crane operator.

C. RSN 41 22 14-2, Runway Rail Survey and Report

1. Pictures and diagrams of existing rails.
2. Recommendations for either adjusting or removing and replacing existing rails.
3. Include commercial product data if replacement is recommended.

D. RSN 41 22 14-3, Approval Drawings and Data:

1. Sufficiently detailed to show technical and functional requirements met, compliance with performance criteria, or justification for noncompliance. Include modifications resulting from discussions during selection process.
2. Drawings:
   a. General arrangement. Show layout and dimensions of equipment; hook limits, approaches and clearances; parts identification/bill of materials; assembly and details of crane components, including nameplates, controls, and control cabinets.
3. Design and sizing calculations:
   a. Verify and demonstrate choice of components for crane, including, but not limited to the following:
      1) Hoist, end trucks and wheels, structural beams, drive systems, brakes, motors, controls, and overcurrent protection of motors, controls, and branch circuits.
   b. Provide weights of components, maximum wheel loads, and rated speeds of bridge, trolley and hoist when loaded to full capacity.
4. Commercial product data. Provide dimensional and rating data. Mark data sheets to indicate specific make, model number and features of equipment provided.

Identify which assembly (e.g.: main hoist, aux hoist, trolley, bridge, etc.) equipment used. Include data for:

a. For all electrical equipment, submit the following rating information in addition to manufacturer product data:

1) Voltage.

2) Ampacity.

3) Horsepower (if applicable).

4) Short Circuit.

5) NEMA Sizes.

b. Electric motors:

1) Submit one IEEE 841 Annex A datasheet per motor in addition to manufacturer product data.

2) Motor characteristics and tabulated data (tested or calculated):

a) Motor ratings and settings.

b) Speed-torque curves.

c) Time-current characteristic curves.

c. Power factor, efficiency, current and power input against percent of rated motor load encoders.

d. Load cell.

e. Gear reducers.

f. Hook and blocks.

g. Hoist assembly.

h. Bridge, trolley, and end truck assembly.

i. Bumpers.

j. End stops.

k. Brakes.

l. Bearings.

m. Overload devices.

n. Limit switches.

o. Service disconnect switch.

p. Recommended spare parts list.

5. Certified by a Professional Engineer.

E. RSN 41 22 14-4, PLC Code:

1. Copy of the PLC code to implement for crane.
2. Using ladder logic format
3. With comments for each block or blocks describing its functional intent.
4. Include a copy of the development software, and license if applicable, for viewing.

F. RSN 41 22 14-5, Installation Plan and Procedures:

1. Provide a narrative including details for installation plan and procedures for crane components:
   a. Scope of installation.
   b. Preparation for installation.
2. Format narrative in step-by-step fashion with diagrams and figures where necessary to explain exact means and methods, as well as procedure for installation of crane equipment.
3. Include storage and handling plans, construction loads, test weight plan.

G. RSN 41 22 14-6, Crane Operational and Load Test Plan:

1. Includes check list for all crane operation for commissioning, alarms, simultaneous travel operations, speed modification zones and criteria.
2. Engineered Lift Plan per ASME B30.2 for load test, including:
   a. Floor loading calculations.
   b. Stacking diagrams.
   c. Rigging details.
   d. Crane operator certifications or training.
   e. Equipment required.

H. RSN 41 22 14-7, Factory Acceptance Test Procedure:

1. Includes all items and systems in Part 2 Products of Section 41 22 15 – Bridge Crane Electrical Components and 41 22 16 – Crane Motors.
2. Refer to Section 41 22 16 – Crane Motors, 2.06 F - Factory Acceptance Test Procedures.

I. RSN 41 22 14-8, Factory Acceptance Test Report – 30-Ton Bridge Crane:

1. Refer to Section 41 22 16 – Crane Motors, 2.06 H - Factory Acceptance Test Reports.
2. 30-Ton Bridge Crane Hoist, Trolley and Bridge Motors:

a. A written record of the tests that were performed and the results of those tests demonstrating that all equipment verifying proper performance prior to shipment.

b. Performance Tests in accordance with NEMA MG 1 and IEEE 841:

1) Determination of locked-rotor (zero-speed) torque and current.

2) Determination of speed-torque curve.

3) Determination of speed-current curve.

4) Bearing and winding temperature rise tests at rated kilowatts (horsepower).

5) Determination of full-load current and slip.

6) Determination of efficiency at 100, 75 and 50 percent of full load.

7) Determination of power factor at 100, 75 and 50 percent of full load.

8) Airborne sound pressure level at no load, on sinewave power.

9) Vibration level.

10) Determination of temperature rise when used with variable frequency drives.

c. Flame Resistance Test:

1) Verify to have minimum average ignition time of 60 seconds and a maximum average burning time of 500 seconds in accordance with method II of ASTM D229. The materials shall meet requirements of IEEE C37.13.

d. Production Tests:

1) Control wiring insulation test, continuity, polarity, phase verification and sequence tests in accordance with IEEE C37.21.

e. The following tests shall be performed on every motor in accordance with NEMA MG 1 and ANSI AR100:

1) Lead-to-lead resistance test

2) Surge test.

3) Shaft runout and current tests.

4) Inrush current test.

5) Line-to-line voltage test.

6) Unbalanced voltage test.

f. Dielectric Test in accordance with IEEE C37.21

g. Checklist verifying wire size, nameplates, and device function numbers in accordance with IEEE C37.21.

3. Variable Frequency Drives:

a. A written record of the tests that were performed and the results of those tests demonstrating that all equipment verifying proper performance prior to shipment.

b. Test insulation resistance for each VFD element, component, feeder and control circuit.

c. Verify voltages are within 10 percent of motor nameplate rated voltages.

d. Test for proper phase rotation.

e. Perform tests in accordance with NEMA ATS.

J. RSN 41 22 14-9, Final Data:

1. Service manuals that include the following data and drawings:

a. All approved commercial products data and cut sheets. Clearly mark data applicable to equipment furnished.

b. Approval drawings updated to "as-built" changes made during construction. Refer to Section 01 78 30 – Project Record Documents:

1) General arrangement drawings, including complete parts lists.

2) Schematic diagrams specific to the installation for all items and systems in Part 2 Products of the following Sections:

a) Section 41 22 16 – Crane Motors.

b) Section 41 22 15 – Bridge Crane Electric Components.

3) Generic "typical" schematic diagrams to cover multiple installations or pieces of equipment will not be accepted.

4) Schematic diagram to show all portions of the actual circuitry, regardless of whether the circuitry is located within the enclosure or at another location.

5) Provide wiring diagrams for the installation in accordance with 104-D-1165.

c. Maintenance data, including:

1) Preventative maintenance requirements and schedules.

2) Lubrication data: specific lubricants, replacement intervals, their point of application, and quantities required.

3) Pertinent installation, alignment, and calibration information for commercial products.

4) Recommended maintenance schedule.

5) Recommended spare parts list.

d. Certified reports:

1) Contractor field quality testing.

2) Record test data on report form including crane operational and load test.

3) Operations and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment on site in shipping containers with labeling in place.

B. Protect equipment from damage, moisture, and dust.

1.05 QUALIFICATIONS

A. Qualified Professional Engineers: Demonstrated experience on cranes of similar size and capacity as the Warehouse crane on at least three separate crane contracts.

1. Registered in the state of California.

B. Qualified Crane Inspectors: Demonstrated experience on cranes of similar size and capacity as the those described on at least three separate crane contracts and employed as crane inspectors for at least the two (2) previous years by firm specializing in crane inspection work.

C. Qualified Crane Electricians: Minimum of one (1) licensed electrician during field wiring and critical aspects of the crane field work.

D. Qualified Crane Operators: Meeting requirements of OSHA 1910.179 and ASME B30.2.

1.06 FIELD MEASUREMENTS

A. Verify field measurements, building and site dimensions prior to fabrication. Coordinate and relate work to building structure and work done by various trades.

PART 2 PRODUCTS

2.01 BRIDGE CRANE

A. Design, furnish and install one overhead, top-running, traveling bridge crane in the Warehouse at Folsom Dam, CA.

B. New crane shall have equal or greater hook boundary limits as existing crane.

C. See Sections 41 22 15 – Bridge Crane Electrical Components, and 41 22 16 – Crane Motors for items not included in this Section.

D. Design Features:

1. Comply with applicable sections of:
   a. CMAA 70, Class C, indoor service.
   b. ASME B30.2.
   c. Electrical: NFPA 70.
   d. Safety: 29 CFR Parts 1910 and 1910.179.
2. Components suitable for indoor operation in ambient operating temperature range from 50 to 120 degrees F at approximate elevation 500 feet above sea level. All electronic components for installed control systems must be rated for 200 deg F.
3. Retention of historical character defining features:
   a. Design crane components to have similar size, shape, and scale of existing crane, to preserve and maintain their historical character. Including but not limited to:
      1) Trolley.
      2) Crane structure.
      3) Bridge platform/walkway.
      4) Access ladders (where OSHA does not require change).
   b. Coatings: Match existing crane color and gloss of finish coats using manufacturer's standard finishes, unless otherwise indicated, in accordance with Section 09 96 20 – Coatings.
4. Type: Overhead, top running, single trolley, single hoist, bridge crane.
5. Capacity: 30-tons.
6. Operation: Electrically-operated.
7. Control: Pendant. See Section 41 22 15 – Bridge Crane Electrical Components and Section 25 00 01 – Automation Control System.
8. Span: 40-feet.
   a. New crane is to be installed on the existing rails if possible.
9. Runway length: Equal to that of existing crane, approximately 150-feet.
10. Single swivel hook, spring loaded gate with locking pin.
    a. Match dimensions of existing hook.
11. Hook travel: Approximately 22-feet.
12. Power supply: 480 Volts, 3-phase, 60 Hz
13. Ladders, walkways, safety railing, steps, ramps, grating, screens, covers, etc., as required to provide full, safe access to components for maintenance and inspection.

a. See Section 51 00 10 – Photographs.

14. Working area floodlights.

15. End stop zones:

a. Bridge travel speed limited to 10% of normal operating speed within 3 feet of all end stops.

b. Trolley travel speed limited to 10% of normal operating speed within 3 feet of all end stops.

c. Hoist travel speed limited to 10% of normal operating speed within 3 feet of upper limits.

E. Motors: See Section 41 22 16 – Crane Motors.

F. Motor Brakes:

1. Bridge and trolley travel motor brakes:

a. AC electro-hydraulic thrustor brakes unless otherwise specified.

b. Braking against travelling shall be capable of arresting motions within a distance equal to 10 percent of the rated speed.

2. Hoist motor brakes:

a. Electromagnetic double shoe DC shunt brakes, spring-set, adequate to hold 150 percent of the rated hoist static loads.

b. Capable of arresting the rated load while lowering.

c. Provided with manual release.

d. Braking action in the OFF position and release with current are provided.

G. Hoists:

1. Electric motor-driven.

2. Hoist ropes:

a. In accordance with ASTM A1023.

b. Construction: 6 by 37, improved (IPS) or extra-improved (EIP) plow steel (minimum), bright finish, preformed, regular lay, independent wire rope core (IWRC).

c. Maximum fleet angles: 4 degrees (drums), 4.75 degrees (sheaves).

d. End connections (other than drum connections): Termination fittings in accordance with manufacturer's recommendations, providing 100 percent termination efficiency.

e. Safety factor: 5:1 minimum, based on breaking strength of ropes.

f. Length: To provide minimum two dead wraps on rope drums when hooks reach low hook elevation.

3. Sheaves:

a. Material: steel per CMAA 70.

b. D/d Ratio: 20:1 minimum ratio of pitch diameter to rope diameter.

c. Provide with sealed roller -bearings.

4. Drum:

a. Material: steel per CMAA 70.

b. D/d Ratio: 20:1 minimum ratio of pitch diameter to rope diameter.

c. Helical grooves:

1) Designed with capacity for minimum of two dead wraps at anchored ends when hooks reach low hook elevation.

2) Machined on drum surfaces to receive hoisting ropes to ensure that they spool and unspool in an orderly and controlled manner.

3) Maximum surface texture: 125 micro-inches.

4) Minimum depth: Not less than 37.5 percent of rope diameter.

5) Minimum groove pitch: Nominal rope diameter multiplied by a factor of 1.14 or rope diameter plus 1/8”, whichever is smaller.

d. All brakes shall have a separate brake drum and couplings shall not be used as brake drums.

5. Overload limit devices.

6. Secondary upper limit switch.

7. Machinery enclosures: Steel.

H. Gearing:

1. Steel, sizing in accordance with requirements of AGMA 2001 and 6013.

2. Rated for reversing loads where applicable and with service factor appropriate for application, in accordance with manufacturer’s recommendations.

3. Fully enclosed in reducer housings, except for final reduction, which may be open gears. Open gears required to be provided with safety guards or covers, with access for inspection and lubrication.

4. Reducer housings:

a. Oil-tight, split-case, steel. Provide jack bolts to aid removal of upper portion of housing and lifting eyes/connections.

b. Inspection ports: Oil-tight, removable cover, located to accommodate inspection of gearing.

c. Provide packing glands or seals at gear shaft openings.

d. Oil-tight, with filler cap, breathers, oil level dipstick or sight glass, lifting lugs.

e. Lubricant drainage:

1) Accessible, piped to convenient locations where necessary.

2) Shut-off ball-type drain valves and drain plugs.

I. Bearings:

1. Sealed roller- or ball-type, unless otherwise indicated.

2. Replaceable.

3. Fit and load rating: Per manufacturer's recommendations for application, with appropriate rating factors.

J. Shafts: Structural design in accordance with CMAA 70.

1. Provide guards for all rotating shafts.

K. Flexible couplings:

1. Metallic (except for grease seals), gear-type, dustproof, and fully enclosed.

2. Gear teeth: Crowned at base, tip, and face.

3. Bored and fit to the actual diameter of the shaft, within tolerance of manufacturer's recommendations.

4. Capacity: Torque rating, with appropriate service factor, suitable for loads transmitted.

5. Enclosed, sealed oil-tight, retaining lubricant, even in the case of misalignment.

6. Keys, setscrews, bolts, nuts, and revolving surfaces made flush or guarded by a metal cover, so the coupling will present no hazard to personnel.

7. Grease fittings.

8. Single-engagement couplings: Accommodating angular misalignment of 0.75 degrees. Provide paired single-engagement couplings on floating shafts as required.

9. Double-engagement couplings: Accommodating angular misalignment of 0.75 degrees per half coupling and offset misalignment of 1.5 percent of maximum bore.

L. Service platforms, ladders, and stairways:

1. Designed per CFR 1910.29.

2. Permanent service platforms, ladders, and stairways required for accessing equipment in accordance with ASME B30.2. Attach securely to steel framework.

a. Match platform layout of existing crane. See Section 51 00 10 – Photos.

3. Fabricate from welded structural steel shapes and plates, with slip-resistant checkered steel flooring plate, designed for live load of 50 pounds per square foot.

4. Platforms and stairways: 42-inch high guard rails, intermediate guard rails, and toe plates.

   a. Where possible, employ passive fall protection through the use of guard rails, rather than active fall protection means.

5. Minimum clearance in front of control equipment in accordance with NFPA 70, sufficient to open hinged doors 90 degrees.

6. Minimum 15-inch clearance from machinery.

7. Provide self-closing, spring-loaded safety gates at all ladder access locations.

M. Crane Structure:

1. Design per CMAA 70.

2. Unless otherwise stated in this Section, the structure is to match the appearance of the existing crane.

N. Bridge:

1. Electric motor-driven. Provide CMAA 70 type A-4 drive arrangement.

2. Steel Frame: Structural steel construction, in accordance with ASTM A992, braced and welded to maintain squareness with trucks.

3. End Trucks:

   a. Frame: Steel, welded from structural shapes, designed to prevent distortion and mismatch of gears under maximum rated load.

   b. Provide with restraining lugs to prevent truck drop of greater than 1-inch in the event of an axle or wheel failure.

   c. Provide jacking pads for removal or repair of wheel assemblies.

   d. Wheelbase: In accordance with CMAA 70.

      1) 4-wheel.

   e. Wheels: Steel, sized in accordance with CMAA 70.

   f. Designed to run on upper surface of crane runway rail.

4. Provide with rubber bumpers in accordance with CMAA 70.

5. Provide a fire extinguisher mounted to bridge walkway handrail.

O. Trolley:

1. Electric motor-driven.

a. End drive system coupled directly to both drive wheels with a fixed wheel axle.

2. Wheeled, suitable for mounting on bridge rails.

3. Wheels: Steel, sized in accordance with CMAA 70.

4. Frame: Structural steel truck and load girts, welded into one-piece unit. Provide jacking pads for removal or repair of wheel assemblies.

5. Bearings: Sealed, roller- or ball-type, permanently lubricated.

6. Holding brake: Electro-mechanical continuous-duty, spring-set, energized-release, disk-type, rated for minimum 100 percent full load traveling torque.

7. Provide with rubber bumpers in accordance with CMAA 70.

P. Enclosures:

1. In accordance with NEMA 250, Type 12 for indoor use and Type 4X for outdoor use, unless otherwise indicated.

2. Cabinets:

a. Lockable.

b. Hinged and gasketed doors.

c. Anti-condensation heaters and air conditioned, as required.

d. UL certified.

Q. Controls:

1. Pendant controls of hoists, trolley, and bridge.

a. See Section 41 22 15 – Bridge Crane Electrical Components.

2. Variable frequency drive (VFD) controls for bridge, trolley, and hoist:

a. See Section 41 22 15 – Bridge Crane Electrical Components.

R. Load cells:

1. Sheave block pin strain gauge type, with range suitable for associated hoist.

2. Alarm and disconnect circuitry for adjustable overload limit.

3. Continuous readout.

4. Capacity to “zero” or calibrate readout.

5. Display: 4-Digit, with readout to 1/100 Ton (e.g XX.XX Ton).

6. Accuracy: Indication within 2 percent of the actual load, at the rated hoist capacity.

S. Electrification:

1. In accordance with requirements of CMAA 70 Class C service.
2. Runway conductor rails:
   a. See Section 41 22 15 – Bridge Crane Electrical Components.

T. Stops:
1. Provide stops at each end of runways, located to permit maximum possible travel.

U. Labeling:
1. Mark rated crane load capacity, in tons, on each side of crane bridge so that it is legible from the operating floor.
2. Mark on the crane structure, in a location visible from the operating floor, with direction arrows coinciding with those indicated on control station.
3. Identification plates:
   a. Provide permanently attached, non-corrosive metal plates for crane components identifying manufacturer, model number, size, serial number, capacity, and other essential information.
   b. Provide in accordance with drawing No. 40-D-6234.
4. Mount a crane hand signal chart on existing column at a location determined by COR.

V. Warning devices:
1. Warning horn, operable from operator station.
   a. Maximum noise level: 70 dB
2. Travel warning bell, automatically operated during bridge and trolley motion.
   a. Maximum noise level: 70 dB
3. Warning strobe or rotating beacon, illuminated during movement of hoist, bridge or trolley.

W. Convenience power receptacles:
1. Extra-heavy duty type, industrial grade.
2. GFCI type, duplex 125-Volt, 20 Ampere, 2-pole, 3-wire, polarized.
3. Two (2) located bridge walkway.
4. One (1) located on trolley platform.

X. Bridge Runway Rails:
1. Conforming to ASTM A1.
2. Material: Steel

3. Size for wheel loads per CMAA 70 and ASME B30.2.
4. Length: divided into approximately equal sections adding up to a total travel length of 150-feet.
5. Punch rail section ends at splice locations.
6. Mounted on continuous soleplate.
   a. Material: HDG steel.
7. Splice bars, bolts, and accessories:
   a. Commercial quality free from scale and rust which can be removed by firm rubbing with burlap or equivalent treatment.
8. Threaded Weld Studs:
   a. ASTM A29.
   b. Fully threaded.

Y. Crane rail clips:
1. Permit mounting of crane rail with resilient pad.
2. Attached to structural steel with welded studs.
3. Maximum lateral force:
4. Dimensions compatible with rail size.
5. Constrain rail in vertical and lateral planes while allowing controlled movement in axial direction.

Z. Lubrication:
1. Suitable for ambient air temperatures ranging from 50 to 120 degrees F.
2. Grade and type meeting manufacturer's recommendations.
3. Grease fittings: Industrial button-type fittings and grease vent fittings of uniform size and design, located for ease of accessibility.

AA. Spare parts:
1. Greases and lubricants for minimum 2 years of service.
2. Manufacturer recommended spare parts.

2.02 ACCESS LADDER

A. Modify existing access ladder, mounted on the South wall of the Warehouse, to meet CFR 1910.28 for new fixed ladders.
1. Remove the existing ladder cage.
2. Install a ladder safety device to be used in conjunction with a fall arrest harness.

3. Ladder height: 25 feet.

2.03 FABRICATION

A. Structural Steel: In accordance with these specifications and AISC 360.

B. Fabricate all load bearing components, couplings, shafts, and gears in hoist drive trains from rolled or forged steel. Brake drums may be fabricated from ductile iron.

C. Welding:

1. In accordance with qualified procedures per AWS D14.1/D14.1M.
2. Welding operators: Capable of meeting qualification tests for operators as outlined in AWS D14.1. COR may require test specimens by welding operator in accordance with AWS D1.1 appendix.

PART 3 EXECUTION

3.01 INSTALLATION

A. Prior to submitting approval drawings and data, survey and measure existing crane runway rails. Submit survey report detailing recommendations for either reuse and adjustment or replacement of the rails.

1. For reuse and adjustment:
   a. Adjust existing crane rails to be straight, parallel, level, at same elevation, and aligned in accordance with CMAA 70 tolerances.
      1) Replace rail hardware as necessary where broken or missing items are discovered.
      2) Fully torque all clamping nuts, bolts, and anchors.
      3) Prepare report that confirms rail alignment.
2. For replacement:
   a. Install rails on existing structure in same location as existing rails.
   b. Reuse existing mounting bolts where possible. Install new mounting bolts where missing or damaged.
   c. Align rails to within acceptable tolerances set forward by CMAA 70.

B. Work to replace crane shall not proceed until entirety of replacement crane equipment has been delivered on-site.

C. As required, install shear blocks at corners of gear reducer bases with welds adequately sized to resist shearing forces.

D. Perform electrical installation and grounding procedures in accordance with NFPA 70 and other applicable Sections.

E. Perform work in accordance with manufacturer(s) installation instructions. Ensure all components are fully lubricated and ready for operation upon installation.

F. Install crane on crane rails, adjust and calibrate equipment, and perform brake run-in operations as required.

G. Conduct a full inspection of the installed crane with COR, prior to testing. Visually inspect all steel castings. Subject to non-destructive testing if deficiencies are observed. Verify crane is ready for testing.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Notify COR at least five days prior to testing.

B. Perform operational and load tests designated for new crane in accordance with the requirements for an Initial Inspection as outlined in ASME B30.2. The tests are to include but are not limited to the following items:

1. Conduct an operational test including the following items with no load:
   a. Lifting and lowering of hoist.
   b. Bridge travel the full length of the runway.
   c. Trolley travel the full length of the bridge.
   d. Operation of limit devices.
2. Conduct a load test including the following items:
   a. Use test weights to test the hoist at a load greater than 100% capacity but not greater than 110% capacity.
      1) Contractor shall supply all equipment for testing.
   b. Complete and submit all requirements of an engineered lift prior to completing the load test.
   c. Lift the load to above the floor level and hold for 10-minutes to ensure hoist brakes are holding the load.
   d. Travel the bridge and trolley the full length of their respective runways.
3. Verify that bridge, trolley, and hoist brakes automatically set upon loss of power.
4. During and after operation and tests, inspect for:
   a. Permanent deformation, cracking, bending, or damage to structural elements.
   b. Slippage of wire ropes at their terminations.

c. Proper spooling of wire ropes on drums and sheaves.

d. Proper operation of electrical drives.

e. Overheating, abnormal noise or vibration.

f. Damage to or abnormal wear of gear teeth.

g. Proper lubrication of mechanical components.

C. Record test data on report form and submit with operations and maintenance manuals:

1. Record operating and startup current (and corresponding loads) data for motors and verify that they meet manufacturer's recommended values.

2. Record speeds of hoist, trolley and bridge during each test cycle. Verify that performance requirements have been met.

3. Measure and verify shaft and gear alignment are within tolerances.

4. Monitor system harmonics during operation of VFDs.

5. Verify full functionality and correct deficiencies and improper adjustments encountered during testing. Perform any adjustments or repairs in accordance with standard practice or manufacturer's recommendations.

6. If required, retest crane operation to satisfaction of COR.

7. Reset overload limit devices for hoist for the rated capacity.

D. Provide an approved marking to be installed in the operator cab indicating that the crane has been certified for operation and including the following information:

1. Name of crane.

2. Certifying organization.

3. Certification date.

E. Site Acceptance Testing:

1. Refer to Section 41 22 16 – Crane Motors 3.02.

3.03 COATING REPAIR AND REMEDIAL WORK

A. Repair defective or damaged areas of coatings in accordance with coating manufacturer's recommendations.

1. Coating damaged by the Contractor during installation shall be repaired at the Contractor's expense.

3.04 FINAL AND AS-BUILTS DRAWINGS

A. Final As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents and Section 01 33 26 – Electrical Drawings and Data.

1. Marked prints of specifications drawings indicating "Final As-Built" changes made to crane and crane components during construction.

3.05 TRAINING

A. Refer to Section 01 79 20 – Training.

END OF SECTION

SECTION 41 22 15
BRIDGE CRANE ELECTRICAL COMPONENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Furnish, Install, and Test New Crane Electrical System for 30 Ton Bridge Crane:

1. Payment: Lump sum price offered in the Price Schedule.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B30.2-2022	Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

B. Code of Federal Regulations (CFR)

1.	29 CFR 1910 - 2022	Occupational Safety and Health Standards

C. Facilities Instructions, Standards and Techniques (FIST)

1.	FIST 3-3-1991	Electrical Connections for Power Circuits

D. Crane Manufacturers Association of America, Inc. (CMAA)

1.	CMAA 70-2020	Top Running and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

E. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE 399-1997	IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis
2.	IEEE 519-2022	IEEE Recommended Practice and Requirements for Harmonic Control In Electrical Power Systems
3.	IEEE 3004.8-2016	Recommended Practice for Motor Protection in Industrial and Commercial Power Systems
4.	IEEE C37.90-2011	Standard For Relays and Relay Systems Associated With Electric Power Apparatus
5.	IEEE C37.96-2012	Guide for AC Motor Protection

6.	IEEE C37.14-2015	DC (3200V and below) Power Circuit Breakers Used in Enclosures
7.	IEEE C37.2-2022	Electrical Power System Device Function Numbers, Acronyms, and Contact Designation
8.	IEEE C37.13-2015	Low-Voltage AC Power Circuit Breakers Used In Enclosures
9.	IEEE C57.13-2016	Instrument Transformers

F. International Electrotechnical Commission (IEC)

1.	IEC 60825-1:2017	Safety of Laser Products – Part 1: Equipment classification and Requirements

G. International Society of Automation (ISA)

1.	ISA 62381-2011	Automation Systems in the Process Industry – Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Site Integration Test (SIT)

H. National Electrical Contractors Association (NECA)

1.	NECA 1-2015	Good Workmanship in Electrical Construction

I. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2020	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA ATS-2021	Standard for Acceptance Testing Specifications for Electric Power Equipment and Systems
3.	NEMA FU-1-2012	Low-Voltage Cartridge Fuses
4.	NEMA ICS 1-2022	Industrial Control and Systems General Requirements
5.	NEMA ICS 2 – 2020	Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated Not More than 2000 Volts AC or 750 Volts DC
6.	NEMA ICS 2.9-2002	AC Vacuum-Break Magnetic Controllers Rated 1500 Volts AC

7.	NEMA ICS 3-2005	Medium Voltage Controllers Rated 2,001 to 7,200 VAC
8.	NEMA ICS 5-2017	Control Circuit and Pilot Devices
9.	NEMA ICS 7-2020	Adjustable-Speed Drives
10.	NEMA ICS 6 – 2016	Industrial Control Systems: Enclosures
11.	NEMA ICS 8-2019	Application Guide for Industrial Control Systems Crane and Hoist Controllers
12.	NEMA KS 1-2013	Enclosed and Dead-Front Switches (600 V Maximum)
13.	NEMA MG 1-2021	Motors and Generators
14.	NEMA WC 70-2021	Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

J. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electric Code (NEC)

K. Underwriters Laboratories (UL)

1.	UL 50 – 2015	Enclosures for Electrical Equipment
2.	UL 94 - 2023	Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing
3.	UL 98 – 2016	Enclosed and Dead-Front Switches
4.	UL 508-2018	Industrial Control Equipment
5.	UL 489-2016	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
6.	UL 1449-2021	Transient Voltage Surge Suppressors

1.03 DEFINITIONS

A. Class A controller: alternating current air-break, vacuum-break or oil-immersed manual or magnetic controllers for service at 600 volts or less. Capable of interrupting operating overloads but not short circuits or faults beyond operating overloads.

B. Class B controller: direct current air-break manual or magnetic controllers for service on 600 volts or less. Capable of interrupting operating overloads but not short circuits or faults beyond operating overloads.

C. Class V controller: alternating current vacuum-break magnetic controllers for service on 1500 volts or less, and capable of interrupting operating overloads but not short circuits or faults beyond operating overloads.

D. Class I Controllers: Controllers intended for use with CMAA crane service class C, D, E and F.

E. Class II Controller: controllers intended for use with CMAA crane services class A and B.

F. Control system diagram: conceptual diagram of the functional interrelationship of subsystems, usually in block form.

G. Corrosion-resistant: so constructed, protected, or treated that corrosion will not exceed specified limits under specified test conditions.

H. Dielectric test: tests made to determine ability of insulating materials and spacings to withstand specified overvoltages for a specified time without flashover or puncture.

I. Drift: as applied to devices such as pressure switches, temperature switches etc., a change in operating characteristics over a specified number of operations or time and specified environmental conditions.

J. Dynamic braking: control function that brakes the drive by dissipating its stored energy in a resistor. A method of controlling speed by using the motor as a generator.

K. Electric motor controller: device or group of devices that serves to govern in some predetermined manner the electric power delivered to the motor.

L. Electrical release indicator: A control circuit contact that changes state when the brake setting mechanism has moved to the release position.

M. Emergency dynamic braking: A resistor inserted into a travel circuit to decelerate the travel motion under controlled conditions after loss of power.

N. EMI: Electromagnetic Interference.

O. Girder: The principal horizontal beam of the crane gantry. It is supported by the crane end legs. Normally the crane trolley is mounted on top of the girder, and the hoist is suspended from the trolley to below the crane girder; however, the trolley and cab may also be suspended from the girder.

P. Hoist: A motor machinery unit that used for lifting and lowering a load.

Q. IGBT: Insulated-gate bipolar transistor.

R. Jog: (Inch) to move in a series of short, discontinuous, increments by momentary operation of a controller.

S. Main Line Contactor: A magnetic contactor used in the incoming power circuit from the main line collectors.

T. Main Line Disconnect Switch: A Manual switch that breaks the power lines leading from the main line collectors.

U. Master Switch: A manually operated device that serves to govern the operation of contactors and auxiliary devices of crane control.

V. Motor Control Enclosure: An assembly of electrical components which governs the flow of power to or from a motor in response to signals from a master switch, pushbutton station or automation control device.

W. Motor Percent ED: "Einschaltdauer" Motor Duty Cycle.

X. MOV: Metal Oxide Varistor

Y. Plugging: A control function that accomplishes braking by reversing the motor line voltage polarity or phase sequence.

Z. PLC: Programmable Logic Controller.

AA. Rated Load: The maximum load that the crane is designed to handle safely as designated by the manufacturer.

BB. Static Stepless Control: A type of control system with infinite speed control between minimum speed and full speed without the use of contacts.

CC. TDD: Total demand (harmonic current) distortion.

DD. THD(V): Total harmonic voltage demand.

EE. Trolley Mounted Hoist: A combined unit consisting of a wheeled trolley that provides horizontal motion along the gantry girder, and a hoist suspended from the trolley, that provides lifting and lowering of a freely suspended load.

FF. VFD: Variable-frequency drive motor controller.

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data:

B. RSN 41 22 15-1, Approval Drawings and Data:

1. Drawings:

   a. Provide a title block that designates a unique drawing number and drawing title, including revision number and date.

   b. Schematic Drawings:

      1) Include schematic modifications on existing facility drawings.

      2) Show all portions of the actual circuitry, regardless of whether the circuitry is located within the crane control enclosure, motor terminal box or at another location.

      3) Description of operation.

   c. Wiring Diagrams:

      1) Show wiring modifications on existing facility drawings, where space allows.

   d. Single-Line Drawings.

   e. Three-Line Drawings.

   f. Block Diagram Drawings.

2. Dimensioned plan, side and elevation views of crane control enclosures panelboard, motor controllers and VFD layout drawings including:

   a. Show device layout, nameplate locations, nameplate legends, wireway, connection and support points and grounding locations.

   b. Floor plans drawn to scale, showing required working clearances, and required area above and around VFDs. Show VFD layout and relationships between electrical components. Show support locations, type of support and weight on each support.

   c. Supply layout and wiring diagrams showing the location of all Contractor supplied devices, protection relays, motor contactors and auxiliary devices.

   d. Conduit service entrance locations and requirements.

3. Time-Current Characteristic Curves and Equipment Damage Curves:

   a. Provide characteristic curves for motor circuit breaker or fuse, motor overload, and other protective devices.

   b. Include motor inrush, full-load, and locked-rotor currents.

   c. Curves to be plotted on same log-log graph.

4. Commercial product data.

   a. Design Criteria.

b. Variable frequency drives: For each type and rating of VFD indicated.

1) Performance electrical ratings.

2) Operating characteristics.

3) Shipping and operating weights.

4) Furnished specialties and accessories.

5) Seismic qualification certificates for VFDs, accessories and components.

6) Product certificates.

7) Harmonic analysis study and report: In accordance with IEEE 399 and NETA ATS. Identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze designated operating scenarios.

8) Include recommendations for VFD input filtering to limit TDD and THD at each VFD to specified levels.

c. Electrification Systems.

d. Provide integral schedule of crane electrical components.

5. Electrical equipment ratings:

a. Voltage.

b. Ampacity.

c. Horsepower.

d. Short Circuit.

e. NEMA Sizes.

6. Low-Voltage Transformers:

a. Enclosures and accessories.

b. Unit Weight.

c. Voltage.

d. kVA.

e. Impedance ratings and characteristics.

f. Loss data.

g. Efficiency at 25, 50, 75 and 100 percent rated load.

h. Tap configurations.

i. Insulation system type.

j. Rated temperature rise.

7. Certified by a Professional Engineer.

C. RSN 41 22 15-2, Installation Plan and Procedures.

1. Storage, refer to Section 01 14 10 – Use of Site.

2. Installation Instructions:

a. Equipment erection.

b. Seismic anchorage of crane electrical components.

c. Grounding of control enclosures.

d. Conduit and cable interface.

3. Provide a narrative including details for installation plan and procedures.

a. Scope and preparation.

D. RSN 41 22 15-3, Final Product Data:

1. Operation and Maintenance Manuals including, but not limited to, the following data and drawings:

a. Title page/index.

b. Bill of materials.

c. Copies of informational data.

d. Half-size prints of As-Built drawings.

e. Time-current characteristic curves.

f. Equipment damage curves.

g. Motor circuit breaker ratings and settings.

h. Motor overload relay settings.

i. Undervoltage relay setting.

j. Power fuses for each size and type.

k. VFD emergency operation and maintenance.

l. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and trip settings.

m. Manufacturer's written instructions for setting field-adjustable overload relays.

n. Written instructions for testing, adjusting and reprogramming microprocessor control modules.

o. Manufacturer's written instructions for setting field-adjustable timers, controls and status and alarm points.

E. Obtain Government acceptance prior to proceeding to the next design phase.

1. Design submittals, including re-submittals, shall contain drawings, criteria, and interview documentation and updates.

2. Include revised drawings and related documentation resulting from the review of the submittal and additional comments in the re-submittal.

1.05 DESCRIPTION OF WORK

A. The automation process encompasses everything from the reception of a control signal to the movement of the crane motors. The electrical subsystems are:

1. Digital Automation Control utilizing closed-loop vector position control, open-loop position control.

2. Electric crane motors and protection devices.

3. Gear train transmission to alter the torque or speed.

B. Provide new crane electrical components as specified herein. The design shall consist of a series of motor protection devices, programmable logic controllers, intelligent low-voltage devices, pendant control device, pushbuttons, control enclosures and motors specifically designed for crane operation, characterized by high starting torque and low starting current.

C. Provide new crane motor drives as specified herein. The design shall consist of separately enclosed, preassembled, combination VFDs, rated 600 Volts and less, for speed control of three-phase squirrel-cage induction motors.

D. Design, Furnish, Install, and Test: Crane Motor Controller Assembly and Crane Electrical Components.

E. Interface with PLC specified in Section 25 12 10 – Programmable Logic Controller.

1.06 RELATED WORK

A. Coordinate features of crane electrical components and accessory devices to be compatible with the following Sections:

1. Section 41 22 14 – Bridge Crane

2. Section 41 22 16 – Crane Motors

3. Section 25 00 01 – Automation Control System

4. Section 25 12 10 – Programmable Logic Controller

1.07 DESIGN AND FUNCTIONAL REQUIREMENTS

A. Design electrical equipment layout of crane control on bridge girders, trolley and cab.

B. The electrical design of the crane shall conform to CMAA 70, NFPA 70, NECA 1, ASME B30.2, NEMA ICS 8, and other requirements specified herein.

C. All hardware design and installation shall conform to OSHA Regulations per 29 CFR 1910.

D. All crane electrical components shall be industrial grade, commercially available and comply with UL.

E. All provided hardware shall be rated per UL 94, where applicable.

F. All crane components shall be rated for operation in the expected environment as described in section 1.08. Uprate motors, controls, and associated equipment as required for service in this environment.

G. All crane electrical components shall be located to be easily accessible for inspection and maintenance without removing other parts.

H. The Contractor shall coordinate equipment information with the motor manufacturer to ensure that the correct type of motor starters and protection equipment are provided, properly sized to operate and provide proper protection to the devices served.

I. The Contractor shall verify that all motor protection equipment will fit physically within the space allotted.

J. Provide independent relays, contactors, drive inputs or other logic components for directional control such that failure of a single device cannot result in motion in an unintended direction.

K. All electrical equipment shall be equipped with proper hazard signage per CMAA 70 and NFPA 70.

L. Power supply for the crane shall be 480 Volts, 3φ, 60 Hz. All power required for the operation shall be developed from this source.

   1. Control Voltage: 120 Volts AC.

M. Runway electrification shall be furnished by the following:

   1. Runway 4-bar conductor rail system to supply electrical power across the crane for bridge, trolley and hoist motions, fully compliant to CMAA 70 and NFPA 70.

      a. Design the location, size and type of conductor rail bar system:

1) Sized for simultaneous motions of the hoist, bridge, trolley motions and ancillary loads.

2) The maximum continuous length of conductor rails shall not exceed 30 meters without an expansion joint.

3) Provide electrical continuity across the expansion joint on both sides with flexible copper conductors as per manufacturer's standard.

4) The support assembly shall be capable of withstanding high impact and shocks resulting from crane movements.

5) Provide adequate tension and compression strength to withstand the weight of the collector system during crane motions.

6) Provision for connecting incoming feeder terminations to conductor rails.

b. Include all necessary cables and hardware to the crane from a wall or column mounted disconnect switch.

c. Provide emergency switches in a totally enclosed metal enclosure with an operating lever outside at each end of the bridge to cut-off power supply under emergency condition by tripping the mainline circuit breaker.

2. Fused disconnect switches.

N. Crane Control Systems:

1. Provide a separate motor controller for each motor.

a. Provide overload protection in accordance with NEMA ICS-2.

b. Electrically interlock contactors used for starting, stopping and reversing.

2. Provide simultaneous motions of the hoist and travel drive mechanisms.

3. Design to provide a Class II motor controller.

4. Hoist Motion Controls:

a. Provide multi-speed control with five specific speed points, minimum.

b. Provide AC Static Stepless Control with the following minimum requirements:

1) Master switches to provide variable-speed and torque control with 10:1 speed range, minimum.

2) Plugging and jogging control.

3) Non-wearing Solid state devices.

c. Provide Variable Frequency Control with the following minimum requirements:

1) PLC controlled allowing acceleration and deceleration rates to be adjusted digitally and independently for smooth stops and starts.

2) Jogging control capability.

3) Provide reduction of shock loading.

4) Load swing and positioning control.

5) Static reversing.

6) Closed-Loop Flux Vector Control.

7) Dynamic braking.

5. Travel Motion Controls:

a. Provide Variable Frequency Control with the following minimum requirements:

1) PLC controlled allowing acceleration and deceleration rates to be adjusted digitally and independently for smooth stops and starts.

2) Jogging control capability.

3) Provide reduction of shock loading.

4) Load positioning control.

5) Static reversing.

6) Open-Loop Control.

7) Anti-collision controller.

8) Dynamic braking.

b. Provide AC inverter duty, totally enclosed non-ventilated, squirrel cage induction type bridge and trolley drive motors.

6. Configure to allow simultaneous, independent operation of all motors.

7. Drive Control System

a. Provide static reversing, adjustable frequency controllers conforming to NEMA ICS 3, NEMA ICS 8 for the hoist and travel drives.

b. Design with infinitely variable electric drives. Provide two step infinitely variable speed control for the hoist and travel functions, controlled via pendant pushbuttons.

c. The hoist, and travel brakes shall set after associated controller decelerates motor to a controlled stop.

d. Size the hoist and travel controllers to provide sufficient starting torque to initiate motion of that crane drive mechanism from standstill with 0 to 225 percent of rated torque.

e. Drive motors shall run smoothly, without torque pulsations at the lowest speed, and be energized at a frequency not exceeding 60 HZ.

O. Control Enclosures

1. Individual control panels shall be provided for each motion of the bridge crane.

   a. All power and auxiliary contactors, magnetic overload relays, time delay relays shall be housed in the enclosures.

2. Nameplates shall be provided for each enclosure and for equipment mounted to the enclosure per Section 2.20.

3. Enclosures shall be designed for operational environment.

4. Enclosures shall be designed according to CMAA 70, and NFPA 70.

5. Installation shall be properly secured to the crane structure provided with adequate lifting lugs. Anti-vibration pads shall be furnished.

6. Components shall be installed within enclosure in accordance with each component's manufacturer recommended installation instructions.

7. Provide ventilation kits and heaters to prevent condensation.

8. Enclosure shall be installed on support similar to standard drawing 40-D-60001.

9. Convenience Features:

   a. 120VAC Convenience Outlet:

      1) Rating: 120-Volt, 15 Ampere, 2-Pole, 3-Wire, polarized, GFCI Included

      2) Mounted in standalone enclosure with spring-loaded door.

P. Coordinate features of motors, load characteristics, VFDs and accessory devices to be compatible with the following:

1. Torque, speed and horsepower requirements of the maximum anticipated load.

2. Ratings and characteristics of supply circuit and required control sequence.

3. Ambient and environmental conditions of installation location.

Q. Emergency Crane Shutdown:

1. Provide fail-safe spring set electrically-controlled brakes when power is interrupted.

2. Release brakes with a mainline contactor pushbutton or a master switch for the associated drive.

3. Brakes shall automatically stop when there is a power failure.

4. Design electric system to be mechanically released.

5. Provide enclosures for electrical-controlled brake components conforming to NEMA ICS 6.

6. Provide direct current shunt magnetic shoe brakes with an electrical forcing circuit for rapid release of brake. Circuit each shunt coil brake for both conductors to open simultaneously when the brake is de-energized.

R. Programmable Logic Controller Process Automation

1. Refer to Section 25 12 10 – Programmable Logic Controller.

S. Crane Operating Parameters:

Table 41 22 15A-Rated Speeds

Rated Speeds (feet per minute)			
Description	**Minimum**	**Maximum**	**Micro-drive**
Hoist	[10]	[25]	[Yes]
Trolley	[50]	[125]	[Yes]
Bridge	[75]	[180]	[Yes]

1. Contractor shall determine the following operating parameters:

   a. Acceleration: [___] ft/s^2

   b. Load Position: Speed control and torque control.

   c. Maximum swing angle: [___] degrees.

2. Anti-sway and Anti-collision functions.

T. If not specified on drawing, Contractor shall determine size and ratings of the following:

1. Circuit breakers.

2. Fuses.

3. Resistors.

4. Motor controllers, contactors and overload relays. Size overload relays in accordance with requirements of NFPA 70, NEMA ICS-2, and NEMA ICS-8.

5. Control circuit transformers.

6. Instrument transformers.

U. Conform to referenced IEEE, NEMA, NFPA, and UL standards.

V. Provide surge suppressors in accordance with UL 1449.

W. Transients and Harmonics Protection:

1. Provide transient protection for drive controllers that is internal to the drive.
2. Provide line reactors rated for continuous duty operation based upon the motor nameplate amperes.
3. Crane motors of 50 horsepower or greater shall have harmonics protection provided by an isolation transformer.
4. For drive motor branch circuits that exceed 150 feet in length, a reactor shall be connected in series with the controller load terminals to for standing wave protection.

1.08 PROJECT CONDITIONS

A. Plant Layout: See Section 52 00 00 – Drawings, for informational drawings showing general plant layout and work areas, if available.

B. Altitude: 500 feet.

C. Average maximum outdoor ambient temperature: 36 degrees Celsius.

D. Relative Humidity Range: 25 to 89 percent.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in shipping containers with labeling in place.

B. Protect equipment from damage, moisture, and dust, free from contact with soil and weather.

1.10 QUALIFICATIONS

A. Qualified Professional Engineers: Demonstrated experience on cranes of similar size and capacity as bridge crane under this specification on at least three separate crane contracts.

1. Licensed in the state of California.

B. Qualified Crane Electricians: Minimum of one licensed electrician during field wiring and critical aspects of the crane field work.

C. Crane Controls System shall be designed and manufactured by a company with a minimum of 10 years of specialized experience.

D. Installation Supervisor:

1. Responsible for installation of electrical components and materials.
2. Technically qualified to supervise installation and testing work, meeting with COR approval.

3. Present or represented at work site during installation period.
4. Report, in writing to CO, work not in accordance with manufacturer's recommendations or other conditions possibly resulting in unsatisfactory job.
5. Maintain daily log of accomplished work.

E. VFDs and options shall be UL 508 listed as a complete assembly. The base VFD shall be UL listed for SCCR without the need for input fuses. Base VFDs with red label UL stickers requiring additional branch circuit protection are not acceptable.

F. VFDs shall be supplied with external filters. The entire assembly, including the bypass shall be seismically certified.

1. Provide seismic certification and installation requirements at time of submittal.

1.11 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of turnover to the Government.

PART 2 PRODUCTS

2.01 RATINGS AND GENERAL REQUIREMENTS

A. General:

1. Design and test all electrical devices and circuits associated with crane controls system. All devices shall be furnished as described in the layout drawings and shall be mounted as indicated and wired by the contractor. The contractor shall provide updated wiring diagrams in Reclamation RESF format as part of the operations and maintenance manual.
2. UL Listed Equipment, Conform to NEMA ICS-1, ICS-6, and ICS-8.

2.02 MOTORS – HOIST, BRIDGE, AND TROLLEY

A. Refer to Section 41 22 16 – Crane Motors.

2.03 VARIABLE FREQUENCY DRIVES

A. Enclosures per VFD shall be provided designed per Section 2.04, suitable for the corresponding VFD package.

B. Provided VFDs shall be in compliance with NEMA ICS 7, NEMA ICS 8 and NEMA ICS 61800-2.

C. VFDs shall be suitable for operation of NEMA MG 1, Design D hoist motors and Design B for travel, trolley and bridge motors.

D. Motions:
   1. Hoist: Static reversing, adjustable frequency, speed regulated, open loop vector controller with dual-channel, incremental encoder feedback.
   2. Bridge/Trolley: Static reversing, adjustable frequency, speed regulated, closed loop vector controller with dual-channel, incremental encoder feedback.

E. VFD model Allen-Bradley PowerFlex 755, 755-PP004, manufactured by Rockwell Automation, 1201 S. Second Street, Milwaukee, WI 53204; or equal, having the following essential characteristics:

   1. Rating:

      a. 480Volts, 3 **φ**, 60 Hz.

      b. Contractor to determine the following ratings:

         1) Rated Continuous Current.

         2) Maximum Full-Load Current.

         3) Rated Locked-rotor current.

         4) Short-Circuit Withstand

   2. Pulse Width Modulation (PWM), torque-rated for crane use.

   3. Insulated gate bipolar transistors in inverter.

   4. Dynamic Braking Diode Bridge.

   5. Brake and load monitoring features for hoist motion:

      a. Load monitoring to verify sufficient motor torque is developed before holding brake release.

      b. Load monitoring to verify that holding brake is maintaining load before removing motor power.

      c. Continuously monitor and alarm if holding brakes slip while crane is energized.

   6. Fail-Safe Brakes and programming, such that electrical failure does not cause runaway motion.

   7. Provide Dynamic Braking for all electric drives in accordance with CMAA 70.

      a. Brakes to set only after associated controller decelerates the motor to a controlled stop.

8. Rated for operation in environment described in Section 1.08 and at ambient temperatures of 40 degrees centigrade at rated motor current.

9. Provide full rated output from a line of plus or minus 10 percent of nominal voltage and continuous operation without faulting from a line of minus 35 to 30 percent of nominal voltage.

10. The continuous rating of the controller shall not be less than 125 percent of the calculated motor full load current per CMAA 70 and NFPA 70.

11. Input alternating-current line reactor for voltage transient protection.

12. Conformal-Coated circuit boards.

13. Identical user interfaces, including digital display and keypad.

    a. Keypads shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings.

    b. Keypads shall include automatic and manual speed control. The drive shall incorporate bumpless transfer of speed reference when switching between MANUAL and AUTOMATIC modes.

14. Built-in time clock with battery backup with 10 years minimum life span.

    a. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault.

15. Programming held in non-volatile memory, not dependent on battery power.

16. Capability to utilize pre-programmed application macros to facilitate motor start-up.

17. Possess temperature- and program-controlled cooling fans which are removable without disturbing other components.

18. Capable of starting into coasting loads up to full speed and accelerate or decelerate to set point without tripping or component damage.

19. Design for High-Impact loads and standstill loads.

    a. Speeds for all motors:

    b. Infinitely-variable and -adjustable, with a slow or jog mode limited to 25 percent of rated speed.

    c. Speed regulation: $\pm$ [0.02] % of max. frequency.

    d. Speed Response: Greater than 50 Hz.

    e. Speed Control Range: 1:1,500.

    f. Starting Torque: 225 percent of rated torque.

g. Speed detection to prevent load over-speed conditions.

h. Automatically reset inverse-time trip running overload protection contacts in each phase with thermal time constant set to be the same as motor.

20. Provide capability to automatically restart after an overcurrent, over-voltage, undervoltage or loss of input signal protective trip.

    a. The number of restart attempts, trial time, and time between attempts shall be programmable.

21. The overload rating of the drive shall be 150 percent of its normal duty current rating for 1 minute.

22. Provide non-linear chokes to yield impedance equivalent to 5 percent to reduce harmonics to the power line.

23. Input and output current ratings shall be included on the nameplate.

24. The input rating of the VFD shall not be greater than the output current rating.

    a. VFDs with higher input current ratings shall require the upstream conductors, protection devices and source transformers to be oversized per NEC 430.122.

25. Provide AC transient surge protection:

    a. MOVs, phase to phase and phase to ground.

    b. Capacitor clamp.

26. Provide the following minimum Harmonics Protection:

    a. Line reactor connected in series with each controller's line terminals.

    b. All reactors shall be rated for continuous duty operation based upon motor nameplate amperes and shall be designed for 60 Hz operation.

    c. Isolation transformer for the motor branch circuit.

    d. For motor branch circuits that exceeds 150 feet in length, a reactor shall also be connected in series with the controller load terminals to provide standing wave protection.

    e. Compliance to IEEE 519 does not relieve the Contractor from the requirement to provide Active Front End drives.

27. Provide a programmable loss-of-load Form-C relay output.

    a. Loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

28. If the input reference is lost, the VFD shall give the following operator options:

    a. Stopping and displaying a fault.

    b. Running at a programmable preset speed.

c. Hold the VFD speed based on the last good reference received.

d. Issue a warning.

29. Motors shall operate smoothly at all speeds without torque pulsations and shall only be energized within the frequency range of 50-60 Hz at rated speed.

30. Anti-Collision System:

a. Prevent collision between crane and runway stops, or other cranes, if applicable.

b. Prevent collision between trolley(s) and end stops, or other trolleys, if applicable.

c. Activate creep mode of crane and trolleys when within proximity to the other crane(s), other trolley(s), the end stops, or the runway stops.

31. Anti-Skewing System:

a. Correct misalignment of bridge end truck motion to prevent wheel and rail damage.

b. Software and laser-sensor based, closed-loop monitoring and adjustment.

32. "No Fly Zone" functionality as described in Section 25 00 01 "Automation Control System" Article 2.02 A5 Collision Avoidance/" No-Fly Zone" function.

33. Labels:

a. Provide for pushbuttons, switches, indicating lights, load cell displays, and crane motion operation devices, as described in Article 2.19.

b. As applicable, indicate direction of motion and associated component.

34. Provide limit switches per Article 2.12.

35. Run permissive circuit: VFD shall provide a dry contact closure when motor does not operate. Two separate safety interlock inputs shall be provided.

36. The following operating values shall be capable of being displayed:

a. Output Voltage.

b. Output Frequency.

c. Motor Speed (RPM).

d. Motor Current.

e. Motor Torque.

f. Motor Power.

37. Provide the following minimum Inputs and Outputs:

a. Digital Inputs: Six programmable.

b. Digital Outputs: Six programmable.

c. Analog Inputs: Two programmable, accepts current or voltage signals.

d. Analog Outputs: Eight programmable, 0-20 mA or 4-20 mA. The outputs shall be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Power, Active Reference and Active Feedback.

F. Provide any unlisted, required hardware for compatibility between VFDs and operator control device as described in Article 2.07.

G. Communications:

1. EIA-485 Port.

2. Modbus TCP, Profibus, EtherNet IP.

3. Serial communication shall include, but not limited to; run-stop controls and speed set adjustment.

4. Provide process variable feedback to the crane PLC.

H. Hoist Motor Variable Frequency Drive AC motor controller:

1. Closed-Loop Flux Vector Control

2. Provide Hoist Load Cells in accordance with the following:

a. Sheave block pin strain gauge type, with range suitable for associated hoist.

b. Provide per hoist, if applicable.

c. Overload Limit:

1) Adjustable disconnect circuitry for safety lock out to prevent overload lifting with back out ability.

2) Audible alarm at 90 percent load capacity with silencing option.

d. Continuous readout.

e. Capability to “zero” or calibrate readout.

f. Display: 7-Digit, with readout to 1/100 US ton (e.g. XXX.XX US ton) and equivalency in pounds on HMI.

g. Accuracy: Indication within 3 percent of the actual load, at the rated hoist capacity.

3. If a Non-Design D motor is used, negative slip compensation shall be employed to emulate the speed-torque characteristic of a NEMA Design D motor in accordance with NEMA MG 1.

a. Provide to reduce the effect of motor slip.

b. Provide load torque signal to the speed controller to increase the output frequency in proportion to the load.

c. Utilize with direct torque control with an accuracy of 10 percent of the nominal motor slip, minimum.

4. Design to provide an Active Front End with the following minimum features:

a. Dynamic braking using a chopper IGBT and resistor combination; sized per manufacturer's requirements.

b. Regenerative drive.

c. Active rectifier to mitigate harmonic distortion in accordance with IEEE 519.

d. IGBT Rectifier design providing four-quadrant operation.

1) Hoist motor produces either positive or negative torque. Motoring and regenerative power shall be maintained near unity power factor.

5. Provide hoist drives with a motor overtorque limit to lock out the hoist and prevent gross overload.

a. The overtorque limit shall be set at 225 percent of the motor torque required to hoist 100 percent load.

6. Hoisting functions shall not produce any rollback and shall produce no more than 1/8 inch of roll-up.

7. Hoist Brakes Operation:

a. Brakes shall release upon movement of the VFD drive controller from the OFF position and verification of motor torque.

1) Verify sufficient motor torque is developed before brake release.

2) Monitor load to verify holding brake adequately maintains load before removing power from the hoist motor.

3) Alarm under brake slip conditions.

b. The brakes shall set after the drive's controller is returned to the OFF position and motors have regeneratively slowed to a controlled stop.

c. The hoist's secondary brake shall be controlled separate from the primary brake and connected to a different output from the primary brake.

d. A three position maintained keyswitch shall be installed on the outside of the motor control enclosures for each hoist to allow for testing each brake independently.

1) Primary Brake Test.

2) Secondary Brake Test.

3) Normal: Allow both brakes and the drive to function in normal operation.

I. Travel and Bridge Motor Variable Frequency Drive AC motor controller:

1. Open-Loop Control

Travel assemblies with one driven wheel on each side. Motors shall be self-contained gear reduction units.

2.04 ENCLOSURES

A. Unless otherwise specified, enclosures shall be designed and installed in accordance with NEMA 250, CMAA 70, and NFPA 70, where applicable and appropriate for contained hardware.

B. All enclosures and installed hardware shall be UL-Listed per UL 50 and UL 98, where applicable.

C. In addition, all enclosures to have the following features:

1. Conduit entry: Bottom and side entry.
2. Provide interior light with a door switch to turn lights off when the doors are closed.
3. Doors:
   a. Hinged, latching, gasket-sealed.
   b. Pad-lockable.
4. Support:
   a. Wall mounted or Unistrut mounted in accordance with Standard USBR Drawing 40-D-60001.
5. Heating and Ventilation Kits:
   a. Where necessary for type of installed equipment and/or operating environment, provide thermostatically-controlled heaters and/or enclosure ventilation kits to regulate humidity and temperature to within safe operational parameters, or prevent buildup of hazardous gases.
   b. Heaters and ventilation kits shall be selected based on equipment manufacturer recommendations, equipment compatibility, and environmental conditions.

D. Crane Control Enclosures

1. Locations: Bridge Crane Walkway

2. Fabricate control panels of solid sheet steel designed and constructed to conform to requirements of NEMA ICS 6.

3. Provide pilot light to indicate that power is available on load side of crane disconnect switch. Pilot light shall be white and labeled CRANE ENERGIZED.

4. Provide pilot light to indicate that the main contactor is energized. Pilot light shall be blue and labeled CONTACTOR ENERGIZED.

5. Provide a non-resettable hour meter for each VFD per Article 2.21, connected across the main line contactor, readable from the exterior of the main control panel, to indicate the elapsed number of hours the crane is energized.

2.05 HUMAN MACHINE INTERFACE

A. Location: Enclosures: On the outside of the PLC Enclosure.

B. Provide red pushbutton on enclosure to allow for reset functionality.

1. Reset function shall reset Emergency Stop/fault lockout/crane control permissives and allow crane operation.

C. Refer to Section 25 12 10 – Programmable Logic Controller.

2.06 PROGRAMMABLE LOGIC CONTROLLER

A. Location: Controls enclosure, nearby the crane, accessible from ground level.

B. Refer to Section 25 12 10 – Programmable Logic Controller.

2.07 MANUAL CONTROL DEVICE

A. Where not described hardwired control (switch, pushbutton, joystick, etc.) characteristics shall conform to Article 2.13 “Hardwired Controls”.

B. Contractor shall provide all required hardware and components for wired crane control via a device possessing the following essential characteristics:

1. Pendant-style remote control device, attached to underside of crane.

2. Compatible with other provided hardware and capable of controlling all required and listed crane functionality.

3. Contractor shall provide pushbuttons, switches, visual indicators, and any other required components, compatible with selected control device and suitable for the operation of all listed crane functionalities.

a. Pushbuttons shall include tactile feedback for different stages of operation, where appropriate.

b. HORN function shall be controlled via pushbutton.

c. Hoist, Trolley, and Bridge motions shall be controlled pushbuttons with tactile feedback and multiple stages for different operating speeds.

d. Emergency stop functionality, to operate the main-line contactor and trigger Emergency Stop Permissive, shall be controlled via a red, latching, mushroom-head pushbutton.

1) Push to lock, turn and pull to release.

e. Crane control permissive shall be operated by shrouded, two-stage switch with maintained "ON" and "OFF" positions.

f. Provide Pilot light to indicate that control is active. Pilot light shall be green and labeled POWER ON.

g. Control switches/devices for required functionalities not listed shall be additionally provided by Contractor.

4. All pushbuttons, switches, indicating lights and joysticks shall be legibly and permanently marked per Article 2.19.

5. Provide double block contacts:

a. Mechanically interlocked.

b. Spring return operators.

2.08 FUSED DISCONNECTS

A. Designed with all listed features per following subsection in Article 2.08 as minimum requirements, in addition to the following:

1. Disconnecting means in accordance with NFPA 70, IEEE C37.13, IEEE C37.96, IEEE 3004.8, where applicable.

2. Installed per applicable NFPA 70, CMAA 70.

3. UL Rated per UL 98 and UL 489, where applicable.

4. Possessing padlockable, trip free handles or switches.

5. Multiple pole disconnects shall have a single operating handle or switch.

6. Contactors and relays shall not be definite purpose. The crane application shall not exceed the contactor manufacturer's AC3 rating.

7. All contactors and relays shall have appropriate MOVs or R-C surge absorbers installed across the respective device's coil.

8. Enclosures designed per Article 2.04 except where indicated.

a. Readily accessible and operable from the ground or floor level, placed within view of the runway contact conductors and other equipment operated by switch.

9. Fuses for Disconnects:
    a. Fuses 600 Amperes and less: Dual element, time delay, and current-limiting type.
    b. Rated Voltage: 600 Volt.
    c. UL Class [RK 1] [RK 5] [J], Contractor to determine.
    d. Interrupting Rating in accordance with NFPA 70.
    e. Fuses conform to NEMA FU 1, UL listed.

B. Main-Line Fused Disconnect:
1. Purpose: Disconnect isolation for all powered crane systems.
2. Rated Voltage: 600 Volts, 3 **φ**, 60 Hz, 3-pole.
3. Current Rating: shall have a continuous current-rating equal to or greater than the larger of:
    a. Fifty percent of the combined intermittent-duty current ratings of all the motors on the crane, plus the rated current of auxiliary loads on the load side of the disconnecting means.
    b. Seventy-five Percent of the sum of intermittent-duty current ratings of all motors required for the other crane motion having the largest horsepower plus the rated current of all auxiliary loads (other than crane motions) on the load side of the disconnecting means.
4. Interrupting Rating: Contractor to determine.
5. De-energized during:
    a. Crane Shutdown
    b. Undervoltage
    c. Reverse-phase or open phase condition.
    d. Motor overload.
6. Designed in accordance with NEMA ICS-2, NEMA ICS-8 and NFPA 70.

C. Fused Service Disconnect Switch:
1. Purpose:
    a. Disconnect isolation for main crane systems and control circuits.
    b. Disconnect isolation for PLC cabinet.
2. Location: Mounted in standalone enclosures on crane bridge and on PLC cabinet(s).
3. Rated Voltage: 600 Volts 3 **φ**, 60 Hz.

4. Interrupting rating determined by contractor.
5. Type: Heavy-Duty industrial, quick-make, quick-break, load interrupter, single-throw, and fusible.
6. Mechanism/Handle:
   a. Steel operating mechanism with no plastic parts.
   b. Operating Handle:
      1) Integral part of switch enclosure. Use of cover as disconnect device not acceptable.
      2) Steel knife switch with no plastic parts, other than handle grip.
      3) Provision for padlocking in OFF position.
7. Cover Interlock:
   a. Prevents unintentional opening of switch cover when switch is ON.
   b. Prevents closing switch with switch cover open.
8. Provide warning sign with the following text:
   a. "WARNING – THIS DOES NOT ISOLATE POWER TO LIGHTING, RECEPTACLES, AND ANCILLARY EQUIPMENT".
9. Disconnect switch conform to NEMA KS 1 and UL listed.

2.09 CIRCUIT BREAKERS

A. General:
1. Circuit breakers shall be capable of being padlocked in the open position.
2. Voltage: Appropriately rated for connected devices.
3. Each circuit breaker shall have separate trip indication independent of the ON or OFF positions.
4. Interrupting Rating: 10,000 amperes, minimum.
5. Includes arc quenchers.
6. Number of Poles: Two with auxiliary contacts.
7. Circuit breakers shall be Bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.
8. Tandem type circuit breakers shall not be permitted.
9. Quick-make and quick-break toggle mechanisms.
10. Trip-free operating handle.

11. Equip multiple-pole breakers with common trip so an overload on one pole will automatically cause all breaker poles on that breaker to open.
12. Cover blank spaces with removable plates.
13. Assemble boards with molded-case circuit breakers individually mounted on fixed framework behind easily removable covers.
14. Connect breakers in branch circuits of direct-current boards to main buses such that adjacent poles of each breaker are opposite in polarity. Mount circuit breaker handles to be operable from front of boards.
15. Assemble boards so that individual breakers can be removed or added without disturbing adjacent units, without loosening or removing supplemental insulation supplied to meet requirements of UL, and without additional machining, drilling, or tapping.
16. In accordance with FS W-C-375, IEE C37.13, IEEE C37.14, NEMA AB 3, and UL 489.

B. Main and Branch Breakers:

1. Thermal-magnetic type with inverse-time trip characteristics on overload and instantaneous trip on short circuit.
2. Sized in accordance with NFPA 70.8

C. Motor Circuit Breakers:

1. Sized in accordance with NFPA 70 and NEMA ICS 8.
2. Circuit breakers shall be molded case thermal-magnetic type.
3. Quick-make and quick-break type with wiping type contacts. Provide with arc chutes, individual trip mechanisms on each pole. Three pole breakers shall be common trip.
4. Provide motor circuit breakers as means of disconnect for hoist and travel motors.
5. Motor Operate on magnetic principle with a current sensing coil in each of the three poles to provide an instantaneous trip for short circuit protection.
6. The Trip setting shall be adjustable from 700 to 1300 percent of the motor full load amperes from the front of the breaker.
7. Set at lowest position at the factories.
8. Provide auxiliary contacts which open when the breaker is in the OFF position.

D. Continuous Current Rating:

1. Main Supply Disconnect Switch: Match main bus rating.

2. Branch Breakers and Motor Disconnects: 22,000 symmetrical RMS amperes, minimum.

2.10 INDICATOR LIGHTS AND WARNING DEVICES

A. Indicating lights and beacons shall have the following essential characteristics:
   1. LED type, suitable for indoor and outdoor use.
   2. Rated for operation using available power.
   3. UL Listed.
   4. 30,000 hour rated life, minimum.
   5. Sized, located, and with lumen rating chosen to be visible from the ground or expected working distance during any time of the day.
   6. Accessible per NFPA 70 definition for replacement or repair, through a cover panel on front of light enclosure or similar.
   7. Impact-resistant materials.

B. Provide the following minimum indicating lights in a stack under the crane and on the Crane PLC Enclosure for 120 VAC operation:
   1. A “White” indicating light to indicate that power is available on the load side of the crane disconnect.
   2. A “Blue” indicating light to indicate the main contactor is energized.
   3. An “Amber” light to indicate slow speed operation.
   4. A “Red” light to indicate a hoist brake fault.

C. Provide a warning horn operable from the crane controller.

D. Provide a travel warning bell, automatically operated during hoist or travel motion.

E. Provide a Warning Strobe or Rotating Beacon, automatically illuminated during hoist or travel motion.

F. Provide Overhead Crane Warning Floor-Projection Spotlights:
   1. Line Characteristics: Red, 4-8 inch width, M-Type: 1 x irradiation distance.

2.11 LOW-VOLTAGE GENERAL PURPOSE TRANSFORMERS

A. Capacity: Contractor to determine kVA rating.

B. Location: On the bridge walkway.

C. Type: Dry type, copper windings, and sized to have adequate capacity for control power requirements of the motor control circuit.

D. Primary Voltage: 480 volts, 60 Hz.

E. Secondary Voltage: 120 volts, 60 Hz.

F. Class: AA – Ventilated, Self-Cooled, 60kV BIL

G. Insulation: shall be rated at 220 degrees Celsius.

H. Winding Temperature: Rise shall be rated at 150 degrees Celsius above a 40 degree Celsius ambient.

I. Integral fuse block mounted on transformer.

1. Primary Fuses: 600 volt, current-limiting type.
2. Secondary Fuses: 250 volt, current-limiting type.

J. Transformer UL listed. Fuses conform to FU 1 and UL listed.

K. Transformers conform to IEEE C57.13.

L. Provide enclosure designed per Article 2.04, equipped with lifting eyes or brackets.

M. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap sized to meet NEMA and UL standards.

N. Coil Conductors: Continuous windings with termination pads brazed or welded.

O. Isolate core and coil from enclosure using vibration absorbing mounts.

P. Nameplate: Include transformer connection data.

Q. Mounting: 75 kVA and less shall be suitable for wall, floor, or trapeze mounting.

R. Provide Electronic Temperature Monitor.

2.12 LIMIT SWITCHES

A. Provide heavy-duty quick-break double-pole double-throw type gear limit switches conforming to NEMA ICS-2 and ICS-5 with the following minimum characteristics:

1. Screw type with self-resetting feature.
2. Incorporated in the control circuit of each respective drive motor for each travel direction.
3. Include back-up limit switch with under voltage release circuit of the incoming circuit breaker.
4. Interruption of motion in one direction shall not prevent the opposite motion.
5. Shall slow the crane to 25 percent of its rated speed before reaching end stops.

6. Prevent overtravel: activate when reaching end stops in either motion direction.
7. Mounted rigidly and set brakes upon activation.

B. Provide block-actuated upper limit switch on hoist to prevent two-blocking, requiring resetting prior to continued operation of the hoist.

2.13 HARDWIRED CONTROLS

A. Contact arrangements shall be determined by contractor.

B. Pushbuttons shall have the following characteristics:

1. Type: Heavy-duty, watertight/oiltight with 30.5 mm mounting hole. Momentary or maintained contacts and multi-stage tactile feedback as required.
2. Black, flush-head style, unless otherwise specified.
3. Contact rating: NEMA A600, P600.
4. Provide auxiliary, field convertible contacts per NEMA ICS 5.

C. Emergency stop buttons shall be red, latching, mushroom-head pushbuttons with “push to lock” and “turn and pull to release” functionality.

D. Controls shall have nameplates or labels installed per Article 2.20.

E. Hardwired Controls shall conform to NEMA ICS 5.

2.14 POWER CIRCUIT RESISTOR RATINGS

A. Rated for continuous duty.

B. Corrosion resistant metal.

C. Size resistors in accordance with NEMA ICS-8 Table 2-3-1 or 2-3-2, part 11.

D. Rate resistors for applications requiring continuous duty, speed-regulating resistors, in accordance with NEMA ICS-8 Table 2-3-3, part 11.

E. Provide appropriate Class resistors, in accordance with NEMA ICS-8 Table 11-9-2.

1. Resistors for CMAA Class D, E, or F crane shall have a rating not less than Class 160 unless specified.

F. Provide dynamic braking resistor bank rated for contractor-determined back-current generated during braking under full-load conditions.

2.15 RELAYS AND TIMERS

A. General:

1. Relays shall be installed in accordance with manufacturer's recommended installation.
2. When the output is turned off the relay coil will de-energize.
3. UL listed.
4. For applications requiring switching of very low current signals, such as 4-20 mA control loops, relays shall be hermetically sealed and use mercury wetted contacts.
5. All relays with similar functions shall be supplied by the same manufacturer.

B. Provide control, timing and interposing relays as required.

2.16 AUTOMATION CONTROL SYSTEMS

A. Refer to Section 25 00 01 – Automation Control Systems.

2.17 ELECTRIFICATION

A. In accordance of requirements with CMAA 70 Class C, Indoor Service.

B. Runway:

1. Contractor shall provide enclosed, rigid, four bar conductor system, suitable for use with furnished VFDs.
   a. Contractor shall design location, size, length, and material of bridge travel conductors, per CMAA 70, Section 41 22 14 – Bridge Crane, operational environment described in Article 1.08, and all other project requirements.
   b. Contractor shall provide all brackets, hangers, splice covers, power feeds, expansion gap assemblies and collectors as required by manufacturer.
2. Enclosures:
   a. Rigid or flexible self-closing type, grounded, designed to cover all conductors, and shaped to prevent contact with conductors except through bottom collector opening.
3. Collectors:
   a. Heavy duty, sliding-shoe, spring-loaded type, compatible with electrification system.
   b. Collector arms: Designed to maintain positive collector contact with conductor during small amounts of misalignment caused by bridge movement past the runway beam.
   c. Tandem collector heads for each conductor rail.

4. Rating:

   a. Voltage: 600 Volts, maximum

   b. Voltage drop along the conductors within three percent of the rated voltage.

   c. Contractor shall determine the total expected load current.

   d. Flame rating for all materials: UL 94 V-1.

5. Maximum conductor temperature: 85 degrees Celsius.

6. The maximum continuous length of conductor rails shall not exceed 30 meters without an expansion joint.

7. Rail Connectors: Clamping type connectors with insulated cap.

8. Anchor Clamps: Clamping element type.

9. Hanger Clamps: Freely rotating and height adjustable during thermal expansion.

10. Phase and ground end covers: conductor rail terminator protection against accidental contact.

C. Convenience Features:

1. 120VAC Convenience Outlet:

   a. Location: Crane Bridge

   b. Rating: 120-Volt, 15 Ampere, 2-Pole, 3-Wire, polarized, GFCI Included

   c. Mounted in standalone enclosure with spring-loaded door.

2. 120 VAC Cord Reel:

   a. Location: Mounted where accessible below crane

   b. Rating: 120-Volt, 20 Ampere, 2-pole, 3-wire, polarized

   c. Spring-Loaded, self-retracting cord reel with 50 feet of cord and plug.

2.18 SENSORS

A. Provide Laser sensors for anti-sway and anti-skew systems conforming to IEC 60825-1 with the following minimum characteristics:

1. Laser Angular Measurement Sensor:

   a. Supply Voltage: 48 VDC.

b. Range: 40 meters.

c. Usable scanning angle: 180 degrees.

d. Angle resolution scanner: 0.25, 0.5 and 1 degrees.

e. Measuring resolution: 13.6 mm, minimum.

f. Wavelength of laser diode: 905 nm, infrared light.

g. Laser Class: Class I, in accordance with IEC 60825-1.

h. Beam divergence: 11.9 mrad.

i. Communication suitable for chosen PLC.

j. Vibration and shock resistant.

2. Laser Distance Sensor:

a. Supply Voltage: 48 VDC

b. Range: 0.05 up to 500m.

c. Measuring Accuracy: Plus or minus 1.0 mm.

d. High measurement speed: 250 Hz, 1000 Hz output rate.

e. Communication suitable for chosen PLC.

f. Analog Output: One programmable.

g. Digital Input: One programmable.

h. Digital Output: Two programmable.

i. Four LED's for status signaling.

j. Laser Class: Class II, in accordance with IEC 60825-1.

B. Provide additional sensors as required for Obstacle Avoidance/No-Fly Zone capability as described in section 25 00 01 – Automation Control System, Article 2.02.A.5.

2.19 LIGHTING

A. Provide one lighting transformer which shall be designed for a minimum continuous rating of 2.5 kVA.

B. Crane-mounted floodlights to illuminate the work area under the crane shall be provided as follows:

1. Minimum 40 foot-candle illuminance at 3 feet above the floor.

2. Lighting fixtures shall be provided complete with reflector, lamps, shock absorbing mount, and all safety cables and features to prevent fixtures or parts thereof from falling in the event of damage or equipment failure.

3. LED Type, 4000-6000K Burn Temperature
4. 50,000 Hour Lifetime (L70) and 3-year manufacturer warranty, minimum.
5. All lighting fixtures shall be rated for rough service, vibration resistant, and be made of impact-resistant material.

2.20 NAMEPLATES AND LABELS

A. Where no drawings or other information are available:
   1. Labels shall be white with black, block, machine-lettering, adhesive-type, sized appropriately for legibility from normal operation distance on corresponding panel or mounting surface.
   2. Nameplates shall be designed in accordance with Reclamation Standard Drawing 40-D-6234, sized and colored for maximum legibility from normal operation distance on corresponding panel or mounting surface.
   3. At minimum, nameplates and labels shall identify the direction of motion, associated function, and/or crane system designation, as applicable.
   4. Labels shall be white with black machine-lettering, adhesive-type.

B. Nameplates shall be provided for all electrical control equipment such as contactors, relays, transformers, etc., and all electrical panels and junction boxes.

C. Labels shall be provided for equipment mounted on wiring side of equipment panels.
   1. Provide double letter device location labels attached to the panel for every device as shown on the drawings.
   2. Include additional labels for devices that use the IEEE C37.2 device designation naming convention.
      a. Attach the device designation label directly on the device itself if possible or in an adjacent location that clearly indicates the equipment that the label is identifying.

D. Labels shall be provided for terminal blocks.
   1. Labels shall contain the single letter terminal block designation as shown on wiring diagrams.

E. Where not manufacturer-provided, labels shall be provided for all control and visual display features – including, but not limited to, hardwired controls (switches, buttons, joysticks, and similar), indicators, lights, informational displays (meters, readouts, and similar) - on enclosures, motors, manual control panels and devices, and any other hardware provided possessing any of these features.

2.21 METERS AND INDICATING DEVICES

A. Hour Meter:

1. Provide a non-resettable hour meter, connected across the main line contactor, readable from the exterior of the motor control enclosure to indicate the elapsed number of hours the crane is energized.
2. Provide with nonvolatile memory (EEPROM), which retains data for at least 25 years.

B. Power Monitor, Allen Bradley Power Monitor 1000, or equal:

1. The unit shall monitor all three phases and display volts (phase to phase and phase to neutral), amperes, power factor, and hertz.
2. Provide with a serial or equivalent direct connection for communication to the crane control PLC.

2.22 SPARE PARTS

A. Provide a set of spare parts, identical to those selected for provision, for the following systems/components and in the quantities indicated:

1. Any manufacturer-recommended spare parts.
2. Operator Interface Terminal Display (QTY: 1)
3. Full PLC System, including processor, chassis, power supply, and all I/O Cards. (QTY: 1)
4. Auxiliary Control Panel Relays (QTY: 2)
5. Control Panel Indicating Lights (QTY: 4, 1 of each)
6. Control Panel Fuses (QTY: 2)
7. Pendant Components
   a. Black Pushbutton (QTY: 2)
   b. White Pushbutton (QTY: 1)
   c. Red Mushroom-Head Button (QTY: 1)
   d. 30mm Green Pilot Light (QTY: 1)
   e. 30mm Black Short-Handle 2-Stage Selector Switch (QTY: 1)
8. Transformer Fuses (QTY: 2)
9. Crane-Mounted Indicating Lights
   a. Full Fixture (QTY: 1)
   b. Replacement Lenses (QTY: 1/ea color)

10. Wall-Mount Emergency Stop Button (QTY: 1)

2.23 SOURCE QUALITY CONTROL

A. Perform production tests in accordance with manufacturer's standard shop and quality control procedures.

B. Test for correct operation and mechanical adjustment.

C. Perform AC dielectric test on power circuit in accordance with NEMA ICS 1.

2.24 FACTORY ACCEPTANCE TEST

A. General:

1. Perform FAT for control enclosures and crane electrical components to include a functional test of the following equipment and all affiliated I/O interfaced to the Automation Control System:
   a. Programmable Logic Controller and all I/O cards.
   b. Variable Frequency Drives and regenerative units.
   c. Power Supplies.
   d. HMI
   e. Surge protection devices.
   f. Enclosure heater.
   g. Protection devices and components.
   h. Pendant control station.
   i. Warning devices and lights.
   j. Sensors and lasers.
2. Tests shall verify ability of all equipment and components to perform intended functions, such that when equipment is shipped and correctly connected to external devices, the complete system operates as designed and specified in these specifications.

B. Factory Acceptance Test Procedures

1. Test procedures shall define the tests required to ensure that the system meets technical, operational, and performance requirements.
2. Support personnel provided during testing shall be familiar with the project and be capable of fixing problems identified during testing.
3. Perform Factory Acceptance Testing for PLCs and VFDs in accordance with requirements in ISA 62381.

4. Perform 100 percent I/O checkout.
5. Verify all validated software and hardware updates and patches are installed prior to start of functional testing.
6. Test procedures shall define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required.
    a. Any simulation programs, equipment, personnel, facilities and supplies required shall be provided by the Contractor.
7. Provide test procedures for testing all process control system capabilities and functions specified.
8. Test Procedures shall cover actual equipment and sequences to be used for the specified project and include detailed instructions for test setup, execution, and evaluation of test results.

C. Factory Acceptance Test Notification:
1. Government reserves the right to witness FAT. Notify government at least 60 days in advance when tests are to be performed.

D. Factory Acceptance Test Reports:
1. Provided to the Government within 21 days of the completion of the FAT.
2. List of all equipment tested and results of each test.
3. 4-inch by 6-inch or larger pictures provided clearly showing the following:
    a. Front and side view clearly depicting the control panel label, lockable handle, and vents for each enclosure.
    b. Front view of Control Enclosure Swing Panel clearly showing placement of HMI Touch Screen for each enclosure.
    c. PLC, VFD and affiliated components within enclosure wiring to include legible wire labels for each enclosure.
    d. For each enclosure, front view of Control Enclosure with Swing Panel opened clearly showing placement of components within Control Enclosure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Develop and format detailed instructions and checklists in accordance with Section 01 33 26 – Electrical Drawings and Data.

B. In accordance with requirements in NFPA 70.

C. Installation shall be completed in a neat and workmanlike manner in accordance with NFPA 70. All damage to enclosures or installation area shall be repaired and left in a finished condition.

D. Provide cable where necessary for a complete functional system. Provide cable for all power and control connections required for the Contractor supplied equipment.

E. Contractor shall replace existing cables and raceway that exit crane controls system.

F. Furnished cables and conductors shall be in accordance with Section 26 05 10 – Conductors and Cables and NEMA WC 70-2021.

G. Installation of electrical wiring, conduit and components shall be performed in accordance with the requirements of NFPA 70. As a minimum, the items below shall be followed.

1. All electrical connections shall be installed in accordance with NFPA 70 sections 110.14 and 430.9 as required, or as recommended by the manufacturer.
2. Spare conductors shall be identified as spare conductors and shall have their ends insulated to preclude accidental contact with energized equipment.
3. Panels and enclosures shall have their doors, back sheets and panel boards bonded together with flexible bonding straps. Bonding straps and equipment grounding conductors shall be connected to ground points, have all paint removed from their termination points to insure proper grounding of the equipment.

H. Install in accordance with manufacturer's instructions and recommendations.

I. Assemble, level, and secure equipment in position.

J. Select and install motor overload heater elements. Size heater in accordance with NFPA 70.

K. Make cable and conduit connections. Terminate in accordance with FIST 3-3.

L. Make grounding and bonding connections in accordance with Section 26 05 20 – Grounding and Bonding and NFPA 70.

M. Control Cable and Wire Identification: In accordance with Section 26 05 33 – Raceways and Boxes.

N. Wiring and Connections:

1. Install all wiring and terminal blocks and make all connections and terminations in accordance with Section 26 05 20 – Grounding and Bonding.

2. Provide and install required raceways, conduits, cable trays, marked conductors, cables, and grounding equipment, suitable for provided equipment and ratings thereof, per Sections 26 05 10 – Conductors and Cables, 26 05 20 – Grounding and Bonding, and 26 05 33 – Raceways and Boxes.

O. Nameplates, Legend Plates, and Labels: In accordance with Standard Drawing 40-D-6234 and Article 2.20 "Nameplates and Labels".

P. Align control system in accordance with manufacturer's instructions.

1. Store a copy of the final alignment data in control panel door, including but not limited to, timer settings, resistor tap settings, potentiometer settings, test-point voltages, supply voltages, motor voltages, motor currents and test conditions such as ambient temperature, motor load, date performed and person performing the alignment.

Q. Coordinate layout and installation of VFDs with other construction including conduit, equipment and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

R. Disconnect switches shall be in accordance with the following methods:

1. Mounting:

a. Disconnects shall be fastened securely to supporting structure at walls.

b. Machine bolt to metal framing or plates.

c. Expansion anchors to concrete walls.

d. Provide 1 inch spacers to set enclosure out from concrete or block wall.

2. Stands and Supports:

a. Disconnect stands and support shall be secured as shown on standard Drawing 40-D-60001.

b. Corrosion-resistant materials and finishes.

c. Unistrut-type materials for fabrication.

d. Expansion anchors for bolts in concrete floor.

e. Machine bolt to metal framing or plates.

f. Fasten stand securely to floor.

g. Dimensions as required by equipment to be mounted.

3. Height:

a. Center of handle shall be 4 feet 6 inch above the finished floor or work platform.

S. Install fuses in each fusible-switch VFD.

T. Install fuses in control circuits if not factory installed.

U. Provide fuses for all fused disconnect switches. Size fuses in accordance with nameplate requirements for each load served.

V. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

W. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

X. Cable and Wire Identification and connections in accordance with Section 26 05 10 – Conductors and Cables.

Y. Conduit connections in accordance with Section 26 05 33 – Raceways and Boxes.

Z. Grounding and bonding connections in accordance with Section 26 05 20 – Grounding and Bonding.

3.02 SITE ACCEPTANCE TEST

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.03 HARMONIC ANALYSIS STUDY

A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze designated scenarios, including recommendations for VFD input filtering to limit TDD and THD at each VFD to specific levels.

B. Prepare a harmonic analysis study and report in accordance with IEEE 399 and NETA ATS.

3.04 COMMISSIONING VERIFICATION

A. Refer to Section 26 08 00 – Commissioning of Electrical Equipment.

3.05 OPERATION AND MAINTENANCE

A. Submit manufacturer's operating and maintenance manual to the COR no later than 30 days prior to final acceptance.

B. Submit manufacturer's instructions for crane VFDs including special provisions required to install equipment components and system packages. Include all special notices regarding detail impedances, hazards and safety precautions.

3.06 FINAL AND AS-BUILT DRAWINGS

A. Final As-built Drawings (Government Format): refer to Section 01 78 30 – Project Record Documents and Section 01 33 26 – Electrical Drawings and Data.

1. Marked prints of specifications drawings indicating "Final As-Built" changes made to crane electrical components during construction.

3.07 TRAINING

A. Refer to Section 01 79 20 – Training.

END OF SECTION

SECTION 41 22 16
CRANE MOTORS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of 30 Ton bridge crane motors in price offered in the Price Schedule for Design, Furnish, Install and Test 30 Ton Bridge Crane.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME B30.2-2022 — Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

B. American National Standard Institute (ANSI)

1. ANSI/AGMA 6013 — Standard for Industrial Enclosed Gear Drives
2. ANSI AR100-2020 — Recommended Practice for the Repair of Rotating Electrical Apparatus

C. Code of Federal Regulations (CFR)

1. 29 CFR 1910 - 2022 — Occupational Safety and Health Standards

D. Facilities Instructions, Standards and Techniques (FIST)

1. FIST 3-9-2000 — Methods for Coordinating System Protective Equipment

E. Crane Manufacturers Association of America, Inc. (CMAA)

1. CMAA 70-2020 — Top Running and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

F. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C37.2-2022 — Electrical Power System Device Function Numbers, Acronyms, and Contact Designation
2. IEEE C37.96-2012 — Guide for AC Motor Protection

3.	IEEE 112 – 2017	Standard Test Procedure for Polyphase Induction Motors and Generators
4.	IEEE 115 - 2019	Test Procedures for Synchronous Machines including Acceptance and Performance Testing and Parameter Determination for Dynamic Analysis
5.	IEEE 117 – 2015	Standard Test Procedure for Thermal Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery
6.	IEEE 841-2021	Premium-Efficiency, Severe-Duty, Totally Enclosed Squirrel Cage Induction Motors 1HP to 500HP
7.	IEEE 3004.8-2016	Recommended Practice for Motor Protection in Industrial and Commercial Power Systems

G. International Electrotechnical Commission (IEC)

1.	IEC 60034-1: 2022	Rotating Electrical Machines – Part 1 : Rating and Performance
2.	IEC TS-60034-31-2.0-2021	Rotating Electrical Machines – Part 31: Selection of energy-efficient motors including Variable Speed Applications
3.	IEC 60034-5:2022	Degrees of Protection of Rotating Electrical Machines
4.	IEC 60034-6: 2022	Cooling Methods for Rotating Electrical Machines
5.	IEC 60034-11:2022	Built-In Thermal Protection
6.	IEC 60034-12:2002	Rotating Electrical Machines – Part 12: Starting Performance of Single-Speed Three-Phase Cage Induction Motor
7.	IEC 60034-14:2022	Mechanical Vibrations for Rotating Electrical Machines

H. National Electrical Manufacturers Association (NEMA)

1.	NEMA ATS-2021	Standard for Acceptance Testing Specifications for Electric Power Equipment and Systems
2.	NEMA ECS-2020	Standard for Electrical Commissioning Specifications for Electrical Power Equipment and Systems

3.	NEMA ICS 2.4-2020	NEMA and IEC Devices for Motor Service
4.	NEMA ICS 7-2020	Adjustable-Speed Drives
5.	NEMA ICS 16 – 2001	Motion/Position Control Motors, Controls, and Feedback Devices
6.	NEMA MG 1-2021	Motors and Generators
7.	NEMA MG 2 -2014	Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators
8.	NEMA WC 70-2021	Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

I. National Fire Protection Association (NFPA)

1.	NFPA 70-2023	National Electric Code (NEC)

J. Underwriters Laboratories (UL)

1.	UL 508-2018	Industrial Control Equipment
2.	UL 1004-2020	Safety Rotating Electrical Machines – General Requirements.

1.03 DEFINITIONS

A. Breakdown Torque: The maximum torque that will develop with rated voltage applied at rated frequency, without an abrupt increase in speed.

B. Dielectric test: Tests made to determine ability of insulating materials and spacings to withstand specified overvoltages for a specified time without flashover or puncture.

C. Dynamic braking: Control function that brakes the drive by dissipating its stored energy in a resistor.

D. Electric motor controller: Device or group of devices that serves to govern in some predetermined manner the electric power delivered to the motor.

E. Full-Load Torque: The Torque necessary to produce its rated horsepower at full-load speed.

F. Induction Motor: An induction machine in which primary winding on one member is connected to the power source, and a polyphase secondary winding or a squirrel-cage secondary winding on the other member carries induced current.

G. Locked-Rotor Current: The steady-state current taken from the line, with the rotor locked and with rated voltage applied to the motor.

H. Locked-Rotor Torque: The minimum torque that will develop at rest for all angular positions of the rotor, with rated voltage applied at rated frequency.

I. Motor Percent ED: "Einschaltdauer" Motor Duty Cycle.

J. Pull-Up Torque: The minimum torque developed by the motor during the period of acceleration from rest to the speed at which the breakdown torque occurs.

K. Service Factor: An AC motor multiplier that, when applied to the rated horsepower, indicates permissible horsepower loading that may be carried under the conditions specified for the service factor.

L. Squirrel-Cage Induction Motor: An induction motor in which the secondary circuit consists of a number of conducting bars having their extremities connected by metal rings or plates at each end.

M. TEFC: Totally Enclosed Fan Cooled

N. TENV: Totally Enclosed Non-Ventilated

O. Wound-Rotor Induction Motor: An induction motor in which the secondary circuit consists of a polyphase winding or coils whose terminals are either short-circuited or closed through suitable circuits.

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 26 – Electrical Drawings and Data:

B. RSN 41 22 16-1, Motor Design Data

1. Time-Current Characteristic Curves and Equipment Damage Curves:
   a. Provide characteristic curves for motor circuit breaker or fuse, motor overload, etc.
   b. Include motor inrush, full-load, and locked-rotor currents.
   c. Curves to be plotted on same log-log graph.
2. Submit calculates to determine the required horsepower rating of each motor.
3. Submit detailed descriptive specifications of the motor, with necessary cuts, photographs and drawings to clearly indicate the construction of the machine.

1.05 DESCRIPTION OF WORK

A. Section includes general requirements for three-phase motors for use on AC power systems up to 600 Volts installed in Bridge Crane.

B. Provide new AC electric motors designed for crane hoisting duty, travel motors and trolley motors as specified herein. The design shall consist of a series of motor protection devices, protection class enclosures and motors specifically designed for crane operation, characterized by high starting torque and low starting current.

C. Design, Furnish, Install, Test and Deliver: Hoist, trolley and travel motors for the 30 Ton Bridge Crane.

D. Interface with Programmable Logic Controller and Variable Frequency Drives.

1.06 RELATED WORK

A. Coordinate features of crane motors, installed assemblies and accessory devices to be compatible with the following Sections:

1. Section 41 22 14 – Bridge Crane
2. Section 41 22 15 – Bridge Crane Electrical Components
3. Section 25 00 01 – Automation Control System

1.07 DESIGN AND FUNCTIONAL REQUIREMENTS

A. In accordance with NEMA MG 1, NEMA MG 2 and IEC 60034-1.

1. In accordance with IEEE 841 for severe-duty motors.

B. Motors shall operate successfully under running conditions at rated load with variation in the voltage or frequency not exceeding the following conditions:

1. Plus or minus 10 percent of rated voltage, with rated frequency.
2. Plus or minus 5 percent of rated frequency, with rated voltage.
3. Voltage and frequency of the source varies simultaneously and the sum of absolute percentage values in variation does not exceed 10 percent.

C. Motors shall operate successfully under running conditions at rated load and frequency when the voltage unbalance at the motor terminals does not exceed 1 percent. For voltage unbalance greater than 1 percent the motor shall be derated in accordance with clause 14.36 of NEMA MG 1.

D. Hoist motors shall be connected to the hoist gearbox by a driveshaft with a coupling, flexible gear type.

1. Refer to Section 41 22 14 – Bridge Crane.

E. Hoist motors shall never be placed inside the wire rope drum.

F. Cooling fans shall be non-sparking bronze alloy, coated aluminum or conductive plastic suitable for Class I, Division 2 applications.

G. Vibration:

1. All fully assembled 2, 4, 6 and 8 pole motors shall meet the levels of vibration in accordance with NEMA MG 1, IEC 60034-14, and IEEE 841.

H. Crane Motors shall be designed with the following minimum requirements:

1. Motors sized for operation with the crane manufacturer.
2. Design to incorporate motor integral reversing starter.
3. Provide full digital feedback of torque and position to automation control interface.
4. Design with adequate load amperes at rated torque. Locked rotor current shall be rated to ensure maximum potential starting conditions.
5. Startup characteristics and requirements in accordance with IEC 60034-12.
6. Motor cooling in accordance with NEMA MG 1 and IEC 60034-6.

I. Environmental:

1. Electric motors shall be suitable for indoor and outdoor use.
2. Capable of functioning in an ambient temperature range from 10 degrees C to 49 degrees C.
3. Up to 100 percent relative humidity.
4. Provide seals, lubrication and bearings to suit lower ambient temperature range for extreme conditions.

J. Motor Protection shall be provided as follows:

1. Stall: the motor shall be de-energized within a defined time in the event of a stall when attempting to lift and lower loads.
2. Overtemperature: thermostat will cause tripping of the motor, auto-reset on cooling.
3. Single phasing: lost phase protection.
4. Direction: phase rotation correction.
5. Main disconnect circuit breakers with provision for locking in the OPEN position.
   a. 3 poles.
6. Undervoltage relay or accessory to provide undervoltage protection for each motor.
7. One set of mechanically and electrically interlocked reversing contactors to open all lines.

1.08 PROJECT CONDITIONS

A. Plant Layout: See Section 52 00 00 – Drawings, for informational drawings showing general plant layout and work areas.

B. Altitude: 500 feet.

C. Maximum outdoor ambient temperature: 39 degrees Celsius.

D. Relative Humidity Range: 25 to 89 percent.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in shipping containers with labeling in place.

B. Protect equipment from damage, moisture, and dust, free from contact with soil and weather.

C. Ensure all motors and related equipment are packaged and protected to prevent any damage during shipping, after acceptance of delivery, storage, and handling at the project site. Include manufacturer's instructions for proper handling and uncrating with the shipment of the motors.

1.10 QUALIFICATIONS

A. Qualified Professional Engineers: Demonstrated experience on cranes of similar size and capacity as crane under this specification on at least three separate crane contracts.

1. Licensed in the state of California.

B. Qualified Crane Electricians: Minimum of one licensed electrician during field wiring and critical aspects of the crane field work.

C. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such motors which are of equal material, design and workmanship. Provide products which have been in satisfactory commercial or industrial use for 2 years prior to bid opening.

PART 2 PRODUCTS

2.01 RATINGS AND GENERAL REQUIREMENTS

A. Motor Characteristics:

1. Continuous operation at ambient temperature of 49 degrees C and at altitude of 500 feet above sea level.

2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with

indicated operating sequence and without exceeding nameplate ratings or service factor.

B. Conform to NFPA 70, NEMA MG 1 and UL 1004-1

C. Provide one embedded thermal sensitive device in hoist motor windings. Device and associated circuitry shall serve as an alarm signal or pilot light when motor temperatures become excessive. Establish set point below the Class B insulation temperature limit.

D. Provide motors with Class H rated insulation based on an 125 degree C motor temperature rise above 40 degrees C ambient, with frame size selection based on continuous ratings.

1. Treated to prevent damage from temporary exposures to dampness.

E. Maximum temperature rise when motor is at rated voltage, rated frequency, and is delivering rated output continuously:

1. Windings: In accordance with NEMA MG 1 and not in excess of insulation rating.

F. Other Parts of Motor: Class B insulation in accordance with NEMA MG 1.

G. Motor Leads:

1. Brought out of stator frame to terminal box.
2. Insulation: Completely sealed to winding coil insulation so that connection is equal to stator or winding coil insulation in regard to voltage and resistance to moisture.

H. Nameplate:

1. One on the actuator housing showing all relevant actuator data.
2. Motor housing: Manufacturer, model number, serial number, supply voltage, phase, frequency, full load current, RPM, horsepower rating, temperature rise, IEC duty rating and NEMA designation.

2.02 MOTORS – HOIST

A. Torque Design: NEMA MG 1, Design D, minimum.

1. Appropriate for operational conditions listed in specifications, in accordance with NEMA MG 1. Coordinate motor characteristics with torque requirements so that proper operation is obtained during the sequence of starting, accelerating and normal running.
2. Breakdown torque not less than 275 percent of the full load rated torque.
3. High starting-torque and high-slip design capable of delivering rated torque.

4. The starting torque of the motor shall be 2.25 times the full load torque of the motors.

5. Crane motors shall develop full torque at start-up to facilitate lifting of high impact loads.

B. Hoist motors shall be suitable for quick reversing crane duty.

C. Select hoist motors with the following requirements:

1. Voltage: 480 Volts, 3 **φ**, 60 Hz.

2. Motor Duty Rating: Duty cycle rating not less than S4, 40 percent CDF in accordance with IEC 60034-1.

   a. Suitable for continuous operation with periodic related variations in load and speed.

   b. Starts: 480,000, minimum.

   c. Starters per Hour: 150, minimum.

   d. Overloads: 1,000.

3. Hoist motors shall be continuously rated and amply dimensioned to withstand frequent repeated current surges.

   a. Provide adequate bracing to withstand the repetitive starting and stopping accelerating forces.

4. Design for critical load handling, self-excited alternator with electrical load brakes or emergency dynamic braking is preferred.

D. Construction: AC Asynchronous, squirrel cage induction motor or wound-rotor slip-ring motor:

1. Type: Heavy-Duty construction.

   a. Vector duty if used with variable frequency drive.

   b. Drives shall be rated to carry the full load current of the hoist motors continuously for 60 minutes.

2. Motor Enclosure: IP68, minimum.

3. Operating Location: outdoor rated.

4. Totally enclosed, fan-cooled or ventilated.

5. Certified for 60 minute time-rated operation at full identification plate power output.

6. Combination drain/breather for removal of moisture from motor enclosure.

7. Non-plugging reversing.

8. Bearings:

a. Grease lubricated, antifriction type.

b. Sealed against loss of the lubricant or entrance of dirt.

9. Finish internal ferrous surfaces of motor, including rotor with applied protective covering that will effectively inhibit corrosion.

10. Enclosure Material: Cast iron or extruded aluminum.

E. Service Factor: 1.15, minimum.

F. Multispeed Motors: Separate winding for each speed.

G. Contractor shall determine the speed of motors for a safe running speed.

H. All brakes shall have a separate brake drum and coupling face shall not be used as a brake drum. Brakes shall be mounted on the load side of the drive.

I. The design shall include for automatic application of motor brakes in the event of a failure of the electronic circuitry or of the power supply.

J. Provide full magnetic, electrically operated, reversing-type controller with thermal-overload protection.

K. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

L. Motors Used with Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Thermal Protection: In accordance with NEMA MG 1 requirements for thermally protected motors.

M. Severe-Duty Motors: Comply with IEEE 841.

2.03 MOTORS – TRAVEL

A. Travel motors include trolley, and bridge traversing motors.

B. Torque Design: NEMA MG 1, Design B, minimum.

1. Appropriate for operational conditions listed in specifications, in accordance with NEMA MG 1. Coordinate motor characteristics with torque requirements so that proper operation is obtained during the sequence of starting, accelerating and normal running.

2. High starting-torque design capable of delivering rated torque.
3. The starting torque of the motor shall be 2 times the full load torque of the motors.

C. Travel motors shall be suitable for quick reversing crane duty.

D. Select travel motors with the following requirements:
1. Voltage: 480 Volts, 3 **φ**, 60 Hz.
2. Motor Duty Rating: Duty cycle rating not less than S4, 40 percent CDF in accordance with IEC 60034-1.
   a. Suitable for continuous operation with periodic related variations in load and speed.
   b. Starts: 480,000, minimum.
   c. Starts per Hour: 150, minimum.
   d. Overloads: 1,000.

E. Construction: AC Asynchronous, squirrel cage induction motor.
1. Type: Heavy-Duty construction.
   a. Inverter duty.
   b. Drives shall be rated to carry the full load current of the long travel motors continuously for 60 minutes.
2. Designed for speed control of 10 to 100 percent variable speed.
3. Motor Enclosure: IP55, minimum.
4. Operating Location: outdoor rated.
5. Totally enclosed, fan-cooled or ventilated.
6. Certified for 60 minute time-rated operation at full identification plate power output.
7. Combination drain/breather for removal of moisture from motor enclosure.
8. Non-plugging reversing.
9. Bearings:
   a. Grease lubricated, antifriction type.
   b. Sealed against loss of the lubricant or entrance of dirt.
10. Finish internal ferrous surfaces of motor, including rotor with applied protective covering that will effectively inhibit corrosion.
11. Enclosure Material: Cast iron or extruded aluminum.

F. Service Factor: 1.15, minimum.

G. Multispeed Motors: Separate winding for each speed.

H. Contractor shall determine the speed of motors for a safe running speed.

I. All brakes shall have a separate brake drum and coupling face shall not be used as a brake drum. Brakes shall be mounted on the load side of the drive.

J. The design shall include for automatic application of motor brakes in the event of a failure of the electronic circuitry or of the power supply.

K. Provide full magnetic, electrically operated, reversing-type controller with thermal-overload protection.

L. Motors Used with Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Thermal Protection: In accordance with NEMA MG 1 requirements for thermally protected motors.

2.04 MOTOR PROTECTION AND ACCESSORIES

A. Refer to Section 41 22 15 – Bridge Crane Electrical Components.

2.05 FABRICATION

A. Structural and Mechanical Features:

1. Assemble using corrosion resistant hardware.

2. Attach neoprene gaskets with oil-resistant adhesive.

B. Internal Wiring:

1. Wire power and control circuits in accordance with approved drawings and as necessary for equipment to function as required.

2. Terminate circuits wired to external equipment on terminal blocks.

3. Make wire terminations with terminal connectors with ring tongues.

a. Use pin type connectors where the use of ring tongues is not practical such as terminations at selector switches, pushbuttons, indicating lamps, and auxiliary relays.

b. Do not use bare wire connections, except for motor power circuit conductors.

4. Do not splice wiring.

5. Make connections at device studs or terminal blocks.
6. Do not terminate more than two wires at each terminal point.
7. Make wiring between devices by most direct method. Do not loop back and forth across panels and between switchboard sections.
8. Use cable tie mounting bases to firmly support and secure exposed wire bundles.
   a. Mount cable tie base with two No. 8 screws.
   b. Do not mount cable tie bases with only an adhesive.
9. Arrange wires or grouped on terminal blocks so that number of individual conductors associated with external cables can be minimized.
10. Use adjacent terminals for 3-phase leads.

2.06 FACTORY ACCEPTANCE TEST

A. General:
   1. Perform production tests in accordance with manufacturer's standard shop and quality control procedures.
   2. Perform FAT for all crane motors to include a functional test and all affiliated components.
   3. Tests shall verify ability of all motors to perform intended functions, such that when equipment is shipped and correctly connected to external devices, the complete system operates as designed and specified in these specifications.

B. Test for correct operation and mechanical adjustment.

C. Factory test all motors in accordance with the requirements of NEMA MG 1. Ensure motors are factory-tested in accordance with IEEE 115, Method B, consisting of measurements of voltage, frequency, speed, and current under no-load conditions; voltage, frequency and current under locked rotor conditions; and efficiency, noise, power factor and thermal protection.

D. Verify routine tests on wound-rotor induction motors include the measurement of wound-rotor open-circuit voltage across the slip rings under locked-rotor conditions.

E. Provide written documentation of electrical tests including winding resistance, insulation resistance, and high-potential tests. Submit certified copies of factory test results for approval prior to shipment from the factory. Previous test reports on identical motors are not acceptable.

F. Factory Acceptance Test Procedures:
   1. Test procedures shall define the tests required to ensure that the system meets technical, operational, and performance requirements.

2. Support personnel provided during testing shall be familiar with the project and be capable of fixing problems identified during testing.

3. Test procedures shall define location of tests, milestones for the tests, and identify equipment, personnel, facilities, and supplies required.

4. Test Procedures shall cover actual equipment and sequences to be used and include detailed instructions for test setup, execution, and evaluation of test results.

G. Factory Acceptance Test Notification:

1. Government reserves the right to witness FAT. Notify government at least 60 days in advance when tests are to be performed.

H. Factory Acceptance Test Reports:

1. Provided to the Government within 21 days of the completion of the FAT.

PART 3 EXECUTION

3.01 INSTALLATION

A. Develop and format detailed instructions and checklists in accordance with 01 33 26 – Electrical Drawings and Data.

B. Furnished cables and conductors shall be in accordance with Section 26 05 10 – Conductors and Cables.

C. Install, align and connect motors in accordance with the equipment manufacturer's instructions.

D. Mount motors with alignment jack bolts.

E. Select and install motor overload heater elements. Size heater in accordance with NFPA 70.

F. Make cable and conduit connections. Terminate in accordance with FIST 3-3.

G. Make grounding and bonding connections in accordance with Section 26 05 20 – Grounding and Bonding and NFPA 70.

H. Control Cable and Wire Identification: In accordance with Section 26 05 33 – Raceways and Boxes.

I. Wiring and Connections:

1. Make connections at device terminals or terminal blocks. Maximum two wires at terminations. No wire splices permitted.

2. Support and secure wire bundles with cable tie mounting bases. Secure cable tie mounting base with two No. 8 screws. Mounting Cable tie bases with only adhesives is not allowed.

3. Install ring tongue pressure-crimp-type connectors for terminations at terminal blocks and electrical devices.

4. Do not terminate wire without terminal connector.

5. Do not splice wiring.

3.02 SITE ACCEPTANCE TESTING

A. Perform field wiring checkout and test in accordance with Section 26 05 90 – Wiring Checkout and Tests.

B. Submit field test report containing results of all tests and checks. Submit to the Contracting Officer before final acceptance.

C. Electrical Tests:

1. Perform continuity test on all phases.

2. Perform insulation resistance and polarization index test on each phase of motor. Conduct insulation tests on 480 Volt motors using a 1000 Volt insulation test set.

3. Include in test data the location and identification of motors and megohm readings versus time. Record test data at 15, 30, 45 seconds, and in 1 minute increments not to exceed 10 minutes. Ensure Megohm readings are not less than 25 Megohms for each phase; and each phase reading is within 10 percent of the other two.

4. Perform inspections and test procedures on all motors in accordance with NETA ATS and NETA MTS for rotating machinery, AC motors.

5. Calculate the polarization index of each phase by dividing the 10 minute reading by the 1 minute reading. Verify that the polarization index is greater than 2.0. Reject any lower values and return the motor to the factory.

D. Vibration Tests:

1. To measure vibration levels, use a fast Fourier transformer analyzer having the following characteristics:

a. A dynamic range greater than 70 dB; a minimum of 400 line resolution.

b. A frequency response range of 5 Hz to 10 KHz.

c. The capacity to perform ensemble averaging.

d. The capability to use a Hanning window.

e. Auto-ranging frequency amplitude.

f. A minimum amplitude accuracy over the selected frequency range of plus or minus 20 percent or plus or minus 1.5 dB.

2. Use an accelerometer, low mass magnet and sound disk with the analyzer to collect data.

3.03 COMMISSIONING VERIFICATION

A. Document changes and update Government copies final as-built drawings.

B. Submit completed and approved Electrical Commissioning Forms.

C. Government will review Contractor's test reports and if found acceptable will respond accordingly. Refer to Section 01 46 00 – Quality Procedures.

3.04 FINAL AND AS-BUILT DRAWINGS

A. Final and As-built Drawings Government Format: refer to Section 01 78 30 – Project Record Documents.

1. Marked prints of specification drawings indicating "Final As-Built" changes made to electrical conduit during construction.

3.05 OPERATION AND MAINTENANCE

A. Submit manufacturer's operating and maintenance manual to the Contracting Officer no later than 30 days prior to final acceptance.

B. Submit manufacturer's instructions for crane Motors including special provisions required to install equipment components and system packages. Include all special notices regarding detail impedances, hazards and safety precautions.

END OF SECTION

SECTION 51 00 00
INFORMATION AVAILABLE TO OFFERORS

PART 1 GENERAL

1.01 ORDER OF PRECEDENCE

A. In case of differences between Sections in Division 51 – Information Available to Offerors and Sections in other divisions of the specifications, requirements in other divisions will govern.

B. Government assumes no responsibility for deductions, interpretations, or conclusions made by Contractor based on information made available by Government, in accordance with clause at FAR 52.236-3 "Site Investigations and Conditions Affecting the Work."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 51 00 10
PHOTOGRAPHS

PART 1 GENERAL

1.01 PHOTO'S

A. Photos are for reference only.

Figure 1 – Folsom Warehouse 30-Ton Bridge Crane.

Figure 2 – Hoist and Trolley equipment.

Figure 3 – Power supply conductor rails and collector.

Figure 4 – Pendant controller.

Figure 5 – Lower Block.

Figure 6 – Bridge walkway platform.

Figure 7 – Folsom Warehouse exterior North bay door entrance.

Figure 8 – Folsom Warehouse interior, looking South.

Figure 9 – Main disconnect panel.

PART 1 PRODUCTS

Not Used

PART 2 EXECUTION

Not Used

END OF SECTION

SECTION 51 00 50

ELECTRONIC MEDIA RELEASE

Bureau of Reclamation
Electronic Media Release

Bureau of Reclamation, Contract Number/Solicitation Number: _____

This release for electronic media is dated the ___ day of _____ (month), ____ (year), between _____ (RECIPIENT) and Bureau of Reclamation, for the exchange of electronic media (CD ROMs, DVD, Flash Drives, External Hard Disk Drives, etc.) containing information on the _____ project (hereinafter referred to as the PROJECT) for use by the RECIPIENT.

Therefore, RECIPIENT and U.S Bureau of Reclamation (Reclamation), agree as follows:

1. All data and intellectual property contained on the electronic files remains the property of Bureau of Reclamation and may not be copied or distributed to any other party without the written permission of Bureau of Reclamation.
2. The electronic files provided to RECIPIENT by Bureau of Reclamation, for the PROJECT may be used or adapted by RECIPIENT for their own use. If RECIPIENT chooses to alter in any way, in whole or in part, the electronic files provided for the PROJECT or any future project(s), RECIPIENT agrees that the use of the altered files shall be without liability or legal exposure to Bureau of Reclamation.
3. Because information and data provided electronically may be altered, whether inadvertently or otherwise, Bureau of Reclamation, reserves the right to retain copies of the electronic file(s) and to remove from the electronic files provided to RECIPIENT all identification (such as logo, surveyor's seal, etc.) reflecting the involvement of Bureau of Reclamation, in their preparation.
4. The electronic files are provided solely as a convenience to RECIPIENT by Bureau of Reclamation and shall not be considered "Drawings of Record" or "Construction Documents." All documents considered "Drawings of Record" or "Construction Documents" will be hardcopy drawing sheets with signatures or scanned files of the hardcopy drawings with signatures.
5. RECIPIENT is advised to check all electronic media for viruses and malware before loading the files. RECIPIENT is solely responsible for intercepting and disabling viruses, if any, that may be transmitted with the electronic files and hereby agrees to indemnify and hold Bureau of Reclamation harmless from and against all claims of any type or nature asserted by RECIPIENT or any party as a result of viruses transmitted with the electronic files.
6. Files distributed electronically are subject to data erosion, erasure, and/or alteration, and computer systems and software become obsolete in time. By accepting these electronic files, RECIPIENT acknowledges these risks and agrees to waive all claims against Bureau of Reclamation, should data erosion, erasure, and/or alteration of these electronic files occur.

7. RECIPIENT agrees to defend, indemnify, and hold Bureau of Reclamation, harmless from all claims, injuries, damages, losses, expenses, and costs, including attorney's fees, arising out of breach of this agreement, or the modification or reuse of the electronic files.

ACCEPTED FOR RECIPIENT:	RELEASED BY BUREAU OF RECLAMATION:
By: _____	_____
Title: _____	_____
Date: _____	_____

END OF SECTION

SECTION 51 02 82

HAZARDOUS MATERIALS SURVEY AND ANALYTICAL RESULTS

PART 1 GENERAL

1.01 SURVEY AND ANALYTICAL RESULTS

A. Hazardous Materials Survey and Analytical Results are provided.

B. The following is a summary of the analytical results collected during hazardous materials survey conducted at Folsom Warehouse in August and September 2022, see **Error! Reference source not found.**A.**Error! Reference source not found.**

C. After the summary are pictures of the features and sample locations. See Table 51 02 82-B for the complete analytical results.

D. Copies of the complete hazardous materials survey, 8540 2022 58, Folsom Elevator and Crane Modernization Hazardous Materials Survey

E. Summary of results:

1. Warehouse bridge crane:

   a. The travel motor oil sample passed the regulatory used oil specifications for metals, flashpoint, and volatile organic compounds. This oil needs to be tested for polychlorinated biphenyls to determine proper disposal options.

   b. The travel motor brake pads tested positive for asbestos.

   c. The hoist motor brake pads tested negative for asbestos.

   d. The crane coating tested positive for one or more regulated metals. This coating needs to be tested for asbestos to determine if an asbestos abatement is needed.

   e. No suspect asbestos-containing material was found in the bridge crane control panel.

   f. Suspect asbestos samples collected during this survey were non-friable however methods to remove them may render them friable.

F. Summary of sample findings:

Table 51 02 82- A – Summary of Analytical Results for the Folsom warehouse bridge crane.

Sample No.	Sample Location	Description	Material	Asbestos	CAM17 Metals	Used Oil Specifications
FECM0030	Bridge crane	Tan/red	Coating	-	X	-
FECM0060	Travel motor	Brown	Oil	-	X	*

Table 51 02 82- A – Summary of Analytical Results for the Folsom warehouse bridge crane.

Sample No.	Sample Location	Description	Material	Asbestos	CAM17 Metals	Used Oil Specifications
FECM0070	Travel motor	Brown	Brake pad	X	-	-
FECM0071	Travel motor	Brown	Brake pad	X	-	-
FECM0072	Travel motor	Brown	Brake pad	X	-	-
FECM0080	Hoist motor	Brown	Brake pad	ND	-	-
FECM0081	Hoist motor	Brown	Brake pad	ND	-	-
FECM0082	Hoist motor	Brown	Brake pad	ND	-	-

Notes:
X: Detected at or above the analytical laboratory's adjusted reporting limit
ND: Not detected at or above the analytical laboratory's adjusted reporting limit or not detected (asbestos).
-: Not tested for
*: Pass for metals, flashpoint, and VOCs, needs to be tested for PCBs.

1.02 SAMPLING PICTURES

Figure 1.—The bridge crane is located in the warehouse (red circle).

Figure 2.—Sample FECM0030 was collected from the tan/red coating on the bridge crane in the warehouse and was tested for CAM17 metals (red arrow).

Figure 3.—Close up of sample FECM0030.

Figure 4.—Sample FECM0060 was taken from the travel motor oil reservoir on the warehouse bridge crane. The oil was access using a panel (red arrow).

Figure 5.—Sample FECM0060 was taken from the travel motor oil reservoir on the warehouse bridge crane and was tested for flashpoint, metals, VOCs, and halogens.

Figure 6.—Samples FECM0070 through FECM0072 were taken from the warehouse bridge crane travel motor brake pad (red arrows).

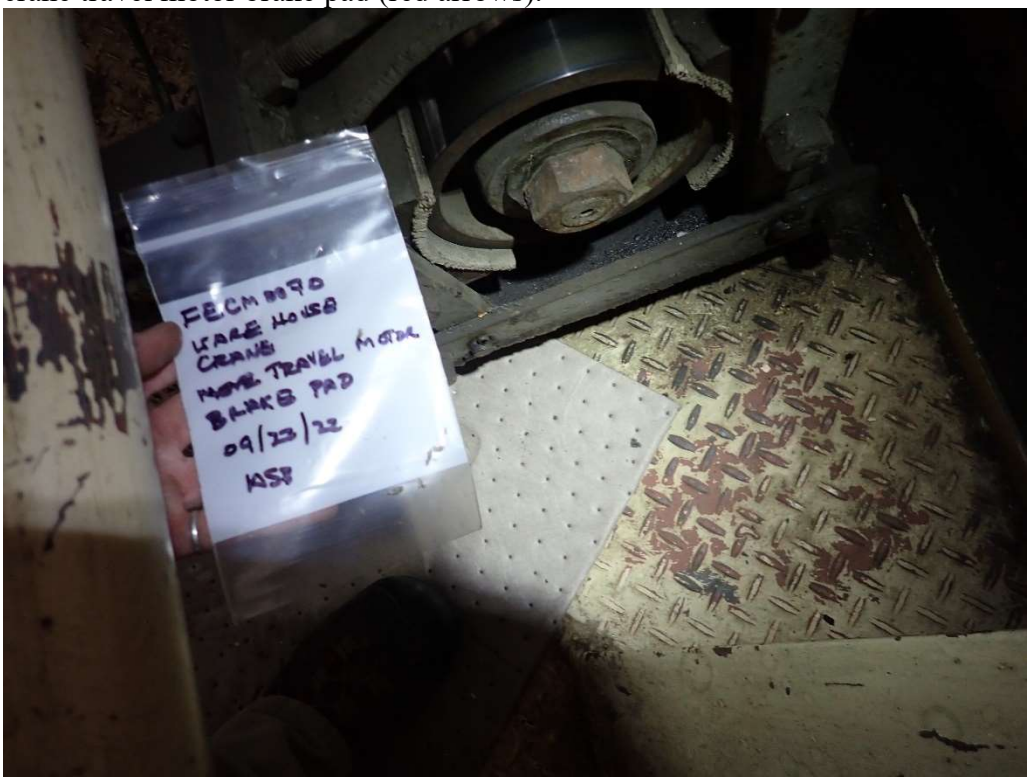

Figure 7.—Sample FECM0070 was taken from the warehouse bridge crane travel motor brake pad and was tested for asbestos.

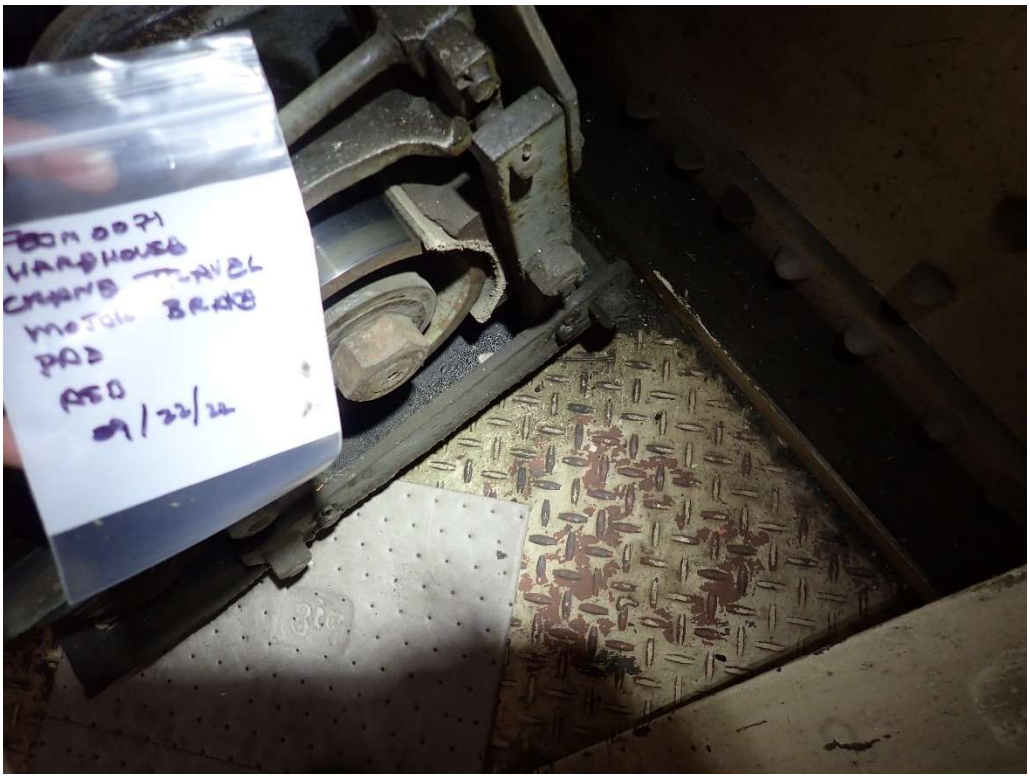

Figure 8.—Sample FECM0071 was taken from the warehouse bridge crane travel motor brake pad and was tested for asbestos.

Figure 9.—Sample FECM0072 was taken from the warehouse bridge crane travel motor brake pad and was tested for asbestos.

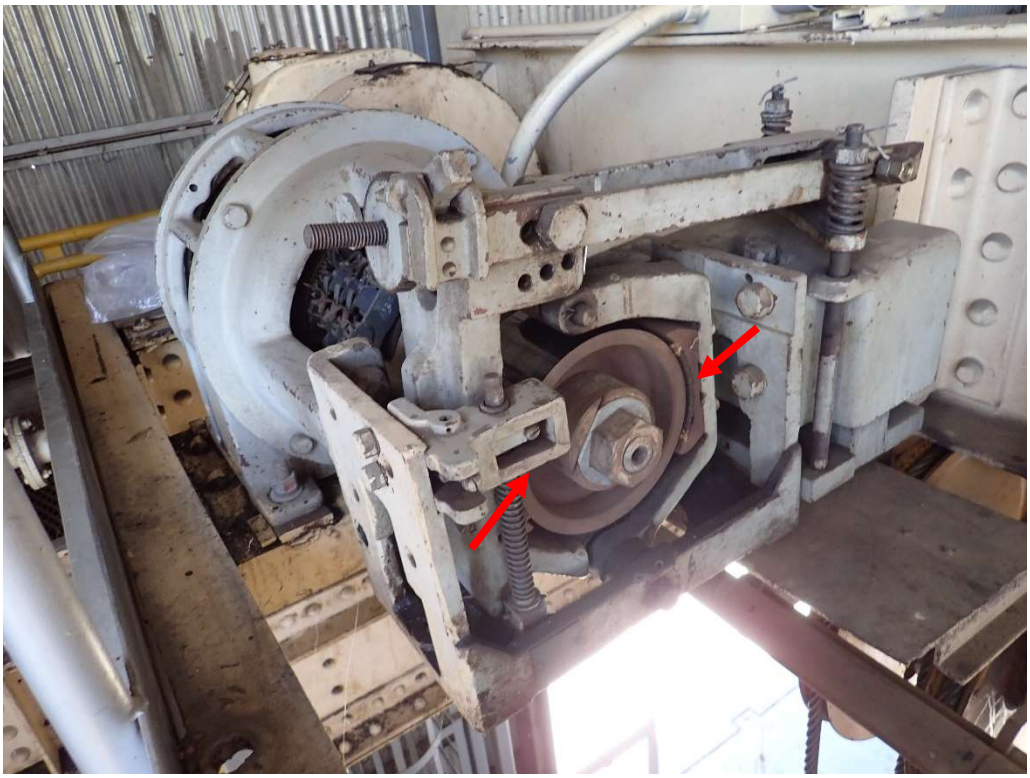

Figure 10.—Samples FECM0080 through FECM0082 were taken from the warehouse bridge crane hoist motor brake pad (red arrows).

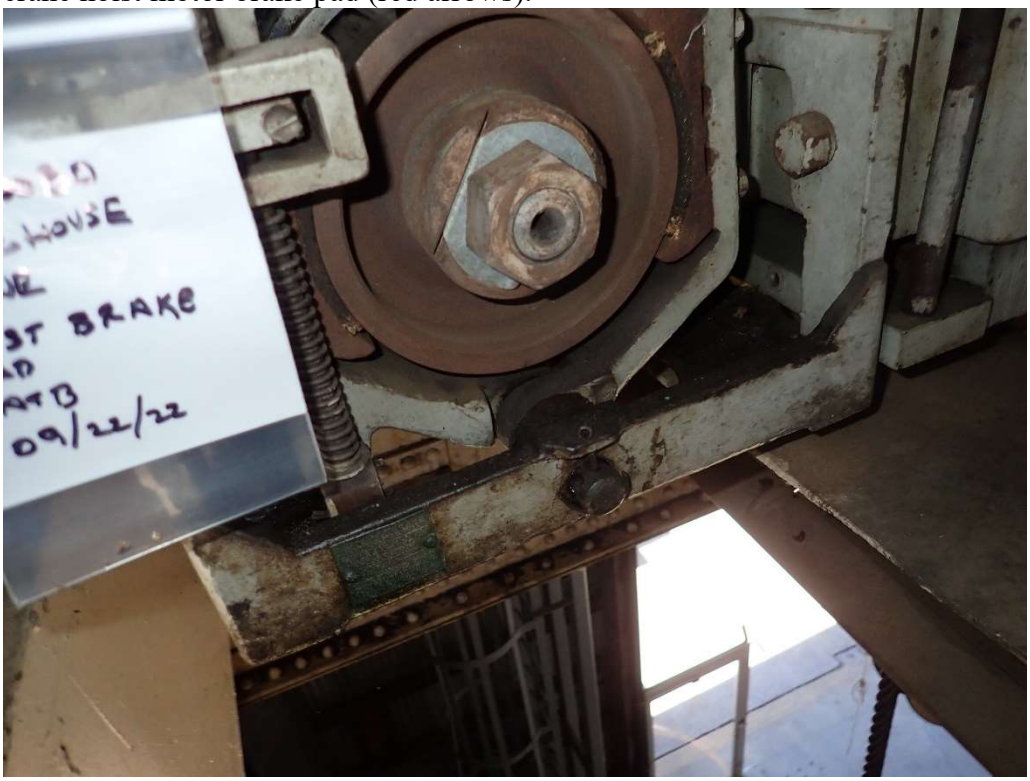

Figure 11.—Sample FECM0080 was taken from the warehouse bridge crane hoist motor brake pad and was tested for asbestos.

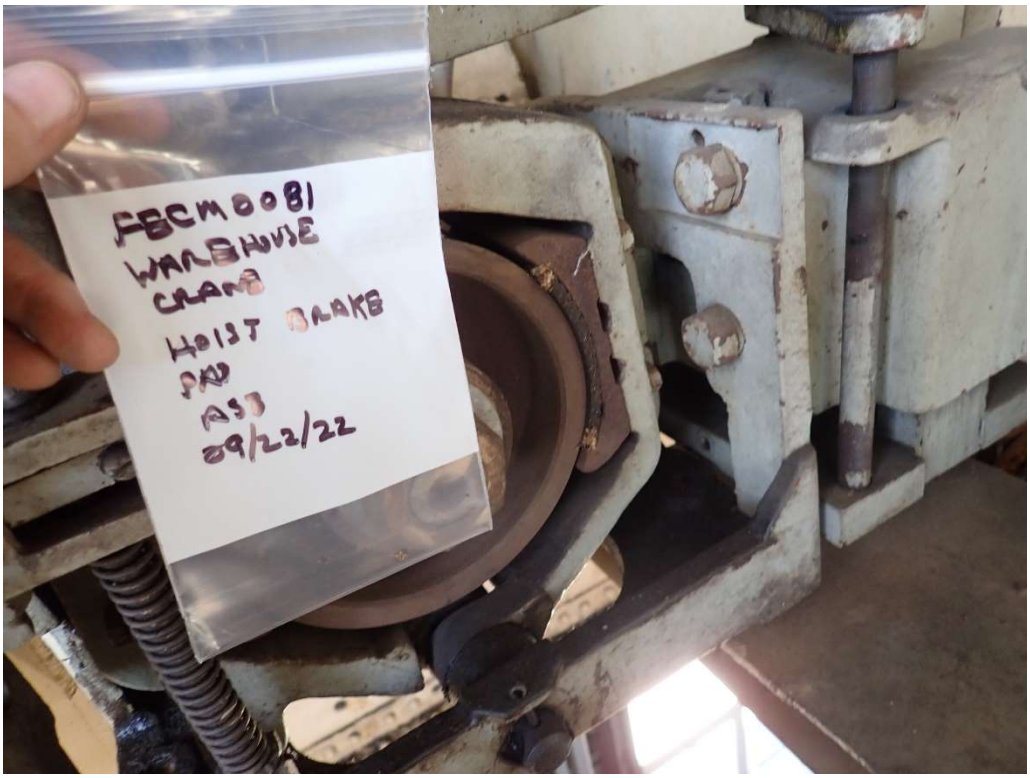

Figure 12.—Sample FECM0081 was taken from the warehouse bridge crane hoist motor brake pad and was tested for asbestos.

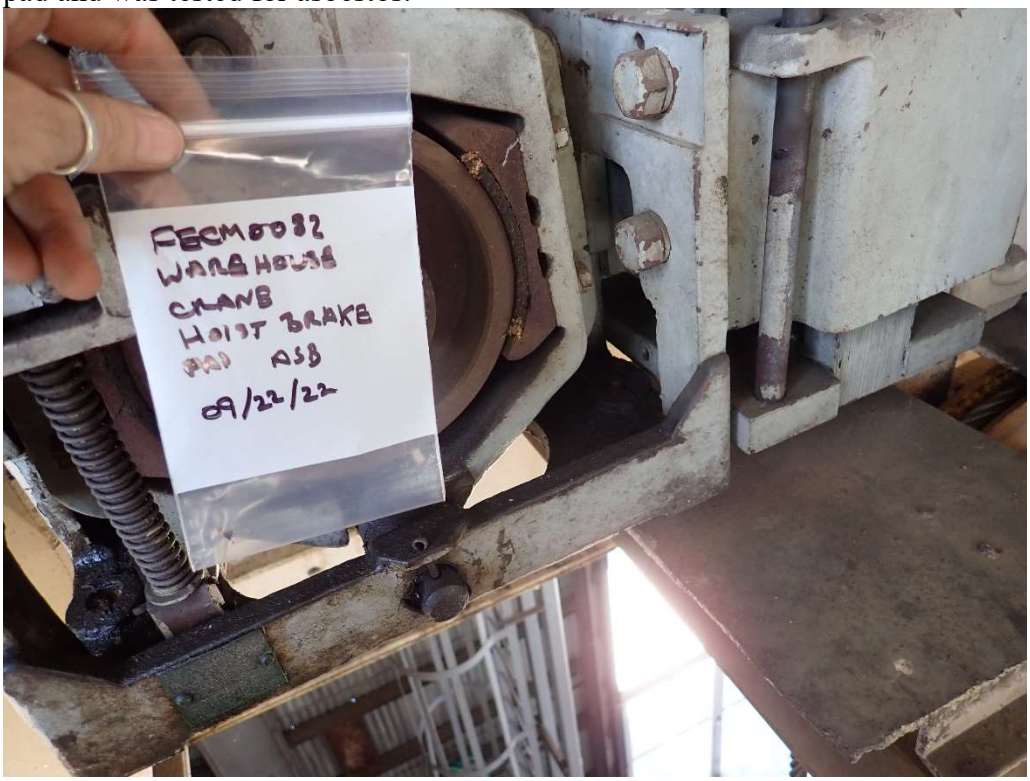

Figure 13.—Sample FECM0082 was taken from the warehouse bridge crane hoist motor brake pad and was tested for asbestos.

Figure 14.—The control panel for the bridge crane was inspected for suspect ACM.

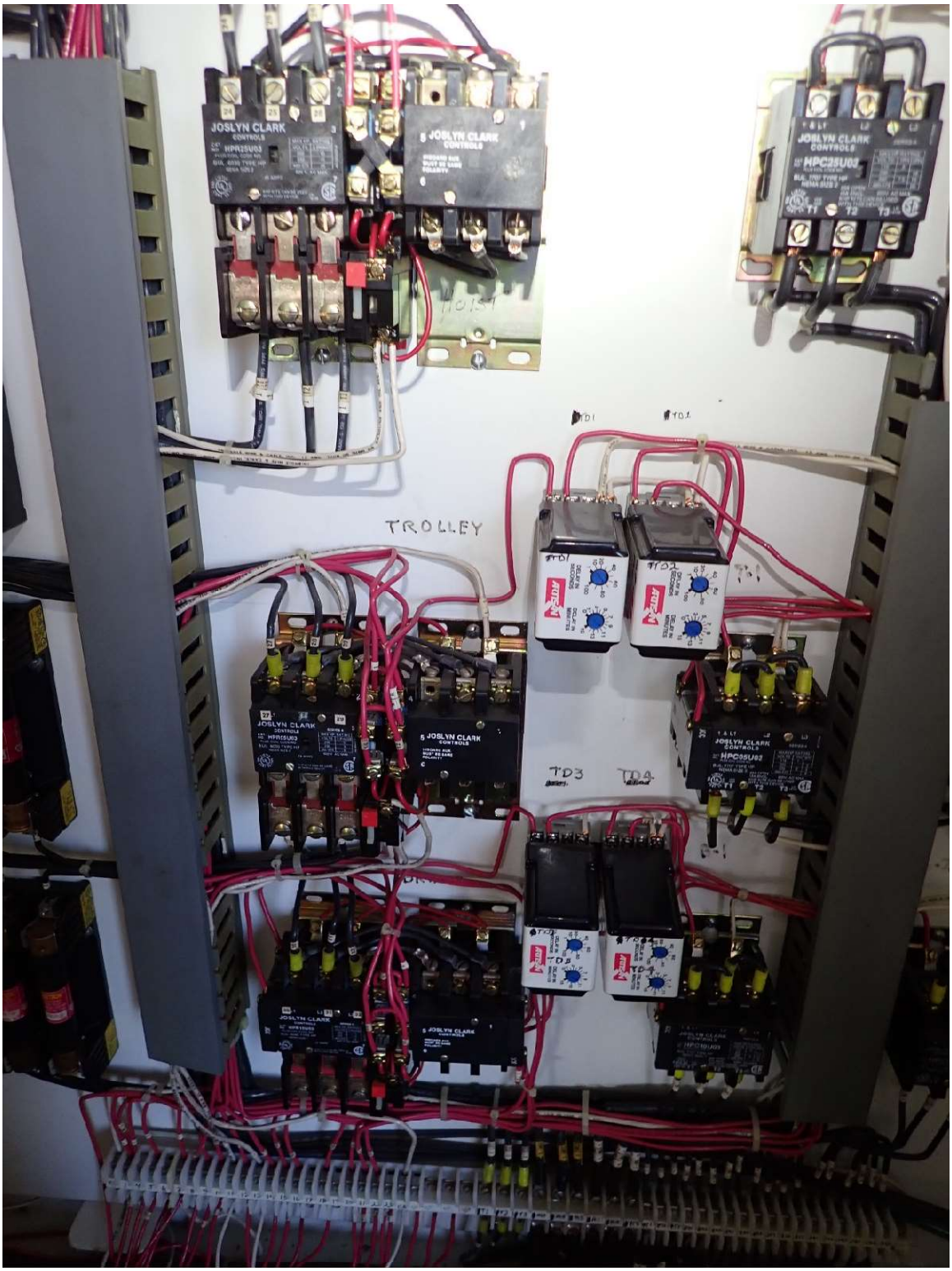

Figure 15.—No suspect ACM was found in the bridge crane control panel.

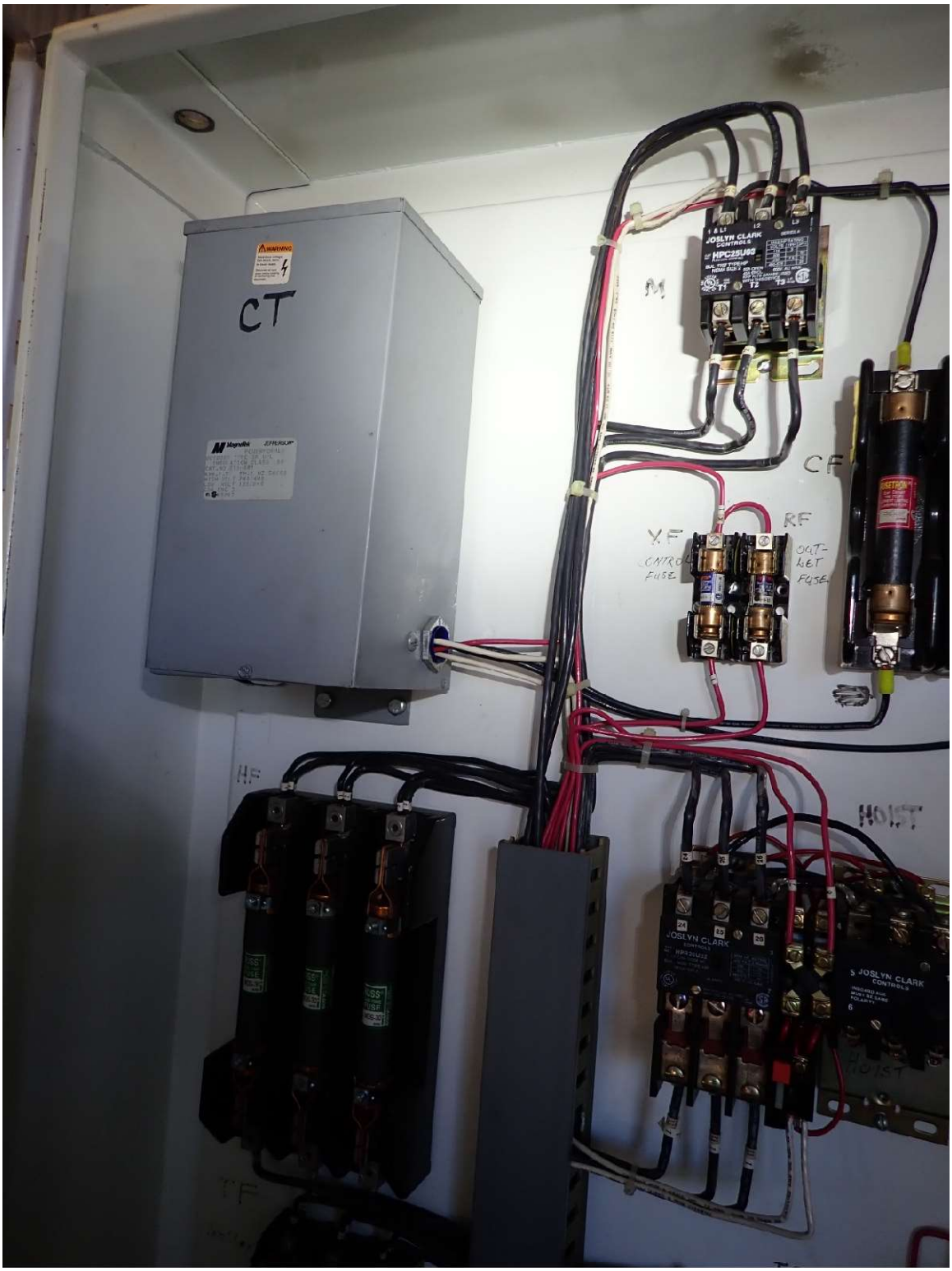

Figure 16.—No suspect ACM was found in the bridge crane control panel.

1.03 COMPLETE ANALYTICAL RESULTS

Table 51 02 82- B, Complete Analytical Results

Sample No.	Sample Location	Description	Material	Method	Analyte	Results	Units
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Antimony	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Arsenic	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Barium	618	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Beryllium	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Cadmium	0.87	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Chromium	24.2	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Cobalt	296	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Copper	27.1	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Lead	71200	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Molybdenum	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Nickel	9.5	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Selenium	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Silver	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Thallium	ND	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Vanadium	2.3	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 6010	Zinc	241	mg/kg
FECM0030	Bridge crane	Tan/red	Coating	EPA 7471	Mercury	0.043 J	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Arsenic	0.20 J	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Cadmium	1.2	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Chromium	0.40 J	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Lead	40.9	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1,1,2-Tetrachloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1,1-Trichloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1,2,2-Tetrachloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1,2-Trichloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1-Dichloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1-Dichloroethene	ND	µg/kg

Table 51 02 82- B, Complete Analytical Results

Sample No.	Sample Location	Description	Material	Method	Analyte	Results	Units
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,1-Dichloropropene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2,3-Trichlorobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2,3-Trichloropropane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2,4-Trichlorobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2,4-Trimethylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2-Dibromo-3-chloropropane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2-Dibromoethane (EDB)	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2-Dichlorobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2-Dichloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2-Dichloroethene (Total)	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,2-Dichloropropane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,3,5-Trimethylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,3-Dichlorobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,3-Dichloropropane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	1,4-Dichlorobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	2,2-Dichloropropane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	2-Butanone (MEK)	1,420	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	2-Chlorotoluene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	2-Hexanone	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	4-Chlorotoluene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	4-Methyl-2-pentanone (MIBK)	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Acetone	11,400	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Benzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Bromobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Bromochloromethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Bromodichloromethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Bromoform	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Bromomethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Carbon disulfide	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Carbon tetrachloride	ND	µg/kg

Table 51 02 82- B, Complete Analytical Results

Sample No.	Sample Location	Description	Material	Method	Analyte	Results	Units
FECM0060	Travel motor	Brown	Oil	EPA 6010	Chlorobenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Chloroethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Chloroform	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Chloromethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Dibromochloromethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Dibromomethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Dichlorodifluoromethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Ethylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Hexachloro-1,3-butadiene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Isopropylbenzene (Cumene)	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Methyl-tert-butyl ether	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Methylene Chloride	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Naphthalene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Styrene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Tetrachloroethene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Toluene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Trichloroethene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Trichlorofluoromethane	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Vinyl chloride	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	Xylene (Total)	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	cis-1,2-Dichloroethene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	cis-1,3-Dichloropropene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	n-Butylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	n-Propylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	p-Isopropyltoluene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	sec-Butylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	tert-Butylbenzene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	trans-1,2-Dichloroethene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	EPA 6010	trans-1,3-Dichloropropene	ND	µg/kg
FECM0060	Travel motor	Brown	Oil	ASTM D92	Flashpoint	>212	deg F

Table 51 02 82- B, Complete Analytical Results

Sample No.	Sample Location	Description	Material	Method	Analyte	Results	Units
FECM0060	Travel motor	Brown	Oil	EPA 9056	Bromide	ND	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 9056	Chloride	ND	mg/kg
FECM0060	Travel motor	Brown	Oil	EPA 9056	Fluoride	ND	mg/kg
FECM0070	Travel motor	Brown	Brake pad	EPA 300/R-93/116	Asbestos	15	%
FECM0071	Travel motor	Brown	Brake pad	EPA 300/R-93/116	Asbestos	15	%
FECM0072	Travel motor	Brown	Brake pad	EPA 300/R-93/116	Asbestos	15	%
FECM0080	Hoist motor	Brown	Brake pad	EPA 300/R-93/116	Asbestos	ND	%
FECM0081	Hoist motor	Brown	Brake pad	EPA 300/R-93/116	Asbestos	ND	%
FECM0082	Hoist motor	Brown	Brake pad	EPA 300/R-93/116	Asbestos	ND	%

Notes:

J: Estimated concentration above the analytical laboratory's adjusted method detection limit and below the adjusted reporting limit
ND: Not detected at or above the analytical laboratory's adjusted reporting limit
%: Percent by volume
mg/kg: Milligrams per kilogram
µg/kg: Micrograms per kilogram
>: greater than
Deg F: degrees Fahrenheit

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 52 00 00
DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Promptly inform the CO of discrepancies discovered on the drawings. The CO will make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense.

B. Anything mentioned in the written specifications and not shown on the drawings, or shown on the drawings and not mentioned in the written specifications, shall be of like effect as if shown or mentioned in both. In case of differences between drawings and written specifications, the written specifications shall govern.

1.02 SPECIFICATION DRAWINGS

A. Some drawings show details of installation or other details and specifications which are not a part of work under these specifications. Disregard specifications and details shown on these drawings which are not applicable to work under these specifications.

B. Reference drawings referred to on specifications drawings not included in specifications are not considered necessary for contract performance.

1.03 INFORMATION DRAWINGS

A. Drawings marked "For Information Only" in the drawing list are included to show existing future features about which knowledge is required to perform work under this contract. These drawings do not show work to be performed under this contract.

B. If there are differences as determined by the CO between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.04 COPIES OF DRAWINGS

A. One set of full size 22- by 34-inches drawings will be furnished to the Contractor.

1.05 LIST OF DRAWINGS

A. Drawings listed in Table 52 00 00A - List of Drawings, are made a part of Section C - Description/Specifications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
Information Drawings:		
1	485-208-85	Folsom Power Plant – Warehouse "A" – Plan, Elevations and Details
2	485-208-86	Folsom Power Plant – Warehouse "A" – Foundation-Concrete Outline and Reinforcement
3	485-208-87	Folsom Power Plant – Warehouse "A" – Roof Plan and Details
4	485-208-91	Folsom Power Plant – Warehouse "A" – Electrical Installation
5	485-208-1009	Folsom Dam – Electrical Modifications to Warehouse A 30-Ton Crane
6	485-208-1010	Folsom Dam – Electrical Modifications to Warehouse A 30-Ton Traveling Crane
Standard Drawings:		
7	40-D-4334	Electrical Standards - Typical Grounding Details – Sheet 1 of 2
8	40-D-4335	Electrical Installation - Typical Grounding Details – Sheet 2 of 2
9	40-D-4753	Electrical Installation - Typical Grounding Details for Switchyards and Substations
10	40-D-4874	Electrical Installation - Substation and Switchyard Platforms Grounding Details
11	40-D-5324	Electrical Standards – Control and Instrument Switch – Escutcheons and Indicating Lamps

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
12	40-D-6234	Standard Nameplates
13	40-D-6376	Transmission Lines – Fencing Within Right -of-Way – Typical Grounding Details
13A	40-D-7095	Switchyards and Substations – Electrical Installation – Identification, Warning and Safety Signs
14	40-D-7098	Electrical Installation – Equipment, Location and Voltage Symbols Key Lists
15	40-D-7102	Drawing Border, Sample Title Block and Signature Lines
16	104-D-1150	Major Power/Pumping Plants - Electrical Installation Device Designations and Symbols to Be Used on Single-Line and Schematic Diagrams
17	104-D-1165	Main Control Board CSA – Panel 7R – Wiring Diagram
18	40-D-60001	Electrical Equipment Support, Type 1 – Sections and Detail

END OF SECTION

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