BUREAU OF RECLAMATION

Glen Canyon Powerplant Fire Alarms Systems Modernization

Glen Canyon Power Plant

Colorado River Storage Project, Arizona-Utah

Upper Colorado Basin Region

U.S. Department of the Interior **AUGUST 2023**

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GLEN CANYON POWER PLANT FIRE ALARM SYSTEMS MODERNIZATION
GLEN CANYON POWER PLANT
COLORADO RIVER STORAGE PROJECT, AZ

FOREWORD

Work is located approximately 3 miles northwest of Page, Arizona, in Coconino County.

Principal components of work include removal and disposal of existing equipment and components, furnishing, installing, and testing the new fire alarm control panel, fire alarm notification equipment, fire alarm signaling and control devices and new laptop computer compatible with system.

PRE-BID SITE VISIT: SEE SECTION L FOR SITE VISIT INFORMATION. ATTENDEES ARE TO PROVIDE AND WEAR SAFETY BOOTS, HARD HATS, AND SAFETY VESTS.

FOR INFORMATION REGARDING BUREAU OF RECLAMATION'S PUBLICATION "RECLAMATION SAFETY AND HEALTH STANDARDS" INCLUDING REVISIONS AT https://www.usbr.gov/safety/rshs/index.html WHICH IS APPLICABLE TO WORK UNDER THIS CONTRACT, SEE CLAUSE AT WBR 1452.223-81, SAFETY AND HEALTH.

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SECTION B - SUPPLIES OR SERVICES AND PRICES / COSTS

GLEN CANYON POWER PLANT FIRE ALARM SYSTEMS MODERNIZATION
GLEN CANYON UNIT - ARIZONA - UTAH
COLORADO RIVER STORAGE PROJECT

B.1 PRICE SCHEDULE

(a) Offers will be considered for award on the following Price Schedules, but no offer will be considered for award on only a part of the Price Schedules.

(1) Offerors shall complete Price Schedules A and B. Offers for less than the total of Schedules A, and B will be considered nonresponsive and will not be evaluated for award.

(2) Offers will be evaluated based on the total of Price Schedules A, and B. Award will be made to responsible Offeror with the lowest responsive offer for the total of all Price Schedules.

(3) The Government may award Price Schedule A, or Price Schedules A, and B; depending on available funds.

(b) Offers are subject to the terms and conditions of this solicitation.

(c) Quantities in the Price Schedule are estimated quantities for comparison of offers only. Variation in Estimated Quantity, no claim shall be made against the Government for overruns or underruns.

(d) See the contract clause at WBR 1452.232-81, "Payment for Mobilization and Preparatory Work" which applies to CLIN 1.

(e) Definitions:

(1) CLIN - Contract Line Item Number.

PRICE SCHEDULE A

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
A-1	WBR 1452.232 -81	Mobilization and Preparatory Work	For the lump sum of		$
A-2	01 31 30	Construction Document Management System	For the lump sum of		$
A-3	01 78 30	As-Builts, Final Drawings, and Operations & Maintenance (O&M) Manuals	2		
A-4	01 79 20	Training	For the lump sum of		$
A-5	01 91 13	Commissioning	For the lump sum of		$
A-6	26 05 10	Conductors and Cables	For the lump sum of		$
A-7	26 05 33	Raceways and Boxes	For the lump sum of		$
A-8	28 31 00	Fire Alarm System	For the lump sum of		$
A-9	28 31 75	Remote Station Monitoring System	For the lump sum of		$

TOTAL FOR SCHEDULE A $_____

OPTIONAL PRICE SCHEDULE B

CLIN	Section	Supplies or Services	Quantity and Unit	Unit Price	Amount
B-1	21 25 00	Hybrid Water Mist Fire Suppression System	For the lump sum of		$

TOTAL FOR PRICE SCHEDULE B $_____

TOTAL FOR PRICE SCHEDULES A AND B $_____

END OF SUPPLIES OR SERVICES AND PRICES / COSTS

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

A. Work is located at Glen Canyon Power Plant, approximately 3 miles northwest of Page, Arizona, in Coconino County.

1.02 PRINCIPAL COMPONENTS OF WORK

A. Remove, dispose and replace existing fire detection and alarm systems.

B. Remove the existing interconnection wiring for the fire detection and alarm system.

C. Design, furnish, and install a new fire detection and alarm system.

1. At three locations, the Glen Canyon Powerplant, Carl Hayden Visitor Center, and the Facility Workshop Building.
2. New laptop computer compatible with and, able to operate and monitor system.
3. Communicate and Integrate alarm signals from the fire alarm panels at the Government Project Warehouse Building, Carl Hayden Visitor Center, and the Facility Workshop.

D. Design, furnish, and install a hybrid water mist fire suppression system in the powerplant computer room.

E. Modify 120 volt distribution systems to accommodate new fire detection and alarm equipment.

F. Integrate new fire alarm system with existing elevators, stairwell pressurization system, generator CO2 release system, transformer deluge system, and heating, ventilation, and air conditioning systems.

G. Test and commission the systems.

H. Plan and sequence work to eliminate or minimize Interruptions of Service to critical station loads within plant.

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. CO: Contracting Officer.
2. COR: Contracting Officer's Representative.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 11 22
CONSTRUCTION SEQUENCING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 SUBMITTALS

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

B. RSN 01 11 22-1, Work Sequence Plan:

1. Describe sequencing and how work is to be accomplished for the fire alarm system replacement, which includes: new FACP, NAC and SLC circuits, annunciation panel, integration with existing duct detectors and elevators at the powerplant, new fire alarm system at the administration building/work shop, and addition and integration of communication paths to the fire alarms at the project warehouse and administration building/work shop.

   a. How each main component of the fire alarm system is de-energized and removed.

   b. Installing new equipment, testing, and placing new equipment in service.

   c. Method of keeping existing fire alarm in place until new system is tested and ready to be put in service.

   d. List any concerns or expectations for actions to be performed by the Government in the plan.

1.03 PROJECT CONDITIONS

A. Proposed work sequence requirements:

1. Coordinate and perform the work so that the powerplant has continuous fire alarm coverage throughout the construction.

2. Ensure annunciation of the fire alarm system is clear to plant personnel at all times.

3. Restrictions or limitations on when work can be performed are noted below:

   a. Project office to supply.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other ongoing contracts in accordance with Section 01 14 10 - Use of Site.

B. Scheduling:

1. Proposed schedule for installing new equipment, cutting over existing equipment and removing equipment in accordance with Section 01 32 10 - Construction Program.

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 in prices offered in Price Schedules 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 includes the following:

1. Hydraulic Elevator.
2. Crane Modernization.
3. GCFD POWERPLANT UPS (SCADA EACCS)

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

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

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 Price Schedules for other items of work.

1.02 PROJECT CONDITIONS

A. For Contractor supplied equipment to be stored on Government land, coordinate with COR for delivery and storage.

B. When private land is used for construction facilities, or other construction purposes, make necessary arrangements associated with use of private land.

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

1. Locations of contractor laydown area, parking and dumpster placement to be coordinated with COR.

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

E. Coordinate materials shipment arrival dates and times and storage with COR prior to material arrival.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 RESTORATION

A. Restore Contractor use areas to pre-construction condition.

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 Price Schedules for other items of work.

1.02 WORK RESTRICTIONS

A. Bureau of Reclamation operates and maintains the Glen Canyon Powerplant.

B. Maintain Government access to the Glen Canyon Powerplant and other facilities at all times.

C. Allowable Work Hours at Glen Canyon Powerplant:

1. Monday through Thursday: 7:00 a.m. to 5:00 p.m.
2. Alternate work schedules, including Fridays and weekend work, shall be submitted in writing, 7-working days in advance of the proposed schedule and may not be granted.
3. Night work is discouraged. Night work shall require a written request, a minimum of 2 calendar weeks advance notice, and may not be granted.

D. No work will be allowed during Federal holidays or Sundays.

E. Contractor shall provide names of all employees for background check. List of employees provided by contractor. ID's issued by Government are to be used by Contractor to access facilities.

F. All onsite contractor employees shall wear PIV. Contact COR to obtain PIV.

G. Access to the facilities will remain locked outside of allowable working hours.

H. Photographs of the powerplant, facilities and equipment are not allowed, unless coordinated with COR in advance.

I. Work in the Server Room shall be observed by the COR or authorized Government escort at all times. See Section 01 74 00 – Cleaning and Waste Management, 3.01 B.

J. Tunnel dimensions are approximately 22 high and 25 ft wide. Presently a 2-lane roadway passes through the tunnel. Contractor shall coordinate deliveries with COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 14 30
INTERRUPTION OF SERVICE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedule A for items of work for which Interruption of Service are required.

1.02 SUBMITTALS

A. Submit 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 (by number or other description).
2. Outline procedures for accomplishing work including:
   a. Specific safety precautions to be taken.
   b. Type and location of barricades.
   c. Warning signs.
   d. Protective grounds and devices to be used.
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 on site.

1.03 PROJECT CONDITIONS

A. Coordinate and schedule interruption of services with COR:

1. Coordinate work with Government operations.
2. No specific interruption of service request will be considered unless:
   a. COR has reasonable assurance that materials and equipment required for work will be onsite.
   b. Be prepared to perform work on date and during period-of-time requested for specific interruption of service.

3. Allowable time and available interruption of service periods will govern interruption of service requests, work scheduling, onsite delivery of materials, and required drawings and data submittals.

4. Interruption of service scheduling will depend upon power demand requirements and related operating conditions.

   a. Interruption of services may be scheduled during off-peak periods, nights, or weekends.

   b. Government reserves right to schedule interruption of service for any period during 24-hour day, any day of week.

   c. Contractor will be informed of type of interruption of services available and restrictions prior to start of construction.

B. When work cannot be performed during an approved interruption of service period, notify COR that interruption of service is not required.

C. Show construction interruption of services greater than 4 hours in construction schedule.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 30
CONTRACT DOCUMENT MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Contract Document Management System:

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

1.02 DEFINITIONS

A. CDMS: Contract Document Management System.

1. Contract Documents include, but are not limited to:
   - a. Specifications.
   - b. Contract Drawings.
   - c. Submittals.
   - d. RFCs: Request for Change (Contractor generated document).
   - e. RFIs: Request for Information (Contractor generated document).
   - f. RFPs: Request for Proposal (Reclamation generated document).
   - g. CMs: Contract Modifications.
   - h. Contractor Proposals.
   - i. Value Engineering Proposals.
   - j. Bureau of Reclamation (Reclamation) Inspection Reports.
   - k. Invoices and Progress Payments.
   - l. Contract Schedules.
   - m. Meeting Agendas and Meeting Minutes.
   - n. Letters and Memos.

1.03 SUBMITTALS

A. Submit the following 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. DVD or CD of all documents uploaded to CDMS.

1.04 QUALIFICATIONS

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

1.05 CDMS REQUIREMENTS

A. CDMS shall be capable of generating, storing, tracking, categorizing, and managing Contract Documents.

B. Access:

1. Web-Based:

a. Contract Documents are stored and accessed by authorized individuals via an internet site.

b. Compatible with web browsers MS Internet Explorer, Apple Safari, Mozilla Firefox, and Google Chrome.

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

a. Adobe Acrobat.

b. Microsoft Word.

c. Microsoft Excel.

d. Microsoft Project.

e. Oracle Primavera P6 Project Manager.

f. Autodesk AutoCAD Civil 3D.

3. 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.

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

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

b. Each organization shall be capable of defining its 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.).

5. 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 a new submittal);
    b. Changes to project information (e.g. approval of a submittal);
    c. Alerts (e.g. submittal under review for greater than 15 days without action).
6. Ability to link files; examples:
    a. RFP linked to a CM.
    b. Submittal linked to a specification section or drawing.

C. Reports:
1. Generate reports that list and sort documents by status; examples include:
    a. Submittals that have been 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 turnaround.
    b. RFI turnaround.
4. Reports shall be printable, exportable as searchable Portable Document Format (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. For example, in a submittal report, clicking on a 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.

D. Document Security and Backup:
1. Secure Sockets Layer (SSL) encryption for secured data exchange between browser and server (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. 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.

E. General Tracking and Control:

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

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).

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

c. When a reviewer has opened an item.

F. 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.

a. 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. 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).

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.

G. RFI Tracking and Control:

1. Supply standard RFI form to enter information.
2. Ability to create or attach documents to the 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.

H. 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. Plant inspection reports.
   d. Testing reports.
2. Ability to link or attach photos to forms and link forms to other documents within CDMS.

I. Contract Modifications:

1. Supply standard Contractor proposal form with ability to attach documents and link to other documents within CDMS.
2. Provide ability to upload Reclamation's standard CM 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 CM form with Cost & Time impacts.
5. Ability to track date CM issued and date responded, with automatic notification after specified days without response.

J. Cost Tracking and Payment Request Management:

1. Ability to import payment bid items cost from a MS Excel spreadsheet.
2. Ability to edit percent complete and payment amount each month. Format to be spreadsheet, e.g. all items available for editing at once, rather than needing to edit one item at a time, save, open next item and edit that, etc.

K. 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. CDMS shall automatically assign sequential meeting numbers.

L. Miscellaneous Tracking and Controls. Ability to:

1. Generate reports tracking REAs, RFCs, RFIs, RFPs, RFSs, CMs Submittals, Memos, DIRs, survey requests, plant inspection reports, and testing reports.

2. Filter logs based on criteria:

a. Submittals: Specification Section, Days Out, Status (A/CA/NA/Acc/CAcc/NAcc).

b. RFIs: Days out, Status (Open/Closed), Specification Section/Dwg No., Responsibility/Ball-In-Court.

3. Sort logs based on a criterion, e.g. for Submittal, Specification Section, Days Out, Status, or other criterion determined by the COR.

4. Supply forms to match Government's CM Form and Progress Payment Form or other forms when needed.

5. Track Cost Exposure with links to RFI and CM requests.

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

7. Ability for keyword search of documents in database.

8. Ability to allow online Payment Requests, (electronic invoicing), by Contractor.

M. Budget and Funding Source Tracking:

1. Ability to enter funding sources and assign contract line items to multiple funding sources.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. The Contractor shall be the administrator of the CDMS site.

1. The Contractor shall maintain and manage CDMS services directly with the software provider.
2. All data and stored information shall belong to the Contractor who has sole responsibility for the CDMS solution.

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

C. 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 the property of the Federal Government and must be maintained in accordance with established standards.

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

D. 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.

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

1. RSNs listed in Table 01 33 00A - List of Submittals.
2. Scheduled submittal date.

F. Contractor shall provide a report of submittal status monthly or as requested by COR. Submittal status report shall be in a table format and include:

1. Required Submittal Number (RSN).
2. Section title.
3. Submittal title.
4. Date submitted.
5. Date of response.
6. Approval status (Approved/Conditionally Approved, Not Approved, Accepted, Conditionally Accepted, Not Accepted).
7. Days in review.

8. Due date.

G. CDMS shall be operational until final project closeout.

3.02 TRAINING

A. Provide the following training sessions:

1. One 30-minute minimum project scoping session for Contractor and USBR personnel to ensure the CDMS system is set up correctly to perform everything necessary for the contract.
2. One 60-minute minimum personalized administrator training session for those administering the CDMS system. Includes both Contractor and USBR personnel.
3. One 60-minute minimum personalized basic user training session for Contractor and USBR personnel.
   a. Include the process of receiving and responding to RSNs and RFIs.

B. Coordinate timing, location, and personnel to attend each session with COR.

END OF SECTION

SECTION 01 32 10
CONSTRUCTION PROGRAM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 DEFINITIONS

A. 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.

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

1.03 REFERENCE STANDARDS

A. Associated General Contractors of America (AGC)

1. AGC Manual-04 — Construction Planning and Scheduling Manual

1.04 SUBMITTALS

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

1. Database files in format compatible with Oracle Primavera P6 Professional Project Management or Microsoft Project 2010.
2. Schedule and analysis data on CD-ROM or DVD disk.
3. Information and data used to develop and maintain Construction Program to CO.

B. RSN 01 32 10-1, Baseline Schedule:

1. Include:

a. Construction Program/Schedule database.

b. Definition of project calendars.

c. Primavera layout file (.plf) or Microsoft Project.

d. Gantt chart (Bar chart) for project on 11 by 17-inch prints 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.

C. RSN 01 32 10-2, Updated Schedule Reports:

1. This submittal is required for a proper invoice for progress payments Government disapproval of this submittal will be considered failure of Contractor to comply with contract requirements and payment due date may be delayed until 14 days after submittal contents are approved. Include:

a. Construction Program database with updated activity and milestone data.

b. Definition of project calendars if revised from baseline calendars.

c. Primavera layout file (.plf) or Microsoft Project.

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

e. Narrative report specifically stating status of project.

1) 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.

2) 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.

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

f. Submittal Register:

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

2) 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).

3) This register document is separate from scheduling database.

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 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 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. Include appropriate logic relationships for revised activities.
3. Assign a unique project file name for each schedule update.

1.08 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 7 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. Schedule pre-submittal meeting with Contractor's representative each month to review draft updated schedule prior to Contractor submitting, Updated Schedule Reports.

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 Government using approved CPM schedules.

1.09 FAILURE TO COMPLY

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

B. CO may terminate 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 Price Schedules for other items of work.

1.02 DEFINITIONS

A. Days: Calendar days.

B. Required Submittal Number (RSN): Identifies items to be submitted together as a complete submittal.

C. Submittal Types, as listed in Table 01 33 00A - List of Submittals:

1. A - Action:
   a. Government will respond as to adequacy of submittal.
   b. Action Submittals: Considered "shop drawings" within the terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction.
2. I - Informational:
   a. Government will acknowledge receipt of Informational submittals.
   b. Government may reject an Informational submittal when the submittal does not satisfy contract requirements. Correct mistakes or deficiencies in rejected Informational submittals and resubmit.
   c. Informational Submittals: Considered "shop drawings" within terms of the clause at FAR 52.236-21, Specifications and Drawings for Construction, except that approval by Government is not required.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME Y14.1-2020 — 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

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.

C. Drawings:

1. Minimum Identification in Title Block:
   a. Contract number and title.
   b. Contractor's or supplier's title and drawing number.
   c. Date.
2. Reserve 3- by 3-inch space next to title block for review stamps.
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 2018 or later.
      3) Compile using "eTransmit" utility in AUTOCAD.
   b. Drawing prepared with drafting equipment, when allowed: Lettering shall be neat.
5. Drawings Designated as "Government Format" in Specifications:
   a. Also in accordance with Section 01 33 28 – Fire Alarm Drawings and Data.
   b. Computer drafted.
   c. Government will provide an electronic AutoCAD format template.
   d. Title block and sheet format:
      1) As shown on standard drawing 40-D-7102.
      2) Government will provide template.
      3) Government will provide specific title block information to be used.

6. Final Drawings:
    a. Show as-built changes, including revision dates, made during installation. Indicate changes by clouding.

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 items to be furnished in a manner that will photocopy (no highlighter).
    d. Strike through items that do not apply.

E. Certifications:
1. Certifications by a Registered Professional: Signed and sealed by registered professional.
2. Manufacturer’s Certifications: Signed by authorized representative of manufacturer.

F. Manuals:
1. Copies:
    a. Printed copies: Bound and indexed.
    b. Electronic copies: Adobe pdf.
        1) Bookmark longer files to assist in navigating file.
2. Contents:
    a. Parts identification lists, lists of special tools, and accessories.
    b. Schematics and wiring diagrams.
    c. Detailed instructions for installing, operating, lubricating, and maintaining equipment.
    d. As-built drawings, photographs, and test records or reports.

G. Photographs / Images:
1. Format: .jpeg or similar format, 10 megapixel, minimum.

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. 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.

D. Resubmittal of submittals not approved:

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 30 days after receiving the comments, unless otherwise directed.
4. Requirements for initial submittals apply to resubmittals.

E. Resubmittal of submittals not approved:

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 7 days after receiving the comments, unless otherwise directed.
4. Requirements for initial submittals apply to resubmittals.

1.06 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 28 days for 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 mailing postmark date.

B. 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,

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.

C. Return of Submittals:

1. Submittals: One set of submittals required for will be returned either approved, approved subject to identified changes, or not approved.

a. Revise and resubmit submittals not approved.

b. Do not change designs without approval of the CO after drawings, documentation, and technical data have been approved.

2. Informational Submittals: Government will acknowledge Informational submittals.

a. Informational submittals will not be returned when they satisfy contract requirements.

b. Informational submittals that do not satisfy contract requirements may be returned for resubmittal or additional information may be requested.

1.07 ELECTRONIC TRANSMITTALS

A. Except as noted, transmit electronically through Government supported CDMS Site. Contact information will be provided to the Contractor after award.

B. CDMS submittal shall meet the requirements of Article 1.05 Submittal Procedures.

C. Only one complete set shall be submitted with each CDMS submittal.

D. Each submittal shall be submitted separately.

E. Electronic file size shall not exceed 40 Megabytes (MB). Electronic files in excess of 40 MB must be transmitted as hard copy transmittals on Government approved storage medium.

F. Submit data in required format; e.g., survey data ASCII, electronic drawings AutoCAD .dwg.

G. Where format is not specified, preferred format is searchable portable document format (.pdf).

H. The Government, at the discretion of the COR, may require the Contractor to resubmit as hardcopy any transmittals which appear unclear or illegible in their electronic format.

I. Time required for review of each submittal or resubmittal begins on the next business day after transmittal of a complete set and ends the day the response is transmitted.

J. CDMS submittals will be responded to through CDMS.

K. Submittals required by the 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.

1.08 HARD COPY TRANSMITTALS

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

1. Contracting Officer, Bureau of Reclamation, Attn: UC-846, 125 South State Street, Salt Lake City UT 84138-1147.
2. Contracting Officer's Representative, Bureau of Reclamation, Glen Canyon Field Division, Attn. GC-200, 805 Bureau Street, PO Box147, Page, AZ 86040-1477.
3. Technical Service Center, 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 Technical Service Center. Send these submittals to the TSC address shown above.

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

* Submittal Types: A - Action, I - Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	Sets to be sent: **		
						CO	COR	TSC
01 11 22-1	Construction Sequencing	Work Sequence Plan	At least 56 days before removal of existing station service equipment	A	86-684 20	CDMS		
01 14 30-1	Interruption of Service	Interruption of Service Request	At least 21 days before interruption of service	A	COR	CDMS		
01 31 30-1	Construction Document Management System	Approval Data	Within 7 days after receipt of Notice to Proceed	A	COR	1	1	0
01 31 30 -2	Construction Document Management System	Final Data	Within 7 days of commissioning	I	COR	CDMS		
01 32 10-1	Construction Program	Baseline Schedule	Within 21 days after receipt of Notice to Proceed	A	COR	1	1	1
01 32 10-2	Construction Program	Updated Schedule Reports	With monthly requests for progress payments.	A	COR	CDMS		
01 35 10-1	Safety Data Sheets	Complete LHM and SDS	At least 14 days before jobsite delivery of hazardous material	I	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	I	COR	CDMS		
01 35 20-1	Safety and Health	Safety Program	At least 28 days before commencing construction activities	A	COR	CDMS		
01 35 20-2	Safety and Health	Job Hazard Analysis (JHA) List	At least 28 days before commencing construction activities	I	COR	CDMS		
01 35 20-3	Safety and Health	Monthly Accident Summary Report	Monthly	I	COR	CDMS		
01 35 30-1	Contractor's Onsite Safety Personnel	Resume	Prior to employment	A	COR	CDMS		
01 35 30-2	Contractor's Onsite Safety Personnel	Safety Inspection Reports	At least once each week	I	COR	CDMS		
01 56 10-1	Protection of Existing Installations	Plan for Protecting Existing Installations	At least 28 days before commencing construction activities	A	COR	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	Sets to be sent: **		
						CO	COR	TSC
01 74 00-1	Cleaning and Waste Management	Waste Production and Disposal Plan	At least 28 days before starting onsite work	A	COR	CDMS		
01 74 00-2	Cleaning and Waste Management	Waste Production and Disposal Records	Within 7 days of waste disposal	I	COR	CDMS		
01 78 30-1	Project Record Documents	Final As-built Drawings	Within 14 days of completion of work	I	COR	CDMS		
01 78 30-2	Project Record Documents	Extra Materials	Within 14 days of completing work	I	COR	CDMS		
01 78 30-3	Project Record Documents	Warranties	Within 14 days of completion of work	I	COR	CDMS		
01 78 30-4	Project Record Documents	Electronic Media Release Form, Upon Request.	Within 14 days of Notice to Proceed	I	COR	CDMS		
01 79 20-1	Training	Training Outline	At least 60 days before starting training	I	COR	CDMS		
01 79 20-2	Training	Training Materials	At least 60 days before starting training	I	COR	0	1	1
01 79 20-3	Training	Training Summary	At least 60 days before starting training	I	COR	CDMS		
01 91 13-1	Commissioning	Qualifications	At least 28 days before starting testing	A	COR	CDMS		
01 91 13-2	Commissioning	Test Plan	At least 56 days before starting testing	A	COR	CDMS		
01 91 13-3	Commissioning	Test Procedures	At least 56 days before starting testing	A	COR	CDMS		
01 91 13-4	Commissioning	Test Reports	Within 3 days of completion of tests	I	COR	CDMS		
01 91 13-5	Commissioning	Post Testing and Commissioning Documentation	Within 7 days of completion of testing	I	COR	CDMS		
21 25 00-1	Hybrid Water Mist Fire Suppression System	Qualifications	At least 28 days before starting onsite work	A	86-68420	CDMS		
21 25 00-2	Hybrid Water Mist Fire Suppression System	Approval Drawings and Data	At least 28 days before starting onsite work	A	86-68420	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	Sets to be sent: **		
						CO	COR	TSC
21 25 00-3	Hybrid Water Mist Fire Suppression System	Test Plan	At least 28 days before starting onsite work	A	86-68420	CDMS		
21 25 00-4	Hybrid Water Mist Fire Suppression System	Contractor Field Test Notification	At least 7 days before Test	I	86-68420	CDMS		
21 25 00-5	Hybrid Water Mist Fire Suppression System	Test Reports	Within 3 days of testing	I	86-68420	CDMS		
21 25 00-6	Hybrid Water Mist Fire Suppression System	Final Drawings and Data	At least 28 days before starting onsite work	I	86-68420	CDMS		
26 05 10-1	Conductors and Cables	Approval Data	At least 56 days before procurement	A	86-68430	CDMS		
26 05 10-2	Conductors and Cables	Construction Documentation	At least 28 days prior to installation	A	86-68430	CDMS		
26 05 26-1	Grounding and Bonding	Inspection and Test Reports	Within 14 days of completion of test and reports	I	COR	CDMS		
26 05 33-1	Raceways and Boxes	Approval Drawings and Data	At least 28 days prior to installation	A	86-68430	CDMS		
26 05 33-2	Raceways and Boxes	As-Built Drawings and Data	Within 14 days of completion of work	I	COR	CDMS		
26 05 90-1	Wiring Checkout and Tests	Test Notification and Plan	Within 10 days prior to checkout and test	A	86-68430	CDMS		
26 05 90-2	Wiring Checkout and Tests	Test Reports	Within 30 days after tests are completed	I	86-68430	CDMS		
28 31 00-1	Fire Detection and Alarm	Qualifications	At least 56 days before procurement	A	86-68420	CDMS		
28 31 00-2	Fire Detection and Alarm	Approval Drawings and Data	At least 56 days before installation	A	86-68420	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	Sets to be sent: **		
						CO	COR	TSC
28 31 00-3	Fire Detection and Alarm	Test Plan	At least 30 days before testing	A	86-68420	CDMS		
28 31 00-4	Fire Detection and Alarm	Test Notification	At least 10 days prior to test	I	COR	CDMS		
28 31 00-5	Fire Detection and Alarm	Test and Completion Reports	Within 30 days after tests are completed	A	86-68420	CDMS		
28 31 00-6	Fire Detection and Alarm	Final Drawings	Within 14 days of commissioning	I	COR	CDMS		
28 31 00-7	Fire Detection and Alarm	Operation and Maintenance Manuals	At Commissioning	I	COR	CDMS		
28 31 00-8	Fire Detection and Alarm	Test and Completion Report for Annual Fire Alarm System Testing	Within 3 days of test completion or at commissioning	I	COR	CDMS		
28 31 75-1	Remote Station Monitoring	Qualifications	At least 56 days before installation	A	86-68420	CDMS		
28 31 75-2	Remote Station Monitoring	Approval Drawings and Data	At least 56 days before installation	A	86-68420	CDMS		
28 31 75-3	Remote Station Monitoring	Test Plan	Within 30 days after tests are completed	A	86-68420	CDMS		
28 31 75-4	Remote Station Monitoring	Test Notification	Within 30 days after tests are completed	A	86-68420	CDMS		
28 31 75-5	Remote Station Monitoring	Test and Completion Reports	Within 30 days after tests are completed	A	86-68230	CDMS		
28 31 75-6	Remote Station Monitoring	Final Drawings	Within 30 days after tests are completed	A	86-68420	CDMS		

Table 01 33 00A. - List of Submittals

* Submittal Types: A - Action, I - Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	Sets to be sent: **		
						CO	COR	TSC
28 31 75-7	Remote Station Monitoring	Operations and Maintenance Manuals	At commissioning	I	COR	CDMS		

END OF SECTION

SECTION 01 33 28
FIRE ALARM DRAWINGS AND DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules for items requiring fire alarm drawings and data.

1.02 REFERENCE STANDARDS

A. International Code Council

1.	IFC-2021	International Fire Code

B. National Fire Protection Association (NFPA)

1.	NFPA 4-2018	Standard for Integrated Fire Protection and Life Safety System Testing
2.	NFPA 70-2023	National Electrical Code (NEC)
3.	NFPA 72-2021	National Fire Alarm and Signaling Code
4.	NFPA 170-2018	Standard for Fire Safety and Emergency Symbols

C. Underwriters Laboratory

1.	UL 864- 2008	Standard for Control Units and Accessories for Fire Alarm System

1.03 SUBMITTAL PROCEDURES

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

B. Prepared by a qualified designer. Certified and stamped by licensed fire protection professional engineer.

C. At a minimum furnish documentation required in NFPA 72 Chapter 7 and additional requirements listed below.

D. Symbols for diagrams and layouts shall be as described in NFPA 170 without exception.

E. One-Line/Riser Diagram:

1. One-line/riser diagram shall be provided in place of the NFPA 72 required riser diagram.
2. Show the general arrangement of system in building cross-section.
3. Show each system component and device installed separated by either elevation, floor, or story.
4. Indicate the system ID of components and devices.
5. Show the number and type of all circuits.
6. Indicate the wire or cable type between equipment and devices including number of conductors, wire gauge, and jacket rating.
7. Indicate size and type of conduit if used.

F. Layout Drawings:

a. Location of risers, terminal junction boxes, penetrations, gutters, cable trays, and raceways.

b. Indicate size of penetrations.

c. Indicate the mounting and height of cable trays, gutters, and open raceways.

d. Indicate the system ID of components and devices. Indicate the candela rating for visual notification devices.

e. Show ceiling mounted devices on reflected ceiling plan.

f. For ceiling mount notification devices indicate the mounting height above the finished floor.

g. For projected beam type smoke detectors, include calculations for smoke stratification, beam coverage pattern, and mounting height.

2. Show the wiring, conduit and raceways between devices and equipment.
3. Indicate the wire or cable type between devices and equipment, including number of conductors, wire gauge, and jacket rating.
4. Indicate the conduit size and type between devices and equipment.
5. Show piping layout for air sampling-type smoke detectors. Include isometric layout.

G. Wire Legend:

1. Show in a table information about each type of cable and conductor used in the design.
2. List the following:

a. Wire gauge.

b. Number of conductors.

c. Jacket type.

d. System color code.

e. Manufacturer.

H. Voltage Drop Calculations:

1. Use the worst-case scenario aggregating the entire load at the end of the circuit.
2. Demonstrate NAC operation at 85% of battery voltage per UL 864.
3. Use manufacturer's NAC terminal cut-off voltage for starting voltage. Include manufacturer's documentation.
4. Resistance values for conductors shall be in accordance with NFPA 70 Table 8 for uncoated copper conductors.
5. Voltage shall not drop below 16 VDC at the last appliance.

I. Conduit Fill:

1. Demonstrate the conduit is properly sized to accommodate the conduit fill limitations as described in NFPA 70.
2. Provide a table with conduit fill calculations for each conduit branch of the same number and type of cables and/or conductors.
3. Provide manufacturer's data for each cable type.
4. Show fill percentage as a function of the total cross-sectional area of cables and conductors in the conduit to the overall internal area of the conduit as listed in NFPA 70.

J. Sequence of Operation:

1. Describe the operation of the fire alarm system and connected sub-systems during:
   a. A fire event. Include detail of monitoring and supervision processes.
   b. Supervisory and/or fault condition.
2. Include input/output matrix with initiating events (inputs) as rows and response events (outputs) as columns. Indicate the correlation of input to output with a dot or an 'x'.

K. Input/Output Matrix:

1. Illustrating the sequence of operations.
2. Separate each initiating and response events by device, panel, system and/or signal type.
3. Initiating events shall include:
   a. Manual initiation of alarm or supervisory features.

b. Manual initiation of special extinguishing systems.

c. Automatic initiation from detection such as smoke, fire, other emergency alarms.

d. Initiating detection devices activating specific mechanisms or life safety functions.

e. Automatic initiation of fire suppression systems; flow switches and special suppression systems shall be identified separately.

f. Functions monitored by the fire alarm system, including:

1) Equipment/device/appliance/system trouble signal.

2) Equipment/device/appliance/system supervisory signal.

3) Equipment/systems monitored for integrity.

g. FACU input functions including:

1) Acknowledge.

2) Alarm/Signal Silence.

3) Reset.

4) Drill.

4. Response events shall include:

a. Activation of FACUs and panel LEDs related to input.

b. Alarm notification including signal transmission to central station, interior and exterior appliances, emergency alarms, voice evacuation, special suppression pre-discharge alarms, etc.

c. Required safety functions including:

1) Damper activation.

2) Activation of opening protection.

3) Activation of electronic security features.

4) Door releasing features.

5) HVAC shutdown.

6) Power shunt.

7) Activation of suppression system solenoids.

5. Example I/O Matrix, for information only:

SYSTEM OUTPUT

SYSTEM INPUT	CONTROL UNIT ANNUNCIATION								NOTIFICATION										FIRE SAFETY CONTROL							SUPPLEMENTARY							
	ACTUATE ALARM LED AND AUDIBLE SIGNAL	ACTUATE SUPERVISORY LED AND AUDIBLE SIGNAL	ACTUATE TROUBLE LED AND AUDIBLE SIGNAL	SILENCE ON-BOARD PIEZO					ACTUATE INTERIOR NAC CIRCUITS	DEACTIVATE INTERIOR AUDIBLE NACS	DEACTIVATE INTERIOR VISUAL NACS	TRANSMIT 'WATERFLOW' TO SUPERVISING STATION	TRANSMIT 'FIRE ALARM' TO SUPERVISING STATION	TRANSMIT 'SUPERVISORY' TO SUPERVISING STATION	TRANSMIT 'TROUBLE' TO SUPERVISING STATION	TRANSMIT 'RESTORE' TO SUPERVISING STATION	SHUT DOWN RESPECTIVE RTU	RESTORE RELAYS TO NORMAL POSITION							RESET PANEL TO NORMAL CONDITION		ACTUATE EXTERIOR HORN/STROBE AT FDC							
PULL STATION	●								●				●																				
SMOKE DETECTOR	●								●				●																				
WATERFLOW	●								●			●																●					
VALVE TAMPERS		●												●																			
DUCT DETECTORS		●												●				●															
IDC FAULT PER NFPA STYLE B			●												●																		
SLC FAULT PER NFPA STYLE 4			●												●																		
NAC FAULT PER NFPA STYLE Y			●												●																		
AC POWER FAIL			●												●																		
LOW BATTERY			●												●																		
PANEL ACKNOWLEDGE				●																													
PANEL SILENCE				●					●																								
PANEL RESET				●					●	●						●	●							●									

L. Manufacturer's Products and Technical Data:

1. In a table, list system products; include manufacturer's name, model numbers, quantity, and description.

2. For data sheets with multiple products or equipment highlight items to be furnished and strike through items that do not apply.

M. As-built Drawings:

1. In accordance with Section 01 78 30 - Project Record Documents.

2. Indicate as-built changes made to equipment and systems during construction.

3. Bill of Material List: Provide information on manufacturer, style, type, rating, quantity, and other identifying information for each device or item of equipment with unique reference number.

N. Final Drawings: In accordance with Section 01 78 30 - Project Record Documents.

1. Be produced after all work and commissioning of system is performed and finalized.

O. Test Plan:

1. Meeting the requirements of NFPA 72 and NFPA 4.

2. For individual fire alarm acceptance testing and for integrated system testing of fire alarm system.
3. Certified by a NICET Level III or IV fire alarm technician, or fire protection engineer.
4. Include the following:
    a. Written verification that fire alarm system has been installed in accordance with approved design documents.
    b. Written verification that fire alarm system has been pre-tested and operates according to design documents, applicable codes and standards and, specifications.
    c. Include certification from an authorized representative of the manufacturer that the installation complies with manufacturers' requirements and that satisfactory total system operation has been achieved.
    d. List of the individual and integrated systems to be tested.
    e. Identify entities required to be in attendance.
    f. Equipment required for testing including testing apparatus, ladders and lift equipment, and safety equipment. Include manufacturer data sheets where applicable.
    g. A comprehensive functional matrix depicting system inputs and associated output functions.
    h. List of necessary drawings, including riser diagrams and control diagrams.
    i. Narrative description of the test scenarios for integrated systems and procedures not described in NFPA 72.
    j. A copy of the fire alarm equipment manufacturer's test instructions where applicable.
    k. The extent of systems to be tested under the direction of the testing agent including system boundaries.
    l. Test schedule.
    m. Fire system outages required.
    n. Ancillary equipment outages required.
5. Supply contact information including address, telephone, website for installation company, manufacturer tech support, testing company, and local certified fire alarm technician.

P. Operation and Maintenance Manuals:
1. In accordance with Section 01 78 30 - Project Record Documents.

2. Include rate of frequency in days, months, or years for each device to be tested. Based on manufacturer's recommendations and/or NFPA 72 testing requirements, whichever is more stringent.
3. One copy of NFPA 72.
4. Approved Test plan.
5. Record of completion per NFPA 72.
6. Inspection and test forms per NFPA 72.
7. List of software used and installation and operation instructions copies of system software (minimum two copies).
8. List of system passwords and codes.
9. Description of operation that gives in detail, information required to properly operate, inspect, test, and maintain equipment and system. Provide all manufacturer's installation limitations.
10. Component technical datasheets.
11. Final fire alarm system drawings and diagrams developed for the project.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01 35 10
SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules 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 Price Schedules 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 https://www.usbr.gov/safety/rshs/index.html
2.	FIST 1-1 (2020)	Hazardous Energy Control Program available at: www.usbr.gov/power/data/fist_pub.html

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 RSHS.
2. Cover aspects of onsite and applicable off-site operations and activities associated with this contract.
3. Follow outline in Appendix B of RSHS
4. Will not be accepted for review by COR unless it addresses, in order, lettered and numbered per Appendix B, narrative for each applicable item in outline. For items in outline that do not apply to this contract write "Not applicable to Contract" next to number/letter.
5. Generic company safety programs are not acceptable. Safety Program must be site specific for this contract.
6. Submitted and accepted prior to commencing onsite work, including mobilization.

C. RSN 01 35 20-2, Job Hazard Analysis (JHA) List:

1. Provide list of JHA's to be submitted throughout project.

D. RSN 01 35 20-3, Monthly Accident Summary Report:

1. In accordance with RSHS.

1.04 DOCUMENTATION AND RECORDS

A. Prepare and retain all safety plans, programs, training content, and training records applicable to scope of work and make available to COR unless already included in written safety program. Some examples include but are not limited to:

1. Electrical Safety Requirement Training Records.
2. Emergency Action Plans Written Program and Training Records.
3. Fall Protection Written Program and Training Records.
4. Fire Protection and Prevention Written Program and Training Records.
5. Flammable and Combustible Liquids Written Spill Control Plan.
6. General Safety and Health Provisions, Written Safety Program, and Regular Safety Inspection Records.
7. Hazard Communication Written Program and Training Records.
8. Ladder Written Compliance Program and Training Records.
9. Lead Written Program and Training Records.
10. Lockout/Tagout: Refer to RSHS Section 15 Hazardous Energy Control Program (HECP) Training Records.
11. Bloodborne Pathogens Exposure Control Plan, Training Records.
12. Methylenedianiline Training Records, if applicable.
13. Occupational Noise Exposure Written Program and Training Audiometric Testing Records.
14. Personal Protective Equipment (PPE) Hazard Assessments and Training Records.
15. Power Operated Hand Tools Training Records.
16. Safety Training and Education Written Program and Training Records.
17. Scaffolds Training Records.
18. Welding, Cutting, and Brazing Written Program and Training Records.

1.05 SAFETY AND HEALTH

A. Provide and maintain work environment and procedures that:

1. Safeguard public, Government personnel, and Contractor employees exposed to Contractor operations and activities.
2. Avoid interruptions of site operations and delays in project completion dates.
3. Control costs in contract performance.

B. Do not begin onsite work, including mobilization, until CO accepts Safety Program.

C. Participate in Contractor Safety Program Review meeting prior to mobilization.

D. Minimum work crew shall consist of no less than two (2) people, unless approved by CO.

E. Develop Job Hazard Analyses for each distinct phase of work under the contract:

1. Do not begin phase of work until JHA is acceptable to COR and shared with construction employees.
2. Activities involving hazardous materials shall have appropriate Safety Data Sheet(s) attached to JHA.

F. Comply with RSHS 29 CFR 1926, FAR 52.236-13 "Accident Prevention and State regulations.

G. Correct safety and health violations identified by CO or COR.

H. When Contractor fails or refuses to correct a compliance directive, CO may issue order to stop all or part of the work:

1. When satisfactory corrective action is taken, order to resume work will be issued.
2. Contractor shall not be entitled to extension of time, claim for damage or additional compensation by reason of either directive or stop order.
3. Failure of CO to order discontinuance of Contractor's operations shall not relieve Contractor of responsibility for safety of personnel and property.

I. Maintain accurate records of and report to CO the following occurrences during performance of this contract:

1. Death.
2. Occupational disease.
3. Traumatic injury to employees or public.
4. Property damage in excess of $2,500.

J. Rights and remedies of Government provided in this section are in addition to any other rights and remedies provided by law or under this contract:

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

K. Provide appropriate safety barricades, signs, and warnings. Erect or label all limited approach and arc flash hazard boundaries for exposed energized equipment. Coordinate activities with Reclamation electricians.

L. Contractor shall be responsible for providing medical and emergency assistance in timely manner consistent with recognized emergency protocols.

M. In instances where local emergency responders are not readily available, responsibility to provide emergency services shall default to Contractor.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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 Price Schedules for other items of work.

1.02 SUBMITTALS

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

B. RSN 01 35 30-1, Resume:

1. Contractor's Onsite Safety Representative.

C. RSN 01 35 30-2, Safety Inspection Reports:

1. Prepare detailed monthly safety inspection reports listing noted deficiencies, digital photos, abatement dates and follow-up action for all jobsite activities.
2. Inspection report shall include findings of jobsite walk-through with Government representative.

1.03 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.

1.04 APPLICATION

A. Designate an employee as the Contractor's Onsite Safety Representative prior to start of construction and employ Safety Professional for part-time on the job.

1. Safety Professional requirements may be met by retaining appropriate level of services of an acceptable safety consultant.

B. Safety Professional duties, and responsibilities:

1. Review and approve Contractor's Safety Program prior to submittal.
2. Visit site on an as-needed basis, but at a minimum of one time per week.

1.05 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 safety effort be considered inadequate, CO has the option to require Contractor to employ a full-time qualified Safety Professional, at no additional cost to the Government.

B. Safety Program:

1. The effectiveness of Contractor's Safety Program will be subject to continued review and approval by CO.

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 Price Schedule A 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 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. Federal Specifications, Standards, and Commercial Item Descriptions; and Military Specifications:

1. Copies of Federal Specifications, Standards, and Commercial Item Descriptions may be obtained from GSA Federal Supply Service.
2. Copies of Military Specifications may be obtained from Department of Defense,

B. Bureau of Reclamation Documents:

1. Bureau of Reclamation manuals and other publications including significant scientific, technical, and engineering works are available from the National

Technical Information Service (NTIS). Information regarding availability and pricing may be obtained by contacting NTIS at the following address:

United States Department of Commerce
National Technical Information Service
5301 Shawnee Road
Alexandria, VA 22312
Telephone: 1-800-363-2068 or 703-605-6060

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
ANSI	American National Standards Institute 1819 L. Street, NW. Washington, DC 20036 www.ansi.org	202-293-8020
ASME	American Society of Mechanical Engineers 3 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
BICSI	Building Industry Consulting Service International 8610 Hidden River Parkway Tampa, FL 33637-1000 www.bicsi.org	1.813.979.1991 or 800.242.7405

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

Acronym	Name and Address	Telephone
ICC	International Code Council 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041 www.intlcode.org	(703) 931-4533
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 1568 Carrollton, GA 30112 http://www.icea.net/	(800) 447-3352
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue,17th Floor New York, NY 10016-5997 www.ieee.org	212-419-7900
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
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602 www.mss-hq.com	(703) 281-6613
NEMA	National Electrical Manufacturers Association 1300 N 17th Street, Suite 1847 Rosslyn, VA 22209 www.nema.org	703-841-3200
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 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

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

Acronym	Name and Address	Telephone
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance 2500 Wilson Boulevard, Suite 300 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 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

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

1.02 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-20 National Electrical Safety Code (NESC)

1.03 TEMPORARY ELECTRICITY

A. Electric power rated at three phase, 480V, may be obtained up to a maximum of approximately 100 kilovolt ampere and single phase, 60 Hertz 120 VAC may be obtained from Government at no charge to Contractor.

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

C. Comply with IEEE C2 clearances and spacing for temporary power and supply lines.

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

1.04 TEMPORARY WATER

A. Water from service water system will be available for construction purposes. Water in plant is not potable.

1. Make arrangements with COR for use of water.
2. The Government will designate locations from which water may be obtained.
3. No charge will be made for water obtained from this source.

B. Use water which meets specified requirements for water used in concrete, grouting, and other permanent work.

C. Contractor to provide means of conveying water to points of use.

D. Contractor to provide potable water for workforce use.

1.05 TELEPHONE

A. Landline is not available, cell service is limited.

1.06 SANITARY FACILITIES

A. Contractor may use on-site restrooms. Coordinate with COR.

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 Price Schedules 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. See drawings.

1. One Contractor vehicle may park at plant, others park at Visitor's Center.

B. Designated areas of existing parking facilities may be used by construction personnel.

C. Do not allow heavy vehicles or construction equipment in established parking areas.

3.03 MAINTENANCE

A. Maintain roadways, parking areas, and haul routes in a sound, smooth condition.

B. Maintain surfacing of gravel-surfaced roads and parking areas in a smooth condition until completion and acceptance of work under this contract.

3.04 REPAIR

A. Promptly repair ruts, broken pavement, potholes, low areas with standing water, and other deficiencies to maintain road surfacing and drainage in original or specified condition.

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 Price Schedules 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 SUBMITTALS

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

B. RSN 01 56 10-1, Plan for Protecting Existing Installations.

1.03 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 the jobsite.

B. Obtain location of embedded conduit, pipe, cable, ground mat, and other buried items before performing 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 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 be back-charged repair costs.

END OF SECTION

SECTION 01 57 20
ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in Price Schedules 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 https://www.usbr.gov/safety/rshs/index.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 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. When Price Schedules include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in the prices offered in Price Schedules for the item.
2. When Price Schedules do not include a separate item for furnishing a material, include cost of furnishing, hauling, storing, and handling in the prices offered in Price Schedules for work for which the 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 B1.1-03(2008)	Unified Inch Screw Threads, (UN and UNR Thread Form)
2.	ASME B1.20.1-13	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (Reclamation)

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

1.05 MAINTENANCE

A. Extra Materials:

1. Furnish additional maintenance materials specified as "extra materials" in the specifications. Provide maintenance material identical to installed material and provide from the same manufacturer's production lot as installed material.
2. Package extra materials for storage and label with complete product identification on packaging.
3. Deliver extra materials to Government at jobsite and place in storage as directed by COR.

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 amount of the adjustment 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 Government or involve less cost to Contractor than specified material, a contract adjustment will be made in favor of Government. Where 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 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.

D. For rotating parts of motors and exciters, maximum unit stress due to runaway speed shall not exceed 2/3 of the yield point.

2.04 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 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 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 Price Schedules 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 https://www.usbr.gov/safety/rshs/index.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.
2. See 3.03 A.

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.

1.05 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.

1.06 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.

B. Server room cleaning shall be monitored by COR or Government representative at all times.

3.02 FINAL CLEANUP

A. Remove temporary plant facilities, buildings, concrete footings and slabs, rubbish, unused materials, concrete forms, and other similar materials which are not part of permanent work.

B. Leave premises "broom clean”.

C. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces.

D. Clean equipment and fixtures to a sanitary condition.

E. Replace filters of operating equipment.

F. Sweep paved areas and rake clean landscaped areas.

3.03 DISPOSAL

A. Dumpster Location:

1. Coordinate location and use of dumpster with COR.

B. Nonhazardous waste materials:

1. Reuse at jobsite or reuse or recycle waste materials removed from jobsite whenever possible.
2. Dispose of materials not reused at jobsite by removal from jobsite.
3. Dispose of nonhazardous waste materials that are not reused or recycled at appropriately permitted disposal facilities.
4. Combustible waste materials: Dispose by removal from jobsite.
5. Noncombustible waste: Dispose by removal from jobsite.
6. Disposal by Removal:
   a. Reuse or recycle waste materials whenever possible.
   b. Dispose of nonhazardous waste materials that are not reused or recycled at appropriately permitted disposal facilities.

3.04 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. As-Builts, Final Drawings, and Operations & Maintenance (O&M) Manuals:

1. Measurement: Number provided.
2. Payment: Unit price of each stated in Price Schedule A.
   a. Two sets of the following:
      1) As-built and Final Drawings for the Fire Alarm System.
      2) Operations & Maintenance (O&M) Manuals for the Fire Alarm System.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals and Section 01 33 28 – Fire Alarm Drawings and Data.

B. RSN 01 78 30-1, Final As-built Drawings:

1. Certified marked sets.

C. RSN 01 78 30-2, Extra Materials:

1. List of extra materials.

D. RSN 01 78 30-3, Warranties.

E. RSN 01 78 30-4, Electronic Media Release Form, Upon Request.

1. Refer to Article 1.04 Electronic Drawings below.

1.03 ELECTRONIC DRAWINGS

A. CADD Files, will be distributed upon request, after:

1. Notice to Proceed.
2. Contractor signs form in Section 51 00 50 – Electronic Media Release.

1.04 RECORD DRAWINGS

A. Maintain 2 sets of full-size prints of contract drawings marked to show accurate and complete records of as-built conditions. Keep drawings at the jobsite and mark as work progresses.

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents.

   a. Include the following:

      1) Buried or concealed construction and utilities.

      2) Existing items, topographic features, and utility lines revealed during construction which differ from those shown on contract drawings.

2. Mark to define construction actually provided, where choice of materials or methods is permitted in specifications, or where variations in scope or character of work from that of the original contract are authorized.

B. Use standard drafting practice to represent changes and include supplementary notes, legends, and details necessary to clearly portray as-built construction.

C. Mark as-built drawings in the following colors:

1. Red - Additions to original drawings.
2. Green - Deletions to original drawings.
3. Blue - Notations necessary for explanation of as-built markings.

D. Allow Government to review drawings at all times.

E. Upon completion of work, sign marked prints as certified correct.

1.05 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:

List of extra materials				
Specification Section	Material Designation	Material	Manufacturer	Extra Material Item

1.06 WARRANTIES

A. Provide warranties in accordance with the clause at FAR 52.246-21, Warranty of Construction, the specifications, and this section.

B. Warranty of Construction:

1. Submit data concerning warranty of construction, required by the clause at FAR 52.246-21, "Warranty of Construction", including the warranty period (dates), and warranty contacts with names, addresses, and telephone numbers. Post this data, under glass, at a location as directed by CO.

C. Other Warranties:

1. For other warranties, including those warranties for equipment specified by CO on a brand name and model basis, provide the following:
2. Warranty List:
   a. Bound and indexed notebook containing written warranties obtained, required, or furnished under the contract. Prepare complete list of warranted products, equipment, materials, processes, and other warranted

items. Fully execute and deliver this list to CO prior to final acceptance of contract work. Provide the list in the following format:

Warranty list			
Specification Section	Warranted Item	Warranty Period Dates	Point of Contact

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 79 20
TRAINING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Training:

1. Payment: Lump-sum price offered in Price Schedule A.

   a. Includes multi-session courses including classroom and field instruction.

1.02 SUBMITTALS

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

B. RSN 01 79 20-1, Training Outline:

1. Syllabus and Outline.

C. RSN 01 79 20-2, Training Materials:

1. Schedule:

   a. Multi-session courses including classroom and field instruction.

   b. Accommodate Government employees working alternate shifts.

2. Presentation, including handouts, in .pdf format.

D. RSN 01 79 20-3, Training Summary:

1. Provide one electronic version on CD-ROM or DVD or COR or Government supplied thumb drive or other Government approved media of the following materials:

   a. Presentation, including handouts, in .pdf format.

   b. Digital video recording of class, format shall be MP4 (MPEG-4).

1.03 QUALIFICATIONS

A. Instructor: Factory-authorized service representative familiar with the project, experienced in operation and maintenance procedures and training.

1.04 COORDINATION

A. Coordination:

1. Coordinate training with COR a minimum of 60-days prior to start of training.

2. Schedule training for after completion of all testing and commissioning activities referenced in Section 01 91 13 – Commissioning.
3. Schedule:
   a. Monday through Thursday
      1) Facility personnel work four days a week.
   b. Schedule to accommodate Government employees working alternate shifts.

B. Provide training for:
1. All equipment supplied.
2. Training provided on the following minimum topics:
   a. System Components.
   b. Operation of system.
   c. Maintenance, including specific methods and activities.
   d. Trouble shooting system errors.
   e. System software packages.
      1) Including, but not limited to, the maintenance laptop, remote monitoring station, and all associated software packages.
   f. Performance of expansions or modifications to systems.

1.05 PERFORMANCE REQUIREMENTS

A. General:
1. Intended Audience:
   a. Engineers.
   b. Electricians.
   c. Power Systems Control Craftsman.
   d. Mechanics.
   e. Operations.
2. Provide training for:
   a. All equipment supplied.
   b. Fire Alarm System:
      1) Includes the following minimum topics:
         a) System components.
         b) Operation of the system.

c) Sequence of operation matrix.

d) System drawings and documentation.

e) Interface between this system and other components or systems.

f) Maintenance, including specific methods and activities.

g) Trouble shooting system errors.

h) System software packages.

i) Performance of expansions or modifications to system.

c. Hybrid Water Mist Suppression System:

1) Includes the following minimum topics:

a) System components.

b) Operation of system.

c) Sequence of operation.

d) System drawings and documentation.

e) Interface between this system and other components or systems.

f) Maintenance, including specific methods and activities.

g) Trouble shooting system errors.

h) System software packages.

i) Performance of expansions or modifications to system.

3. Training on all components shall include the following topics:

a. Provide review of items contained in operating and maintenance instruction books.

b. Operations: Overview of how Contractor furnished systems interact and function in overall operation of the plant. Familiarization with Contractor supplied or modified equipment including operator interface, indications, and operational sequences.

c. Maintenance: Describe and demonstrate all associated maintenance procedures required for new equipment including calibration procedures, replacement of batteries, fuses, device cards, and filters, etc.

d. Programing Setup and Control Details: Include brief theory of operation, description of control components, performing setting changes and implementing control modifications.

4. Include classroom lectures, demonstrations, and hands-on equipment experience in training.

5. Recording of Training Session:
   a. Provide audio and color video recording of training.
   b. Provide a camera operator in addition to class instructor.
   c. Provide necessary equipment to record classroom portions of training.
   d. Ensure projector screen presentations, white board diagrams, and flip chart paper diagrams developed during the class are visible and legible on video recording.
   e. Ensure audio for both instructor and class participants is understandable.
   f. Use DVD format suitable for playback on standard equipment available commercially in the United States.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 TRAINING

A. Training Materials:
   1. Class presentation:
      a. Including PowerPoint presentation and handouts.
   2. In progress as-built drawings.
   3. Draft Operation and Maintenance Manual.
   4. Reclamation reserves the right to reproduce and modify any and all Training Materials.

B. Provide 15 copies of training materials for each session for a total of 30 sets.

C. Government will furnish facilities for training and will retain training materials for future reference.

D. Provide necessary laptop computer for demonstration of software:
   1. Use of spare parts for classroom demonstration to be permitted.
   2. Make written request for use at least 14-days prior to the scheduled class.

E. Training Session Duration:
   1. Provide two training sessions, each including all training on all required topics. Minimum training duration for each session on each topic is as follows:

a. Fire Alarm System: Minimum 8-hour duration per session.

b. Hybrid Water Mist Suppression System: Minimum 4-hour duration per session.

F. Typical Session Content and Sequence:

1. Fundamentals and theory.
2. Operations and maintenance.
3. Hardware.
4. Software.

G. Date: Within 30-days following commissioning of Fire Alarm System and Hybrid Water Mist Suppression System. Government will provide at least 15-days advance notice of preferred training dates.

H. Location: Onsite:

1. Use of actual installed equipment for training demonstration to be coordinated with COR.
2. Submit request to COR at least 14-days in advance. Include details describing intended operational sequences and locations of inspection to determine Government clearance procedures.

I. Attendance at each session will not exceed 15:

1. Provide and incorporate the following minimum training materials into supplied training classes:

a. Agenda.

b. Presentation notes.

c. PowerPoint presentations.

d. Videos.

e. Generic and customized handouts.

f. Personal experience examples.

g. System documentation, including all documentation on system operation and sequence of operation.

h. Operation and Maintenance Manuals and drawings.

J. Where manufacturer instructions are insufficient, develop and provide procedures for system operation.

K. Provide each participant with hard copies of training materials.

L. Contractor shall provide video recording equipment and personnel to operate equipment.

END OF SECTION

SECTION 01 91 13
COMMISSIONING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Commissioning:

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

1.02 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

1.	NFPA 72-2016	National Fire Alarm and Signaling Code
2.	NFPA 3-2021	Standard for Commissioning of Fire Protection and Life Safety Systems
3.	NFPA 4-2021	Standard for Integrated Fire Protection and Life Safety System Testing
4.	NFPA 25-2016	National Fire Alarm and Signaling Code

1.03 SUBMITTALS

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

B. RSN 01 91 13-1, Qualifications.

C. RSN 01 91 13-2, Test Plan.

1. Provide test plan meeting the requirements of NFPA 3, NFPA 4, NFPA 25, and NFPA 72.
2. Provide a test plan for individual fire alarm acceptance testing and for integrated system testing of fire alarm system.
3. Test plan shall include the following:
   a. Written verification that the fire alarm system has been installed in accordance with approved design documents.
   b. List of the individual and integrated systems to be tested.
   c. Identify all entities required to be in attendance.
   d. Equipment required for testing.

e. A comprehensive functional matrix depicting all system inputs and associated output functions.

f. List of necessary drawings, including riser diagrams and control diagrams.

g. Narrative description of the test scenarios, including what is needed for record of completion.

h. The extent of systems to be tested under the direction of the testing agent.

i. Test schedule.

j. Fire system outages required.

k. Ancillary equipment outages required.

D. RSN 01 91 13-3, Test Procedures:

1. Detailed test procedures including step-by-step description of activities that will be performed.

E. RSN 01 91 13-4, Test Reports.

F. RSN 01 91 13-5, Post Testing and Commissioning Documentation.

1.04 DEFINITION

A. Commissioning:

1. Consists of integration testing, verifying component feedback, and verifying operation and control interface for all Contractor supplied equipment and systems.

2. Systematic process of ensuring that all systems perform interactively according to design intent and Government's operational needs.

3. Encompasses and coordinates separate functions of system documentation, equipment startup, control system calibration, testing and balancing and performance testing.

1.05 PROJECT CONDITIONS

A. Prior to performing commissioning tests, the following major features must be complete:

1. Completion of all standalone component testing.

2. Safety features (either permanent or temporary) to safely access and inspect items related to testing.

B. Commissioning timelines may be affected by available facility interruption of services.

1.06 QUALIFICATIONS

A. Entities either preparing testing or commissioning documentation or performing testing or commissioning activities shall have performed services for installations with similar

types of features, (electrical distribution systems, fire alarm systems and heating, ventilation, and cooling systems).

1.07 SCOPE

A. Components supplied, installed, or modified for this Project.

B. Demonstrate correct operation of entire system including, but not limited to:

1. Fire alarm system and its interfaces.
2. Water mist suppression systems.
3. All control and automation functions and operator interfaces used to operate and monitor these systems.

C. Demonstrate hardware and software functionality, performance and stability.

D. Includes:

1. Any field verification of any component rating curves or operational set-points and any required tuning or adjustment of control or settings.
2. Verification that integrated system meets operational and functional requirements in these specifications and that interfaces between systems work properly. Including interfaces between Contractor supplied equipment and existing equipment.

E. Implement software, settings or graphic display modifications requested by the Government as a result of the testing or commissioning activities.

1.08 COMMISSIONING PROCESS DOCUMENTATION

A. General:

1. Documentation prepared by Contractor shall represent testing program in accordance with requirements in these Specifications and the listed codes.
2. Inspection and test documentation shall include the following:
   a. Name and signature of person performing test.
   b. Date at which test was performed.
   c. Identification of component, equipment, or system tested.
   d. Identification of tests performed.
   e. Any data or readings taken during test to verify component, equipment, or system acceptance.

B. Contractor shall generate the following documentation:

1. Test Plan:

a. Specific detailed test plan of testing and commissioning activities planned for site acceptance and commissioning testing. Including the following:

1) Construction testing to provide component level acceptance testing verification of components supplied, installed, or modified by Contractor.

2) Pre-operational and commissioning testing.

3) COR will provide written general guidelines for testing.

2. Test Procedures:

a. Detailed procedures for all planned testing and commissioning activities.

b. Test procedures including step-by-step description of activities to be performed, including identification of where system or component isolation is required and locations and means of applying isolation.

3. Testing and Commissioning:

a. Turnover Books:

1) Contractor assembled and maintained at jobsite.

2) Contains records of all testing and commissioning activities performed, including specific test data and reports.

3) Updated as each test or commissioning activity is performed.

4) Available for COR review immediately upon request.

5) Maintain turnover books onsite in secure location. Contractor shall not remove turnover book from site without specific written approval from COR.

b. Test Reports:

1) Typed, 8 1/2- by 11-inch sheets.

2) Certified, signed, dated, and attested to having passed requirements and tests.

3) Provide data summary and necessary graphs and plots of tests performed.

4) Available for COR review upon request.

5) Use in preparing final drawings.

c. Issues and Resolution Log.

d. As-Built Drawings: Mark as-built drawings with modifications in accordance with Section 01 78 30 – Project Record Documents and Section 01 33 28 – Fire Alarm Drawings and Data.

4. Post Testing and Commissioning Activities:

a. Provide turnover books to Government, including copies of all test reports and documentation of all commissioning activities performed.

1.09 COORDINATION

A. Commissioning process requires active participation of design team, including designers, installation personnel, Manufacturers' Representatives, and other specific subcontractors, as deemed appropriate.

B. Government will witness final functional performance commissioning process.

C. Government reserves the right to witness any inspection, testing, or commissioning activities. Contractor shall inform COR of scheduled activities a minimum of 72-hours prior to performing activity to allow Government the opportunity to witness.

D. Government reserves the right to perform additional equipment testing onsite with cooperation of Contractor to verify operability of equipment.

E. Contractor shall complete each phase of testing and commissioning work and request written confirmation of completion prior to continuing to next phase.

F. Government shall determine final acceptance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 COMMISSIONING PROCESS

A. Coordinate with COR and ongoing work activities at the facilities.

B. Coordinate with requirements in the following Sections:

1. Section 28 31 00 – Fire Detection and Alarm.
2. Section 21 25 00 – Hybrid Water Mist Fire Suppression System.

C. Phases of Testing and Commissioning Work:

1. Construction Testing:
   a. Perform in accordance with requirements in these Sections.
   b. Includes inspections and tests at component and device level.
2. Preoperational Test Phase:
   a. Inspections of complete installation.

3. Commissioning (also Operational Test Phase):
   a. Includes cold- and hot-commissioning activities.
   b. Provide minimum 7-day reliability test run. At completion of other commissioning and startup activities:
      1) Coordinate with COR for scheduling reliability run test.
      2) If malfunction occurs during reliability test run, address issues and restart test run.
      3) During test Government personnel will perform normal system control actions using Contractor supplied equipment.
   c. Technical personnel shall be available onsite to provide consultation with Government personnel if any questions or problems arise during test.
   d. Contractor shall provide COR with a minimum of 3-days advance notice prior to performing each test.

END OF SECTION

SECTION 21 25 00

HYBRID WATER MIST FIRE SUPPRESSION SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Hybrid Water Mist Fire Suppression System:

1. Payment: Lump-sum price offered in Price Schedule B.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME B31.1-2018	Power Piping Code

B. ASTM International (ASTM)

1.	ASTM E779-10-2018	Determining Air Leakage Rate by Fan Pressurization
2.	ASTM E1966-2015	Standard Test Method for Fire-Resistive Joint Systems
3.	ASTM E814-2013	Standard Test Method for Fire Tests of Penetration Firestop Systems
4.	ASTM E 1966-15 (2019)	Standard Test Method for Fire-Resistive Joint Systems
5.	ASTM E 814-13a (2017)	Standard Test Method for Fire Tests of Penetration Firestop Systems

C. International Code Council

1.	IBC- 2018	International Building Code (IBC)
2.	IFC- 2018	International Fire Code (IFC)

D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1.	MSS SP-58-2018	Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

E. National Fire Protection Association (NFPA)

1.	NFPA 70-2017	National Electrical Code
2.	NFPA 72-2019	National Fire Alarm and Signaling Code

3. NFPA 770-2021 Standard on Hybrid (Water and Inert Gas) Fire Extinguishing Systems

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design, furnish, and install a complete hybrid water mist fire suppression system complying with IBC, IFC, NFPA 70, NFPA 72, NFPA 770 and these specifications. Referenced codes and standards within listed codes and standards shall apply.
2. Certify that documents produced comply with listed codes, standards, and these specifications.
3. System shall include the releasing service fire alarm control unit (RSFACU), piping, detection, manual activation, electrical components, batteries, and other components necessary to provide a complete operating system.
4. Protect two zones:
   a. Protect Data Server Room as a zone.
      1) Approximate dimensions: 20 ft x 20 ft x 8.0 ft.
   b. Protect subfloor as a zone.
      1) Approximate dimensions: 20 ft x 20 ft x 16 inch.
   c. Assume all zones normally occupied.
   d. Maintain oxygen concentration between 12% and 15%.
   e. Design agent concentration for Class A and C hazards.
   f. Provide sufficient agent supply for a single discharge to all zones.
   g. No reserve supply agent required.
5. Provide venting to prevent excessive pressures. Developed pressure shall not exceed 5-psf.
6. Provide tank scales for gas cylinders and level indicator for water tanks. Tank scales and level indicators shall be supervised by the RSFACU.
7. Locate agent as close to the protected area as space permits. Coordinate with COR for exact location. Refer to Figure 21 25 00-A for approximate location of agent and RSFACU.
8. System release by RSFACU via Very Early Warning Fire Detection (VEWFD) Systems or manual release.
9. System components may not block egress paths or equipment access.

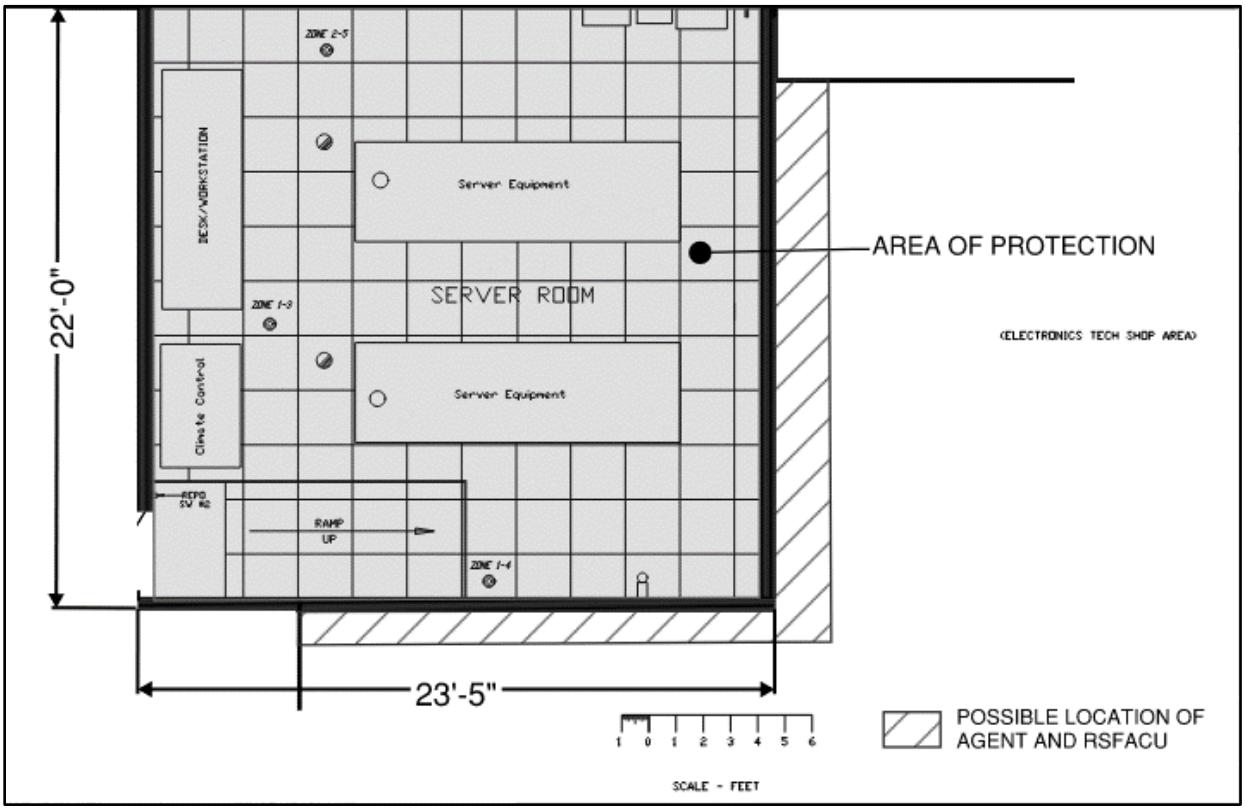

Figure 21 25 00- A Approximate area around protected area (Server Room) for location of agent and RSFACU.

B. Site Conditions:

1. Elevation: 3244.24 feet.
2. Data Server Room temperature setpoint: 68-degrees F.

C. Performance Requirements:

1. Smoke detection for the protected area reports directly to releasing panel.
   a. Note: Smoke detection associated with the building fire alarm system will be installed as specified in Section 28 31 00 – Fire Detection and Alarm within the protected space. Smoke detection associated with the building fire alarm system will not activate the hybrid water mist suppression system.
2. Provide abort switches, pull stations, and a keyed maintenance switch.
3. Provide lockable mechanical valves for maintenance. Mechanical valves shall be supervised by main fire alarm panel.
4. Perform discharge test using gas and water.
5. Provide notification inside and outside of Data Server Room.

6. System Activation:
    a. Activation of the VEWFD or suppression system manual pull station will convey a signal to the Releasing Service Fire Alarm Control Unit (RSFACU).
    b. Activation of the VEWFD at 0.314 percent obs/ft or less will convey a supervisory condition to the RSFACU.
    c. Activation of the VEWFD greater than 0.314 percent and less than 0.625 percent obs/ft will convey a Stage 1 fire alarm signal to the RSFACU.
    d. Activation of the VEWFD greater than 0.625 percent obs/ft will convey a Stage 2 fire alarm signal to the RSFACU.
    e. Activation of subfloor system will also activate above floor discharge.
    f. Activation of main floor does not activate subfloor.
    g. Activation of a Stage 1 fire alarm will trigger a countdown timer. The timer is programmed for 45 seconds, and at expiration, suppression will be released.
    h. Activation of automatic detection devices can be aborted with the “Abort” button.
    i. Temporary abort: The button must be depressed and held until the room is clear. Upon release of the button, the delay timer will start a countdown of 10 seconds.
    j. Activation of a Stage 2 fire alarm or manual suppression release pull station will override abort condition and will immediately release suppression agent.
    k. Maintenance lockout: Suppression system is disabled via the keyed maintenance switch. Activation of the switch will cause a supervisory condition on the RSFACU.
    l. Activation of ceiling-mounted fire alarm system detector will convey an alarm to the building FACU and will not initiate the fire suppression system.
7. Supervision:
    a. Supervise tank scales with building FACU.
    b. Supervise RSFACU with FACU.
    c. Supervise all hybrid water mist devices with RSFACU.

1.04 SUBMITTALS

A. In accordance with Section 01 33 00 – Submittals and Section 01 78 30 - Project Record Documents.

B. RSN 21 25 00-1, Qualifications:
    1. Designers

2. Manufacturers
3. Installers
4. Welders

C. RSN 21 25 00-2, Approval Drawings and Data:

1. All required documentation listed by NFPA 770 11.1.5 Required Information.
2. Releasing panel drawings must meet requirements of RSN 28 31 00-2, Approval Drawings and Data and NFPA 72.

D. RSN 21 25 00-3, Test Plan:

1. Detailed procedures for operational testing.
   a. Step-by-step description of tests to be performed.
   b. Type and location of test apparatus to be employed.
   c. Methods of protecting existing property and equipment.
   d. Methods of cleaning.
   e. Estimated time for each task.
2. Signed by a NICET Level III technician.

E. RSN 21 25 00-4, Contractor Field Test Notification:

1. Installation confirmation:
   a. Verification that all devices, system components, nameplates, and valve tags have been installed.
   b. Verification that Contractor has pre-tested operation of system.
2. Name of manufacturer's certified technician that will be participating in testing.
3. Proposed test dates and times of Contractor Field Quality Testing.

F. RSN 21 25 00-5, Test Reports:

1. Provide complete written test reports of all tests performed with at least the following information:
   a. Date, time, and location of tests.
   b. Names and signatures of witnesses to tests.
   c. Room, dimensions, and volume.
   d. All data generated during tests, including computer printouts.
   e. Descriptions of any special techniques utilized by test technician.
   f. Test equipment make, model, and serial number.
   g. Copy of current calibration, certificate of test equipment.

h. Name and affiliation of testing technician, and signature.

G. RSN 21 25 00-6, Final Drawings and Data:

1. Final Drawings and Data.

2. Operations and Maintenance Manual.

1.05 QUALIFICATIONS

A. Designer:

1. Professional engineer or fire protection engineer experienced in design of this type or registered in one of 50 States of the United States or National Institute for Certification in Engineering Technologies (NICET) Level IV, certified with a minimum of three years' experience in design of special suppression systems.

2. Authorized and certified by equipment manufacturer to determine requirements of hybrid water mist system utilizing manufacturer's equipment.

B. Manufacturer:

1. Company specializing in manufacturing products specified in this section with minimum of 3-years of documented experience.

C. Installation Supervisor:

1. Provide a manufacturer's certified technician with minimum NICET Level III special hazards certification to supervise installation, adjustment, final connections, and system testing.

D. Installers:

1. Trained by manufacturer to install and test hybrid fire extinguishing systems.

E. Welders:

1. Conform to ASME B31.1.

1.06 EXTRA MATERIALS

A. Spare Parts:

1. Furnish spare parts of same type, style, model, and manufacturer as the equipment installed:

a. Furnish installation instructions for each spare part.

b. Package spare parts in hermetically sealed containers labeled with manufacturer's name, part description and part number.

2. At least 1 spare of each type used:

a. Mist nozzle.

b. Master valve.

c. Routing valve.

d. Nitrogen modulating valve.

B. Pull station break rods (if applicable):

1. Furnish 5 break rods in a labeled envelope or bag.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment and system components furnished and installed shall be new, and the manufacturers' current model.

B. The materials, appliances, equipment, and devices shall be listed for their intended use by UL and/or FM Global.

C. All equipment and system components shall be manufactured by a same manufacturer as RSFACU or identified as compatible with RSFACU manufacturer.

D. All equipment and system components shall be rated for the environment in which they will be installed.

E. Weatherproof appliances and devices shall use the manufacturer's weatherproof back box.

2.02 HYBRID WATER MIST SYSTEM COMPONENT REQUIREMENTS

A. Pipe, valves, and fittings in accordance with NFPA 770.

B. Cylinders:

1. Provide assemblies which conform to regulations of the United States Department of Transportation.

C. Tank Scales

1. Accuracy +- 1 percent.
2. Low level relay contacts.
3. Local digital readout.
4. Sized to match each cylinder and tank used in system.
5. 120 VAC power supply.
6. Temperature compensated load cells.

D. Water Storage Tank:

1. Factory made, vertical tanks.
2. Impact resistant.
3. Non-corrosive material throughout.
4. Compatible with both raw and deionized water.
5. Designed to prevent contamination of water.

E. Valves:

1. Forged brass body.
2. Discharge Valves:
   a. Integral safety relief device to protect cylinder against excessive internal pressure.
   a. External connections for actuation devices.
   b. Pressure gauge in PSI units.

F. Nozzles:

1. Corrosion resistant.
2. Factory marked nozzles with type and orifice code.

G. Nameplates:

1. Furnish nameplates for equipment, devices, and instrumentation components of system.
2. Fabricate nameplates from laminated phenolic resin material conforming to the requirements listed on Standard Drawing 40-D-6234:
   a. Minimum 3/32-inch thickness for nameplates mounted on flat surfaces.
   b. Minimum 3/16-inch thickness for nameplates mounted on piping or other non-flat surfaces.
3. Lettering:
   a. White lettering and red background.
   b. Size: 3/16 inch.
4. Fasteners:
   a. Non flat surfaces - Minimum 16-gauge stainless-steel wire tie or chain for hanging nameplates.
   b. Panel mounted – Self-tapping corrosion resistant screws.

H. Pipe Hangers and Supports:

1. Provide galvanized, carbon steel, or stainless-steel pipe hangers and supports in accordance with the provisions outlined in ASME B31.1 and MSS SP-58. Dielectric

protection is required when hanger and support material is not the same as pipe material.

I. Pipe Labels:

1. Adhesive backed.
2. Abrasion resistant.
3. Chemical resistant.
4. Minimum application temperature: 50-Degrees Fahrenheit.
5. Permanent adhesive style.
6. Minimum text size: 5/16”.
7. Pipe marker material: Vinyl.

2.03 DAMPERS (IF UTILIZED)

A. Provide galvanized pressure operated dampers.

2.04 CONTROLS AND RELEASING

A. Releasing Service Fire Alarm Control Unit (RSFACU):

1. Minimum of two (2) releasing circuits required for suppression implementation.
2. Programmable time delay, minimum range 10 to 60 seconds.
3. Visual and audible annunciation for trouble, supervisory or alarm condition.
4. Programmable output circuits.
5. Programmable relays.
6. Capable of strobe synchronization.
7. Built-in programmer.
8. Lockable cabinet.
9. History log with a minimum 250-event storage and accessible from main system display.
10. Panel mounted:
    a. LCD display with keypad.
    b. LED indicators.
11. Primary Power Supply: 120 VAC, 60 Hz.
12. Secondary Power Supply:
    a. Sealed lead acid batteries installed in the control unit cabinet or adjacent listed battery cabinet.

b. Battery cabinet shall be lockable with key matching system RSFACU.

B. Batteries:

1. Sealed, maintenance-free lead acid battery.
2. Rugged construction; spill proof, vibration resistant, and impact resistant.
3. Manufacturer production date or date code embossed on battery case.
4. 5-year design life.

C. Manual Pull Stations:

1. Addressable or conventional.
2. Non-coded.
3. Red in color.
4. Dual action.
5. Clearly labeled “AGENT RELEASE” on cover.
6. Compatible with RSFACU.
7. Indicates activation visually at device.
8. Requires key to reset.
9. Meets ADA requirements.

D. Abort Switch:

1. Momentary abort switch with the following characteristics:
   a. Momentary pushbutton mushroom switch.
   b. Designed to prevent accidental activation.
   c. Factory labeled instructions.
   d. Red housing.

E. Warning and Safety Signs:

1. In compliance with NFPA 770.

F. Keyed maintenance switch:

1. Maintenance switch with the following characteristics:
   a. LED indicators.
   b. Factory labeled.
   c. Metal construction.
   d. 4PDT key switch.

G. Valve Supervision Switches:

1. Factory Mutual (FM) Global approved or National Recognized Tested Laboratories (NRTL) listed.
2. Contacts for connection to control panel.

H. Visual and Audible Notification Appliance:

1. Compatible with RSFACU.
2. Red housing.
3. Labeled "AGENT" on cover.
4. Blue lens.
5. Field-selectable candela settings.
6. Voltage: 24VDC.

2.05 DOCUMENT BOX

A. Document box designed for fire alarm system documents with the minimum characteristics:

1. Metal box large enough to hold all system drawings.
2. Keyed to match fire panels.
3. Red, powder coat finish.
4. 20-gauge steel or thicker.
5. Label indicating "Hybrid Fire Alarm System Documents" or similar.

2.06 CIRCUIT BREAKER LOCKOUT

A. Circuit Lockout Kit manufactured by Space Age Electronics, www.1sae.com, ELOCK-FA; or equal, having the following characteristics:

1. Circuit lockout tab.
2. Hex key.
3. Breaker, legend, and door labels.

2.07 WIRE AND CABLE

A. Wire and cable shall be provided as specified in Section 26 05 10 - Conductors and Cables.

2.08 COATINGS

A. Provide coatings for hybrid fire extinguishing system in accordance with Manufacturer's specifications and requirements.

2.09 WALL SEALS

A. FD/FS Link-Seal Modular Seal as manufactured by Pipeline Seal & Insulator, Incorporated, Houston, TX; or equal, having the following essential characteristics:

1. Modular, watertight, mechanical seal, consisting of inter-locking, synthetic rubber links shaped to continuously fill annular space between pipe and wall opening.
2. Stainless steel or zinc plated hardware.
3. UL listed or FM approved.

2.10 FIRE RATED CAULK

A. Re-enterable and repairable

B. Water based

C. Paintable

D. Halogen free

E. Red

F. ASTM E 1966 -15 (UL 2079) compliant

2.11 FIRE BARRIER PILLOWS

A. Re-enterable and reusable.

B. 3-hour rating.

C. ASTM E 814 (UL 1479) compliant.

PART 3 EXECUTION

3.01 INSTALLATION

A. Field-verify dimensions of protected space, pertinent existing equipment and building floor-space before starting work.

B. Install system in accordance with NFPA 770, as shown on approved drawings, and as recommended by equipment manufacturer(s).

C. Locate the RSFACU in Electronic Tech Shop area on Elevation 3244.24 and shown on Figure 21 25 00- B. Exact location to be coordinated with the COR.

D. Mount cylinders vertically. Support cylinders with cylinder mounting straps. Arrange cylinders to allow for cylinder removal and inspection of tank volume and pressure.

E. Install union immediately downstream of all threaded valves.

F. Install union adjacent to equipment pipe connections such as pressure switches, etc.

G. Piping penetrations through concrete must use existing penetrations or approved core drilling locations.

H. Install all warning and safety signs required by NFPA 770.

I. Install keyed maintenance switches adjacent to RSFACU.

J. Install abort switches as described by NFPA 770.

K. Piping:

1. Install piping with drains for complete system drainage.
2. Pipe, Fittings and Joints:
   a. Ream all pipe after cutting so that burrs and sharp edges are removed.
   b. Clean all pipe thoroughly before installation.
      1) Use compressed air, wire flue brush, or cloth rags as needed.
      2) Use only noncombustible metal cleaner designed for purpose.
      3) Repeat process until pipe is clean and all contaminants are removed.
   c. Thread Preparation:
      1) Coat threaded pipe with an appropriate pipe joint compound or tape. When pipe joint compound is used, coating of the threads must start at least two threads back from the pipe end.
      2) Take care on small pipes not to allow sealant to enter valves or controls.
3. Pipe Sleeves:
   a. Provide pipe sleeve at least two sizes larger than pipe.
   b. Seal around pipe with mechanical seal to prevent agent loss and/or leakage.
   c. Sufficient length to pass through entire thickness of walls.
4. Pipe Hangers and Supports:
   a. Attach all piping to rigid hangers by means of U-bolts locked with double nuts, one on each side of hanger. Allow pipe to be free to move longitudinally within U-bolt except where the piping design requires it to be anchored.
   b. Install piping supports so that they will not be disengaged by movement of supported pipe.

c. Arrange piping supports so that no excessive bending stresses are induced into piping from concentrated loads between supports.

d. Install pipe hangers and supports in accordance with ASME B31.1 and MSS-SP-58.

e. Provide additional hangers and supports wherever concentrated loads from valves or heavy fittings occur, or at changes in direction of piping.

L. Nameplates and Valve Tags: Install prior to testing.

1. Provide labeling and pipe markers on equipment and piping in exceedance of NFPA 770.

2. Label piping and valves as "HYBRID WATER MIST SYSTEM", indicate direction of flow.

3. Label zone specific pipe and valves with room name or subfloor name.

M. Document box shall be installed adjacent to RSFACU.

N. Relief Dampers:

1. Adjust dampers to be closed until system discharge pressures force dampers open.

3.02 TESTING

A. General:

1. Notify COR, in writing, of date and time fire protection systems will be ready for testing, at least 25 days before tests are to be conducted. Include proposed period required for complete testing.

2. Testing shall be conducted in accordance with NFPA 770 and additional requirements with specifications.

3. All tests shall be witnessed by Government.

B. Enclosure Integrity Test:

1. Perform an enclosure integrity test using door fan method of room pressurization for zone to determine leakage.

2. Guidance regarding fan pressurization apparatus design, maintenance and operation is provided by ASTM E779.

3. Contractor shall be responsible for sealing against agent loss and/or leakage.

4. Perform operational test using door fan method of room pressurization for zone to demonstrate operation and sizing of pressure relief dampers.

C. Coordinate test with HVAC contractor Pipe Testing:

1. Pressure test pipe in accordance with NFPA 770. Test pressures shall be as described in NFPA 770 A.12.9.3.2.

D. Contractor Field Quality Testing:

1. Tests shall demonstrate that operational and installation requirements of this specification have been met.
2. Provide service of manufacturer's certified technician with minimum NICET Level III certification, or factory trained engineer authorized by manufacturer to technically supervise and participate during all of adjustments and tests for system.
3. Thoroughly test system upon completion of installation for correct operation and function.
4. Make any repairs, changes, or modifications needed to correct items found during testing and repeat entire test procedure until test is fully successful.
5. Demonstrate discharge test using a single pull station and a single smoke detector.
6. Make any repairs, changes or modifications needed to correct items found during testing and repeat entire test procedure until test is fully successful.
   a. Place the system in full operational condition.

3.03 SYSTEM RESTORATION

A. Evacuate space of all discharged water and gas.

B. Remove any testing related materials.

C. Drain any water from system.

D. Dry the pipe by blowing air through discharge nozzles or drain.

E. Refill all water and gas cylinders.

F. Place the system in full operational condition.

G. Notify Government system is ready.

3.04 TRAINING

A. In accordance with Section 01 79 20 - Training.

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 in prices offered in Price Schedules for items requiring electrical materials.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1. ASME BPVC-IX 19 — Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications

B. ASTM International (ASTM)

1. ASTM A123/A123M-13 — Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A153/A153M-16a — Zinc Coatings (Hot-Dip) on Iron and Steel Hardware

C. International Code Council (ICC)

1. IBC-2018 — International Building Code (IBC)

D. Institute of Electrical and Electronics Engineers (IEEE)

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

E. International Electrical Testing Association, Inc. (NETA)

1. NETA ATS-17 — Acceptance Testing Specifications for Electrical Power Equipment and Systems

F. National Fire Protection Association (NFPA)

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

1.03 SYSTEM DESCRIPTION

A. Design and provide all required cable, conductor and raceway interconnection required for all equipment and components included for this contract:

1. Includes control and other cable interfaces required between equipment provided for this contract and all external interfaces required in these Specifications.

B. Design and provide supports for all supplied electrical components and enclosures as required for a complete installation.

C. Provide installation in accordance with IBC seismic requirements for the installation location.

1.04 QUALIFICATIONS

A. Welder Qualifications: In accordance with ASME BPVC-IX.

1.05 MAINTENANCE

A. Provide special tools and accessories required for installation or normal operation and maintenance of equipment and installations. Studs, bolts, or nuts other than United States Standard provided anywhere in equipment or installation will be considered as requiring special tools.

B. Deliver special tools and spare parts for equipment to a location as directed by COR. Provide shipments with item list(s).

C. Special tools and spare parts must be onsite prior to installation of equipment.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Conform to NFPA 70, IEEE C2, and Section 01 60 00 – Product Requirements.

B. Where nameplates are required provide engraved nameplates of appropriate size. Conform to drawing 40-D-6234 using Type A material. Nameplate engraving to be as required and as listed below:

1. Provide nameplate for each Contractor supplied enclosure.
2. Provide engraved nameplate for each Contractor installed door mounted device mounted on an enclosure door not furnished with manufacturer's nameplate.
3. Government reserves the right to change designations of enclosures and devices during drawing approval process at no change in contract price or completion time.

C. Galvanize mounting brackets, bolts, nuts, and washers for major items of electrical equipment in accordance with ASTM A123 and ASTM A153.

D. 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.

E. 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. Contracting Officer will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.

F. Provide special tools and appliances furnished by manufacturer for maintenance and adjustment of manufacturer's electrical equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by 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.

E. Drill holes in bolted steel structures and provide fastenings required for mounting or installing electrical equipment and materials.

F. Do not drill holes in tubular steel structures. Fasten to tubular steel structures by means of properly drilled and tapped pads or brackets welded to tubular members.

G. Supports:

1. Electrical Enclosure and Control Panel Floor Mounted Supports:

   a. Provide in accordance with drawing 40-D-60001, unless alternate support arrangement is required due to specific component layout or support loading requirements.

2. Provide other supports for electrical components and enclosures as required for installation.

H. 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.

I. Grout electrical equipment installed on concrete foundations in place to provide full and even bearing.

3.02 REPAIR

A. Repair damaged coated surfaces of equipment to match original finish.

3.03 FIELD QUALITY ASSURANCE

A. Government will inspect electrical equipment during construction. Acceptance of equipment will be made after equipment is operational.

B. Equipment field tests to be witnessed by Government. Provide proof of Government witness on field test reports.

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 Price Schedule A.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B8-11(2017)	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
2.	ASTM B 496-16	Compact Round Concentric-Lay-Stranded Copper Conductors

B. Building Industry Consulting Service International (BICSI)

1.	BICSI-TDMM-13th Edition	Telecommunications Distribution Methods Manual (TDMM)

C. Insulated Cable Engineer Association (ICEA)

1.	ICEA S-87-640-16	Optical Fiber Outside Plant Communications Cable
2.	ICEA S-116-732-13	Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use In LAN Communication Wiring Systems

D. Institute of Electrical and Electronics Engineers (IEEE)

1.	IEEE 1202-06	Standard for Flame – Propagation Testing of Wire & Cable
2.	IEEE C2-17	National Electrical Safety Code (NESC)

E. International Organization for Standardization

1.	ISO 11801-2002	Information Technology – Generic Cabling for Customer Premises

F. National Electrical Manufacturers Association (NEMA)

1.	NEMA WC 57-14	Standard for Control, Thermocouple Extension, and Instrumentation Cables
2.	NEMA WC 70-09	Power Cables Rated 2000V or Less for the Distribution of Electrical Energy

G. National Fire Protection Association (NFPA)

1.	NFPA 70-20	National Electrical Code (NEC)
2.	NFPA 262-19	Standard Method of Test for Flame Travel and Smoke of Wire for Use in Air-Handling Spaces

H. Telecommunications Industry Association (TIA)

1.	TIA 568.0-D-15	Generic Telecommunications Cabling for Customer Premises
2.	TIA 568.1-D-15	Commercial Building Telecommunications Infrastructure Standard
3.	TIA-568-C.1-09	Commercial Building Telecommunications Cabling Standard
4.	TIA 568-C.2-09	Balanced Twisted-Pair Telecommunications Cabling and Components Standards
5.	TIA 568-C.3-08	Optical Fiber Cabling Components Standard
6.	TIA 568-C.4-11	Broadband Coaxial Cabling and Components Standard
7.	TIA -598-14	Optical Fiber Cable Color Coding
8.	TIA-1152-16	Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

I. Underwriters Laboratories, Inc. (UL)

1.	UL 444-08	Communications Cables
2.	UL 486B-13	Wire Connectors
3.	UL 1581-01	Standard for Electrical Wires, Cables, and Flexible Cords
4.	UL 1666-07	Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
5.	UL 1685-07	Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

6. UL 2024-14 Standard for Cable Routing Assemblies and Communications Raceways

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittals and Section 01 33 28 – Fire Alarm Drawings and Data.

B. RSN 26 05 10-1, Approval Data:

1. Manufacturer's technical catalog data.

C. RSN 26 05 10-2, Construction Documentation:

1. Test Reports and Wire Termination Sheets:

a. Provide test reports for each cable provided by Contractor.

b. Include electronic PDF and paper copy of each trace made during testing.

1.04 DEFINITIONS

A. Cable: Cable, cables, wire, or wires of one or more insulated conductors.

B. Power Cable: For power loads; motors; alternating- and direct-current distribution circuits; heating, ventilating, and air-conditioning circuits; and cable that is used for controlling heating, ventilating and air-conditioning equipment.

C. Building Premises: For connection of lighting system and power receptacle components below 277 volts.

D. Control Cable: For control, metering, indication, annunciation, and relaying circuits; and circuits not identified as power circuits or fire alarm circuits.

E. Instrumentation Cable: Power limited cable for RTD, transducer output circuits, and can be used for serial communication (RS-232 & RS-485).

F. Telecommunications Cable: For supervisory computer control, data, voice communication, and logic level signals.

G. Enclosure Wiring – For wiring inside of enclosures or control boards.

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, more stringent requirement applies.

B. Verify conductor sizes where shown are provided appropriate for equipment under this contract. Provide conductor sizes and types appropriate for electrical load and installation conditions where used.

C. Cable shall be rated appropriately for installation, and installation conditions where it is installed. At minimum cable shall be rated for wet or dry applications, and for installation in cable trays.

1.06 PROJECT CONDITIONS

A. Locations of existing cables indicated on the drawings are approximate.

PART 2 PRODUCTS

2.01 CABLE, GENERAL

A. Manufactured no more than 24-months prior to Notice to Proceed.

B. Conductors:

1. Copper in accordance with ASTM B8, class B or C.
2. Stranded conductors, except for solid conductor building premises wire.

C. AWG or kcmil designation.

D. UL listed and labeled.

E. Coverings or insulation: Suitable for installation in vertical position without injury to covering or deformation of insulation when supported in accordance with NFPA 70.

2.02 PHASE IDENTIFICATION

A. Power Cable Phase Conductors and Building Premises Wire:

1. 120/240, single-phase: Black.
2. 120/208 or 240 volt. 3-phase: Black, red, blue. Colored phase tape may be used in lieu of colored insulation.
3. 277/480 volt, 3-phase: Black with brown, orange, yellow phase tape.
4. Direct Current (Ungrounded) Conductors:
   a. 125-volt DC positive bus: Red.
   b. 125-volt DC negative bus: Black.

B. Neutral (Grounded) Conductors: In accordance with NFPA 70.

C. 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.

2.03 COLOR CODING

A. Colored insulation or jacket compound. Do not apply color coatings to insulation or jacket surface.

B. Control Cable:

1. In accordance with NEMA WC 57, Table E-2.

C. Instrumentation Cable:

1. Sequentially number each pair/triad for identification.

2.04 POWER CABLE AND CONTROL CABLE

A. 600 volt rated insulation unless specified otherwise.

B. Single-conductor power cable in accordance with NEMA WC 70.

1. Unshielded.

C. Multi-conductor cable in accordance with NEMA WC 57.

1. Shielded.

D. Conductors:

1. Copper in accordance with ASTM or B496, class B or C.
2. Stranded conductors.
3. AWG or kcmil designation.
4. Minimum Conductor Size:
   a. Single Conductor Cable: 12 AWG.
   b. Multi-Conductor Cable: 14 AWG.
   c. Conductors used for Current Transformer (CT) or Potential Transformer (PT) applications shall have minimum conductor sizes of 10 AWG for CT applications and 12 AWG for PT applications.
5. Conductor sized according to application requirements, and in accordance with requirements and recommendation in the NEC.

E. Suitable For:

1. Installation in raceways.
2. Installation in cable trays when required by specifications or installation location.

3. Direct burial installation when required by specifications or installation location.

F. Rated for a minimum of 90 degrees C continuous operating temperature, Wet or Dry.

G. Insulation Type THHN/THWN or XHHW:

1. EPR or XLPE.

H. Overall Jacket:

1. Type: PVC (Polyvinyl chloride) or CPE (Chlorinated Polyethylene).
2. Flame-Retardant.
3. UV Resistant.
4. Includes rip-cord.

I. Flame Test Rating:

1. IEEE 1202 or UL 1685.

J. Provide multi-conductor power cable with integral ground conductor. Size ground conductor in accordance with NEMA WC 70.

K. Round, except for 2-conductor cable with parallel conductors.

L. Small diameter conductors (1/0 AWG and smaller) shall be grouped into multi-conductor cable assemblies where available and where such groupings are permitted by the NEC.

2.05 BUILDING PREMISES CABLE

A. Type: Single, solid or stranded conductor THHN/THWN rated for 600 volts.

B. Conductors:

1. AWG designation.
2. Minimum Conductor Size:
   a. Minimum size 14 AWG.
3. Conductor sized according to application requirements, and in accordance with the requirements and recommendation in the NEC.

C. Suitable for installation in raceways and in locations where installed.

D. Conform to NEMA WC 70.

2.06 INSTRUMENTATION CABLE

A. Minimum 300-volt rated insulation.

B. Cable in accordance with NEMA WC 57.

C. Conductors:

1. Copper in accordance with ASTM 8, class B or C.
2. Stranded conductors.
3. AWG designation.
4. Minimum Conductor Size:
   a. Minimum size 18 AWG.
   b. Conductor sizes to 22 AWG allowed for serial communications applications.
5. Conductor sized according to application requirements, and in accordance with the requirements and recommendation in the NEC.

D. Type:

1. PLTC.
2. Twisted pair/triad.
3. Suitable for installation in above grade or underground raceways and cable trays.

E. Rated for a minimum of 90 degrees C continuous operating temperature, Wet or Dry.

F. Insulation:

1. EPR or XLPE.

G. Shield:

1. Pair/Triad Shield:
   a. Required for each pair/triad.
   b. Aluminum-Mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.
2. Overall Shield:
   a. Required for multi-pair or multi-triad cables.
   b. Aluminum-Mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.

H. Jacket:

1. PVC (Polyvinyl chloride) or CPE (Chlorinated Polyethylene) or better with rip-cord.
2. Flame-retardant.
3. Sunlight and moisture resistant.

I. Flame Test Rating:

1. IEEE 1202.

2.07 TELECOMMUNICATIONS CABLE

A. Fiber Optic Cable:

1. Provide cable in accordance with ICEA S-87-640, as appropriate.
2. Cable performance shall not be impacted by immersion in water.
3. UL listed, where available.
4. Color Coding: Per TIA -598.
5. Fiber Optic Cable:
   a. Gel Free/Stranded Loose Tube.
   b. Rod Filler: Central dielectric strength member.
   c. Cable core: Symmetrically stranded buffer tubes around dielectric central member.
   d. Water blocking.
   e. Suitable for installation in the inner-duct.
   f. Major cable components:
      1) 2.5 millimeter Gel-Free Buffer Tubes:
         a) Color coordinated.
         b) Loose.
      2) Dielectric Strength Member.
   g. Optical fibers:
      1) Single-mode or Multi-mode Fiber as required.
      2) Quantity of fibers as required to complete the installation.
   h. Jacket:
      1) Type: PVC (Polyvinyl chloride) or CPE (Chlorinated Polyethylene) or better, UV resistant, flame-retardant.
   i. Strength members: With expansion and contraction characteristics similar to glass fibers.
   j. Optical fibers:
      1) Wavelengths:
         a) Single Mode: 1310/1383/1550 nanometer
         b) Multimode: 850/1300/ nanometer.

2) Attenuation:

a) Single Mode: 0.4/0.4/0.3 dB/km.

b) Multimode: 3.0/1.0 dB/km.

c) Directly proportional to cable length for an arbitrary cable length section after steady-state conditions are reached.

k. Cable tensile strength:

1) Long term (installed): 135 pounds per foot.

2) Short term (during installation): 600 pounds per foot.

l. Operating temperature range: Minus 40 to 150 degrees F.

B. Fiber Optic Patch Cable:

1. Type fiber: Single-mode or Multimode as required.

2. Length: As required.

3. Connectors: Type LC, SC or ST.

4. Loss per connector: Less than 0.5 decibels.

C. CAT 5e Networking Cable:

1. Provided per ICEA S-116-732, UL 444, and TIA-568-C.2.

2. Four twisted pair, minimum size 24 AWG conductors.

3. Provide communications rated cabling for the installation purpose it is installed (plenum, riser, general purpose, etc.) in accordance with NFPA 70.

4. UL listed and labeled for wet locations.

D. Special Purpose Cable:

1. With the approval of COR.

2.08 FIRE ALARM SYSTEM CABLE

A. Wire and cable:

1. UL listed and labeled for application and intended use.

2. In accordance with NFPA 70 Articles 760.

B. Type of cable chosen should be based on fire system requirements, specification requirements and applicable code requirements. Consideration should also be given to length of cable runs and potential interference.

C. Suitable for installation conditions for location where installed, including plenums and risers where applicable.

D. Non-Power Limited Circuits:

1. 600-volt rated.
2. Rated for a minimum of 75 degrees C continuous operating temperature, Wet or Dry.
3. Conductors:
   a. Solid copper.
   b. Minimum size:
      1) Low-Voltage Circuits: No. 16 AWG, minimum.
      2) Line-Voltage Circuits: No. 12 AWG, minimum.
   c. Twisted pair/triad or as required by fire alarm system manufacturer.
4. Overall Jacket:
   a. Type: PVC (Polyvinyl chloride) or equal.
   b. Flame-retardant.
   c. Colored insulation matching approved color-code as defined in section 28 31 00 – Fire Detection and Alarm.
5. Insulation Type:
   a. Type: PVC (Polyvinyl chloride) or equal.
   b. Flame-retardant.
6. Shield:
   a. Aluminum-Mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.
   b. Or as recommended by fire alarm system manufacturer.
7. Flame Test Rating:
   a. IEEE 1202, IEEE 1666, or UL 1685 as applicable.
   b. NFPA 262, when installed in plenums or other spaces used for environmental air.

E. Power Limited Fire Alarm Circuits:

1. 300-volt rated.
2. Rated for a minimum of 75 degrees C continuous operating temperature, Wet or Dry.
3. Conductors:
   a. Solid copper.
   b. Minimum size:

1) Signaling Line Circuit: No. 18-AWG, minimum.

2) Notification Appliance Circuit: No. 14-AWG, minimum.

c. Twisted pair/triad or as required by fire alarm system manufacturer.

4. Overall Jacket:

a. Type: PVC (Polyvinyl chloride) or equal.

b. Flame-retardant.

c. Colored insulation matching approved color-code as defined in section 28 31 00 – Fire Detection and Alarm.

5. Insulation Type:

a. Type: PVC (Polyvinyl chloride) or equal.

6. Shield:

a. Aluminum-Mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.

b. Or as recommended by fire alarm system manufacturer.

7. Flame Test Rating:

a. IEEE 1202, IEEE 1666 or UL 1685 as applicable.

b. NFPA 262, when installed in plenums or other spaces used for environmental air.

2.09 ENCLOSURE WIRING

A. Wiring inside switchboards, switchgear, motor control centers (MCCs), 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.

2. VW-1 Rated.

3. UL Listed.

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. XLPE, or equal.

F. Insulation Color:

1. White or Grey, unless special purpose application.

G. Flame Test Rating:

1. UL 1581 VW-1.

2.10 ACCESSORIES

A. Single 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. Be 1-inch in length, minimum, and have diameter suitable for installation on the intended conductor.

B. Multi-conductor 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.

C. Terminal connectors for power, control, instrumentation, and enclosure wiring:

1. Heavy-duty, nylon insulated sleeve, pressure-crimp-type with ring or spade tongues.
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. Telecommunications Cable Faceplates and Connectors:

1. Connectorize fiber cables and connect to patch panels using LC, SC or ST type connectors. Make connections to components as required be component terminal.
2. Provide patch cords to connect dielectric fiber cable to fiber optic equipment.

3. Terminate unshielded twisted pair (UTP) cables in accordance with TIA-568-C.1 and TIA-568-C.2 with T-568A color configuration.
4. Use registered jack (RJ) 45 modular connector where applicable.

E. Fiber Optic Cable Patch Panels:
1. Type: Rack mount or wall mount.
2. Metal housing with adaptor plates, and radius limiters.
3. Adaptor Plates:
   a. Same manufacturer as enclosure.
   b. Mount at minimum 6 fibers.
   c. Use LS, SC, or ST Connectors.

F. Innerduct Duct Liners:
1. Conform to UL 2024 and applicable ASTM standards.
2. UL Riser-Rated.
3. Size: 1-inch.
4. Flexible.
5. Non-metallic.
6. Corrugated:
   a. Sequential marked footage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70, IEEE C2, TIA 568 and manufacturer's requirements and recommendations.

B. Maintain manufacturer recommended minimum bending radius for cables.

C. Install all telecommunications cables in raceway, cable tray or similar protected installation.

D. Provide circuit raceway in accordance with Sections 26 05 33 – Raceway and Boxes.

E. 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.

F. Seal cable penetrations into equipment or passing through blockouts, with silicone-foam, fire-retardant type material.

G. Install cable in a neat and workmanlike manner in accordance with industry standards and manufacturer requirements.

H. Use building premises wire for lighting circuits and 120-volt receptacles unless shown otherwise. Stranded wire to be terminated with terminal connectors.

I. Cable Separation:

1. Install cables to provide separation of voltage levels, defined below, except with approval of COR.
2. Voltage Levels:
   a. 64V operating voltage and above.
   b. 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.
5. Do not install cables of different voltage levels in the same cable tray unless separated by a barrier in the cable tray.

J. Do not splice cables.

1. Use of wire nuts, crimped connectors, or twisting of conductors is prohibited.

K. Cable Installed In Conduit:

1. Do not pull cable into conduit until they 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. Do not exceed allowable pulling tensions and sidewall pressures as recommended by cable manufacturer.
4. Install cable to prevent cuts or abrasions in insulation or protective covering and kinks in cable.
5. When a lubricant is needed as an aid to pulling, use only soapstone or other suitable lubricant that is not injurious to cable insulation.
6. When mechanical cable pulling equipment is used, use a tension meter release mechanism to ensure pulling tension remains below tensile strength of the cable.
7. Remove and replace any cable damaged during installation.

L. Cable Installed in Vertical or Inclined Plane:

1. Support with cable grips leaving slack spans between supports.
2. Clamp cable entering enclosures, junction boxes, or equipment with commercial cable clamps.

3. Cables shall not be installed in an open air drop of greater than 4-feet without explicit approval of COR.

M. Cable in Boxes and Enclosures:

1. Provide slack in the cable in all boxes, and enclosures. Cable should not be pulled tight against any edge or component in the enclosures and boxes.
2. If a cable is terminated in box or enclosure include enough spare length in 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.

N. Fiber optic cables:

1. Innerduct Duct Liners:
   a. Where fiber optic cable is installed in cable tray or ducts install cable in 1-inch innerduct. Fiber optic cable shall be compatible with innerduct and lubricants provided.
   b. Provide pulling tape in each innerduct duct liner.
2. Termination:
   a. Terminate fiber optic cable installed between enclosures or building at patch panels.
   b. Coil a reasonable length of fiber cable inside each patch panel as directed by the COR.
   c. Leave spare fibers in each patch panel.
   d. Retain fibers at each cable end equal in length to longest single fiber.
3. Provide fiber optic coils inside pull boxes, junction boxes, and other electrical and control enclosures, and where recommended by the manufacturer.
4. Clamp cable entry with fiber type cable clamp.

O. Networking 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.

P. Grounding:

1. Provide 1 nonactive conductor grounded at both ends in each multiconductor control cable.
2. Ground shielding of each shielded control cable on both ends directly to equipment ground bus.

3. Ground shielding of instrumentation and telecommunications cable only to source equipment ground bus.

4. Ground spare conductors by wire jumpers from equipment terminal block points to equipment ground bus.

Q. Wiring methods:

1. Terminate control, instrumentation, and telecommunications cable with appropriate terminal connectors.

2. At termination point of multiconductor cable, form conductors into neat packs and tie conductors with self-locking cable ties.

3. Do not combine alternating- and direct-current circuits, or current and potential transformer circuits in same multiconductor cable.

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. Retain spare single conductors at each end of a multiconductor cable in a length equal to longest single conductor of multiconductor cable.

7. Terminate spare conductors of multi-conductor cable at terminal blocks.

8. Run both positive and negative leads of a direct-current circuit in same cable.

3.02 CABLE AND CONDUCTOR IDENTIFICATION

A. Cable and Conductor Markers:

1. Text to be machine or computer generated. Handwritten text is not acceptable. Print cable or conductor designations as shown on approved drawings.

2. Tag cables at each end.

3. Cable:

a. Provide cable with cable marker. Print cable designation.

b. Cable designation to be a single-line of text that includes cable number, originating equipment designation, and destination equipment designation. Develop cable designations when not shown. Examples of cable designations are:

1) 1MCA-DV1 - First cable from motor control center MCA to discharge valve No. 1).

2) 3MCB-ACP - Third cable from motor control center MCB to auxiliary control panel ACP.

c. Attach tags to cable with self-locking tie wraps or cable ties.

4. Conductors:

a. Provide individual conductors of multiconductor control cable, instrumentation cable, with conductor marker. Print conductor designation, on first line. Print conductor destination and device terminal number on second line.

b. A single line conductor marker will be acceptable provided the conductor designation is enclosed in parenthesis followed by the conductor destination.

c. Provide markers for spare conductors of multi-conductor cables. The marker to include cable designation and the word "SPARE". Numerically sequence the spare conductor markers e.g. (1CSA-CSB-SPARE1, 2CSA-CSB-SPARE2, etc.).

3.03 CONTRACTOR FIELD QUALITY TESTING

A. Perform cable 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. Testing dates to be mutually agreeable between Contractor and 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:

1) R in MΩ (rated voltage in kV + 1) x 1000/length in feet.

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 Government inspector who witnessed test.

d. Conductor identification.

e. Megohms between conductor and ground.

f. Total length of conductor.

E. For Fiber Optic cables installed or existing spare fiber cables to be used, perform the following tests:

1. Test each fiber using an Optical Time Domain Reflectometer (OTDR):
   a. Purpose and intent of testing:
      1) Determine if installed cable is free from defects.
      2) Compare measured attenuation with cable manufacturer's specified attenuation.
      3) Compare measured connector loss with specified connector loss of 0.5 decibels.
      4) Verify cable length.
   b. OTDR requirements:
      1) Fiber type: Single-Mode or Multimode.
      2) Dynamic Range: 25 decibels, minimum.
      3) Resolution: Selectable 0.1 to 10 meters.
      4) Pulse width: Selectable. 1 for all tests.
      5) Reflectance accuracy: plus or minus 2 decibels.
      6) Loss accuracy (Linearity): 0.02 decibel per decibel.
   c. Obtain an OTDR waveform for each fiber to:
      1) Determine actual cable length.
      2) Determine attenuation and splice loss.
      3) Identify and locate splices and step discontinuities/possible fiber breaks.
   d. Prepare test reports:
      1) Generate a PDF copy of each trace made during testing for inclusion in the report:
      2) OTDR waveform for each fiber showing "A" and "B" range marks.
         a) Do not move or change location of either mark.
      3) Include an Analysis Summary Results Table for each fiber:
         a) Indicate numerical values associated with each event.
         b) Do not use question marks, dashes, or blanks.
      4) Include following information for each trace:
         a) Trace name.
         b) Operator's name.
         c) Date and time.
         d) Fiber type being tested.

e) Bundle color.

f) Fiber color.

g) Fiber number.

h) Launch reel length.

i) OTDR resolution.

j) Pulse width.

k) Wavelength.

l) Index of refraction.

m) Averaging number.

n) Receiver bandwidth.

o) Sampling point count.

p) End to end loss, decibels.

q) Reflectance, decibels.

r) Fiber Break, decibels.

s) Backscatter.

5) Traces to be viewable and reproducible on a PC using Windows 10 or later.

F. If any cable or conductor fails testing, remove and replace cable.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of grounding and bonding in prices offered in Price Schedules for items of work requiring grounding and bonding.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM)

1.	ASTM B3-13	Soft or Annealed Copper Wire
2.	ASTM B8-11	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3.	ASTM B228-11a	Concentric-Lay-Stranded Copper-Clad Steel Conductors

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 142-2007	Grounding of Industrial and Commercial Power Systems
2.	IEEE C2-2012	National Electrical Safety Code (NESC)

C. National Fire Protection Association (NFPA)

1.	NFPA 70-2020	National Electric Code (NEC)
2.	NFPA 72-2019	National Fire Alarm and Signaling Code

D. Underwriters Laboratories (UL)

1.	UL 467-2013	Grounding and Bonding Equipment

1.03 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 28 – Fire Alarm Drawings and Data.

B. RSN 26 05 26-1, Inspection and Test Reports:

1. Test Reports.
2. Inspection Reports, including:

a. Number and location of grounding connections.

b. Results of visual inspections.

c. Results of continuity tests.

1.04 CONDITIONS

A. System to be constructed inside an existing hydro-power facility. A substantial grounding system already exists.

B. Verify size and location of existing facility grounding system risers.

1.05 DESIGN REQUIREMENTS

A. Design and provide grounding system for new components and where existing components grounding system or grounding connections are impacted.

B. Provide grounding in accordance with NFPA 70 and IEEE 142.

C. Grounding and bonding in the area shall have the following vital characteristics:

1. A permanent and continuous path provided with a properly sized copper conductor.
2. Have adequate capacity for the maximum current likely to be imposed.
3. Provide a low impedance current path to ground.

D. The grounding system shall be bonded back to the existing facility electrical grounding system.

PART 2 PRODUCTS

2.01 MATERIALS

A. 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. Ground Wire to be sized per NFPA 70 and NFPA 72.

2.02 ACCESSORIES

A. Cable Connectors:

1. Welded or bolted solderless.
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.

2.03 WELDING PROCESS

A. Use Cadweld, Thermoweld, or equivalent exothermic process.

B. Molds and weld metal:

1. Use fresh stock from same manufacturer.
2. Weld metal and starting material: No significant quantities of hazardous ingredients.
3. Each type of exothermic connection weld shall require a new mold. Replace the mold as recommended by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70, NFPA 72, IEEE C2, IEEE 142, and this Section.

B. General:

1. Make all ground connections between equipment and miscellaneous metalwork, and existing facility ground plates, ground bus or grounding electrode.
2. Remove paint, enamel, scale, oil, grease, or other foreign non-conductive material from point of contact on metal surfaces before making ground connections.
3. Repair damaged or removed paint or galvanizing material on metal finishes.

C. Ground all metallic raceway in accordance with the requirements of NFPA 70.

D. Ground all cable shielding in accordance with the manufacturer's recommendations, and Section 26 05 10 – Conductors and Cables.

E. Conduits may only be considered as a supplementary grounding connection. For conduits terminating at electrical equipment, bond the conduit to the equipment. For conduits terminating at cable trays, terminate with a grounding bushing and provide a ground cable connection between the bushing and the facility grounding system. Make conduit runs containing flexible conduit electrically continuous. Use flex connectors that provide electrical bonding between flex and rigid conduit for this purpose.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Notify COR at least 48-hours in advance of time of test in order that test may be witnessed by COR.

B. Test resistance of grounding system:

1. Test system ground for continuity and proper bonding to main facility grounding system.

C. Inspection of connections:

1. No portion of the conductor within the confines of the weld should be exposed.
2. Surface of connection should be smooth and free of major slag deposits.
3. The connection should be free from porosity.
4. All connections shall be approved by the Government.

END OF SECTION

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 Price Schedule A.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)

1.	ANSI C80.1-2015	Electric Rigid Steel Conduit (ERSC)
2.	ANSI/SCTE 77-2013	Underground Enclosure Integrity
3.	ANSI C858-2007	Underground Precast Concrete Utility Structures

B. ASTM International (ASTM)

1.	ASTM A48-2012	Gray Iron Castings
2.	ASTM C857-2014	Minimum Structural Design Loading for Underground Pre-Cast Concrete Utility Structures
3.	ASTM D448-2012	Standard Classification for Sizes of Aggregate for Road and Bridge Construction

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA FB 1 - 2014	Fittings, Cast Metal Boxes, And Conduit Bodies For Conduit, Electrical Metallic Tubing (EMT) and Cable
2.	NEMA RN 1-2005(Rev. 2013)	Polyvinyl Chloride (PVC) Externally-Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit (IMC)
3.	NEMA 250 – 2014	Enclosures for Electrical Equipment (1000 Volts Maximum)

D. National Fire Protection Association (NFPA)

1.	NFPA 70-2014	National Electrical Code (NEC)

E. Underwriters Laboratories (UL)

1. UL 360-2013 Liquid-Tight Flexible Metal Conduit

1.03 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 28 – Fire Alarm Drawings and Data.

B. RSN 26 05 33-1, Approval Drawings and Data:

1. Manufacturer's catalog data for supplied components.

C. RSN 26 05 33-2, As-Built Drawings and Data:

1. As-built raceway and box location and route.

1.04 DESIGN REQUIREMENTS

A. Determine routing of exposed conduit when not shown.

B. Determine exact locations of embedded conduit stub-ups based on equipment being provided.

C. Determine size of junction, pull boxes and vaults, unless shown otherwise.

D. Determine size of wireways and wiring troughs in accordance with NFPA 70, unless shown otherwise.

E. Design raceway support systems.

F. Reuse existing conduit to the furthest extent possible.

1.05 QUALITY

A. In accordance with NFPA 70. Material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization in order to provide a basis for approval under NFPA 70.

B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc., shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 RACEWAYS

A. Rigid Metal Conduit: ANSI C80.1.

B. Liquidtight Flexible Metal Conduit (LFMC):

1. Interlocked steel construction with flame-retardant PVC jacket.
2. Sunlight resistant.
3. Color: Black for outdoors and Grey for indoors.
4. Conform to NFPA 70 and UL 360.
5. Fittings conform to NEMA FB 1.

C. Wireways: Lay-In NEMA Type 12 Wireway, manufactured by Hoffman Engineering Company, Anoka, Minnesota; or equal, with the following essential characteristics:

1. Material: Manufacturer's standard gauge steel.
2. Seams continuously welded and ground smooth.
3. Smooth, rounded edges on sections and fittings.
4. Hinged covers with quick-release latches and oil-resistant gasket.
5. Furnish without holes or knockouts. Punch holes onsite as required.
6. Finish: Manufacturer's standard grey coating.

D. Wiring Trough: As manufactured by Hoffman Engineering Company, Anoka, Minnesota; or equal, with the following essential characteristics:

1. Material: 16 gauge or 14 gauge galvanized steel.
2. Enclosure:
   a. NEMA Type 3R in accordance with NEMA 250.
   b. Drip shield top and no knockouts.
3. Slip-on removable cover fastened with captive screws along bottom edge and provided with provisions for padlocking.
4. Embossed mounting holes on back of enclosure.
5. Finish: Manufacturer's standard grey coating inside and outside of enclosure.

2.02 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 indoors to be NEMA type 12. Boxes installed outdoors to 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 4 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 4.
2. Sheet steel: 12 gauge, minimum.
3. Seams: Continuously welded and ground smooth.
4. Coating: Polyester powder coating over phosphatized surface, inside and out, ANSI 61 gray.
5. Internal mounting channels welded horizontally to sides at top, bottom, and center.
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.

2.03 CONDUIT FITTINGS

A. Watertight Conduit Hubs:

1. Myers hub manufactured by Cooper Industries, Crouse-Hinds Division, Syracuse New York, catalog series ST-, STA- and SSTG-; catalog series HUB- and HUBG- manufactured by Appleton, Rosemont, IL; catalog series CHM- manufactured by O-Z Gedney, Rosemont, IL; or equal.

B. Conduit Wall Penetration Seals:

1. Elastomeric material to prevent liquid and gas seepage.
2. Dust tight.
3. Fire retardant.

2.04 ACCESSORIES

A. Provide fittings required to complete electrical conduit systems. Includes, but not limited to, 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.

B. Provide 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.

C. Conduit Sealing Bushings:

1. Non-toxic.
2. Non-shrinking.
3. Fire-retardant type.
4. Seals against liquid, gas, and vapor seepage.

D. Watertight Conduit Hubs:

1. Myers hub manufactured by Cooper Industries, Crouse-Hinds Division, Syracuse, NY, catalog series ST-, STA- and SSTG-; catalog series HUB- and HUBG- manufactured by Appleton, Rosemont, IL; catalog series CHM- manufactured by O-Z Gedney, Rosemont, IL; or equal with the following essential characteristics:
   a. Suitable for terminating rigid steel electrical conduit through the walls of enclosures.
   b. Recessed O-ring for raintight connection.
   c. In accordance with NEMA FB-1.
   d. Galvanized malleable iron.
   e. Insulated throat.

E. Protective Sealant:

1. Water repellant.
2. Resistant to peeling and cracking.

F. 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.

G. Adhesive: In accordance with conduit manufacturer's recommendations.

H. Corrosion Protection Tape:

1. ScotchrapTM 50 All-Weather Corrosion Protection Tape manufactured by 3M, St. Paul, Minnesota, or Plymouth Plywrap 11 Vinyl Pipe Wrap manufactured by Plymouth Rubber Company, Canton, Massachusetts; or equal having the following essential characteristics:

a. Thickness: 10 mils minimum.

b. Material: Polyvinyl Chloride (PVC).

I. Pull-Tape, -String, and -Rope:

1. Composition: Polyester.

2. Pulling Strength: 200 pounds, minimum.

J. Conduit Riser Grips:

1. Suitable to support vertical cable runs in rigid steel conduit.

2. Single weave, closed or split mesh type.

3. Mesh material: Tin-coated bronze strands

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with Section 26 05 02 – Basic Electrical Methods and Materials.

B. Layout and Procedures:

1. Determine routing of exposed conduit when not indicated on drawings.

2. Ensure that both new and reused conduit runs and bends are free from kinks, indentations, or flattened surfaces.

C. Preparation:

1. Remove burrs and sharp corners at ends of metal conduit.

2. Coat male threads of rigid metal conduit joints with suitable graphite or zinc sealing material before making joints.

D. Install conduit with necessary fittings and supports:

1. Support conduit as indicated on Standard Drawing 40-D-7094.
2. Tighten conduit joints securely to ensure electrical continuity and to prevent entrance of moisture or foreign material.
3. Provide bushings or Chase-type nipples on ends of conduit to protect insulated conductors from abrasion.
4. Use locknuts and bondnuts to provide tight ground connections between conduit and boxes, panelboards, and cabinets.
5. 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.

E. Bends:

1. Install smooth, continuous radius, gradual bends to permit pulling insulated conductors without undue stress or damage to conductors or conduit.
2. Bend conduit cold to prevent damage to protective coating.

F. Brick masonry walls: Route conduit through centerlines of grouted portions.

G. Exposed conduit runs:

1. Rigid metal conduit, unless shown otherwise.
2. Straight and parallel with each other and with centerlines of room or structure.
3. 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.
4. Installation includes, where required, drilling holes in bottom, side, or top of enclosures or plates of other electrical equipment.
5. Tighten conduit securely.
6. Support conduit rigidly in place.
7. Make connections to outdoor boxes watertight.
8. Conduit shall not block access to any existing equipment or fixtures.

H. Liquidtight Flexible Metal Conduit (LFMC):

1. Use for connections to motors and electrical equipment that is subject to movement, vibration, or misalignment; where flexibility is required; or where shown.

2. Maximum length of conduit section not to exceed 3-feet. Lengths exceeding 6-feet shall be approved by COR.

3. Secure and support conduit sections in accordance with NFPA 70.

I. Seals/Sealing:

1. 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.

2. Furnish and install wall penetration seals for conduits entering structures below grade. Install seals in accordance with manufacturer's instructions.

J. Conduit Tags:

1. Provide metal conduit tags for conduit terminations.

2. Stamp or engrave tag with conduit identification.

3. Permanently attach tag to conduit with wire and metal crimp-type connector.

END OF SECTION

SECTION 26 05 80
WIRING CHECKOUT AND TESTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of wiring checkout and tests in applicable prices offered in Price Schedules.

1.02 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

1. NFPA 70-2020 National Electrical Code (NEC)

1.03 SUBMITTALS

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

B. RSN 26 05 80-1, Test Notification and Plan.

C. RSN 26 05 80-2, Test Reports.

1.04 DEFINITIONS

A. External Wiring: Any conductor, wire, or cable that is external to the enclosure of the equipment being tested.

B. Internal Wiring: Any conductor, wire, or cable that is internal to the enclosure of the equipment being tested.

C. Qualified Person: In accordance with Article 100 of NFPA 70.

D. Wiring Checkout: A complete wire-by-wire, contact-by-contact, terminal-by-terminal inspection of wiring associated with a specific piece of equipment.

1.05 PERFORMANCE REQUIREMENTS

A. These tests are in addition to tests required by Section 26 05 10 – Conductors and Cables.

B. Furnish materials, including test equipment, required for checkout and testing.

C. Make wiring changes and drawing revisions to ensure there are no discrepancies between as-built 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. If required during testing, remove and replace wire connections.

F. Make wiring changes, wire tag revisions, and other repairs or revisions during the testing session the discrepancy is discovered.

G. Perform wiring checkout and operational and functional tests in presence of COR.

1.06 QUALIFICATIONS

A. Testing Personnel:

1. Competent and qualified person to perform wiring checkout, and operational and functional testing.
2. Have thorough knowledge of the electrical equipment, installation, and drawings.
3. Qualified to operate equipment being tested.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR QUALITY CONTROL

A. Notify COR in writing at least 10-days in advance of each testing session.

B. Perform wiring checkout and tests in presence of COR and in accordance with the following:

1. Wiring Checkout:
   a. Use electrical schematic and wiring diagram check prints to perform internal wiring check of equipment.
   b. Use electrical schematic and wiring diagram check prints to perform wiring check of external cabling.
   c. Perform a complete wire-by-wire, contact-by-contact, terminal-by-terminal check of circuit logic.
   d. Verify contact configuration and contact numbering.
   e. Verify continuity of wiring.
   f. Verify proper wire tagging at ends of conductors and cables.

g. Check conductors for insulation damage. Perform additional insulation resistance test of damaged conductors.

2. Operational and Functional Testing:

a. Perform after completion of wiring checkout of equipment being tested.

b. As defined in Section 28 31 00 - Fire Detection and Alarm.

END OF SECTION

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SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Fire Alarm System:

1. Payment: Lump-sum price offered in Price Schedule A.
   a. Includes but not limited to the following:
      1) Furnish, design and installation of new system.
         a) Includes standalone lap-top computer compatible with new system.
      2) Removal and disposal of old system.
      3) Fire Alarm System One Year Warranty Inspection and Testing.

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME)

1.	ASME 17.1-2019	Safety Code for Elevators and Escalators

B. National Fire Protection Association (NFPA)

1.	NFPA 4- 2021	Standard for Integrated Fire Protection and Life Safety System Testing
2.	NFPA 70-2020	National Electrical Code (NEC)
3.	NFPA 72-2019	National Fire Alarm and Signaling Code
4.	NFPA 170-2021	Standard for Fire Safety and Emergency Symbols

1.03 LOCATIONS:

A. These specifications apply to the following locations:

1. Power Plant.
2. The Facility Workshop Building.
3. Carl Hayden Visitors' Center.

B. Additional information and details about these locations are included in Sections:

1. 51 00 00—Information Available to Offerors.

2. 51 00 10—Photographs.
3. 51 00 20—Interface Information.
4. 52 00 00—Drawings.

C. Information provided in these sections are not intended to exhaustively identify pertinent features associated with these locations.

1.04 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 28 – Fire Alarm Drawings and Data.

B. RSN 28 31 00-1, Qualifications:

1. Furnish documentation for qualified individuals associated with the project. This shall include designer, manufacturer, installation supervisor, and testing agent.
   a. See article 1.09 “Qualifications”.
   b. Include current certificates and license information.
   c. Include references and contact information for projects.

C. RSN 28 31 00-2, Approval Drawings and Data:

1. Shall be prepared by a qualified designer and certified and stamped by licensed fire protection engineer.
2. Furnish documentation to meet NFPA 72 Chapter 7 documentation requirements and these specifications.
3. Include graphic map for Graphic Annunciator Panel.

D. RSN 28 31 00-3, Test Plan:

1. Submit with Section 01 91 13 – Commissioning.

E. RSN 28 31 00-4, Test Notification.

1. Provide written test notification with sufficient lead time to facilitate the Test Plan.

F. RSN 28 31 00-5, Test and Completion Reports:

1. Include record of completion in accordance with NFPA 72.
2. Include inspection and test report in accordance with NFPA 72.
3. Include a copy of the final test plan.
4. Include a sequence of operation test form per NFPA 4.
5. Include a narrative or matrix describing each test and the response of each system.

6. Include a description of the status of each system before and after the completion of test.
7. Include a statement that input, and output functions have been tested and operate as intended.
8. Supply contact information including address, telephone, and email for test personnel.

G. RSN 28 31 00-6, Final Drawings:

1. Approval drawings incorporating as-built condition.

H. RSN 28 31 00-7, Operation and Maintenance Manuals:

1. Documentation from operational test, security access codes for system, and replacement devices.
2. Complete list of software used and installation and operation instructions.
3. Clear and concise description of operation that gives in detail, information required to properly operate, inspect, test, and maintain equipment and system. Provide manufacturer's installation limitations.
4. Standby battery calculations under normal operating and alarm modes.
5. Component technical datasheets.
6. Drawings and diagrams developed for the project.

I. RSN 28 31 00-8, Test and Completion Report for Annual Fire Alarm System Testing:

1. Include updates to Record of Completion in accordance with NFPA 72.
2. Include copy of the latest revision of the test plan.
3. Supply contact information including address, telephone, and email for test personnel.

1.05 GENERAL REQUIREMENTS

A. Furnish a detailed system design, installation and testing of a complete fire detection and alarm system in compliance with listed codes, standards, and these specifications.

B. Certify that documents produced meet and comply with applicable codes, standards, and these specifications.

C. Install fire alarm system independently of non-fire related systems, such as automation or security systems except for relay and monitoring connections needed to facilitate life safety systems.

D. Furnish labor and services for installation and testing of a complete and fully functional fire alarm system.

E. Provide materials, devices, components, raceways, cables, and conductors for the complete installation of the fire alarm system.

F. Remove and dispose of the existing fire alarm system devices, components, raceways, cables, and conductors except where explicitly specified otherwise. Dispose in accordance with Section 01 74 00 – Cleaning and Waste Management.

G. Reused Existing conduits and raceways as described in Section 26 05 33 - Raceways and Boxes.

1.06 SYSTEM DESCRIPTION

A. Powerplant:

1. Control Panels and Annunciators:

   a. FACU installed in the Control Room located on Elevation 3244.24 and shown on drawing 577-D-3975.

   b. LCD fire alarm annunciator (FAA) provided in the Control Room, located on Elevation 3244.24 and shown on drawing 577-D-3975, and at the fire command center (FCC), located on Elevation 3188.50 and shown on drawing 577-420-13974.

   c. LED graphic annunciator panel (GAP) provided in the Control Room and at the FCC.

   d. Alarm and supervisory signals annunciated with a one-to-one correlation of one initiating point to one LED on GAP.

   e. Fire fighter smoke control station (FSCS) provided at the FCC.

2. Fire Alarm Notification:

   a. Audible and visual notification provided for fire evacuation throughout the power plant.

   b. Audible and visual fire alarm notification provided at each exit location.

   c. Visual notification method shall be by direct viewing (line-of-sight). Strobes shall be visible from common work and maintenance areas.

   d. Exterior audible and visual fire alarm notification installed at the FCC entrance located at Southeast corner of Elevation 3188.50.

   e. Exterior audible and visual fire alarm notification installed at entrances from the transformer deck and from the Visitors Center on Elevation 3188.50.

   f. Exterior visual emergency notification provided that activates upon generator CO_2 release at entrances of Elevation 3188.50.

   g. Textual notification provided at exits discharging to transformer deck which activates upon transformer deluge system release. Text reads “FIRE ON

TRANSFORMER DECK, DO NOT EXIT." Provide signage instructing personnel to use alternate means of exit when textual notification active.

3. Initiation devices:

   a. Manual pull station provided in Control Room, located on Elevation 3244.24, shown on drawing 577-D-3975, and at the fire command center (FCC), located on Elevation 3188.50, shown on drawing 577-D-3974.

   b. Automatic fire and smoke detection provided throughout the power plant.

   c. Supervisory monitoring provided for fire suppression water supply control valves, riser control valves, and zone control valves.

   d. Digital linear heat detector provided for the cable tray system shown on drawings; 557-D-1095 and 557-420-1096.

   e. Hydrogen Gas Detector system provided in Battery Room shown on drawings.

4. System Interface:

   a. Equipment associated with fire alarm system shall take advantage of equipment's internal trouble detection features, where available.

   b. Clean Agent Suppression System Interface:

      1) Supervision of clean agent suppression system provided for alarm, supervisory, and trouble signals.

      2) Area smoke detection provided for clean agent suppression releasing service fire alarm control unit (RSFACU) in the Electronic Tech Shop area, located on Elevation 3244.24, and shown on drawings 577-420-1711.

   c. Transformer Deluge System Interface:

      1) Supervision of transformer deluge system for alarm, supervisory, and trouble signals.

      2) Contractor may use terminal strip located in Control Room for transformer deluge systems K1, K3, K5, and K7.

      3) Fire alarm system smoke detection coverage provided for transformer deluge system RSFACU. Do not use or remove existing detectors above RSFACU.

5. Generator CO_2 Suppression System Interface:

   a. Supervision of CO_2 suppression system for alarm, supervisory, and trouble signals.

   b. Fire alarm smoke detector for generator CO_2 suppression RSFACU protection.

6. Freon Detection System:

a. Supervision freon detection system for alarm, supervisory, and trouble signals.

b. Fire alarm smoke detector for Freon detection panel protection.

7. Fans, Dampers, and Air Handling Units (AHU):

a. Control and supervision provided for fans, dampers, position switches, and AHUs as required by listed codes and standards.

b. Operation and functionality of new system shall maintain the existing system operation and functionality of existing system.

c. Fans:

1) Fire fighter control provided for exhaust fans at the FCC.

2) Status of each fan shown on smoke control graphic annunciator at the FCC.

d. Fire and Smoke Dampers:

1) Control of electronic actuators provided for fire smoke dampers.

2) Position of the dampers indicated on each smoke control graphic annunciator.

e. AHUs:

1) Shutdown AHUs with any fire alarm.

2) Shutdown of AHUs in accordance with listed codes and standards.

f. Supervision of Battery Room airflow sensor.

8. Elevators:

a. Smoke detection at each elevator landing provided for Phase I Recall in accordance with ASTM 17.1A.

b. System relay interface to elevator control panel provided for Phase I recall.

c. System relay interface provided for elevator power shunt trip.

d. Power for elevator shunt trip monitored.

9. Magnetic Door Holders:

a. Control relays provided to deenergize magnetic door holders with any fire alarm signal.

b. Supervision of the power provided to the magnetic door holders.

c. Magnetic door position contacts provided for each door with magnetic door holder. Monitor open/close position and indicate position of doors at the FCC on the GAP.

B. The Facility Workshop Building:

1. Full featured addressable fire alarm control unit.
2. Full fire/smoke detection provided throughout.
3. Audible and visual notification provided throughout.
4. Exterior notification that activates on alarm conditions at each entrance.
5. Signals transmitted to the Powerplant Control Room.

C. Carl Hayden Visitors' Center

1. Full featured addressable fire alarm control unit provided.
2. Signals annunciated in the business office and security office.
3. Full fire/smoke detection provided throughout.
4. Audible and visual notification provided throughout.
5. Audible and visual notification in the Rotunda shall be ceiling mounted.
6. Exterior notification that activates on alarm conditions provided at each entrance.
7. Smoke detection at each elevator landing provided for Phase I Recall in accordance with ASTM 17.1A.
8. System relay interface provided to elevator control panel for Phase I recall. Include:
   a. Primary Recall.
   b. Secondary Recall.
9. Signals transmitted to the Powerplant Control Room.

D. System design and installation coordinated with the following:

1. Section 21 25 00 – Hybrid Water Mist Fire Suppression System.
2. Section 26 05 10 – Conductors and Cables.
3. Section 26 05 33 – Raceways and Boxes.
4. Section 28 31 75 – Remote Station Monitoring.

1.07 PERFORMANCE REQUIREMENTS

A. General Performance:

1. Activation of supervisory devices associated with duct detectors, sprinkler control valves, and power supervision shall be non-latching.
2. Activation of supervisory devices associated with control panels, power supplies, releasing panels, other critical system components shall be latched until device is restored to a normal operating condition and the FACU is reset.
3. Alarm, supervisory, and trouble signals shall be annunciated at the FACU and FCC.

4. Audible notification may be silenced from FACU, FCC, or control room annunciator.

5. Duct smoke detectors shall initiate a supervisory signal at the FACU.

B. Operational Features:

1. Acknowledge, silence, and reset of FACU shall be done with a single activation of a button, switch, or touch icon. FACU shall not be equipped with a key or special numeric code to accomplish system silence and reset functions.

2. Acknowledge/Signal Silence shall deactivate on board piezo sounder for alarm, supervisory, and trouble signals and shall silence audible alert at remote annunciators.

3. Alarm Silence shall only de-activate the audible notification devices. Visual notification shall continue to flash until the FACU is reset.

4. Alarm Activate (Drill): Activates notification appliance circuits without activating the DACT.

1.08 EXISTING EQUIPMENT

A. Information provided on the existing equipment and conditions are to assist the Contractor in furnishing proper documentation for installation of the new system. Information provided here may not accurately reflect details of the installed system.

B. Contractor shall be responsible for identifying existing equipment. Discrepancies and/or differences between the information provided in the specifications and drawings; and actual equipment on the jobsite shall not represent a change of scope.

C. Existing powerplant fire alarm system is a Siemens based system installed around 2005. Primary components of the system include:

1. Main FACU located in the Control Room, Elevation 3244.24, Level 8.

2. Floor Terminal Junction Boxes located on each level of the powerplant and contain the following:

a. Power supplies with transformers and batteries.

b. NAC booster panel boards.

c. Network interface boards.

3. Fire Fighters Command and Control Panel located on Elevation 3188.50, Level 3, Southeast entrance. Fire Fighters Command and Control Panel includes:

a. Kirkland graphic annunciator panel with integrated exhaust fan controls.

b. Remote LCD annunciator

4. Initiation devices throughout the powerplant; manual fire boxes, smoke detectors, sprinkler flow and supervisory monitoring devices.

5. Notification devices throughout the powerplant.

D. Existing linear heat detection system-

1. Protecto Wire panel located on Elevation 3153.5, Level 1.

E. Existing low-pressure CO_2 suppression system-

1. Notifier FACU is located on Elevation 3153.5, Level 1.
2. Notifier Annunciator is in Control Room Elevation 3244.24, Level 8.

F. Transformer deluge system-

1. Janus control panels located on Elevation 3168.5, Level 2.
2. Terminals for interface are in the Control Room Elevation 3244.24, Level 8.
3. Terminals are in old FACP cabinet and will need to relocate.

G. Refrigerant (Freon) Monitor system-

1. Trane True Sense SD Located on Elevation 3153.5, Level 1.

1.09 QUALIFICATIONS

A. Designer:

1. System documentation shall be prepared by a professional engineer registered with the state of Arizona or National Institute for Certification in Engineering Technologies (NICET) Level IV certified with a minimum of three years' experience in design of fire alarm systems for industrial facilities similar in size and scope.
2. System documentation shall be reviewed and certified by a fire protection engineer (FPE) registered with the state of Arizona and a minimum of three years' experience.
3. Has the following abilities:
   a. Familiar with manufacturer products and installation requirements.
   b. Produce detailed shop drawings including wiring and circuit schematics.
   c. Familiar with NFPA 170.

B. Manufacturer:

1. Company specializing in manufacturing of fire alarm products.
2. Minimum 5-years documented experience in the manufacturing of fire alarm products.
3. Able to provide end-user training and technical support.

C. Installation Supervisor:

1. Certified technician with minimum NICET Level III certification with minimum of three years' experience in supervision, installation, adjustment, termination, and system testing of industrial facilities.
2. Possess the following abilities:
   a. Read and interpret drawings and specifications for the purpose of facilitating the installation and integration of fire protection and life safety systems.
   b. Familiar with manufacturers products and installation requirements either through training or verifiable experience.

D. Testing Agent:
1. Knowledgeable and experienced in the proper application of integrated testing methods, recommended practices, and general industry practices.
2. Professional with advanced, verifiable experience in installation, testing, operation, and maintenance of fire protection systems and life safety systems related to hydroelectric powerplants.
3. Possess the following abilities:
   a. Read and interpret drawings and specifications for the purpose of understanding system installation, testing, operation, and maintenance.
   b. Analyze and facilitate resolution of issues related to failures in fire protection and life safety systems.
   c. Provide clear, concise written reports and verbal communication, and can resolve conflicts.

1.10 EXTRA MATERIALS

A. Two copies of site-specific software for the system and associated components.

B. Furnish special tools and accessories required for installation, normal operation, and maintenance.

C. Fire Alarm System Maintenance Laptop:
1. Furnish one (1) portable laptop computer preloaded with software and supplied with peripherals required to perform programing, testing, history downloads, smoke obscuration reports, and maintenance activities at the facility for the fire alarm system.
2. 15-inch display, minimum.
3. Operating System: Latest version of Microsoft Windows at the time of purchase, or compatible version of Windows required to run manufacturer's software.

D. Spare Parts: Provide a minimum of 10 percent and not less than one of the following:
1. Manual Pull Stations.

2. Notification Devices of each type.
3. Detection Devices including bases of each type.
4. Input, relay, and control modules.
5. Lamp drivers.
6. Projected beam detectors including accessories for mounting and operation.
7. Duct smoke detectors including accessories for mounting and operation.

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment and system components for the Power Plant, the Facility Workshop Building, and Carl Hayden Visitors' Center shall be from the same manufacturer.

B. Equipment and system components furnished and installed shall be new, and the manufacturers' current model. The materials, appliances, equipment, and devices shall be listed for their intended use by UL and/or FM Global.

C. Equipment and system components shall be manufactured by a single manufacturer or identified as compatible with FACU manufacturer.

D. Equipment and system components shall be rated and installed in manner suitable for the environment in which they will be installed.

E. Existing fire alarm system equipment and components, raceways, cables, and conductors shall not be reused except where explicitly specified.

F. Weatherproof or weather resistant appliances and devices, or appliances and devices installed in wet locations shall use the manufacturer's back box.

2.02 FIRE ALARM CONTROL UNIT (FACU)

A. FACU minimum characteristics:

1. Intelligent fully addressable.
2. Supports Class A or B Notification Appliance Circuits (NAC).
3. Supports Class A, B, or X Signal Line Circuits (SLC).
4. Supports multi-criteria addressable detectors.
5. Alarm Verification selection per point, zone, or group.
6. Positive Alarm Sequence (PAS) capable.
7. Field-programmable on panel or with PC.
8. Upload or download programing, event history, or detector status on-site.

9. History file with a minimum 500 event capacity.
10. Walktest mode with walktest log and printout/download.
11. Integral liquid crystal display (LCD) minimum 80-character display with backlighting, or integrated touch screen display.
12. Visual and audible annunciation of any trouble, supervisory or alarm condition on panel display.
13. LED indicators for:
    a. AC Power.
    b. Fire Alarm.
    c. Supervisory.
    d. Trouble.
    e. Ground Fault.
    f. Battery Fault.
    g. Disabled.
    h. Alarm/Signal Silenced.
14. Capable of one-button operation for Acknowledge, Alarm Silence, and Reset.
15. Remote Acknowledge, Alarm Silence, Reset and Drill via addressable modules or remote annunciator.
16. Built-in digital communicator POTS (Plain Old Telephone Service) and Ethernet IP compatible.
17. Lockable cabinet.
18. Operates at 120 VAC, 60 Hz.
19. Secondary power via sealed lead acid batteries installed in the control unit cabinet or adjacent listed battery cabinet.
20. Battery cabinet shall be lockable with key that matches FACU.

2.03 REMOTE FIRE ALARM ANNUNCIATOR (FAA)

A. LCD minimum characteristics:
1. Backlit 80-character display.
2. Mimics FACU information.
3. Controls for System Acknowledge, Alarm Silence, Reset, and Drill.
4. LED indicators for:
    a. AC Power.
    b. Fire Alarm.

c. Supervisory.

d. Trouble.

e. Alarm/Signal Silenced.

5. Local sounder can be disabled and silenced from FACU.

6. Key switches, pass codes, or pins can be disabled at the FACU allowing for one-button operation for Acknowledge, Alarm Silence, and Reset.

7. Powered by 24 VDC from FACU or remote power supply.

2.04 GRAPHIC ANNUNCIATOR PANEL (GAP)

A. GAP minimum characters:

1. Metal enclosure with locking door.
2. Flame retardant grade Lexan cover.
3. Discrete LED indicators for each alarm and supervisory initiating device.
4. Momentary push-button "Lamp Test." Separate indicators for "Trouble" and "Supervisory" conditions shall be provided.
5. Integrated graphic display map.
6. LED indicator for AC power for cabinet mounted power supplies.
7. Powered by 24 VDC from FACU or remote power supply.

B. Graphic display map shall show a graphical representation of the building layout with fire alarm devices and system ID numbering indicated.

C. Graphic display map shall be orientated for user reference based on the viewing orientation.

D. Graphic map shall include:

1. Accurate north arrow based on orientation of each map.
2. Scale and scale bar.
3. Symbol legend identifying each device as shown on graphic map.
4. "You Are Here" arrow indicator in contrasting bold font.
5. Room designations.
6. Device addresses.
7. Initiating devices.
8. Supervisory devices.
9. Utility shutoff locations.
10. Areas of emergency function such as control rooms, area of refuge, etc.

11. Hazardous areas such as fuel storage, battery rooms, oil storage, etc.
12. Concealed and confined spaces.
13. Sprinkler and fire water control valves.
14. Hose stands and fire department connects.
15. Suppression releasing panel locations.
16. NAC booster panel locations.
17. Other features relevant to firefighting operations.

2.05 NOTIFICATION APPLIANCE CIRCUIT (NAC) BOOSTER PANELS/POWER SUPPLIES

A. Minimum characteristics:

1. Compatible with the FACU.
2. Supports Class A and B circuits.
3. Trouble relay.
4. LED indicators for:
   a. AC Power.
   b. Circuit Fault.
   c. Ground Fault.
   d. Battery Fault.
   e. Charger Fault.
5. Operates at 120 VAC, 60 Hz.
6. Secondary power via sealed lead acid batteries installed in the control unit cabinet or adjacent listed battery cabinet.
7. Battery cabinet shall be lockable with key that matches NAC booster panel.

2.06 AUXILLARY POWER PANELS

A. Minimum characteristics:

1. Compatible with the FACU.
2. Trouble relay.
3. LED indicators for:
   a. AC Power.
   b. Circuit Fault.
   c. Ground Fault.

d. Battery Fault.

e. Charger Fault.

4. Operates at 120 VAC, 60 Hz.
5. Secondary power via sealed lead acid batteries installed in the control unit cabinet or adjacent listed battery cabinet.
6. Battery cabinet shall be lockable with key that matches auxiliary power panel.

2.07 BATTERIES

A. Minimum characteristics:

1. Sealed, maintenance-free lead acid battery.
2. Rugged construction; spill proof, vibration resistant, and impact resistant.
3. Manufacturer production date or date code embossed on battery case.
4. 5-year design life.

2.08 MANUAL PULL STATIONS

A. Minimum characteristics:

1. Addressable.
2. Non-coded.
3. Red in color.
4. Dual action.
5. Clearly labeled “FIRE” on cover.
6. Compatible with FACU.
7. Indicate activation visually at device.
8. Require key to reset. Keyed the same as FACU.
9. Meet Americans with Disabilities Act (ADA) requirements.

2.09 SPOT TYPE DETECTOR

A. Addressable smoke detector having the following characteristics:

1. Plugin design for easy mounting.
2. Compatible with FACU.
3. Adjustable addressing on device.
4. Status LED for power, communication, and alarm conditions.
5. Remote LED compatible.

B. Addressable multi-criteria spot type detector having the following characteristics:

1. Plugin design for easy mounting.
2. Compatible with FACU.
3. Adjustable addressing on device.
4. Ability to detect at minimum both smoke and heat.
5. Adjustable sensitivity levels for various environments.
6. Thermal rating of 135 °F.
7. Status LED for power, communication, and alarm conditions.
8. Remote LED compatible.

C. Addressable heat detector having the following characteristics:

1. Plugin design for easy mounting.
2. Compatible with FACU.
3. Adjustable addressing on device.
4. Thermal rating of 135 °F or 195° F depending on installation requirements.
5. Status LED for power, communication, and alarm conditions.
6. Remote LED compatible.

2.10 PROJECTED BEAM SMOKE DETECTOR

A. Addressable single-ended projected beam smoke detector having the following characteristics:

1. Compatible with FACU.
2. Adjustable addressing on device.
3. Transmitter and receiver in one unit.
4. Adjustable sensitivity levels.
5. Built in automatic gain compensation.
6. Visible alarm state identification.
7. Remote test station for inspection and testing from ground level.

B. Remote test station having the following characteristics:

1. Compatible with projected beam smoke detector.
2. Key switch for operation.
3. Status LED.

2.11 DUCT SMOKE DETECTOR

A. Addressable duct smoke detector having the following characteristics:

1. Compatible with FACU.
2. Adjustable addressing on device.
3. Housing to allow for fit in both square and rectangular footprints capable of mounting to a round or rectangular duct.
4. Airflow velocity range: As required for application.
5. Sensor head shall be easily accessible for maintenance.
6. Tamper feature indicating a trouble signal for a removed or improperly installed sensor cover.
7. Front or back mounting of sampling tube with no required tools.
8. Clear cover for visual inspection.
9. Test/Reset interface that can be accessed from outside the housing. Where duct detector cannot be accessed by standing on the floor provide a remote test station to allow remote testing of the detector.

B. Remote test station having the following characteristics:

1. Compatible with duct smoke detector.
2. Key switch for operation.
3. Status LED.

C. Metal sampling tubes:

1. Metal sampling tubes compatible with duct smoke detector.
2. Tubing shall be purchased and installed to fit duct work size.

2.12 LINEAR HEAT DETECTOR

A. Linear heat detector with the following minimum performance requirements:

1. Rated for up to 30-foot spacing and/or proximity detection.
2. Compatible with any listed or approved fire alarm panel.
3. Detect an overheat or fire at 135°F.
4. Two heat sensing technologies. Shorting of cables and thermocouple mode to determine temperature of shorting location.

B. Linear heat detector interface module with follow characteristics:

1. Operating voltage of 12 to 24 VDC, maximum
2. Onboard surge and EMI protection.

3. Backlit LCD display.
4. Integrated LED indicators:
   a. Power: Green.
   b. Alarm: Red.
   c. Fault: Yellow
5. Outputs for monitoring alarms and faults.
6. Programmable in the field.

2.13 VISUAL AND AUDBILE NOTIFICATION APPLIANCES FOR FIRE EVACUATION

A. Wall mounted strobe notification appliance with following characteristics:
   1. Compatible with FACU.
   2. Red housing.
   3. Labeled “FIRE” on cover.
   4. Clear or white lens.
   5. Field-selectable candela settings.
   6. Voltage: 24VDC.

B. Ceiling mounted strobe notification appliance with following characteristics:
   1. Compatible with FACU.
   2. Red housing.
   3. Labeled “FIRE” on cover visible from multiple angles.
   4. Clear or white lens.
   5. Field-selectable candela settings.
   6. Voltage: 24VDC.

C. Horn notification appliance with following characteristics:
   1. Compatible with FACU.
   2. Red housing.
   3. Field-selectable volume settings.
   4. Voltage: 24VDC.

D. Horn strobe combination appliance with following characteristics:
   1. Characteristics of both horn and strobe appliances.

2.14 VISUAL AND AUDIBLE NOTIFICATION APPLIANCES FOR CO_2 RELEASE

A. Horn strobe combination device matching existing CO_2 system appliances.

2.15 TRANSFORMER DECK TEXTUAL NOTIFICATION AND SIGNAGE.

A. LED text messaging appliance with the minimum characteristics:

1. Preprogrammed and custom messages.
2. Powered by fire alarm power supply with battery backup.
3. Status LED.
4. 140-degree viewing angle.
5. 100-foot viewing distance.

B. Plastic sign with the following characteristics:

1. White background
2. Red lettering:
   a. Minimum 6” height.
   b. Minimum 1.25 in. stroke.
3. Reads “DO NOT EXIT WHEN SIGN IS LIT”
4. Minimum thickness 3 mm. Rigidity 2/5.
5. Non-glare finish.

2.16 DOCUMENT BOX

A. Document box designed for fire alarm system documents with the minimum characteristics:

1. Metal box large enough to hold all system drawings.
2. Keyed to match fire panels.
3. Red, powder coat finish.
4. 20-gauge steel or thicker.
5. Label indicating Fire Alarm System Documents or similar.

2.17 CIRCUIT BREAKER LOCKOUT

A. Circuit Lockout Kit manufactured by Space Age Electronics, www.1sae.com, ELOCK-FA; or equal, having the following characteristics:

1. Circuit lockout tab.
2. Hex key.
3. Breaker, legend, and door labels.

4. NFPA compliant.

2.18 WIRE AND CABLE

A. Wire and cable shall be provided as specified in Section 26 05 10 - Conductors and Cables.

PART 3 EXECUTION

3.01 INSTALLATION

A. Work is to be performed under the supervision of NICET III supervisor.

B. Designs and materials shall be approved prior to any work beginning onsite.

C. Install work as shown on approved drawings, as specified herein, and in accordance with applicable codes, standards, and manufacturer's diagrams and recommendations.

D. Equipment and system components shall be installed in accordance with applicable codes and standards, the manufacturers' recommendations and within the limits of listing agencies.

E. When an outage is expected, written notification is to be provided detailing the extent and duration of the outage and the course of action to be taken by the contractor to ensure safe operations.

F. If an outage is taken on facility fire alarm, CO_2, or other life safety system, provide continuous fire watch for the full duration of the outage.

G. When overlap or interference with existing systems or equipment is expected, written notification is to be provided detailing the extent and duration of the overlap or interference and detailing the course of action to be taken by the contractor to ensure safe operations.

H. Mount FACUs so that no part of enclosing cabinet is less than 30-inches or more than 78-inches above finished floor. The integral LCD annunciator shall be legible for average adult viewing while standing on floor.

I. Coordinate exact FACU panel location with COR.

J. Provide FACUs with protection from damage due to lighting or voltage and current transients.

K. Ground equipment in accordance with listed codes, manufacturer's recommendations, and Section 26 05 26 – Grounding and Bonding.

L. Relay and control modules shall be mounted in such a way as to be:

1. Accessible and visible.
2. With face parallel to mounting surface.

M. Input modules shall be installed to 4”-square metallic boxes. In cases where input modules cannot mount to a 4”-square box, then a module designed to mount within a junction box or behind the device may be used. If a module is installed in a junction box or behind a device, label the box cover indicating the presence of the module and the module address. Modules shall be mounted in such a way as to be:

1. Accessible and visible.
2. With face parallel to mounting surface.
3. Within reasonable distance of monitored devices or equipment. For control panels and other FACUs, modules shall be mounted within 3 ft.

N. Raceway and Conductors:

1. Install conduit and conductors with fire system manufacturer’s recommendations, listed codes, Section 26 05 33 – Raceways and Boxes and Section 26 05 10 – Conductors and Cables.
2. Fire system wiring shall be installed in conduit. Wiring for fire system shall not be installed in conduits, junction boxes or outlet boxes with conductors of other systems.
3. Exterior cover of junction boxes must be painted red and identified as “Fire System.” Junction boxes are to be labeled with each circuit type and quantity.

O. Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

P. Wiring shall be terminated at devices or panels using terminal connectors for screw type terminals or in a method described by the manufacturer.

Q. Labeling:

1. Provide labeling of conductors at terminal blocks in terminal cabinets and FACU.
2. Provide a shrink wrap label for each conductor or cable for a unique and specific designation.
3. Each terminal cabinet and FACU, to contain laminated drawing which indicates each conductor, its label, circuit, and terminal. Laminated drawing uses 12-point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with wiring or terminals.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Perform operational and functional tests in presence of Government’s representative identified by COR.

B. Notify COR in writing at least 10-days in advance of each testing session.

C. Ensure proper installation and function of fire alarm system prior to government witnessed testing.

D. Operational Test: Per NFPA 72:

1. Perform testing in witness of Government Representative.
2. Include verification of operation of including operation of the dampers, magnetic door holders, elevator enclosures, CO_2 suppression system interface and alarms to the SCADA and facility annunciation systems.

E. Testing:

1. Inspect the fire alarm system and verify operation of fire alarm system in accordance with NFPA 72 and specifications prior to operational testing of the system.

F. Operational and functional tests in accordance with NFPA 4 and NFPA 72:

1. Demonstrate each device operates per manufacturer's instructions.
2. Perform integrated testing of each remote system interfaced to the fire alarm system including by not limited to:
   a. Generator CO_2 suppression systems.
   b. Transformer deluge suppression systems.
   c. SCADA server room hybrid water mist systems.
   d. Stairwell smoke exhaust systems.
   e. Elevators.
   f. Door-hold open devices.

3.03 COMMISSIONING

A. Perform commissioning of complete fire alarm and detection system in accordance with specifications Section 01 91 13 – Commissioning.

3.04 TRAINING

A. In accordance with Section 01 79 20 – Training.

3.05 ANNUAL INSPECTION AND TESTING

A. Provide on-siteinspection and testing of the complete fire alarm system in accordance with NFPA 72 aproximately 12 months after the final Government acceptance of the new Fire Alarm System.

B. Contractor will be notified at least 30 days before testing is to take place..

C. Inspection and Testing as required by NFPA 72 to include:

1. Locations:
    a. Power plant fire alarm system.
    b. Carl Hayden Visitor Center.
    c. Facility Workshop Building.
2. Equipment:
    a. As listed in NFPA 72 including but not limited to:
        1) Control Unit.
        2) Trouble Signals.
        3) Supervising Station – transmission and receiving.
        4) Secondary Power Supply.
        5) Remote Annunciator.
        6) Initiating Devices.
        7) Interface Equipment.
        8) Alarm Notification Appliances.
3. Qualifications:
    a. Testing Agent, as defined in Article 1.09.
4. Submit final test report and any updates or changes to the Record of Completion.

D. Contractor to replace or repair equipment that fails to pass inspection or testing and is covered under warranty.

E. Provide a test report for annual fire alarm system testing under RSN 28 31 00-8..

END OF SECTION

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SECTION 28 31 75
REMOTE STATION MONITORING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Remote Station Monitoring System:

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

1.02 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

1.	NFPA 70-2020	National Electrical Code (NEC)
2.	NFPA 72-2019	National Fire Alarm and Signaling Code

B. Underwriters Laboratory

1.	UL 864-2014	Control Units for Fire Protective Signaling Systems

1.03 GENERAL REQUIREMENTS

A. Provide a full-featured digital system employing an advanced technology network to monitor various fire alarm system information including:

1. Alarm signals.
2. Supervisory signals.
3. Trouble signals.

B. Furnish a detailed system design complying with all applicable codes, standards, and these specifications.

C. Certify that documents produced comply with all applicable codes, standards, and these specifications.

D. Furnish all labor and services for installation and testing of a complete and fully functional remote monitoring system.

E. Provide all materials, devices, components, raceways, cables, and conductors for the complete installation of the fire alarm system.

1.04 SYSTEM DESCRIPTION

A. A PC based graphical facilities monitoring system shall be installed in accordance to the project specifications and drawings.

B. The PC based graphical facilities monitoring system shall include, but not be limited to, optional touch screen or LCD wide screen monitor, one or more PC based graphical workstations, all input/output devices, network communications media, control equipment, auxiliary control devices, power supplies, and wire / fiber optic media as shown on the drawings and specified herein.

C. The system shall employ an advanced technology network to monitor and control various fire, security, and other facility information over a network.

D. The system shall include an interface to digital alarm communicator receivers for wide area network monitoring.

E. The system shall allow a mixture of different technologies and manufacturers' equipment to operate on the same network and provide the operator with a consistent look and operation for all monitored equipment.

F. The system shall support a variety of topologies and media and shall provide an industry standard open architecture transport layer protocol.

G. Using standard RS-232 ports on existing and future monitoring and control systems used by the facility, the system shall connect to and interpret status change data transmitted from the ports and provide graphic annunciation, control, history logging and reporting as specified herein.

H. The system shall be electrically supervised and monitor the integrity of all conductors.

I. The system shall utilize Boolean logic for automatic event response.

J. System shall monitor fire alarm panels at the following locations as identified on drawing 557-D-60169:

1. Carl Hayden Visitor Center.
2. Facility Workshop and Service Building.
3. Government Project Warehouse.

1.05 PERFORMANCE REQUIREMENTS

A. The network will interface and report the individually monitored system's status via a user-friendly Graphical User Interface (GUI) based software workstation.

B. The software shall operate under Microsoft® Windows® 10 64 bit OS as manufactured by Microsoft Corporation.

C. The GUI based software must be capable of graphically representing each facility being monitored with floor plans and icons depicting the actual locations of the various systems; and / or sensors' locations as well as view the system events in text mode.

D. The software shall use a 1920 pixels X 1080 pixels GUI display capable of showing a large primary floor plan display, a key map representative of a larger view of the primary display and its relationship to the facility being monitored, the current operator, number of fire, supervisory, pre-alarms, troubles, and security events within the network as well as outstanding events and acknowledged events.

E. The software shall have the capacity of at least 1,000 screens / floor plans or as dictated by hard drive space and installed VIDEO and RAM memory for efficient operation.

F. The software shall have the ability to float and dock windows to support dual-monitor display.

G. The workstation shall have the ability to support graphic printing of all data including graphical floor plans, system activity, history, and guidance text. A Windows® compatible printer shall be supported for the graphics and report printer options.

H. The workstation software shall permit automatic navigation to the screen containing an icon that represents the system or sensor in the event of an off-normal condition.

I. The system/sensor icon shall indicate the type of off-normal condition, flash, and change to the color associated with the off-normal condition (e.g., RED for ALARM and YELLOW for TROUBLE).

J. The software shall allow the attachment of text (TXT) files, sound (WAV) files, image (BMP) files, and video (AVI) files to each system or sensor icon allowing additional information to be provided to the system operator for responding to the off-normal condition. The software must have the ability for an attachment for each major event type per device.

K. The software shall allow the importation of externally developed floor plans in Drawing Exchange Format (DXF), Windows Metafile (WMF), JPEG (JPG), Graphics Interchange Format (GIF) and Bitmap (BMP) format.

L. The software shall provide automatic navigation to the screen containing the icon of any system or sensor when an event is initially annunciated. In addition, operator navigation to screens containing outstanding events shall be accomplished by "clicking on" the event from either the acknowledged or unacknowledged event.

M. History Manager. The software shall contain a History Manager, which shall record all system events with a time and date stamp as well as the current system operator's name.

1. The system shall provide the ability to store all off-normal events experienced by the various sub-systems that are monitored by the system.

2. All events shall be recorded with a time and date stamp and the system operator shall be provided with the ability to log a pre-defined response or a custom comment for each off-normal event and have that comment stored in the history file with the time, date, and operator name.

3. Provide the ability to conduct searches and generate subsequent reports, based on all events for a single system / device address, a specific node, a specific type of off-normal condition and date range (mm/dd/yy to mm/dd/yy) or combinations of these search parameters. The number of entries in the history file that match the determined search criteria will be displayed.

4. The History Manager shall automatically back-up the history file at 2,500,000 events.

5. It shall be possible to pre-select data fields for reporting and then saving the report as a template. It shall also be possible to schedule the pre-defined report to print at a designated time.

6. The History Manager shall provide the operator the ability to select the number of days or number of months to back-up history.

N. Alarm Monitoring. The system shall provide for continuous monitoring of all off-normal conditions regardless of the current activity displayed on the screen.

1. If an operator is viewing the history of a sub-system and an alarm condition should occur, the system shall automatically navigate to the graphic screen showing the area where the off-normal event is occurring.

2. The system shall prioritize all off-normal events as defined by National Fire Alarm Code® 72 into the following categories: fire alarms, troubles, supervisory alarms, pre-alarms and security alarms.

3. The system shall display a running count of all events by type in an alarm summary window. The alarm summary window shall include at least five counters, defaulted to Alarm, Pre-Alarm, Trouble, Security, and Supervisory events.

4. The system shall show a running list of all unacknowledged events and acknowledged events and allow the system operator to acknowledge an event by "double-clicking" on that event in the Unacknowledged Events box. The Unacknowledged and Acknowledged Events boxes shall contain an abbreviated description of the off-normal condition.

5. The details of the condition may be viewed by selecting event in the unacknowledged events box.

6. The system shall allow the attachment of user-definable text files, image files, video files, and sound files to each device / system monitored (for every event state) in order to facilitate the operators and response personnel's response to the off-normal condition.

7. The system shall record all events to the system's hard drive. A minimum of 2,500,000 events may be stored.

O. Reports & Logs:

1. The system shall provide for the ability to generate reports based on system history.
2. The system shall allow the system operator to enter custom comments up to 255 characters for each event and have those comments recorded in the system's history file.

P. Boolean Logic:

1. An automated event response application shall be provided to automatically perform actions across the entire system based on network activity.
2. The event response application shall allow event responses (actions) based on predefined user conditions using simplified Boolean logic.
3. Actions shall be configured to be executed immediately or timed as required.

Q. Control Aspects of Software System:

1. The workstation shall provide configuration utilities for monitoring and control profiles. These profiles shall be user definable for distribution of monitoring and control allowances for operators per workstation.
2. Under no condition shall any sub-system be required to rely on the network for any data processing required to perform its particular function. Each individual sub-system shall be in effect "stand-alone" as to ensure its continued operation should a disruption in communication with the system be experienced.

R. The software shall be password protected and provide for the definition of security profiles for operator access control.

S. The software shall contain provision for defining monitoring profiles of pre-selected Nodes for monitoring. This shall include provision for status types within the selected NODES.

T. The software shall support sending real-time off-normal event notifications.

U. The software shall support live voice paging for mass notification.

V. The PC based graphical facilities monitoring system shall include a Configuration Tool that provides the following features:

1. Allows operators the ability to create and edit graphics.
2. Set up Gateway Connections and define their nodes.
3. Set system operating mode.
4. Add and edit objects on screens.
5. Configure colors and sounds for the status classes.

1.06 SUBMITTALS

A. Submit the following in accordance with Sections 01 33 00 – Submittals and 01 33 28 – Fire Alarm Drawings and Data.

B. RSN 28 31 75-1, Qualifications:

1. Furnish documentation for all qualified individuals associated with the project. This shall include designer, manufacturer, installation supervisor, and testing agent.
    a. See article 1.08 "Qualifications".
    b. Include current certificates and license information.
    c. Include references and contact information for all projects.

C. RSN 28 31 75-2, Approval Drawings and Data:

1. Shall be prepared by a qualified designer and certified and stamped by licensed fire protection engineer.
2. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
3. Shop Drawings including:
    a. Information required by NFPA 72.
    b. Floorplan showing location of installed equipment.
    c. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
    d. One-line diagram of transmitting and receiving equipment. Indicate all wiring for each item of equipment and the interconnections between the items of equipment. Indicate transmission means.
4. Manufacturers' data sheets.

D. RSN 28 31 75-3, Test Plan:

1. Provide test plan meeting the requirements of NFPA 72.
2. Test plan shall include the following:
    a. Written verification that the remote monitoring system has been installed in accordance with approved design documents.
    b. Identify all entities required to be in attendance.
    c. Equipment required for testing.
    d. A comprehensive functional matrix depicting all system inputs and associated output functions.

e. Narrative description of the test scenarios, including what is needed for record of completion.

f. The extent of systems to be tested under the direction of the testing agent.

g. Test schedule.

E. RSN 28 31 75-4, Test Notification.

1. Provide written test notification with sufficient lead time to facilitate the test plan.

F. RSN 28 31 75-5, Test and Completion Reports:

1. Include completed record of completion in accordance with NFPA 72.
2. Include inspection and test report in accordance with NFPA 72.
3. Include a copy of the final test plan.
4. Include a sequence of operation test form per NFPA 4.
5. Include a narrative or matrix describing each test and the response of each system.
6. Include a description of the status of each system before and after the completion of test.
7. Include a statement that all input and output functions have been tested and operate as intended.
8. Supply contact information including address, telephone, and email for test personnel.

G. RSN 28 31 75-6, Final Drawings:

1. Approval drawings incorporating as-built condition.

H. RSN 28 31 75-7, Operation and Maintenance Manuals:

1. Documentation from operational test, security access codes for system, and replacement devices.
2. Complete list of all software used and installation and operation instructions.
3. Clear and concise description of operation that gives in detail, information required to properly operate, inspect, test, and maintain equipment and system. Provide all manufacturer's installation limitations.
4. Standby battery calculations under normal operating and alarm modes.
5. Component technical datasheets.
6. All drawings and diagrams developed for the project.

1.07 QUALIFICATIONS

A. Designer:

1. System documentation shall be prepared by a professional engineer registered with the state of Arizona or National Institute for Certification in Engineering Technologies (NICET) Level IV certified with a minimum of three years' experience in design of fire alarm systems for industrial facilities similar in size and scope.
2. System documentation shall be reviewed and certified by a fire protection engineer (FPE) registered with the state of Arizona with minimum of three years' experience.
3. Possess the following abilities:
    a. Familiar with manufacturer products and installation requirements.
    b. Produce detailed shop drawings including wiring and circuit schematics.
    c. Familiar with NFPA 170.

B. Manufacturer:
1. Company specializing in manufacturing of fire alarm products.
2. Minimum 5-years documented experience in the manufacturing of fire alarm products.
3. Able to provide end-user training and technical support.

C. Installation Supervisor:
1. Certified technician with minimum NICET Level III certification with minimum of three years' experience in supervision, installation, adjustment, termination, and system testing of industrial facilities.
2. Possess the following abilities:
    a. Read and interpret drawings and specifications for the purpose of facilitating the installation and integration of fire protection and life safety systems.
    b. Familiar with manufacturers products and installation requirements either through training or verifiable experience.

D. Testing Agent:
1. Knowledgeable and experienced in the proper application of integrated testing methods, recommended practices, and general industry practices.
2. Professional with advanced, verifiable experience in installation, testing, operation, and maintenance of fire protection systems and life safety systems related to hydroelectric powerplants.
3. Possess the following abilities:
    a. Read and interpret drawings and specifications for the purpose of understanding system installation, testing, operation, and maintenance.
    b. Analyze and facilitate resolution of issues related to failures in fire protection and life safety systems.

c. Provide clear, concise written reports and verbal communication, and can resolve conflicts.

1.08 EXTRA MATERIALS

A. Two copies of site-specific software for the system and associated components.

B. Furnish special tools and accessories required for installation, normal operation, and maintenance.

C. Spare Parts:

1. Manual Pull Stations: Two of each type.
2. Notification Devices: Two of each type.
3. Detection Devices including bases: Two of each type.
4. Projected beam detectors including all accessories for mounting and operation: One of each type.
5. Duct smoke detectors including all accessories for mounting and operation: One.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment and system components furnished shall be new, and the manufacturers' current model. The materials, appliances, equipment, and devices shall be listed for their intended use by UL and/or FM Global.

B. All equipment and system components shall be rated for the environment in which they will be installed.

C. Existing fire alarm system equipment and components, raceways, cables, and conductors shall not be reused except where explicitly specified.

2.02 REMOTE FIRE ALARM SYSTEM MONIOTORING EQUIPMENT

A. Digital Alarm Communicator Receiver (DARC) with the following minimum performance requirements:

1. Scalable with capability to manage the specified number of sites plus 50% expansion.
2. IP network based capable of receiving information from on-board communicators or from installed IP modules.
3. Network shall use TCP/IP protocol for local area systems.
4. RS-232 interface to automation server using ContactID format and emulating Surgard, Radionics or Ademco receiver protocols.

5. Support for dynamic or static IP addresses.
6. Line monitoring.
7. Network access monitoring.
8. Memory storage of 1000 events and configuration settings.

B. Workstation/Automation Network:

1. Networked using Ethernet supporting the use of TCP/IP protocol.
2. Capable of supporting multiple clients.
3. UL listed to communicate between clients and gateways over a business computer network (shared IP).
4. Equipped with all necessary gateway modules to allow connection to the network it monitors as standard equipment.
5. Support one or more Windows® compatible printers for graphics and report printing.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work to be performed under the supervision of NICET III supervisor.

B. All designs and materials shall be approved prior to any work beginning onsite to minimize outage of fire alarm systems and required fire watch measures.

C. Install work as shown on approved drawings, as specified herein, and in accordance with all listed codes and manufacturer's diagrams and recommendations.

D. Install DACR in the Control Room located on Elevation 3244.24 and shown on drawing 577-D-3975.

E. Locate the Workstation in the Control Room located on Elevation 3244.24 and shown on drawing 577-D-3975. Workstation location shall be coordinated with powerplant representative.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Submit for approval at least 30-days prior to commencement of formal operational testing. Include detailed procedures for operational testing of each component prepared and signed by a NICET Level III fire alarm technician for performance of an operational system test.

B. Perform operational and functional tests in presence of Government’s representative identified by COR.

C. Notify COR in writing at least 10-days in advance of each testing session.

D. Operational Test: Per NFPA 72:

1. Perform testing in witness of Government Representative and facility operators.
2. Include verification of operation of each remote system interface including operation of the dampers, magnetic door holders, elevator enclosures, CO_2 suppression system interface and alarms to the SCADA and facility annunciation systems.

3.03 TRAINING

A. In accordance with Section 01 79 20 – Training.

END OF SECTION

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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, the requirements in the other divisions will govern.

B. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government, in accordance with the 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

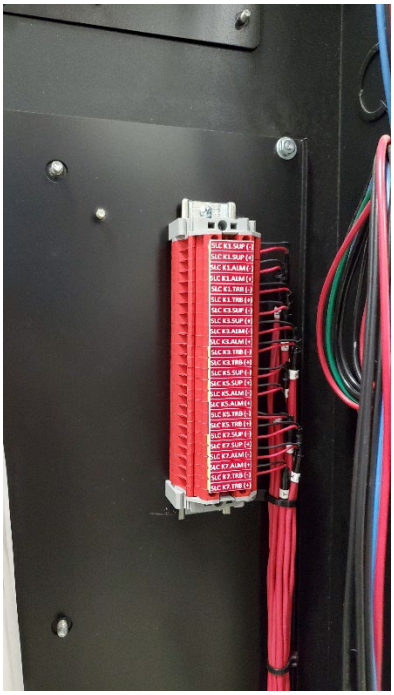
PART 1 GENERAL

1.01 GLEN CANYON POWERPLANT PHOTO'S

A. Photos are for reference only.

Existing Powerplant Fire Alarm Control Panel in Control Room - Level 8

Smoke Detector above FACP. Level 8



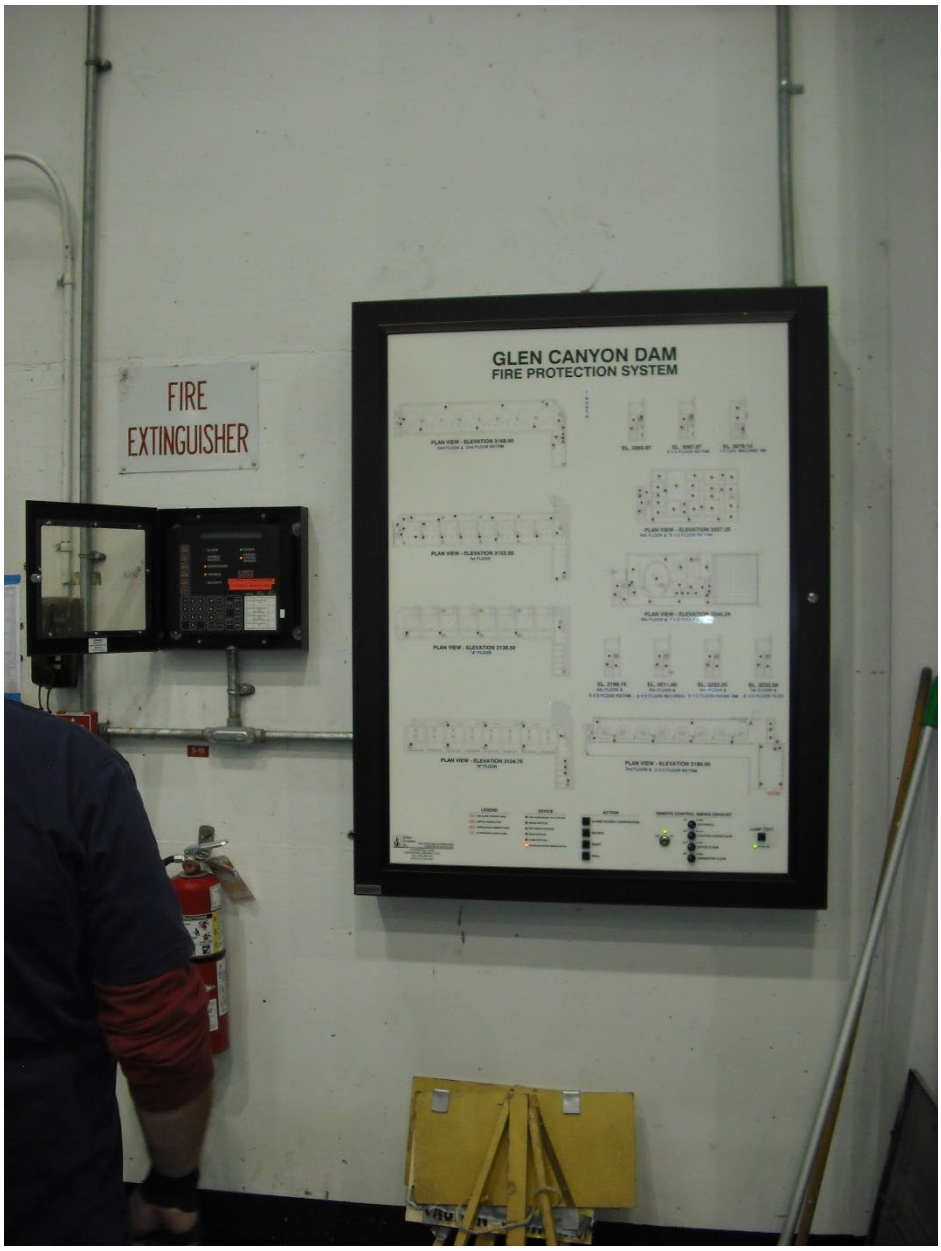
Terminal Block and Wiring for Transformer Deluge Release System connections to FACP – Level 8

Transformer Deluge Manual Release Controls in Control Room – Level 8

Magnetic Door Latch – Level 8

Computer Server Room – Level 8.

Abandoned Halon Release Panel for Computer Server Room – Level 8.



Fire Alarm Lit Point Annunciator Board – Level 3

Fire Alarm Remote Control Panel – Level 3

Motor Control Center MME that houses smoke controls and ventilation motors - Level 3

Smoke Control Circuit Breakers in MME - Level 3

Generator Gallery - Level 3

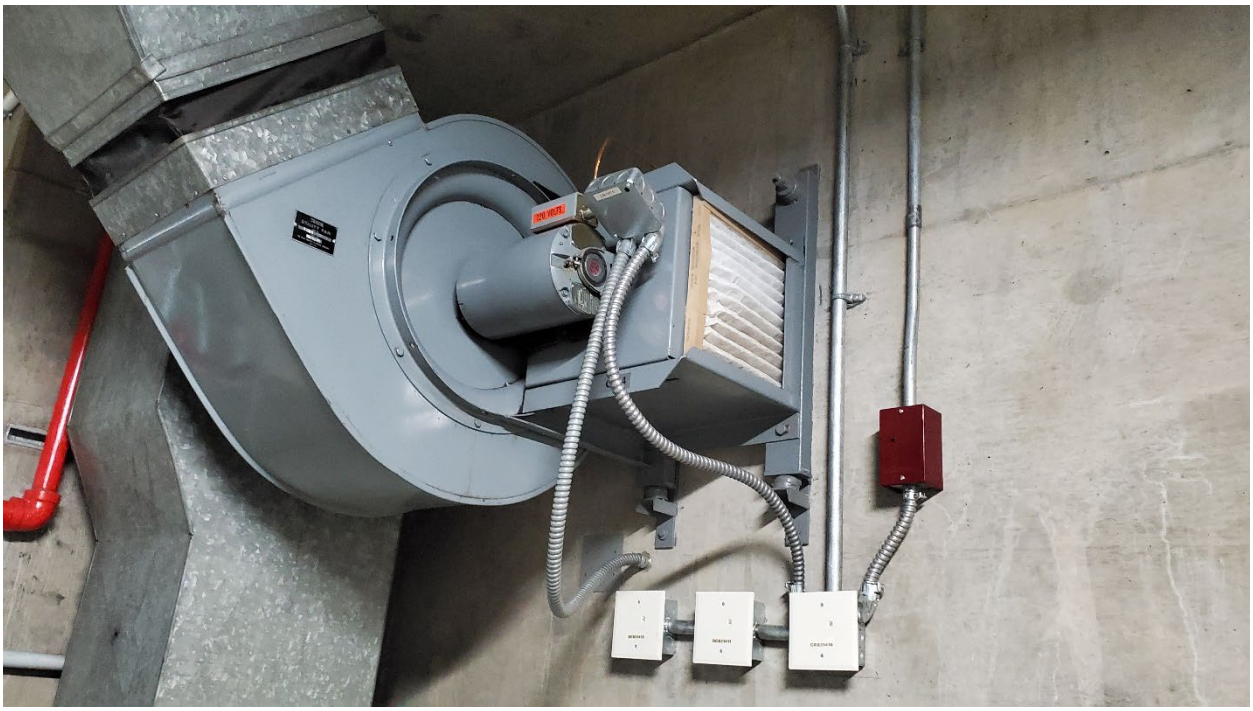
Machine Shop Gallery - Level 3.

Transformer Deluge Release Panels – Level 3.

Cable Tray Linear Heat Detector Panel – Level 1

Generator CO2 Release Panel – Level 1

Generator CO2 Release System – Level 1



Ventilation Fan with Control Modules – Level 1

Freon Detection Panel – Level 1

Fire Water Valve and Tamper Switch – Level A

Fire Water Inlet Valve and Tamper Switch - Level A

Oil Storage Room Containment Tanks – Level B.

Oil Storage Room Sprinkler Piping and Beam Detector- Level B

1.02 FACILITY WORKSHOP BUILDING PHOTO'S

A. Photos are for reference only.

Exterior Of Facility Workshop Building.

Entrance to Facility Workshop Building.

Interior of Facility Workshop and Backside of Facility Workshop Building.

Garage Space in Facility Workshop.

Ceiling of Facility Workshop.

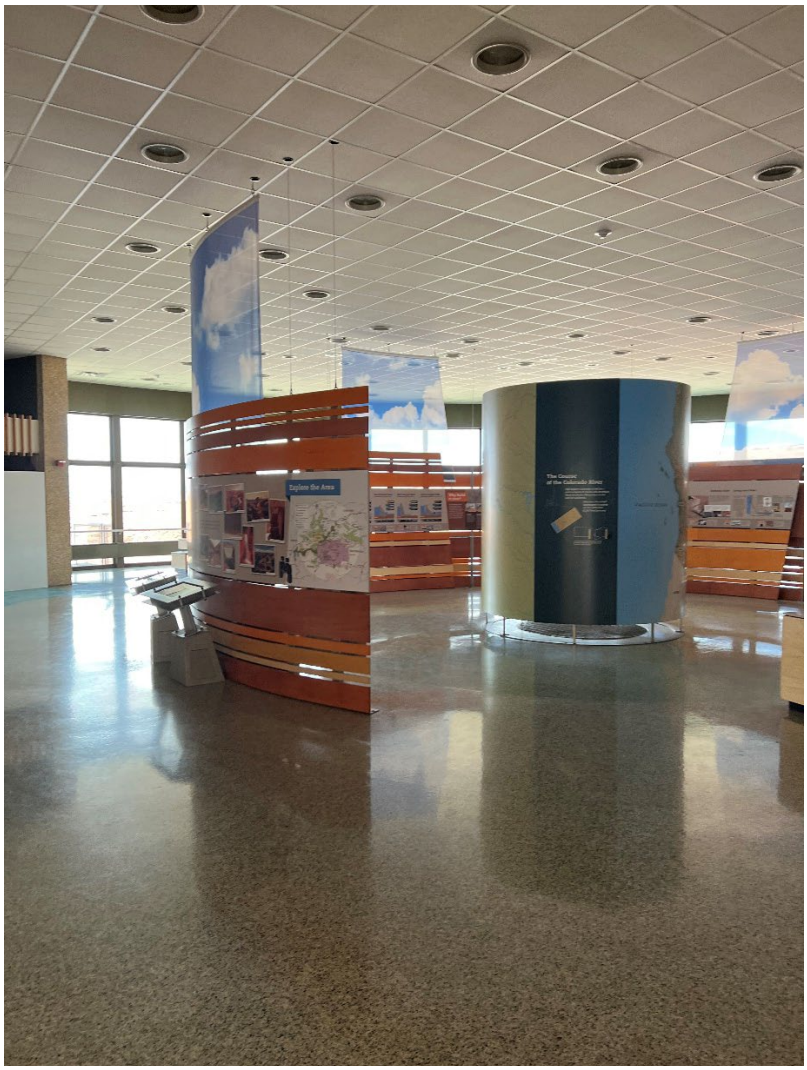
Roll Up Door at Facility Workshop.

Woodworking Equipment in Facility Workshop.

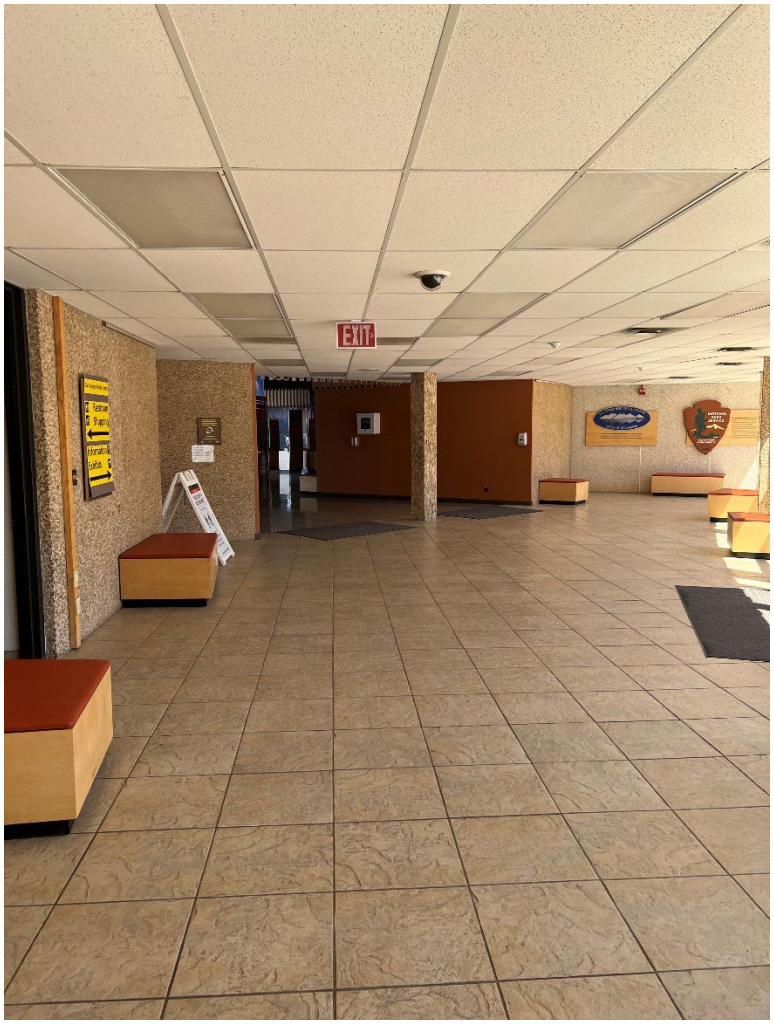
Fiber Optic Panel at Facility Workshop.

1.03 CARL HAYDEN VISITOR CENTER

A. Photos are for reference only.

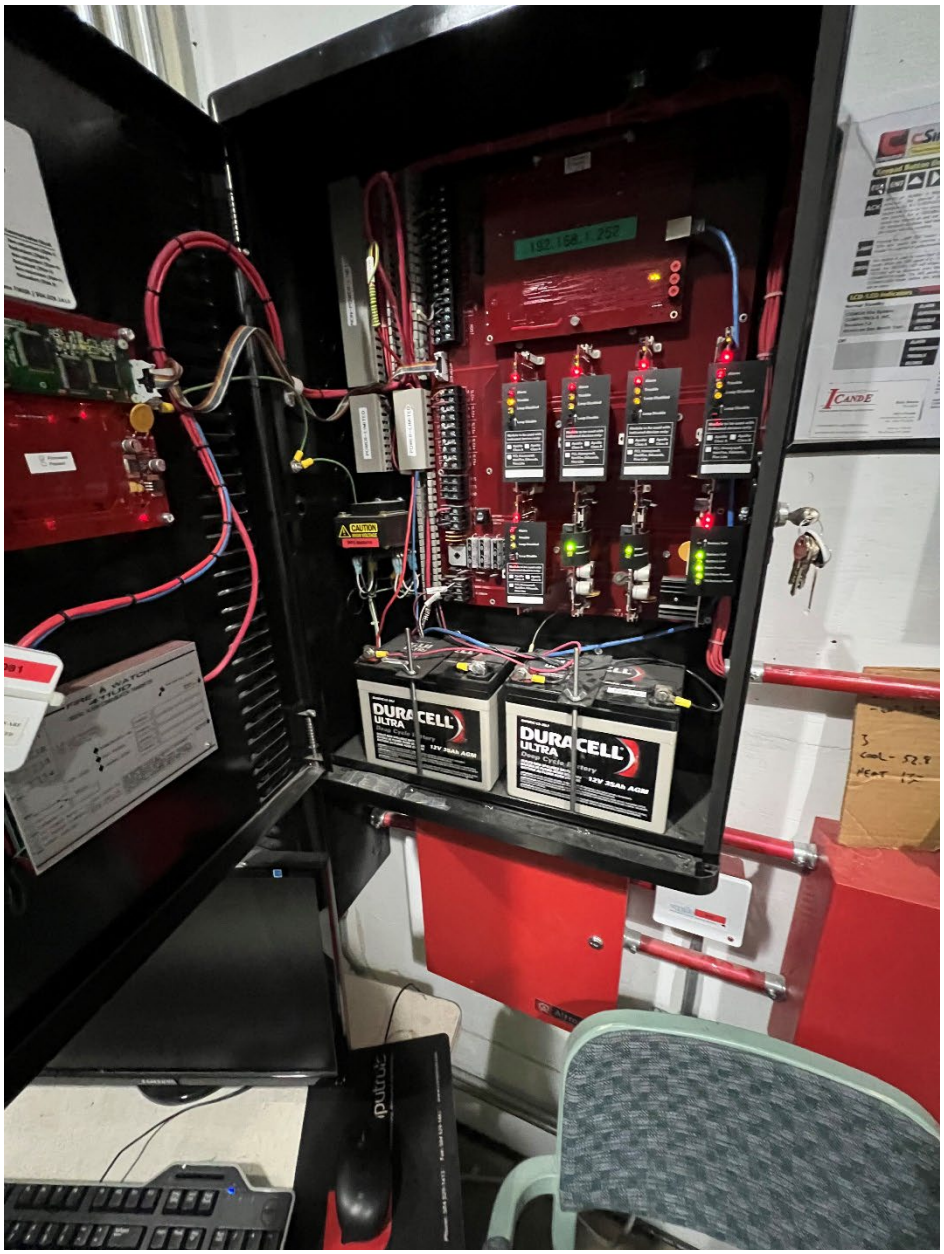


Carl Hayden Visitor Center Rotunda.



Visitor Center Lobby.

Visitor Center Existing Fire Alarm Control Panel.



Visitor Center FACP Interior.

PART 2 PRODUCTS

2.01

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 51 00 20

INTERFACE INFORMATION

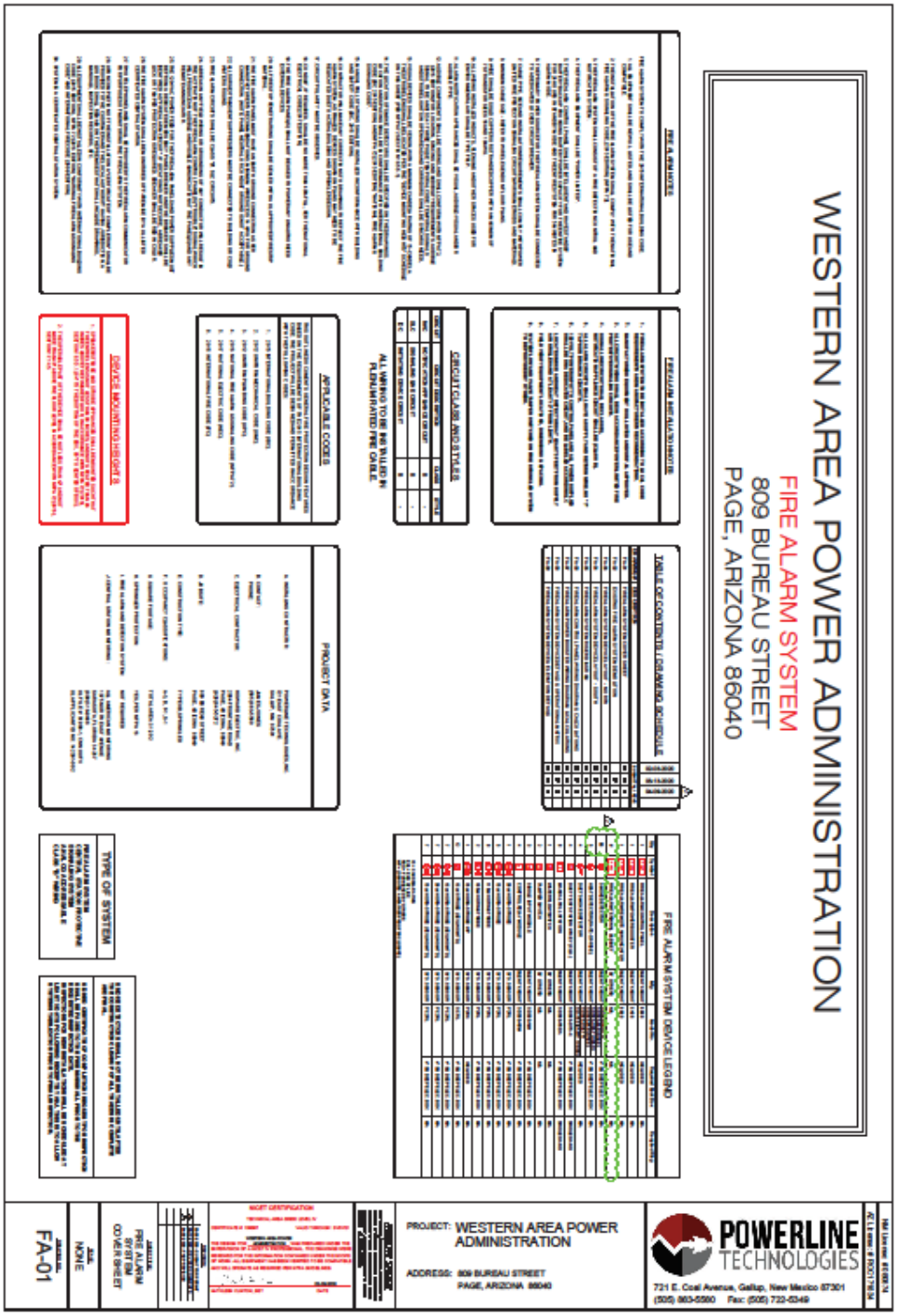
PART 1 GENERAL

1.01 FIRE ALARM DRAWINGS FOR THE GOVERNMENT PROJECT WAREHOUSE

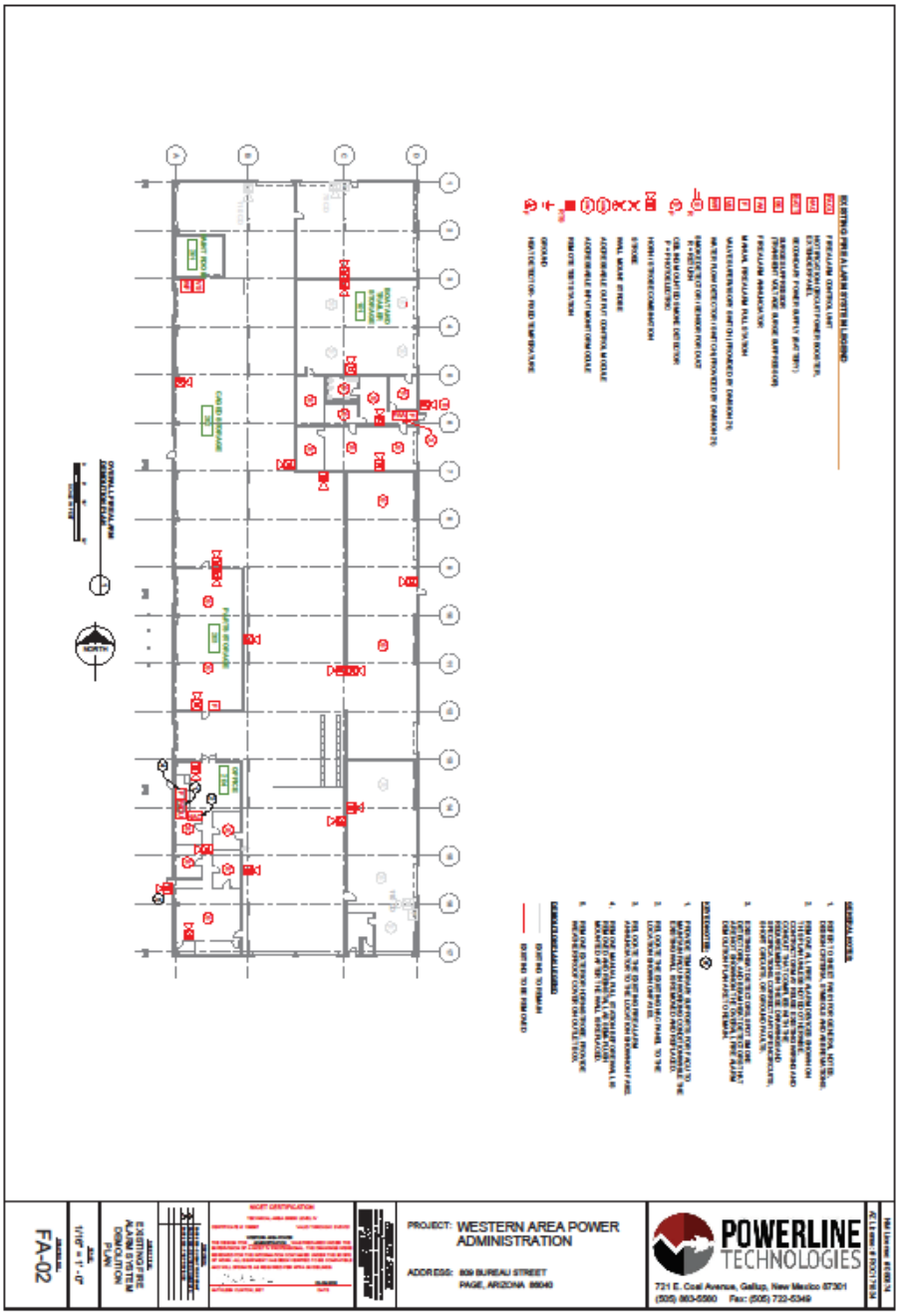
A. This multiuse building is shared by the Bureau of Reclamation and the Western Area Power Administration.

B. Drawings provided for information only.

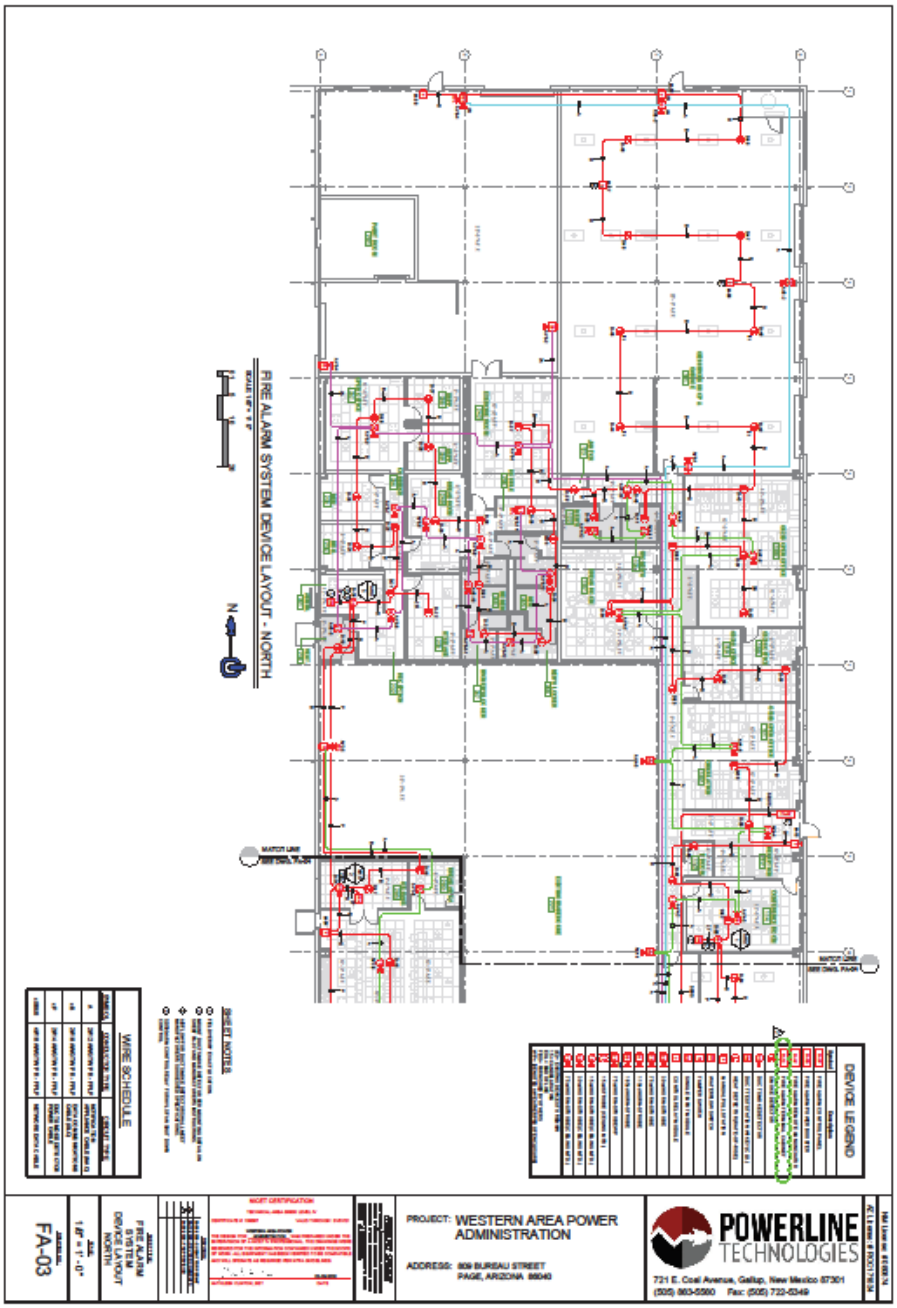
1.


WESTERN AREA POWER ADMINISTRATION
FIRE ALARM SYSTEM
809 BUREAU STREET
PAGE, ARIZONA 86040
FIRE ALARM SYSTEM DEVICE LEGEND
TABLE OF CONTENTS / LOS AMENDS SCHEDULE
CIRCUIT CLASS AND STYLES
APPLICABLE CODES
PROJECT DATA
TYPE OF SYSTEM
DEVICE MOUNTING HEIGHTS
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FA-01

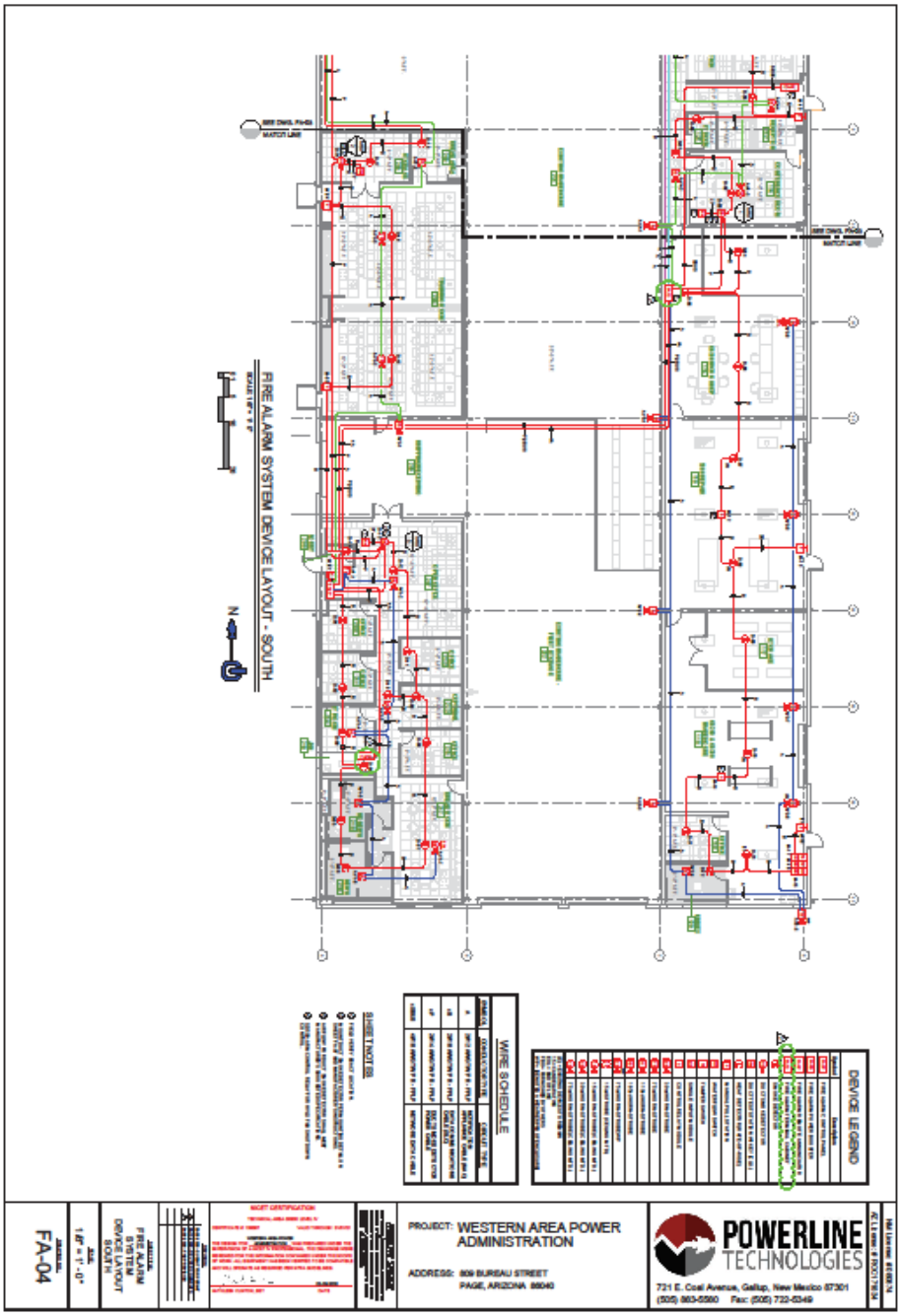
2.


POWERLINE
TECHNOLOGIES
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FA-02
1/16" = 1'-0"
EXISTING FIRE ALARM SYSTEM DEMOLITION PLAN
NORTH

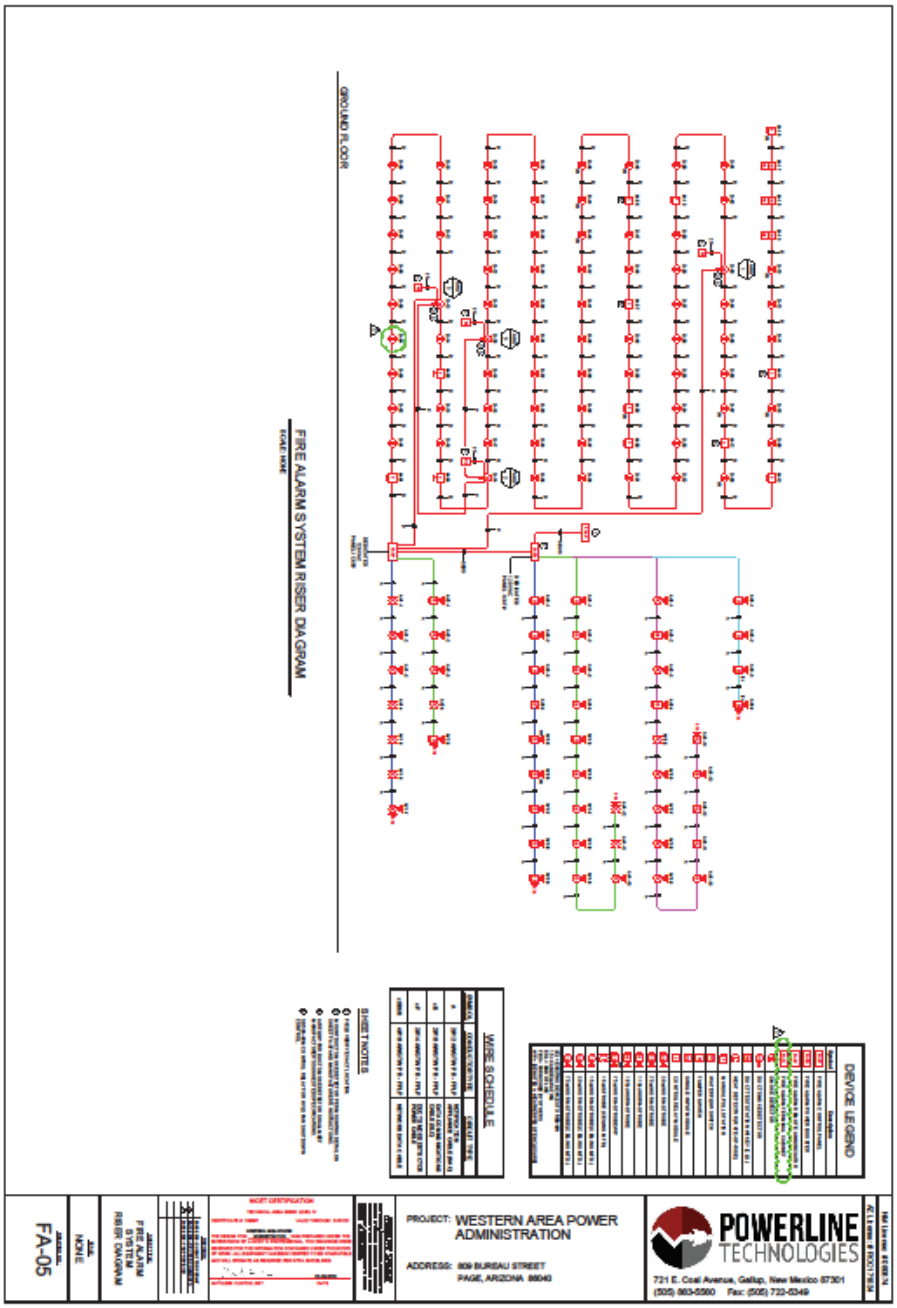
3.

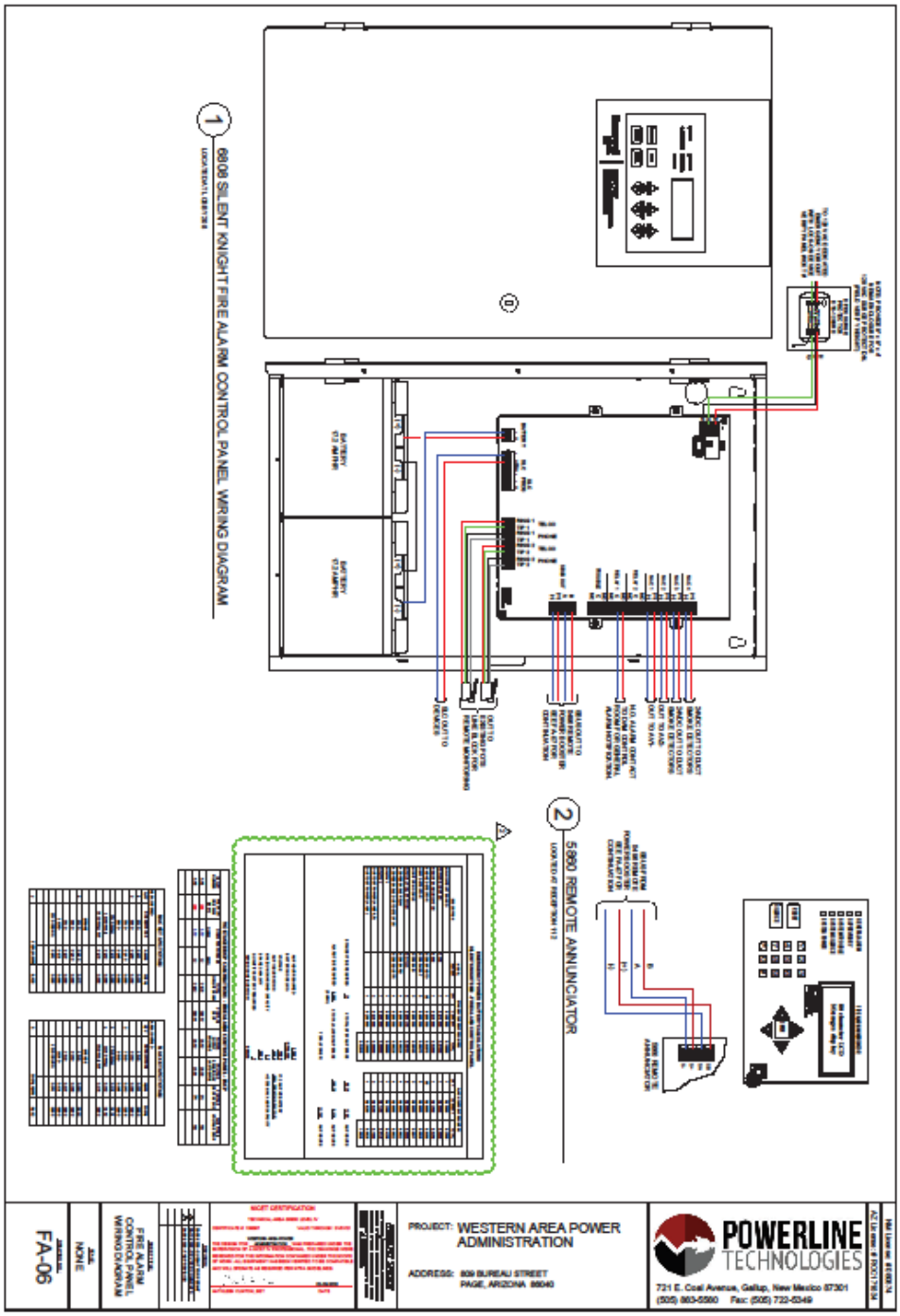

FIRE ALARM SYSTEM DEVICE LAYOUT - NORTH
N
DEVICE LEGEND
WIRE SCHEDULE
SHEET NOTES
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FA-03
FIRE ALARM SYSTEM DEVICE LAYOUT NORTH
1/8" = 1'-0"

4.


FIRE ALARM SYSTEM DEVICE LAYOUT - SOUTH
N
DEVICE LEGEND
WIRE SCHEDULE
SHEET NOTES
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5590 Fax: (505) 722-0349
FA-04
FIRE ALARM SYSTEM DEVICE LAYOUT SOUTH

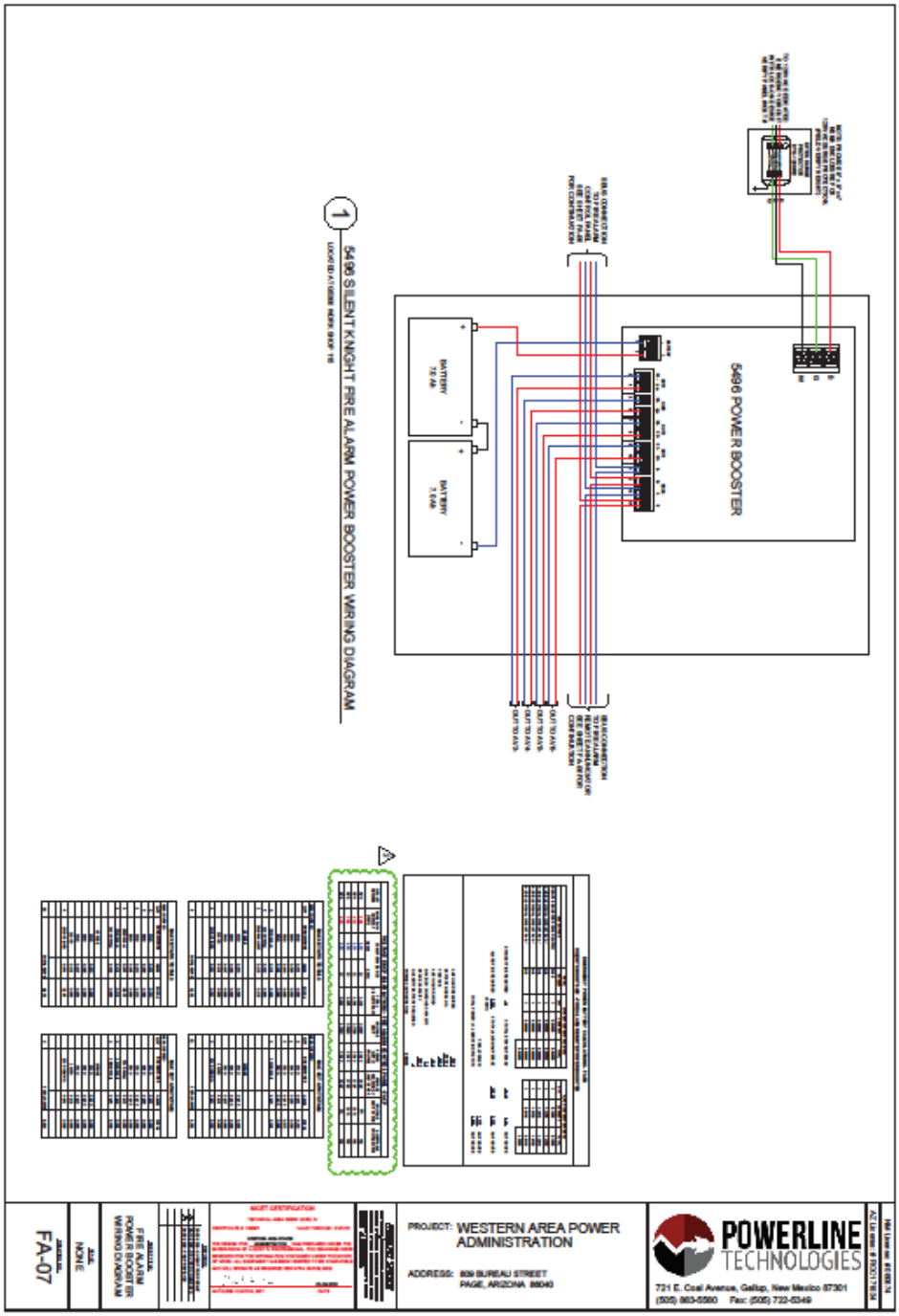
5.


FIRE ALARM SYSTEM RISER DIAGRAM
GROUND FLOOR
DEVICE LEGEND
WIRE SCHEDULE
SHEET NOTES
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 800 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FA-05
FIRE ALARM SYSTEM RISER DIAGRAM

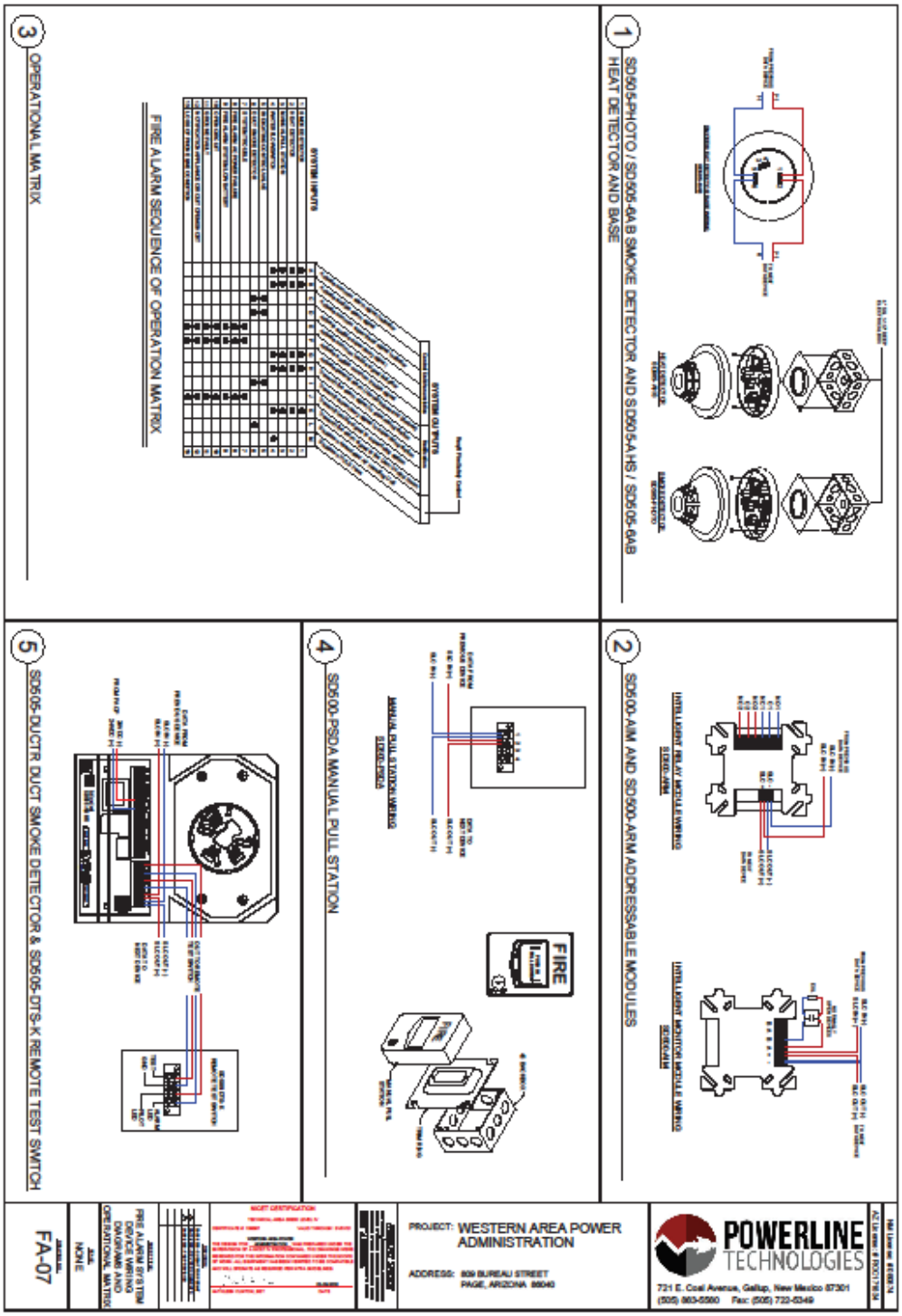

6808 SILENT KNIGHT FIRE ALARM CONTROL PANEL WIRING DIAGRAM
5980 REMOTE ANNUNCIATOR
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5590 Fax: (505) 722-5349
FA-06
FIRE ALARM CONTROL PANEL WIRING DIAGRAM

6.

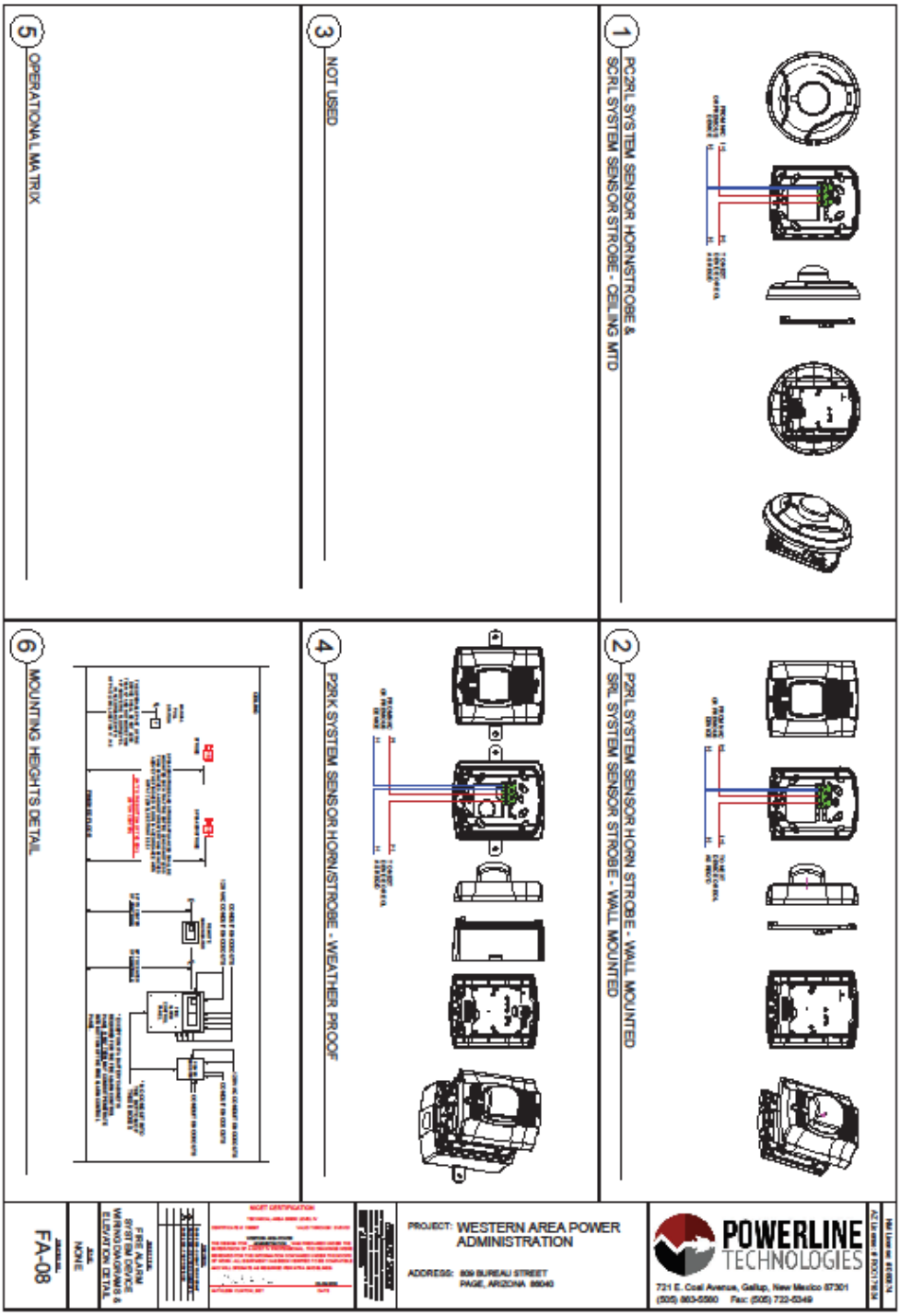
7.


5496 POWER BOOSTER
BATTERY
BATTERY
1
5496 SILENT KNIGHT FIRE ALARM POWER BOOSTER WIRING DIAGRAM
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE
TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FIRE ALARM
POWER BOOSTER
WIRING DIAGRAM
NONE
FA-07

8.

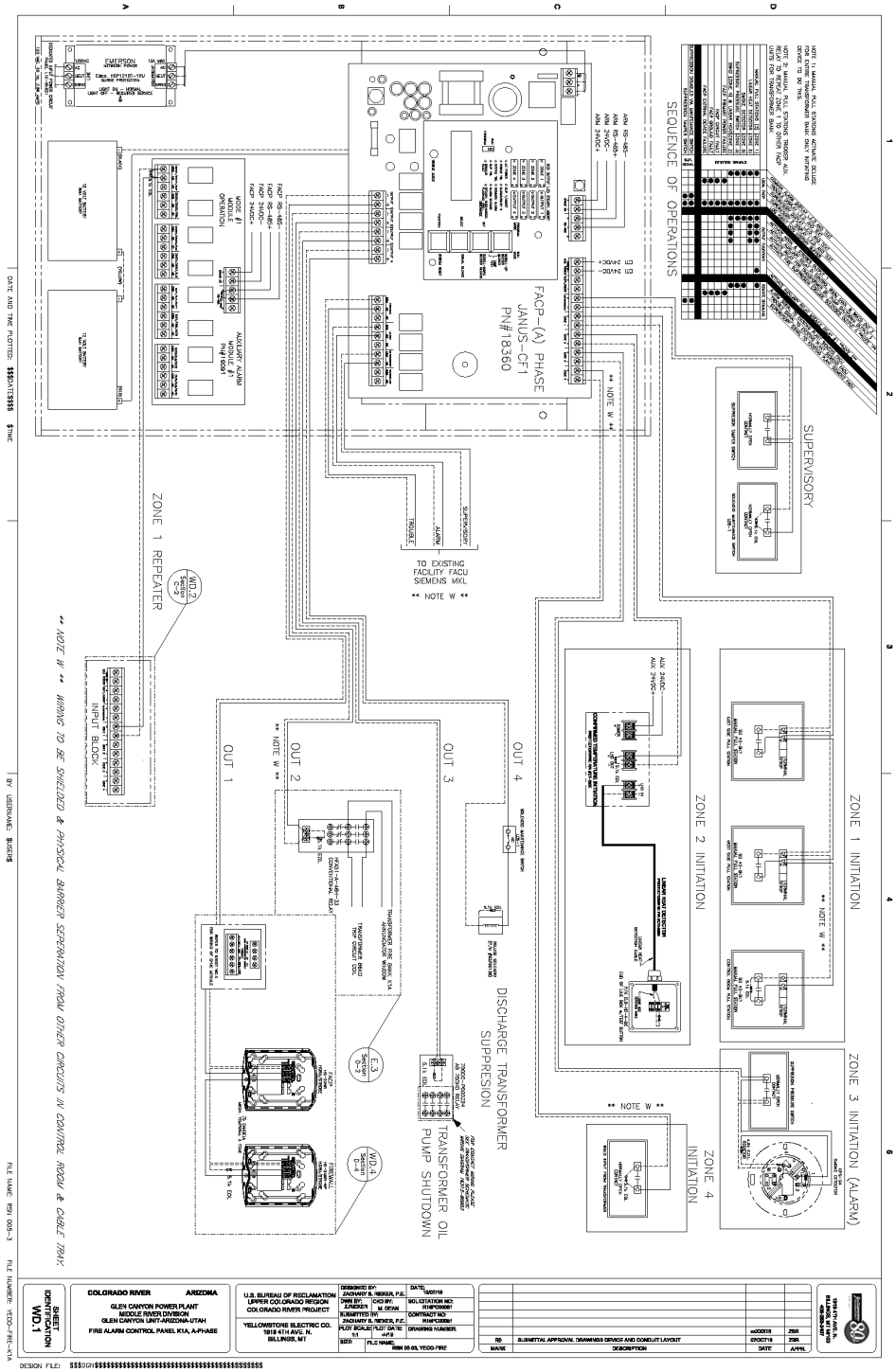

1
SD505-PHOTO / SD505-4A B SMOKE DETECTOR AND SD505-A HS / SD505-6AB HEAT DETECTOR AND BASE
2
SD500-AIM AND SD500-ARM ADDRESSABLE MODULES
INTELLIGENT RELAY MODULE WIRING
SD500-ARM
INTELLIGENT MONITOR MODULE WIRING
SD500-AIM
3
OPERATIONAL MATRIX
FIRE ALARM SEQUENCE OF OPERATION MATRIX
SYSTEM INPUTS
SYSTEM OUTPUTS
4
SD500-PSDA MANUAL PULL STATION
MANUAL PULL STATION WIRING
SD500-PSDA
FIRE
5
SD505-DUCTR DUCT SMOKE DETECTOR & SD505-DTS-K REMOTE TEST SWITCH
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET
PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FA-07
NONE
FIRE ALARM SYSTEM DEVICE WIRING DIAGRAMS AND OPERATIONAL MATRIX

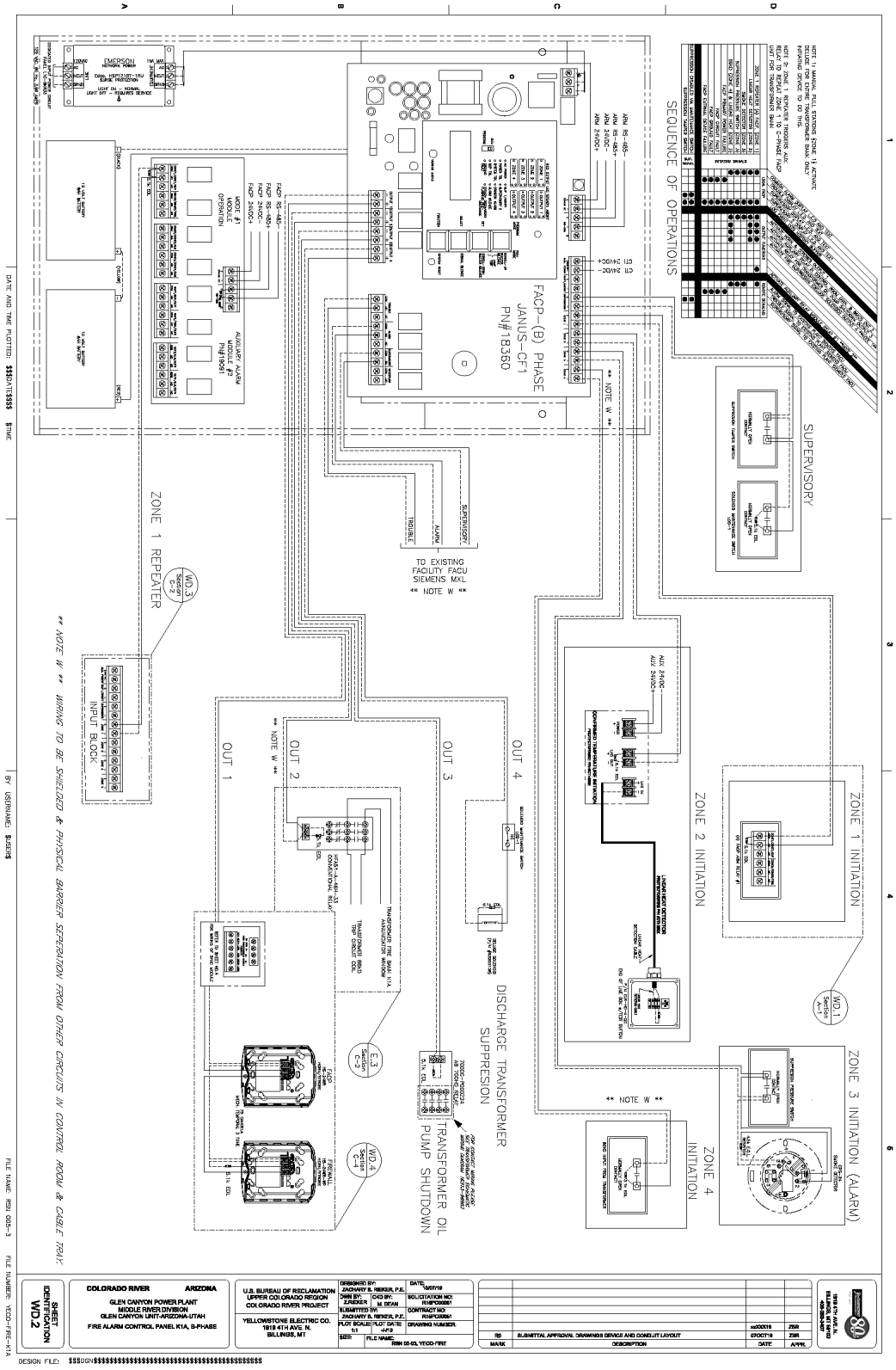
9.

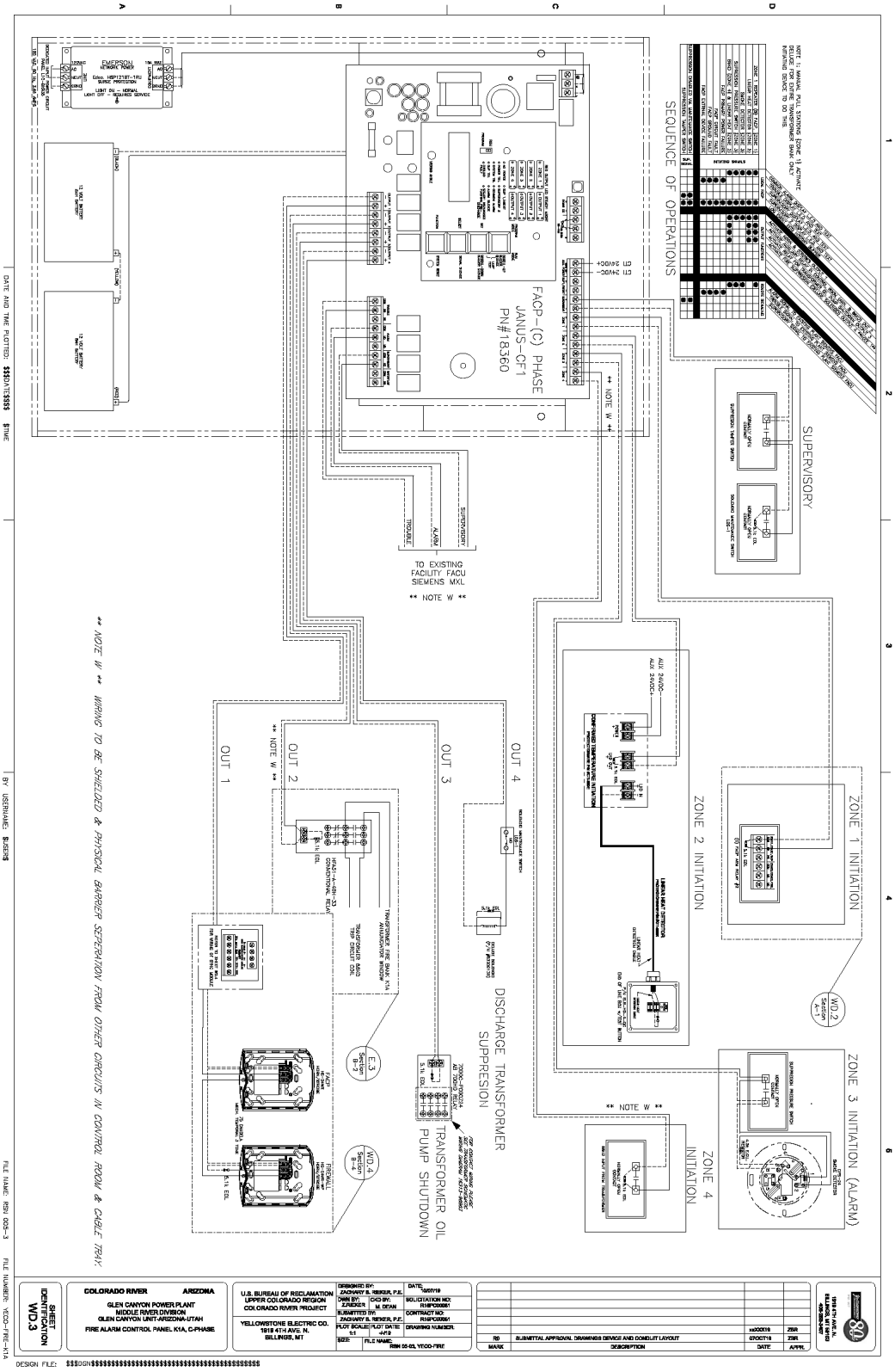

1 PC2RL SYSTEM SENSOR HORN/STROBE & SCRL SYSTEM SENSOR STROBE - CEILING MTD
2 P2RL SYSTEM SENSOR HORN STROBE - WALL MOUNTED SRL SYSTEM SENSOR STROBE - WALL MOUNTED
3 NOT USED
4 P2RK SYSTEM SENSOR HORN/STROBE - WEATHER PROOF
5 OPERATIONAL MATRIX
6 MOUNTING HEIGHTS DETAIL
PROJECT: WESTERN AREA POWER ADMINISTRATION
ADDRESS: 809 BUREAU STREET PAGE, ARIZONA 86040
POWERLINE TECHNOLOGIES
721 E. Coal Avenue, Gallup, New Mexico 87301
(505) 863-5560 Fax: (505) 722-5349
FA-08
NONE
FIRE ALARM SYSTEM DEVICE WIRING DIAGRAMS & ELEVATION DETAIL

1.02 TRANSFORMER DELUGE RELEASE PANEL DRAWINGS

A. Drawings provided for information only.

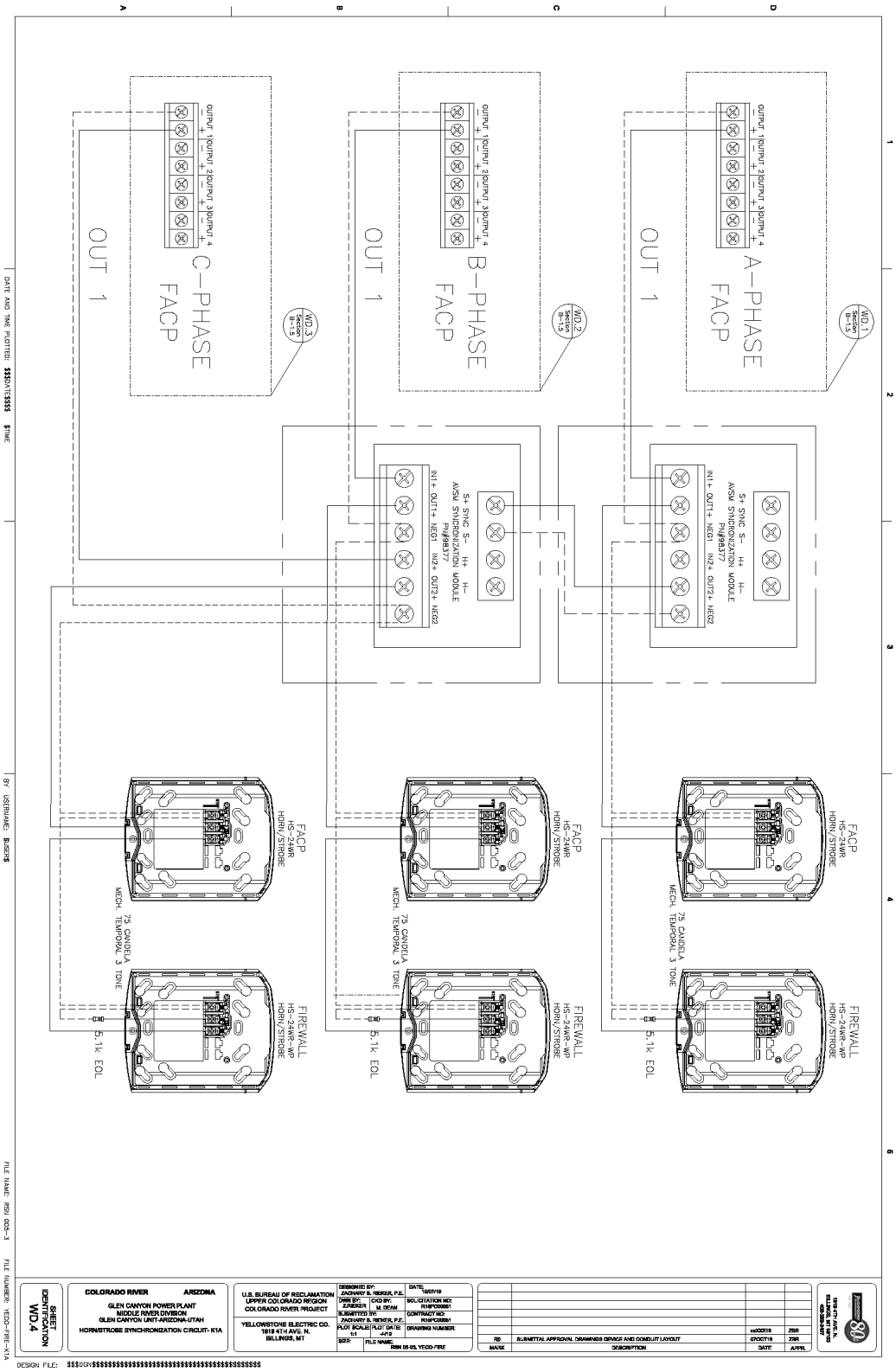
1. 
SEQUENCE OF OPERATIONS
FACP-(A) PHASE
JANUS-CF1
PN#18360
SUPERVISORY
ZONE 1 INITIATION
ZONE 2 INITIATION
ZONE 3 INITIATION (ALARM)
ZONE 4 INITIATION
ZONE 1 REPEATER
TO EXISTING FACILITY FACU SIEMENS MXL
** NOTE W **
OUT 1
OUT 2
OUT 3
OUT 4
DISCHARGE TRANSFORMER SUPPRESION
TRANSFORMER OIL PUMP SHUTDOWN
** NOTE W ** WIRING TO BE SHIELDED & PHYSICAL BARRIER SEPARATION FROM OTHER CIRCUITS IN CONTROL ROOM & CABLE TRAY.
COLORADO RIVER ARIZONA
GLEN CANYON POWER PLANT
MIDDLE RIVER DIVISION
GLEN CANYON UNIT-ARIZONA-UTAH
FIRE ALARM CONTROL PANEL K1A, A-PHASE
SHEET IDENTIFICATION W0.1
U.S. BUREAU OF RECLAMATION
UPPER COLORADO REGION
COLORADO RIVER PROJECT
YELLOWSTONE ELECTRIC CO.
1818 4TH AVE. N.
BILLINGS, MT
DESIGNED BY: ZACHARY S. RENGER, P.E.
DATE: 10/07/15
SOLICITATION NO.: R14PC00087
CONTRACT NO.: R14PC00087
DRAWING NUMBER: RSN 06-03, YECO-FIRE
R0 SUBMITTAL APPROVAL DRAWINGS DEVICE AND CONDUIT LAYOUT
DESIGN FILE: $$$$DGN$$$


SEQUENCE OF OPERATIONS
SUPERVISORY
FACP-(B) PHASE
JANUS-CF1
PN#18360
ZONE 1 REPEATER
TO EXISTING FACILITY FACU SIEMENS MXL
** NOTE W **
ZONE 1 INITIATION
ZONE 2 INITIATION
ZONE 3 INITIATION (ALARM)
ZONE 4 INITIATION
DISCHARGE TRANSFORMER SUPPRESION
TRANSFORMER OIL PUMP SHUTDOWN
OUT 1
OUT 2
OUT 3
OUT 4
INPUT BLOCK
** NOTE W ** WIRING TO BE SHIELDED & PHYSICAL BARRIER SEPERATION FROM OTHER CIRCUITS IN CONTROL ROOM & CABLE TRAY.
COLORADO RIVER ARIZONA
GLEN CANYON POWER PLANT
MIDDLE RIVER DIVISION
GLEN CANYON UNIT-ARIZONA-UTAH
FIRE ALARM CONTROL PANEL K1A, S-PHASE
SHEET IDENTIFICATION WD.2
U.S. BUREAU OF RECLAMATION
UPPER COLORADO REGION
COLORADO RIVER PROJECT
YELLOWSTONE ELECTRIC CO.
1818 4TH AVE. N.
BILLINGS, MT
DESIGNED BY: ZACHARY B. RIEMER, P.E.
DRAWN BY: J.FUDEKER
CHKD BY: M. DEAN
SOLICITATION NO.: R18PC00061
SUBMITTED BY: ZACHARY B. RIEMER, P.E.
CONTRACT NO.: R18PC00061
PLOT SCALE: 1:1
PLOT DATE: APR
DRAWING NUMBER:
SIZE:
FILE NAME: RSN 05-03, YECO-FIRE
R0 SUBMITTAL APPROVAL DRAWINGS DEVICE AND CONDUIT LAYOUT 07OCT18 ZBR
MARK DESCRIPTION DATE APPR.
DESIGN FILE: $$$DGN$$$


SEQUENCE OF OPERATIONS
FACP-(C) PHASE
JANUS-GF1
PN#18360
SUPERVISORY
ZONE 1 INITIATION
ZONE 2 INITIATION
ZONE 3 INITIATION (ALARM)
ZONE 4 INITIATION
DISCHARGE TRANSFORMER SUPPRESION
TRANSFORMER OIL PUMP SHUTDOWN
TO EXISTING FACILITY FACU SIEMENS MXL
** NOTE W **
** NOTE W ** WIRING TO BE SHIELDED & PHYSICAL BARRIER SEPERATION FROM OTHER CIRCUITS IN CONTROL ROOM & CABLE TRAY.
OUT 1
OUT 2
OUT 3
OUT 4
COLORADO RIVER ARIZONA
GLEN CANYON POWER PLANT
MIDDLE RIVER DIVISION
GLEN CANYON UNIT-ARIZONA-UTAH
FIRE ALARM CONTROL PANEL K1A, C-PHASE
U.S. BUREAU OF RECLAMATION
UPPER COLORADO REGION
COLORADO RIVER PROJECT
YELLOWSTONE ELECTRIC CO.
1919 4TH AVE. N.
BILLINGS, MT
SHEET IDENTIFICATION WD.3
SUBMITTAL APPROVAL DRAWINGS DEVICE AND CONDUIT LAYOUT
DESIGN FILE:

3.

4.


A–PHASE FACP
B–PHASE FACP
C–PHASE FACP
OUT 1
OUTPUT 1 OUTPUT 2 OUTPUT 3 OUTPUT 4
WD.1 Section B-1.5
WD.2 Section B-1.5
WD.3 Section B-1.5
S+ SYNC S- H+ H-
AVSM SYNCHRONIZATION MODULE PN#94377
IN1+ OUT1+ NEG1 IN2+ OUT2+ NEG2
FACP HS-24WR HORN/STROBE
FIREWALL HS-24WR-WP HORN/STROBE
75 CANDELA MECH. TEMPORAL 3 TONE
5.1k EOL
COLORADO RIVER ARIZONA
GLEN CANYON POWER PLANT
MIDDLE RIVER DIVISION
GLEN CANYON UNIT-ARIZONA-UTAH
HORN/STROBE SYNCHRONIZATION CIRCUIT- K1A
SHEET IDENTIFICATION WD.4
U.S. BUREAU OF RECLAMATION
UPPER COLORADO REGION
COLORADO RIVER PROJECT
YELLOWSTONE ELECTRIC CO.
1618 4TH AVE. N.
BILLINGS, MT
DESIGNED BY: ZACHARY B. RIEKER, P.E.
DATE: 10/07/19
DWN BY: J.KIRCHER
CKD BY: M. DEAN
SOLICITATION NO: R18PX00661
SUBMITTED BY: ZACHARY B. RIEKER, P.E.
CONTRACT NO: R18PC00061
PLOT SCALE: 1:1
PLOT DATE: -4/12
DRAWING NUMBER:
SIZE:
FILE NAME: RSN 05 03, YECO-FIRE
MARK DESCRIPTION DATE APPR.
00 SUBMITTAL APPROVAL DRAWINGS DEVICE AND CONDUIT LAYOUT 07OCT19 ZBR
DATE AND TIME PLOTTED: $$$$DATE$$$$ $$$$TIME
BY USERNAME: $$$$USER$$$
FILE NAME: RSN 05-03-3
FILE NUMBER: YECO-FIRE-K1A
DESIGN FILE: $$$$DGN$$$$

FACP A-PHASE CALCULATIONS

INPUT IMPEDANCE CHECKS				
REQUIREMENT: < 100 Ω				
ZONE:	WIRE	LENGTH	Ω	PASS/FAIL
ZONE 1:	14 AWG	3450'	11.01	PASS
ZONE 2:	14 AWG	200'	0.64	PASS
ZONE 3:	18 AWG	120'	0.97	PASS
ZONE 4:	18 AWG	1600'	12.93	PASS
SUP 2:	18 AWG	120'	0.97	PASS
Note Table 8 Conductor Properties of NEC 2015 used for resistance.				

VOLTAGE DROP CALCULATIONS							
REQUIREMENT: < 3.6 VOLTS PER CIRCUIT							
OUTPUT:	CIRCUIT DESCRIPTION	CURRENT DRAW mA	WIRE	LENGTH	Ω	VOLTAGE DROP	PASS/FAIL
OUTPUT 1:	SYNC MODULE & 2 HORN/STROBES	118	14 AWG	200	0.64	0.075	PASS
OUTPUT 2:	HFA51 Relay for Annuciator & 86KD	325	14 AWG	1500'	4.79	1.555	PASS
OUTPUT 3:	AB 700 HD Relay for Oil Pump Shutdown	529	14 AWG	200'	0.64	0.338	PASS
OUTPUT 4:	Deluge Solenoid	333	14 AWG	20'	0.06	0.021	PASS
Note Table 8 Conductor Properties of NEC 2015 used for resistance.							

BATTERY CALCULATIONS		
DEVICE/CIRCUIT	SUPERVISORY (mA)	ALARM (mA)
FACP	121	274
ARM:	11	139
INPUTS:	19	0
OUTPUTS incl. SYNC:	19	1305
SUP 2:	5	0
CTI MODULE:	66	NA
TOTALS:	241	1718
STANDBY @ 24 HOURS (Amp-Hours)	5.77	NA
ALARM @ .25 HOURS (Amp-Hours)	NA	0.4295

Amp-Hour Required (Standby+Alarm)*1.2: 7.44 Amp-Hours

FACP B-PHASE CALCULATIONS

INPUT IMPEDANCE CHECKS				
REQUIREMENT: < 100 Ω				
ZONE:	WIRE	LENGTH	Ω	PASS/FAIL
ZONE 1:	18 AWG	20'	0.16	PASS
ZONE 2:	14 AWG	200'	0.64	PASS
ZONE 3:	18 AWG	120'	0.97	PASS
ZONE 4:	18 AWG	1600'	12.93	PASS
SUP 2:	18 AWG	120'	0.97	PASS
Note Table 8 Conductor Properties of NEC 2015 used for resistance.				

VOLTAGE DROP CALCULATIONS							
REQUIREMENT: < 3.6 VOLTS PER CIRCUIT							
OUTPUT:	CIRCUIT DESCRIPTION	CURRENT DRAW mA	WIRE	LENGTH	Ω	VOLTAGE DROP	PASS/FAIL
OUTPUT 1:	SYNC MODULE & 2 HORN/STROBES	118	14 AWG	200	0.64	0.075	PASS
OUTPUT 2:	HFA51 Relay for Annuciator & 86KD	325	14 AWG	1500'	4.79	1.555	PASS
OUTPUT 3:	AB 700 HD Relay for Oil Pump Shutdown	529	14 AWG	200'	0.64	0.338	PASS
OUTPUT 4:	Deluge Solenoid	333	14 AWG	20'	0.06	0.021	PASS
Note Table 8 Conductor Properties of NEC 2015 used for resistance.							

BATTERY CALCULATIONS		
DEVICE/CIRCUIT	SUPERVISORY (mA)	ALARM (mA)
FACP	121	274
ARM:	11	139
INPUTS:	19	0
OUTPUTS incl. SYNC:	19	1305
SUP 2:	5	0
CTI MODULE:	66	NA
TOTALS:	241	1718
STANDBY @ 24 HOURS (Amp-Hours)	5.77	NA
ALARM @ .25 HOURS (Amp-Hours)	NA	0.4295

Amp-Hour Required (Standby+Alarm)*1.2: 7.44 Amp-Hours

FACP C-PHASE CALCULATIONS

INPUT IMPEDANCE CHECKS				
REQUIREMENT: < 100 Ω				
ZONE:	WIRE	LENGTH	Ω	PASS/FAIL
ZONE 1:	18 AWG	20'	0.16	PASS
ZONE 2:	14 AWG	200'	0.64	PASS
ZONE 3:	18 AWG	120'	0.97	PASS
ZONE 4:	18 AWG	1600'	12.93	PASS
SUP 2:	18 AWG	120'	0.97	PASS
Note Table 8 Conductor Properties of NEC 2015 used for resistance.				

VOLTAGE DROP CALCULATIONS							
REQUIREMENT: < 3.6 VOLTS PER CIRCUIT							
OUTPUT:	CIRCUIT DESCRIPTION	CURRENT DRAW mA	WIRE	LENGTH	Ω	VOLTAGE DROP	PASS/FAIL
OUTPUT 1:	SYNC MODULE & 2 HORN/STROBES	118	14 AWG	200	0.64	0.075	PASS
OUTPUT 2:	HFA51 Relay for Annuciator & 86KD	325	14 AWG	1500'	4.79	1.555	PASS
OUTPUT 3:	AB 700 HD Relay for Oil Pump Shutdown	529	14 AWG	200'	0.64	0.338	PASS
OUTPUT 4:	Deluge Solenoid	333	14 AWG	20'	0.06	0.021	PASS
Note Table 8 Conductor Properties of NEC 2015 used for resistance.							

BATTERY CALCULATIONS		
DEVICE/CIRCUIT	SUPERVISORY (mA)	ALARM (mA)
FACP	121	274
INPUTS:	19	0
OUTPUTS incl. SYNC:	19	1305
SUP 2:	5	0
CTI MODULE:	66	NA
TOTALS:	229	1579
STANDBY @ 24 HOURS (Amp-Hours)	5.50	NA
ALARM @ .25 HOURS (Amp-Hours)	NA	0.39475

Amp-Hour Required (Standby+Alarm)*1.2: 7.08 Amp-Hours

DATE AND TIME PLOTTED: $$$DATE$$$$ $TIME | BY USERNAME: $USER$ | FILE NAME: RSN 005-3 | FILE NUMBER: YECO-FIRE-K1A

1918 4TH AVE. N.
BILLINGS, MT 59103
406-259-2457

MARK	DESCRIPTION	DATE	BY
00	ISSUED FOR APPROVAL, DRAWINGS SERVICE AND COMPLIT LAYOUT	10/20/15	ZSR

DESIGNED BY: ZACHARY A. REDDER, P.E. | DATE: 10/20/15
DRAWN BY: ZACHARY A. REDDER | SOLICITATION NO.: R15-PD-00000
CHECKED BY: ZACHARY A. REDDER, P.E. | SUBMITTAL NO.: R15-PD-00000
APPROVED BY: ZACHARY A. REDDER, P.E. | CONTRACT NO.: R15-PD-00000
SCALE: NONE | SHEET SIZE: 11 x 17 | DRAWING NUMBER: WD.5
SHEET: 51 | FILE NAME: RSN 005-3, YECO-FIRE

U.S. BUREAU OF RECLAMATION
LOWER COLORADO REGION
COLORADO RIVER PROJECT

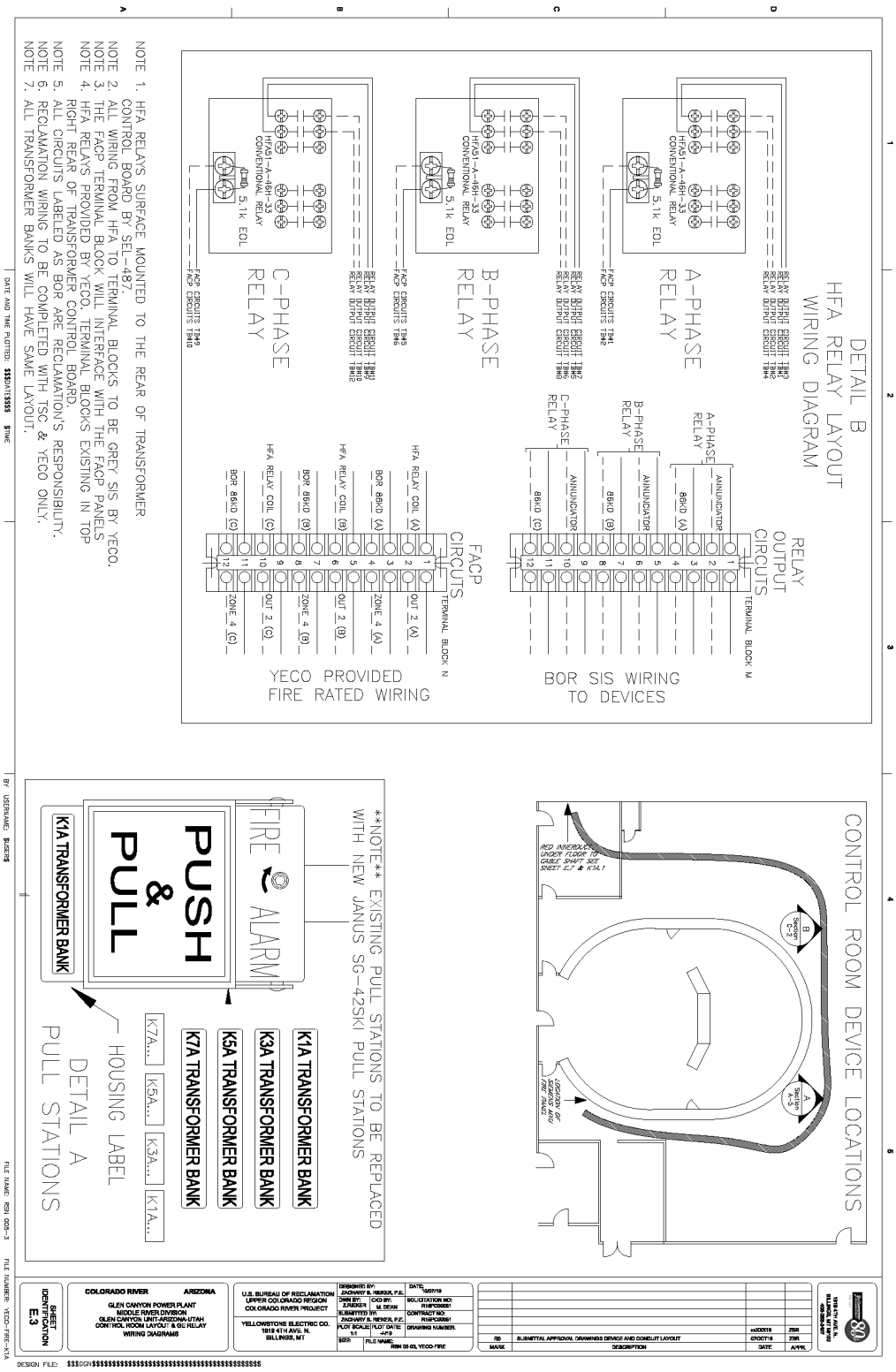
YELLOWSTONE ELECTRIC CO.
1918 4TH AVE. N.
BILLINGS, MT

COLORADO RIVER — ARIZONA
GLEN CANYON POWER PLANT
GLEN CANYON DAM, ARIZONA
GLEN CANYON UNIT, ARIZONA-UTAH
BATTERY, IMPEDANCE & VOLTAGE DROP CALCS

SHEET IDENTIFICATION
WD.5

DESIGN FILE: $$$$$

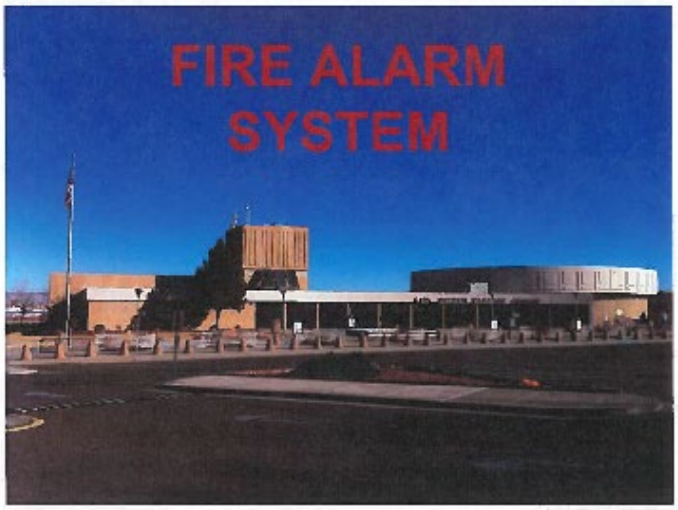
6.


DETAIL B
HFA RELAY LAYOUT
WIRING DIAGRAM
A-PHASE RELAY
B-PHASE RELAY
C-PHASE RELAY
RELAY OUTPUT CIRCUITS
FACP CIRCUITS
YECO PROVIDED FIRE RATED WIRING
BOR SIS WIRING TO DEVICES
NOTE 1. HFA RELAYS SURFACE MOUNTED TO THE REAR OF TRANSFORMER CONTROL BOARD BY SEL-487.
NOTE 2. ALL WIRING FROM HFA TO TERMINAL BLOCKS TO BE GREY SIS BY YECO.
NOTE 3. THE FACP TERMINAL BLOCK WILL INTERFACE WITH THE FACP PANELS
NOTE 4. HFA RELAYS PROVIDED BY YECO. TERMINAL BLOCKS EXISTING IN TOP RIGHT REAR OF TRANSFORMER CONTROL BOARD.
NOTE 5. ALL CIRCUITS LABELED AS BOR ARE RECLAMATION'S RESPONSIBILITY.
NOTE 6. RECLAMATION WIRING TO BE COMPLETED WITH TSC & YECO ONLY.
NOTE 7. ALL TRANSFORMER BANKS WILL HAVE SAME LAYOUT.
CONTROL ROOM DEVICE LOCATIONS
NOTE EXISTING PULL STATIONS TO BE REPLACED WITH NEW JANUS SG-42SKI PULL STATIONS
FIRE ALARM
PUSH & PULL
K1A TRANSFORMER BANK
K3A TRANSFORMER BANK
K5A TRANSFORMER BANK
K7A TRANSFORMER BANK
HOUSING LABEL
DETAIL A
PULL STATIONS
COLORADO RIVER ARIZONA
GLEN CANYON POWER PLANT
MIDDLE RIVER DIVISION
GLEN CANYON UNIT-ARIZONA-UTAH
CONTROL ROOM LAYOUT & GE RELAY WIRING DIAGRAMS
SHEET IDENTIFICATION E.3
U.S. BUREAU OF RECLAMATION
UPPER COLORADO REGION
COLORADO RIVER PROJECT
YELLOWSTONE ELECTRIC CO.
1918 4TH AVE. N.
BILLINGS, MT
SUBMITTAL APPROVAL DRAWINGS DEVICE AND CONDUIT LAYOUT

1.03 DRAWINGS OF FIRE ALARM SYSTEM FOR CARL HAYDEN VISITOR CENTER

A. Drawings provided for information only.

GLEN CANYON DAM
VISITORS CENTER



February 4, 2011

INTEGRATED CONTROLS AND ELECTRIC INC.

(801) 719-0540

3920 So. 3750 W.
West Haven, UT 84401

Parts List

Glen Canyon Dam Fire

FACP & SLC Devices

Description	Manufacture	Part Number	Quantity
cSIMON Fire Panel	Computrols	cSimon-AA	1
CBAS Commercial Software w/Fire Integration	Computrols	CBAS Professional Software	1
12V 35aH Battery	Power Sonic	PS-12350NB	2
Optical Monitor Smoke Detector	Apollo	58000-650APO	59
Smoke Detector Mounting Base	Apollo	45681-250	59
Mini Priority Switch Monitor (Pull Station)	Apollo	55000-830	11
Mini Priority Switch Monitor (Duct Smoke Det.)	Apollo	55000-830	3
Mini Priority Switch Monitor (Dialer)	Apollo	55000-830	1
Switch I/O Monitor (NAC Panels)	Apollo	55000-820	2
Switch I/O Monitor (Recall Elev to 1st Floor)	Apollo	55000-820	1
Switch I/O Monitor (Recall Elev to Dam Top)	Apollo	55000-820	1
Switch I/O Monitor (First Floor Alarm Notifier)	Apollo	55000-820	1
Switch I/O Monitor (Basement Alarm Notifier)	Apollo	55000-820	1
Dialer	Fire Lite	411UD	1
Duct Smoke Detector	System Sensor	D4120	3
Flame Sensor	Takex	FS-2000E	1
Pull Station	Cooper Wheelock	MPS-100	11

NAC Devices

Description	Manufacture	Part Number	Quantity
Power Supply Panel	Altronix	AL802ULADA	2
12V 7aH Battery	Power Sonic	PS127	4
Horn Strobe Indoor	Cooper Notification	HS4-24MCW-FR	79
Horn Strobe Weatherproof	Cooper Notification	ASWP-2475W-FR	4
Weatherproof Backbox	Cooper Wheelock	WP6B-R	4
Damage Protector	STI	STI-1210E	4

Spare Devices

Description	Manufacture	Part Number	Quantity
Optical Monitor Smoke Detector	Apollo	58000-650APO	2
Smoke Detector Mounting Base	Apollo	45681-250	2
Mini Priority Switch Monitor	Apollo	55000-830	2
Switch I/O Monitor	Apollo	55000-820	1
Duct Smoke Detector	System Sensor	D4120	2
Flame Sensor	Takex	FS-2000E	1
Pull Station	Cooper Wheelock	MPS-100	2
Horn Strobe Indoor	Cooper Notification	HS4-24MCW-FR	2

Device Count

Glen Canyon Dam Fire

Building Device Totals

Horn Strobe	29
Weather Proof Horn Strobe	4
Smoke Detector	59
Duct Smoke Detector	3
Pull Station	11
Flame Sensor	1
Mini Monitor	16
I/O Monitor	6

Spare Devices

Horn Strobe	2
Smoke Detector w/base	2
Duct Smoke Detector	2
Pull Station	2
Flame Sensor	1
I/O Monitor	1
Mini Monitor	2

Basement Level Devices

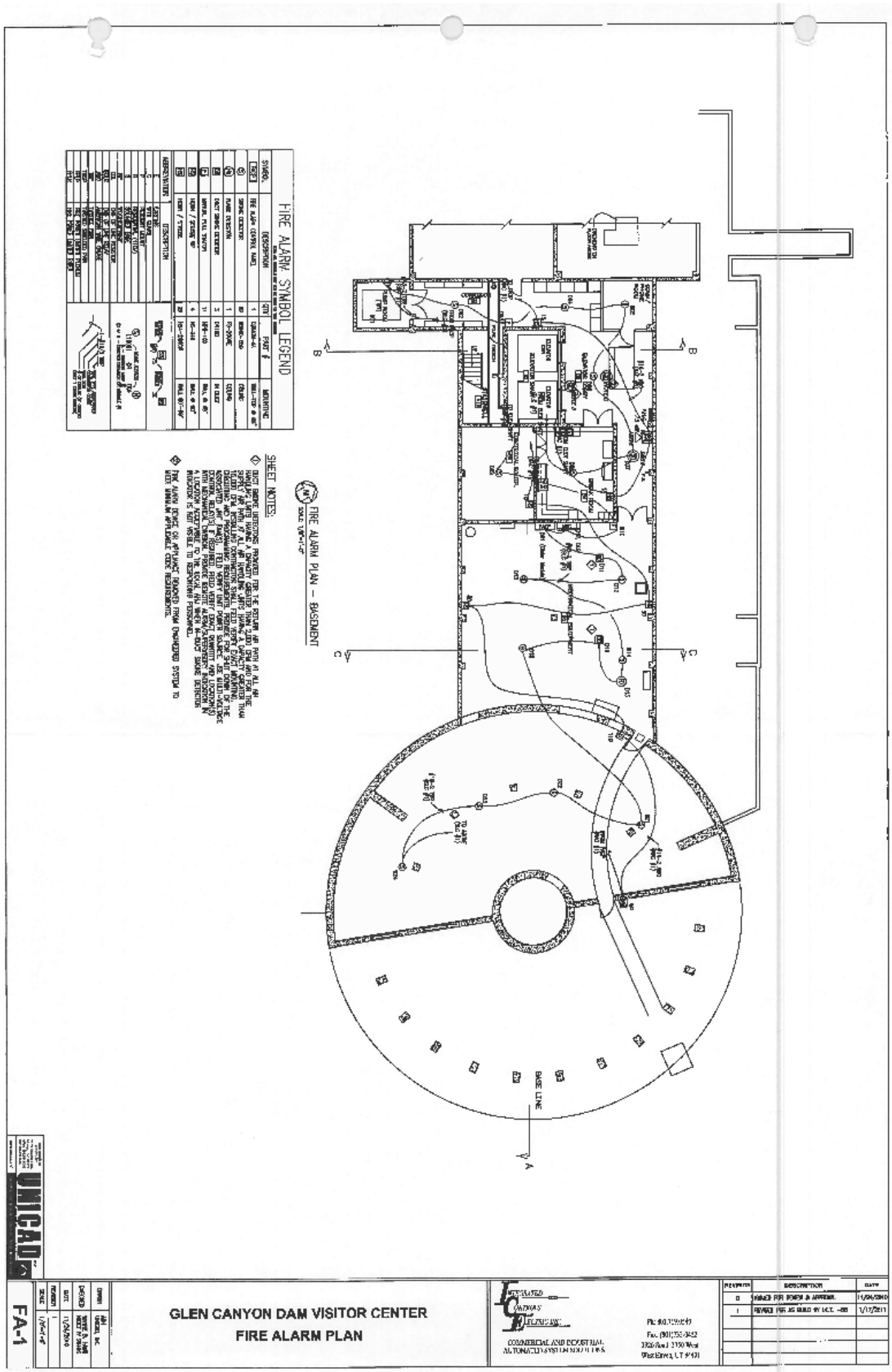
Horn Strobe	7
Weather Proof Horn Strobe	1
Smoke Detector	16
Duct Smoke Detector	2
Pull Station	2
Flame Sensor	1
Dialer	1
Mini Monitor	6
I/O Monitor	2

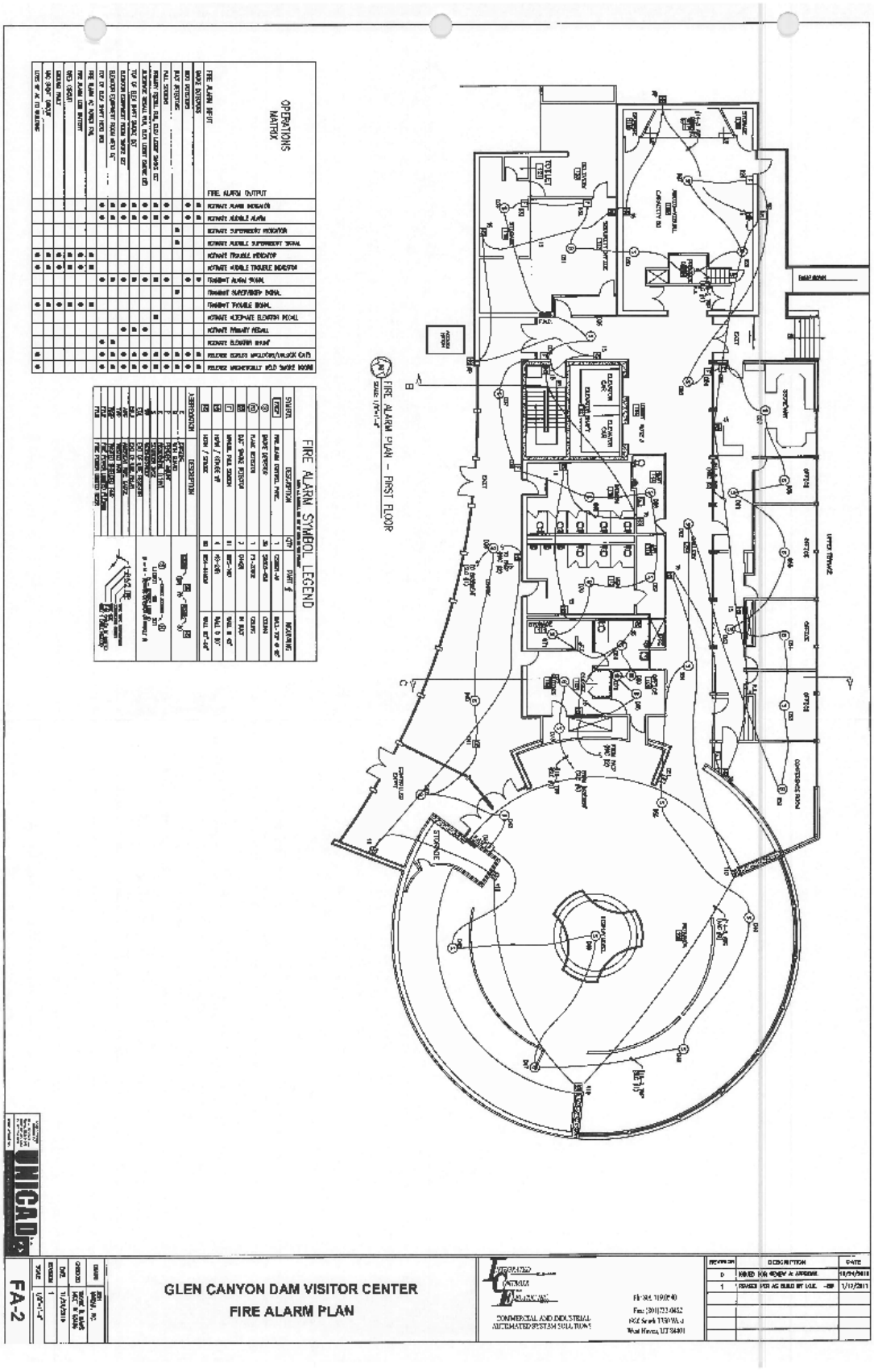
First Floor Level Devices

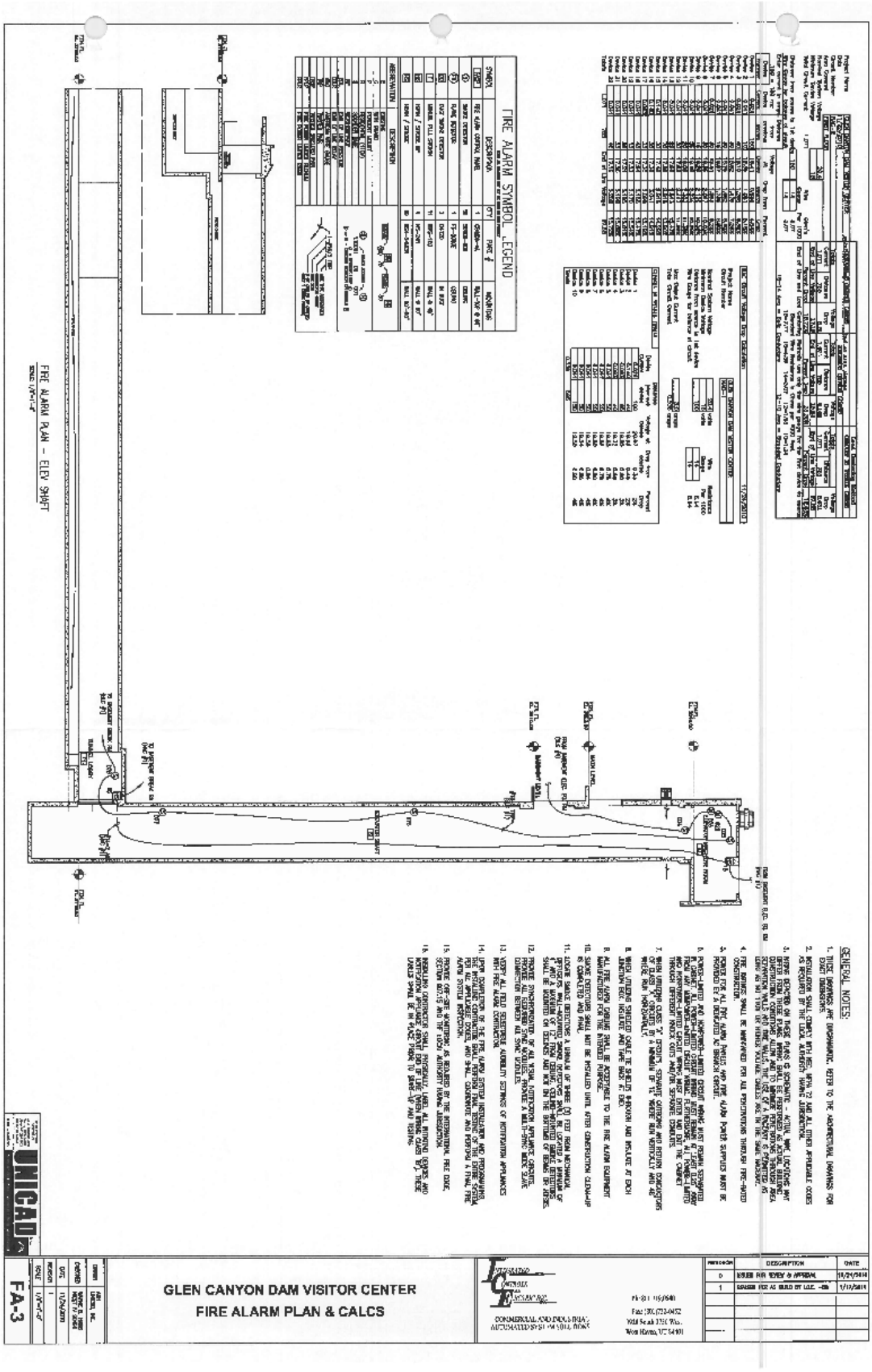
Horn Strobe	20
Weather Proof Horn Strobe	3
Smoke Detector	38
Duct Smoke Detector	1
Pull Station	9
Mini Monitor	10
I/O Monitor	2

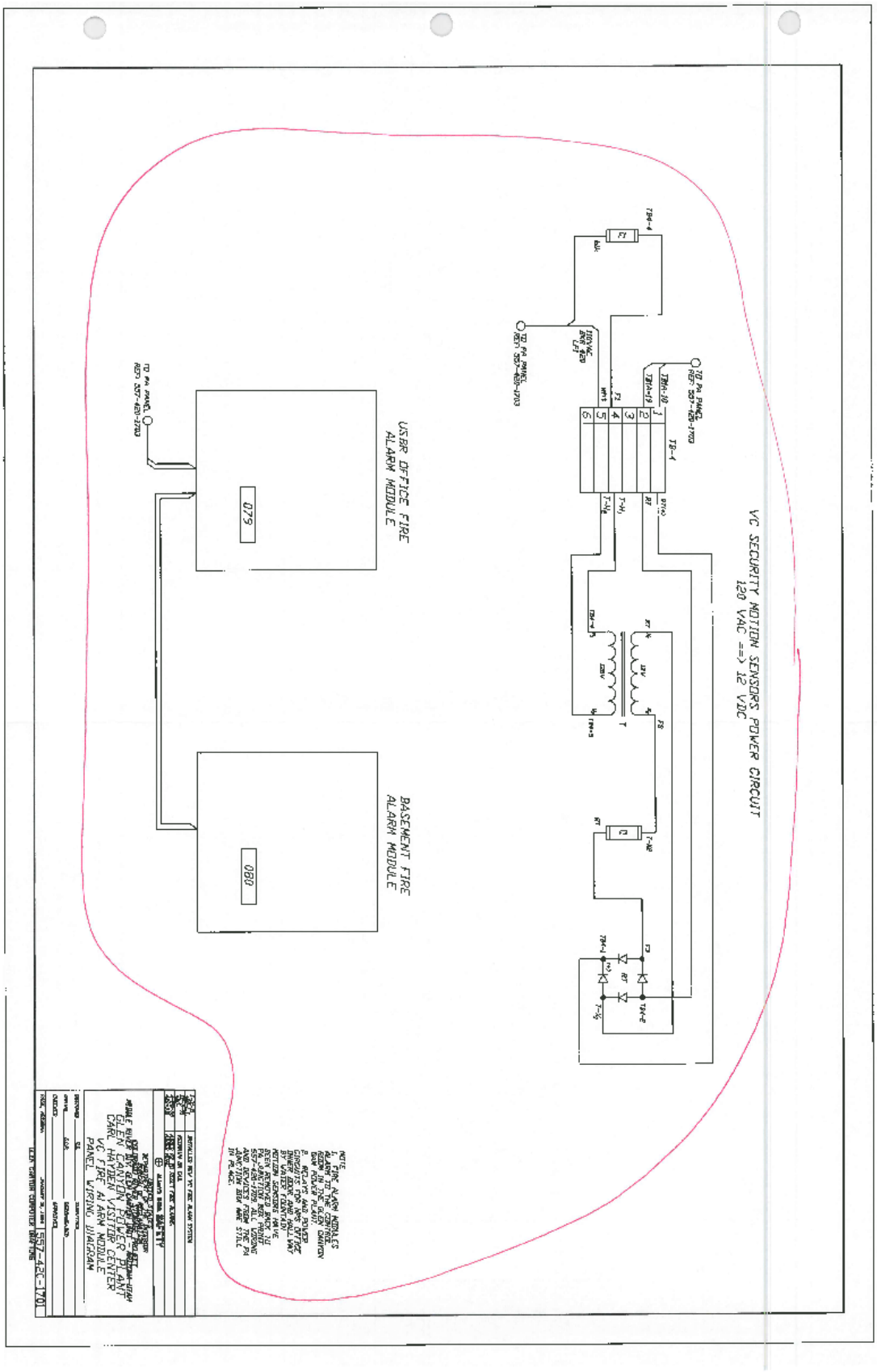
Elevator Shaft Devices

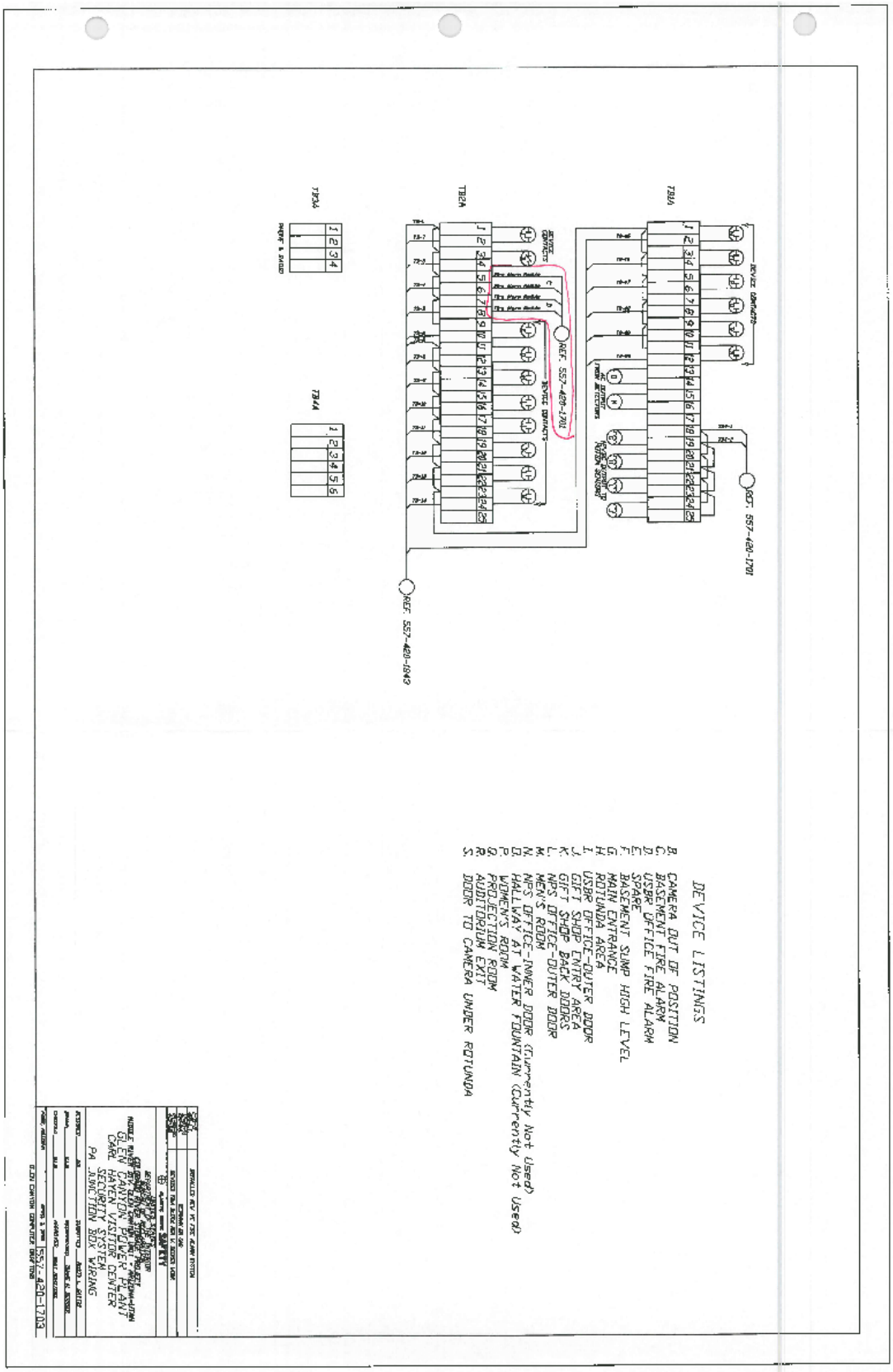
Horn Strobe	2
Smoke Detector	5
I/O Monitor	2

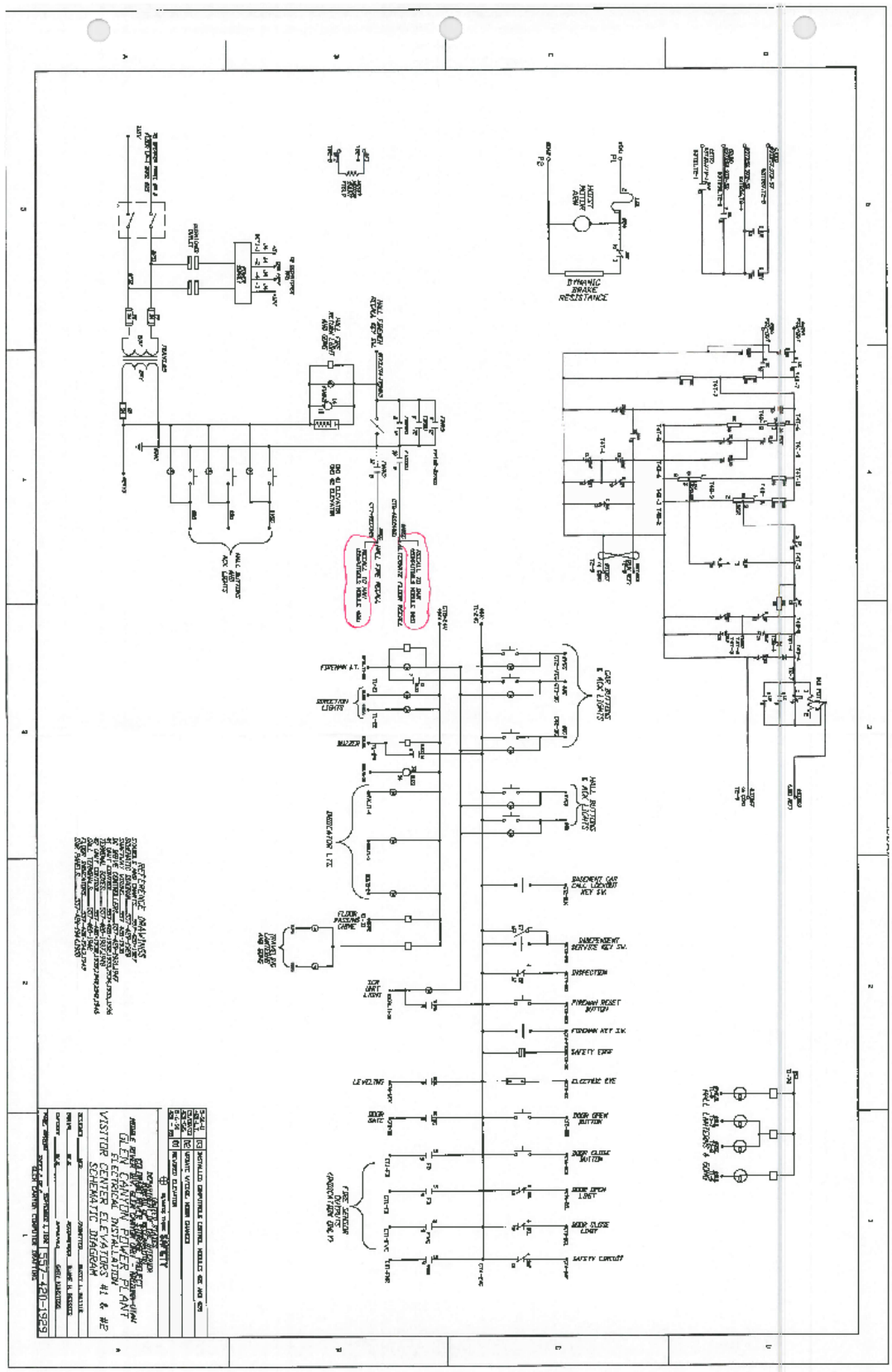

FIRE ALARM SYMBOL LEGEND
FIRE ALARM PLAN – BASEMENT
SHEET NOTES:
GLEN CANYON DAM VISITOR CENTER
FIRE ALARM PLAN
FA-1

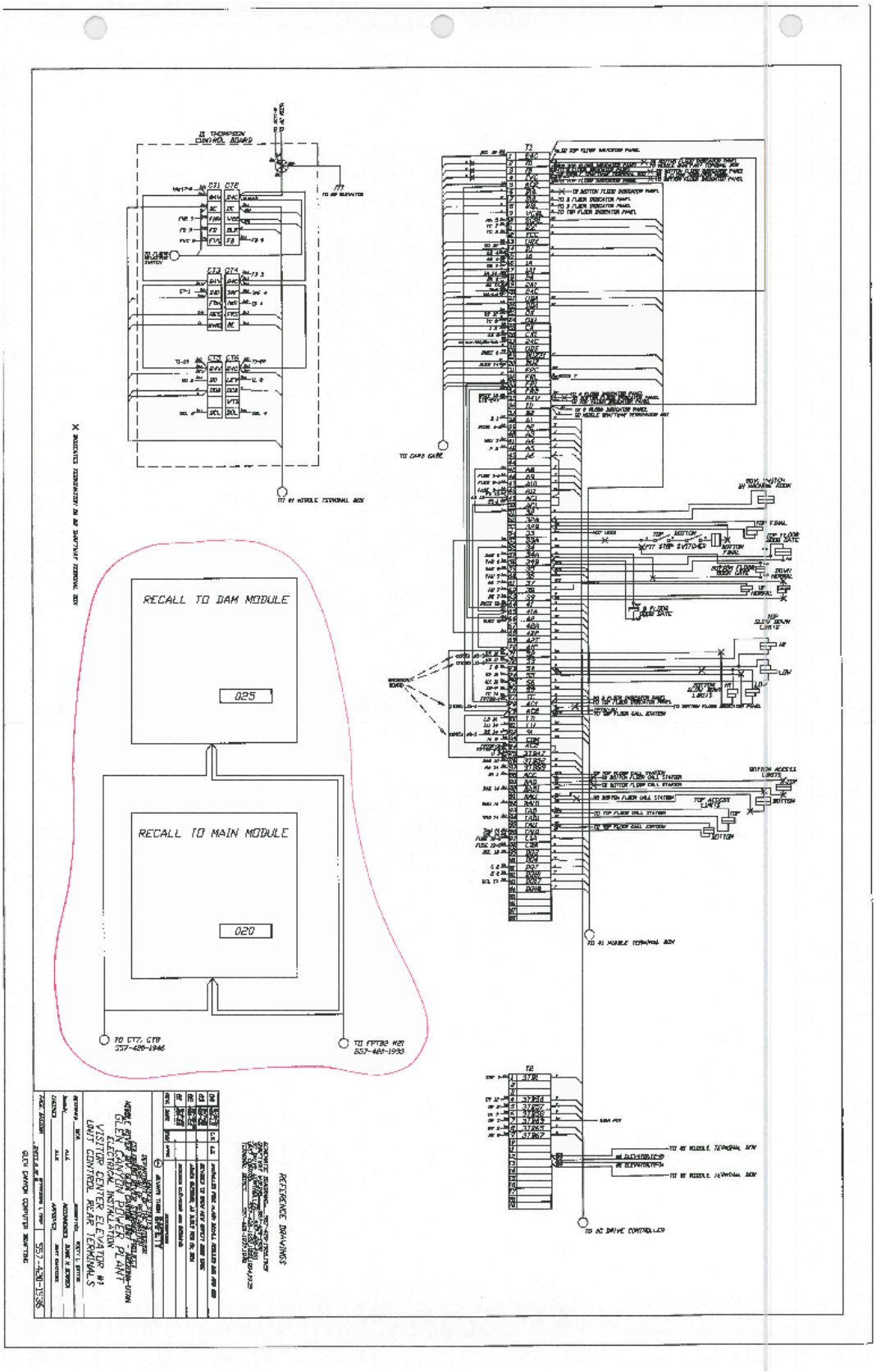

FIRE ALARM PLAN – FIRST FLOOR
SCALE: 1/8"=1'-0"
FIRE ALARM SYMBOL LEGEND
OPERATIONS MATRIX
GLEN CANYON DAM VISITOR CENTER
FIRE ALARM PLAN
FA-2
COMMERCIAL AND INDUSTRIAL AUTOMATED SYSTEM SOLUTIONS

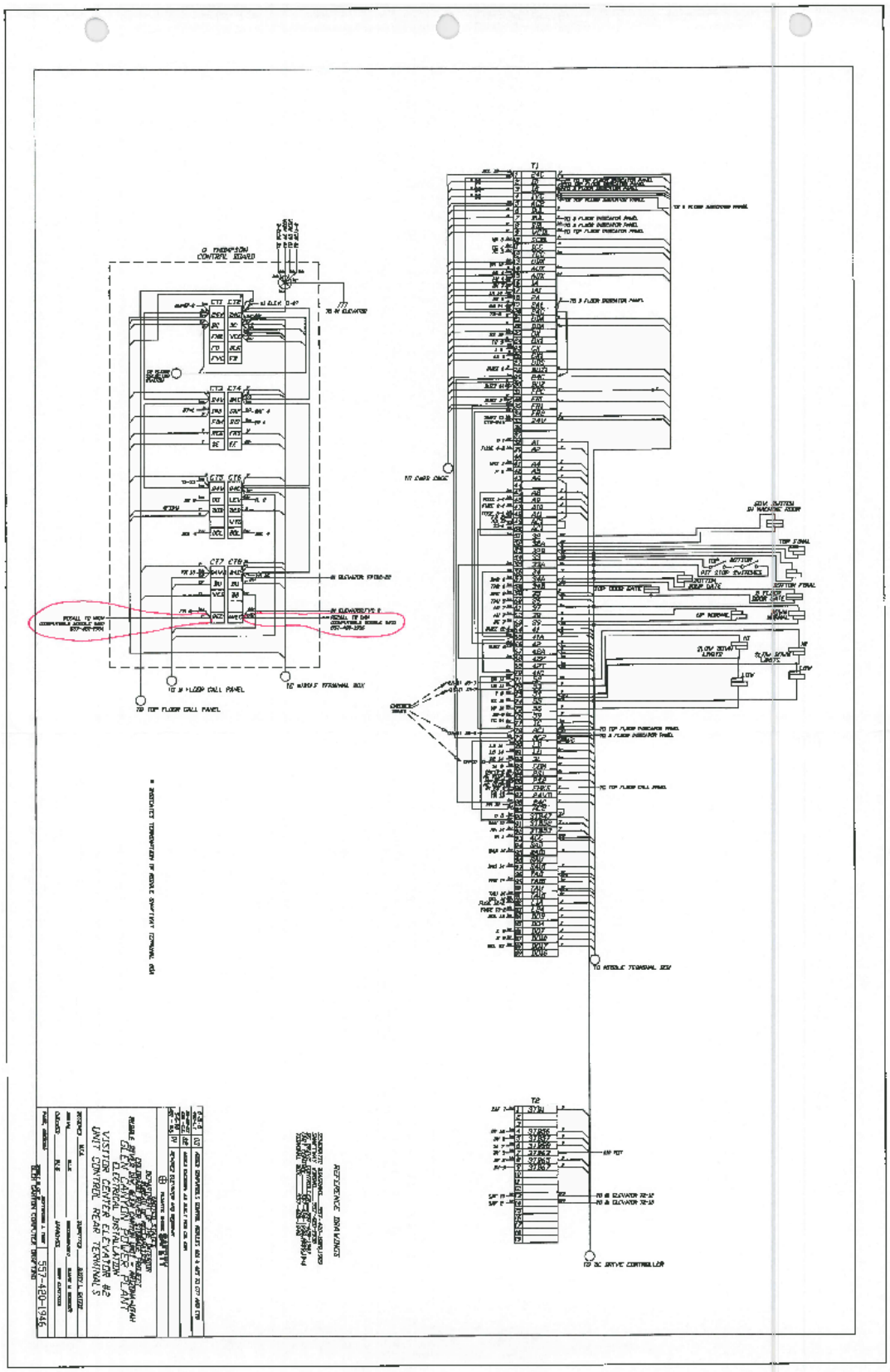

FIRE ALARM SYMBOL LEGEND
FIRE ALARM PLAN – ELEV SHAFT
GENERAL NOTES:
GLEN CANYON DAM VISITOR CENTER
FIRE ALARM PLAN & CALCS
FA-3
UNICAD

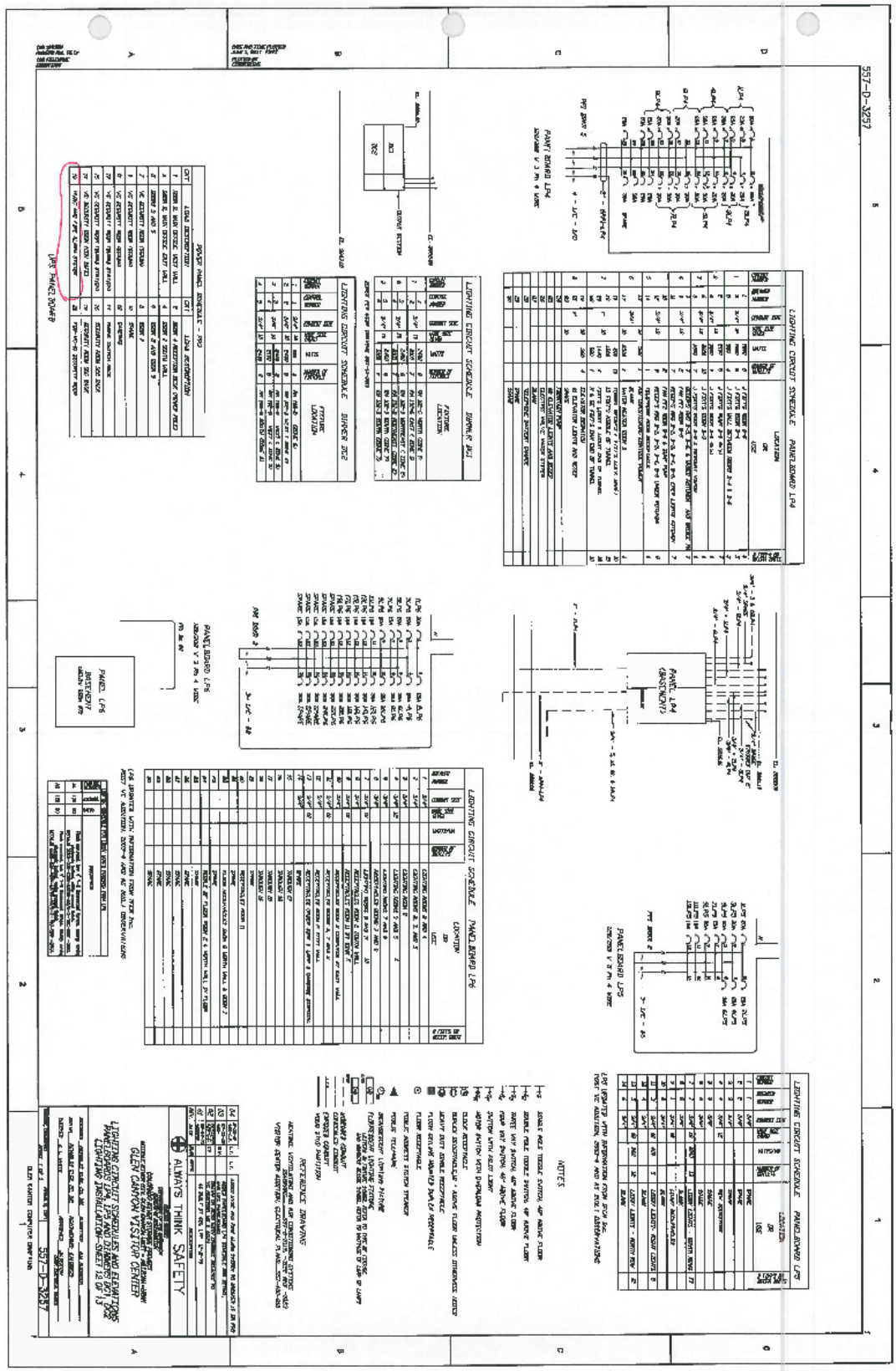

VC SECURITY MOTION SENSORS POWER CIRCUIT
120 VAC => 12 VDC
USER OFFICE FIRE ALARM MODULE
079
BASEMENT FIRE ALARM MODULE
080
TO FA PANEL REF: 557-420-1703
TO FA PANEL REF: 557-420-1703
TO FA PANEL REF: 557-420-1703
NOTE: FIRE ALARM MODULES ALARM TO FIRE ALARM CONTROL ROOM IN THE GLEN CANYON POWER PLANT.
2 RELAYS AND POWER CIRCUITS FOR NEW OPTICAL MOTION SENSORS HAVE BEEN ADDED TO THE FIRE ALARM SYSTEM. SEE DRAWING 557-420-1709 ALL WIRING AND CONDUIT TO BE PER ANSI/NFPA 70 ARTICLE 760 AND STILL IN PLACE.
DRAWN BY: GLA
CHECKED: ASK
APPROVED: ASK
DATE: 2000-07-31
TITLE: GLEN CANYON COMPUTER WIRING
557-420-1701

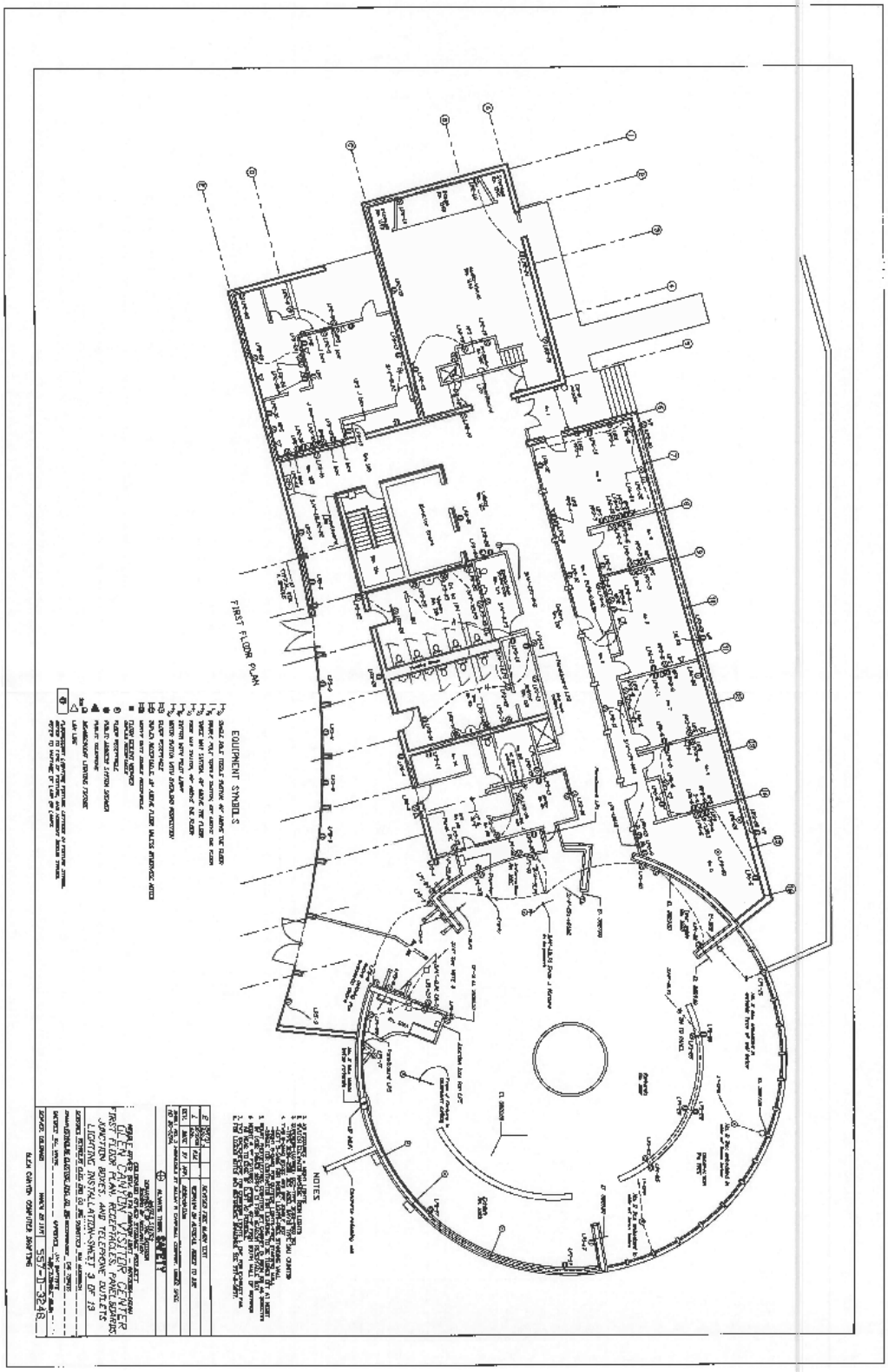

DEVICE LISTINGS
B. CAMERA OUT OF POSITION
C. BASEMENT FIRE ALARM
D. USBR OFFICE FIRE ALARM
E. SPARE
F. BASEMENT SUMP HIGH LEVEL
G. MAIN ENTRANCE
H. ROTUNDA AREA
I. USBR OFFICE-OUTER DOOR
J. GIFT SHOP ENTRY AREA
K. GIFT SHOP BACK DOORS
L. NPS OFFICE-OUTER DOOR
M. MEN'S ROOM
N. NPS OFFICE-INNER DOOR (Currently Not Used)
O. HALLWAY AT WATER FOUNTAIN (Currently Not Used)
P. WOMEN'S ROOM
Q. PROJECTION ROOM
R. AUDITORIUM EXIT
S. DOOR TO CAMERA UNDER ROTUNDA
REF. 557-420-1701
REF. 557-420-1642
TB2A
TB4A
TB3A
TB3A
SAFETY
GLEN CANYON POWER PLANT
HAYDEN VISITOR CENTER
JUNCTION BOX WIRING
557-420-1703


DYNAMIC BRAKE RESISTANCE
FIREMAN A.T.
INSPECTION LIGHT
BUZZER
INSPECTION L.T.
FLOOR PASSING CAME
CAR BUTTONS & KEY LIGHTS
HALL BUTTONS & KEY LIGHTS
BASEMENT CAR CALL LOCKOUT KEY SW.
INDEPENDENT SERVICE KEY SW.
INSPECTION
FIREMAN RESET BUTTON
FIREMAN KEY SW.
SAFETY EDGE
ELECTRIC EYE
LEVELING
DOOR GATE
DOOR OPEN BUTTON
DOOR CLOSE BUTTON
DOOR OPEN LIGHT
DOOR CLOSE LIGHT
SAFETY CIRCUIT
DOOR OPERATOR & SAFETY CIRCUIT
HALL LANTERNS & GONG
GLEN CANYON POWER PLANT
ELECTRICAL INSTALLATION
VISITOR CENTER ELEVATORS #1 & #2
SCHEMATIC DIAGRAM
557-420-1929


RECALL TO DAM MODULE
025
RECALL TO MAIN MODULE
020
TO CTT, CTB
557-420-1946
TO CPT20 #21
557-420-1933
TO CAMS GATE
TO AC DRIVE CONTROLLER
VISITOR CENTER ELEVATOR #1
UNIT CONTROL REAR TERMINALS

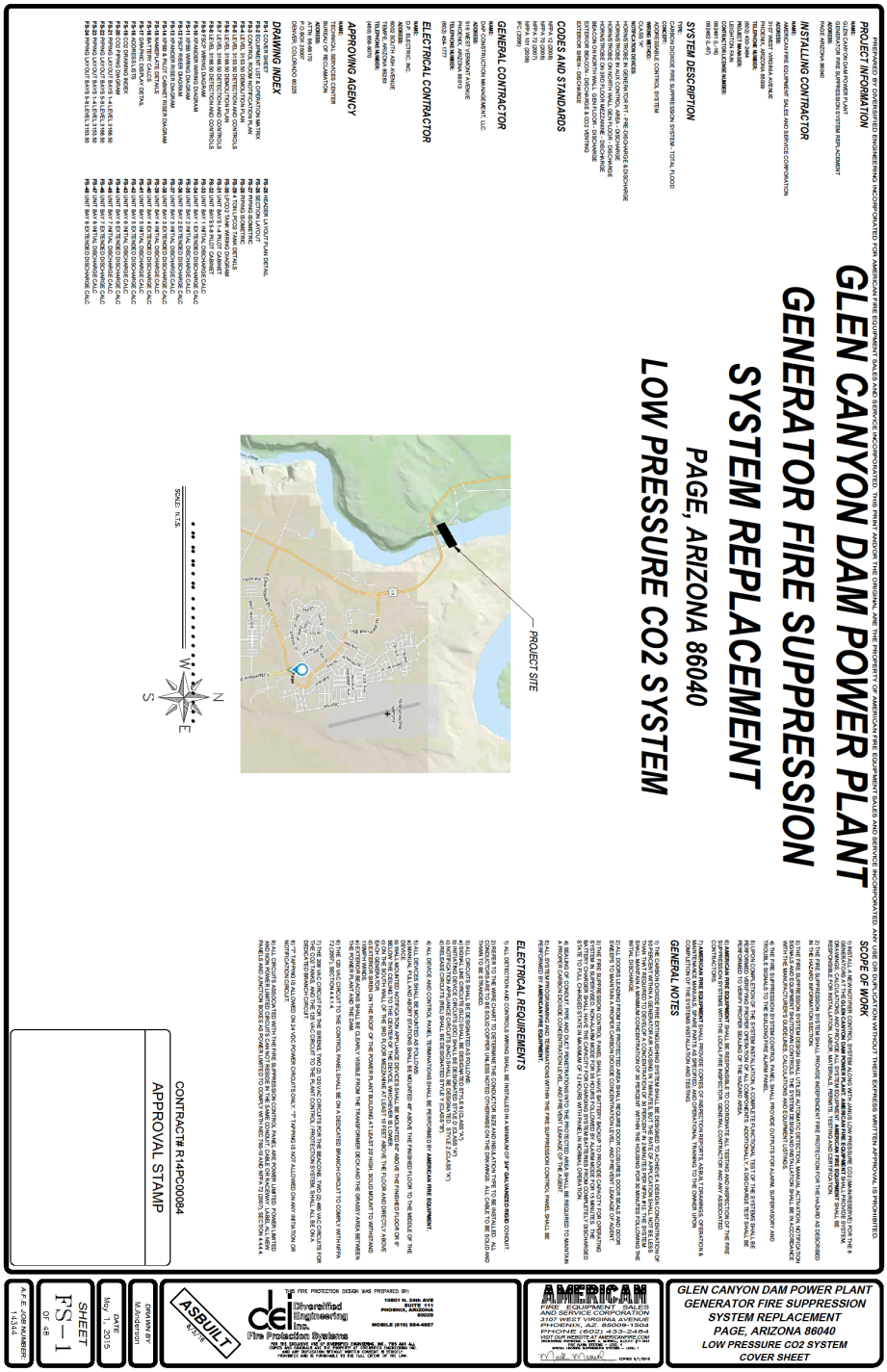

VISITOR CENTER ELEVATOR #2
UNIT CONTROL REAR TERMINALS
557-420-1946


LIGHTING CIRCUIT SCHEDULE PANELBOARD LP4
LIGHTING CIRCUIT SCHEDULE PANELBOARD LP6
LIGHTING CIRCUIT SCHEDULE PANELBOARD LP5
NOTES
ALWAYS THINK SAFETY
GLEN CANYON VISITOR CENTER
LIGHTING CIRCUIT SCHEDULES AND ELEVATIONS
PANELBOARD LP4, LP5, LP6
LIGHTING INSTALLATION-SHEET 13 OF 13
557-D-3287


FIRST FLOOR PLAN
EQUIPMENT SYMBOLS
NOTES
GLEN CANYON VISITOR CENTER
FIRST FLOOR PLAN RECEPTACLES, PANELBOARDS
JUNCTION BOXES AND TELEPHONE OUTLETS
LIGHTING INSTALLATION-SHEET 3 OF 19
SAFETY
557-D-3248

1.04 DRAWINGS OF FIRE CO2 RELEASE PANEL

Drawings provided for information only.



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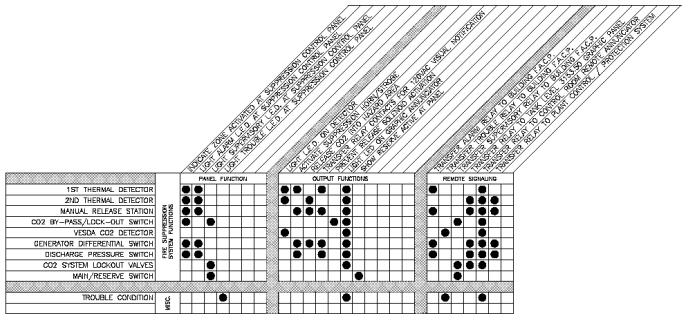
ITEM #	PART NUMBER	QTY	MANUFACTURER	DESCRIPTION	SYMBOL
100	CPU2-640	2	NOTIFIER	NFS2-640 CENTRAL PROCESSING UNIT – FIRE SUPPRESSION CONTROL PANEL	FSCP
101	ACPS-610	2	NOTIFIER	ADDRESSABLE CHARGER/POWER SUPPLY, 120 VAC, 6 AMP	
102	APS2-6R	2	NOTIFIER	AUXILIARY POWER SUPPLY, 120 VAC, 6 AMP	
103	SLA1185	2	POWER PATROL.	12 VOLT, 100 AMP HOUR BATTERY	
104	E120V-GT	2	SPACE AGE	120 VAC HYBRID SURGE SUPPRESSOR	
105	CAB-D4R	1	NOTIFIER	"D" SIZE CABINET FOUR TIERS, RED	
106	DR-D4R	1	NOTIFIER	DOOR ASSEMBLY, WINDOW, FOUR TIERS, RED	
107	NCA-2	1	NOTIFIER	NETWORK CONTROL ANNUNCIATOR	
108	DP-DSP2	1	NOTIFIER	DRESS PANEL FOR TOP ROW	
109	NCA/B40-2-KIT	1	NOTIFIER	NCA-2 MOUNTING KIT	
110	BMP-2	2	NOTIFIER	BLANK MODULE PLATE	
111	DP-1B	3	NOTIFIER	BLANK DRESS PLATE	
112	NCM-W	3	NOTIFIER	NETWORK CONTROL MODULE, WIRE	
113	BB-100	1	NOTIFIER	BATTERY CABINET FOR UP TO 100AMP HOUR BATTERIES, RED	
114	XP10-M	7	NOTIFIER	TEN INPUT MONITOR MODULE	XPNDR
115	CHS-6	1	NOTIFIER	CHASSIS FOR XP MODULES	
116	FCM-1REL	20	NOTIFIER	ADDRESSABLE RELEASING CONTROL MODULE (XMOX = ADDRESS SETTING)	
117	FCM-1	1	NOTIFIER	ADDRESSABLE CONTROL MODULE (XMOX = ADDRESS SETTING)	
118	R-20E	1	NOTIFIER	OPTO CONVENTIONAL RELAY MODULE w/ENCLOSURE	
119	CAB-D4R	1	NOTIFIER	"D" SIZE CABINET FOUR TIERS, RED	
120	DR-D4BR	1	NOTIFIER	SOLID DOOR ASSEMBLY, FOUR TIERS, RED	
121	SLA1185	2	POWER PATROL.	12 VOLT, 55 AMP HOUR BATTERY	
122	BB-100	1	NOTIFIER	BATTERY CABINET FOR UP TO 100 AMP HOUR BATTERIES, RED	
145	XP8-R	2	NOTIFIER	8 RELAY MODULE	
123	VLC-505	1	XTRALIS	VESDA LASER COMPACT AIR SAMPLING SMOKE DETECTOR	VESDA
124	NCA-2	1	NOTIFIER	NETWORK CONTROL ANNUNCIATOR	ANN
125	ABS-2D	1	NOTIFIER	BACKBOX FOR NCA-2 ANNUNCIATOR	
126	NCM-W	1	NOTIFIER	NETWORK CONTROL MODULE, WIRE	
127	BB-XP	8	NOTIFIER	XP CABINET FOR ONE OR TWO MODULES	XP10M
128	184339	8	NOTIFIER	CHASSIS FOR BB-XP	
129	XP10-M	16	NOTIFIER	TEN INPUT MONITOR MODULE	
130	12-337121-000-190	72	FEDWAL	CONVENTIONAL THERMAL DETECTOR 195°	H 195°
131	ECD-D-B-48	1	XTRALIS	VESDA ECO CO2 DETECTOR	C
132	FMM-101	2	NOTIFIER	ADDRESSABLE MINI-MONITOR MODULE (XMOX = ADDRESS SETTING)	M
133	FCM-1	8	NOTIFIER	ADDRESSABLE CONTROL MODULE (XMOX = ADDRESS SETTING)	O
134	RUZV-C-D24	8	IDEC	OPTO CONVENTIONAL RELAY MODULE	R 120VAC
135	SR2V-K3	8	IDEC	RELAY SOCKET	
136	FDM-1	8	NOTIFIER	ADDRESSABLE DUAL MONITOR MODULE (XMOX = ADDRESS SETTING)	D
137	NBG-12LR	8	NOTIFIER	ADDRESSABLE AGENT RELEASE PULL STATION	P
138	P2RKP	32	SYSTEM SENSOR	HORN/STROBE – 24 VDC, MULTI-CANDELA, RED, WALL MOUNT, LENS-A AMBER LENS WEATHER PROOF	100cd H WP
139	LENS-A	32	SYSTEM SENSOR	AMBER LENS	
140	1315T-120A	6	FEDERAL SIGNAL	STARFIRE STROBE WARNING LIGHTS – 120 VAC, AMBER	120VAC L WP
141	10-2898	8	FIKE	BY-PASS/LOCK-OUT SWITCH	S
142	10-1836	8	FIKE	PUSH BUTTON RELEASE SWITCH	PB
143	10-1840	1	FIKE	MAIN-RESERVE SWITCH	S



NOTE: PER SPEC SECTION 13850. 1.03 M. THE SYSTEM MUST ALERT THE LOCAL CENTRAL COMMAND CONTROL CENTER AND FIRE RESPONSE TEAMS WITHIN 15 SECONDS OF ALARM.

CONTRACT# R14PC00084

APPROVAL STAMP

GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
EQUIPMENT LIST & OPERATION MATRIX

AMERICAN FIRE EQUIPMENT SALES AND SERVICE CORPORATION
2120 W. BROADWAY ROAD, SUITE 1
PHOENIX, ARIZONA 85041-8806
PHONE: (602) 433-3454
EMAIL: SALES@AMERICANFIRE.COM
WWW.AMERICANFIRE.COM
ESTABLISHED 1974

ASBUILT 8/3/15

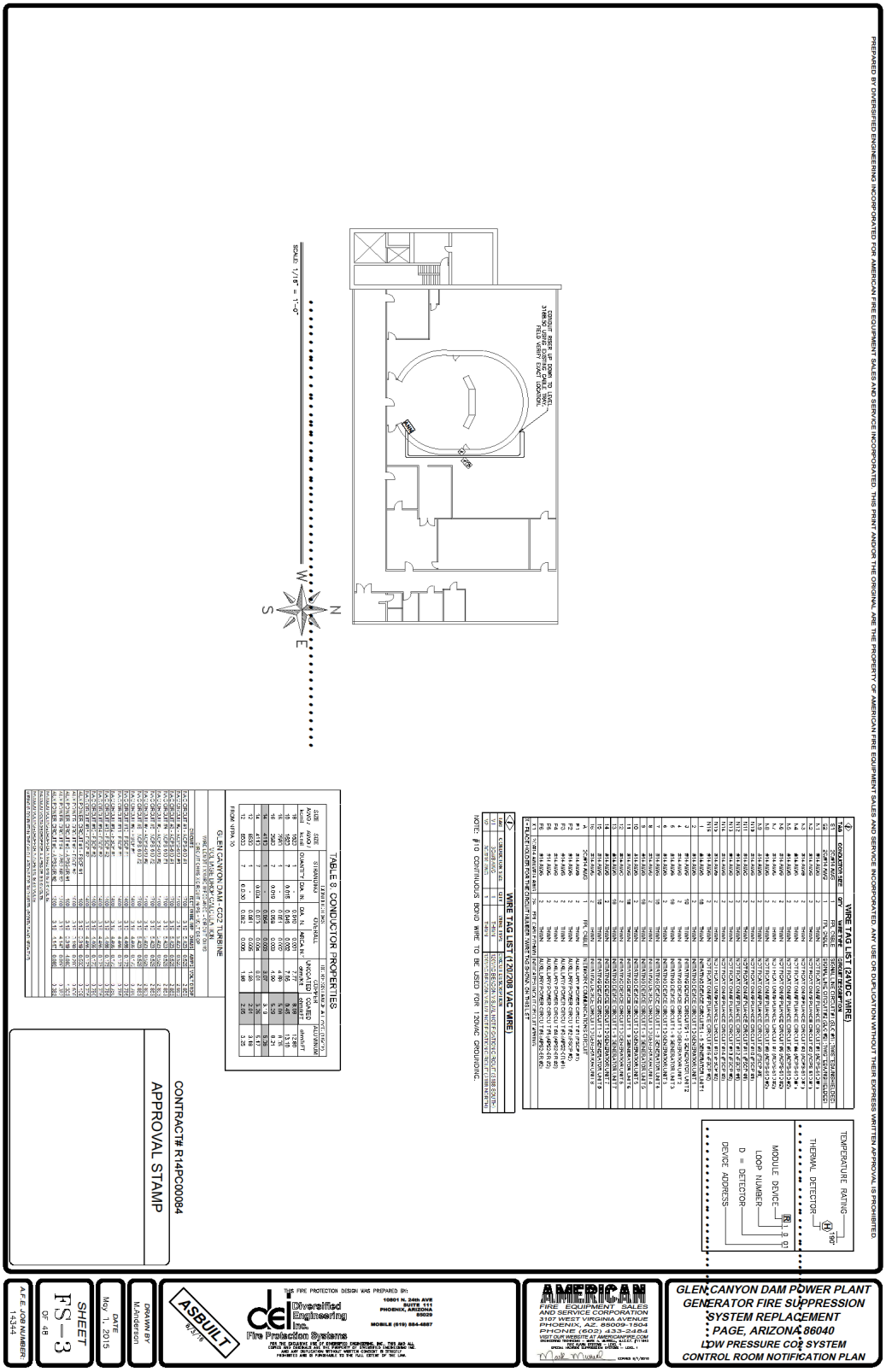
The FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 23RD AVE
SUITE 1
PHOENIX, ARIZONA 85029
MICHELE (623) 934-4837
DIVERSIFIED ENGINEERING INC. IS NOT RESPONSIBLE FOR ANY ALTERATIONS TO THIS PLAN, UNLESS WRITTEN PERMISSION FROM THE ORIGINAL ENGINEER IS OBTAINED.

DRAWN BY
M.Anderson

DATE
May 1, 2015

SHEET
FS-2
OF 48

A.F.E. JOB NUMBER:
14344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WIRE TAG LIST (24VDC WIRE)
WIRE TAG LIST (120/208 VAC WIRE)
TABLE 8: CONDUCTOR PROPERTIES
GLEN CANYON DAM CCO: TURBINE
TEMPERATURE RATING
THERMAL DETECTOR
MODULE DEVICE
LOOP NUMBER
D = DETECTOR
DEVICE ADDRESS
SCALE: 1/16" = 1'-0"
CONTRACT# R14PC00084
APPROVAL STAMP
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
CONTROL ROOM NOTIFICATION PLAN
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
VISIT OUR WEBSITE AT AMERICANFE.COM
ASBUILT
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (510) 564-4087
DRAWN BY
M.Anderson
DATE
May. 1, 2015
SHEET
FS-3
OF 48
A.F.E. JOB NUMBER:
14344

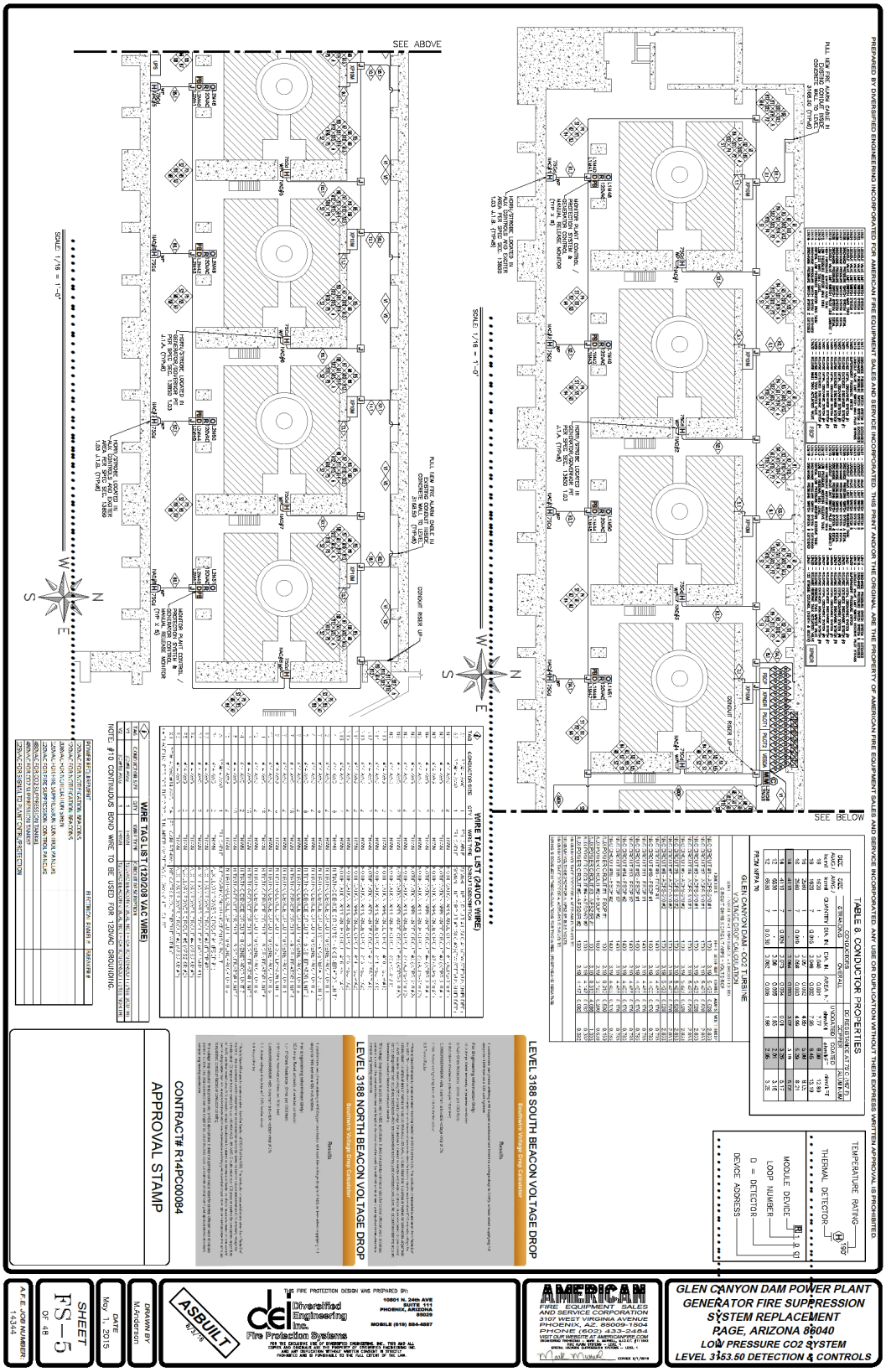
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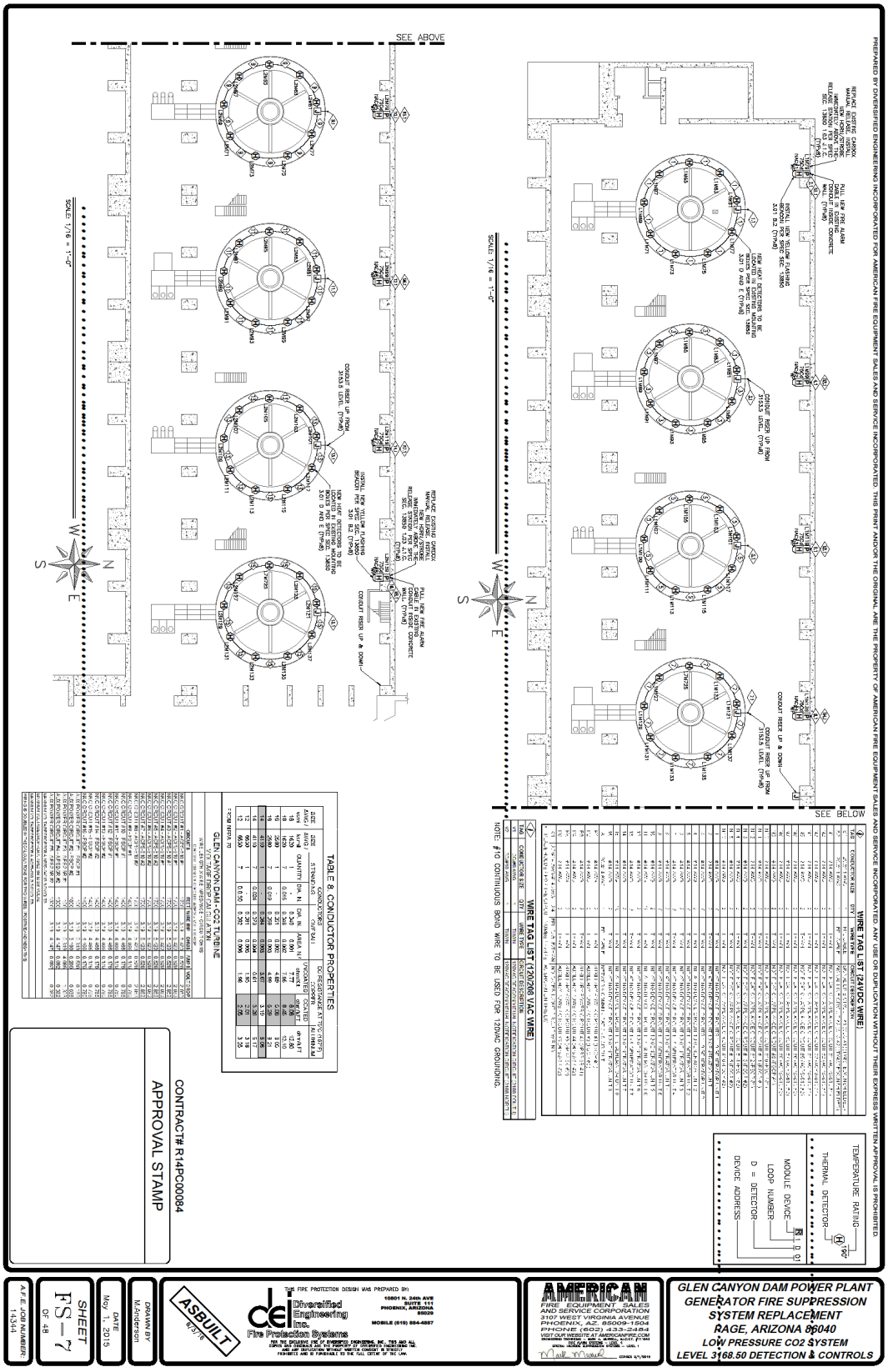
TABLE & CONDUCTOR PROPERTIES
GLEN CANYON DAM COST PER FOOT
LEVEL 3188 SOUTH BEACON VOLTAGE DROP
LEVEL 3188 NORTH BEACON VOLTAGE DROP
WIRE TAG LIST (120/208 VAC WIRE)
WIRE TAG LIST (24VDC WIRE)
CONTRACT# R14PC00084
APPROVAL STAMP
AMERICAN FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
LEVEL 3153.50 DETECTION & CONTROLS
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 554-4687
ASBUILT
DATE
May 1, 2015
SHEET
FS-5
OF 48
A.F.E. JOB NUMBER:
14344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SEE ABOVE
SEE BELOW
SCALE: 1/16 = 1'-0"
WIRE TAG LIST (24VDC WIRE)
WIRE TAG LIST (120VAC WIRE)
TABLE 8. CONDUCTOR PROPERTIES
GLEN CANYON DAM - CO2 TRIBINE
CONTRACT# R14PC00084
APPROVAL STAMP
TEMPERATURE RATING
THERMAL DETECTOR
MODULE DEVICE
LOOP NUMBER
D = DETECTOR
DEVICE ADDRESS
NOTE #10 CONTINUOUS BOND WIRE TO BE USED FOR 120VAC GROUNDING.
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
LEVEL 3168.50 DETECTION & CONTROLS
AMERICAN FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
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VISIT OUR WEBSITE AT AMERICANFIRE.COM
THIS FIRE PROTECTION DESIGN WAS PREPARED BY:
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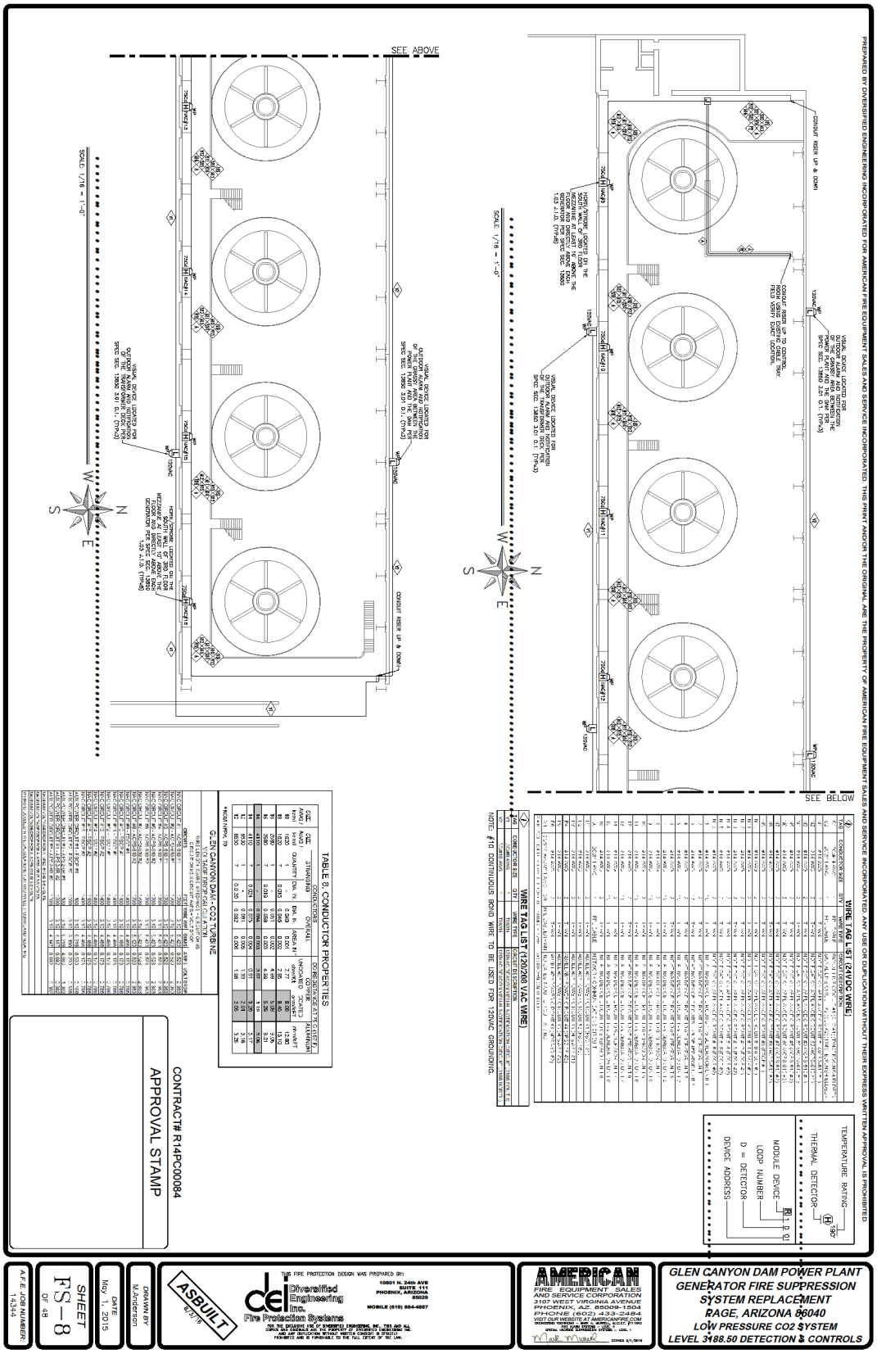
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 594-4687
ASBUILT
DATE
May 1, 2015
SHEET
FS-7
OF 48
DRAWN BY
M.Andersen
A.F.E. JOB NUMBER
14344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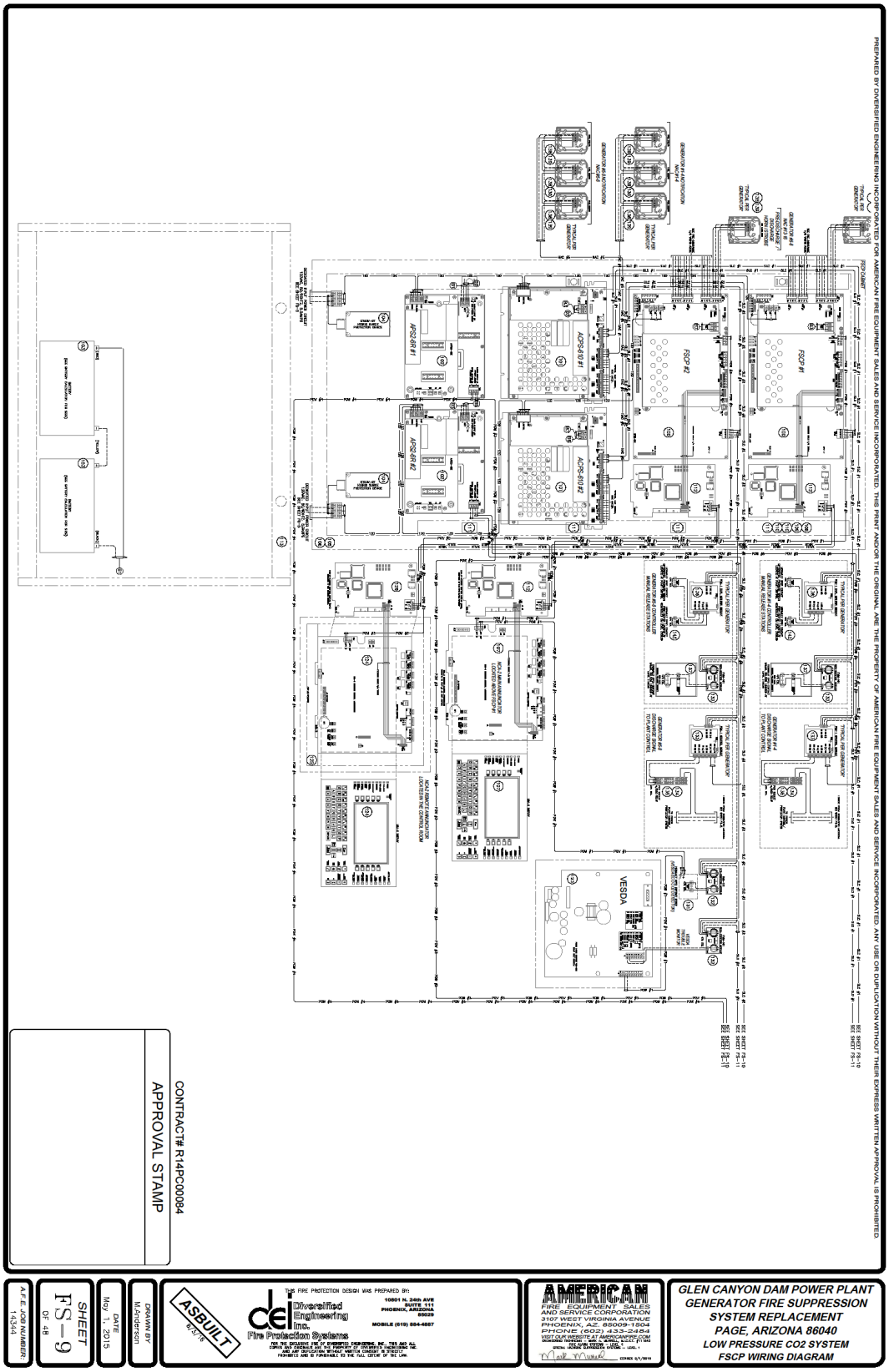
WIRE TAG LIST (24VDC WIRE)
WIRE TAG LIST (120/208 VAC WIRE)
TABLE 8. CONDUCTOR PROPERTIES
GLEN CANYON DAM - COATS BENDE
CONTRACT# R14PC00084
APPROVAL STAMP
SEE ABOVE
SEE BELOW
SCALE 1/16 = 1'-0"
CONDUIT RISER UP & DOWN
TEMPERATURE RATING
THERMAL DETECTOR
MODULE DEVICE
LOOP NUMBER
D = DETECTOR
DEVICE ADDRESS
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
LEVEL 3488.50 DETECTION & CONTROLS
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
Diversified Engineering Inc.
Fire Protection Systems
10851 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 864-4887
ASBUILT
DATE May 1, 2015
SHEET FS-8 OF 48
A.F.E. JOB NUMBER 14344
DRAWN BY M.Anderson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CONTRACT# R14PC00084
APPROVAL STAMP
ASBUILT
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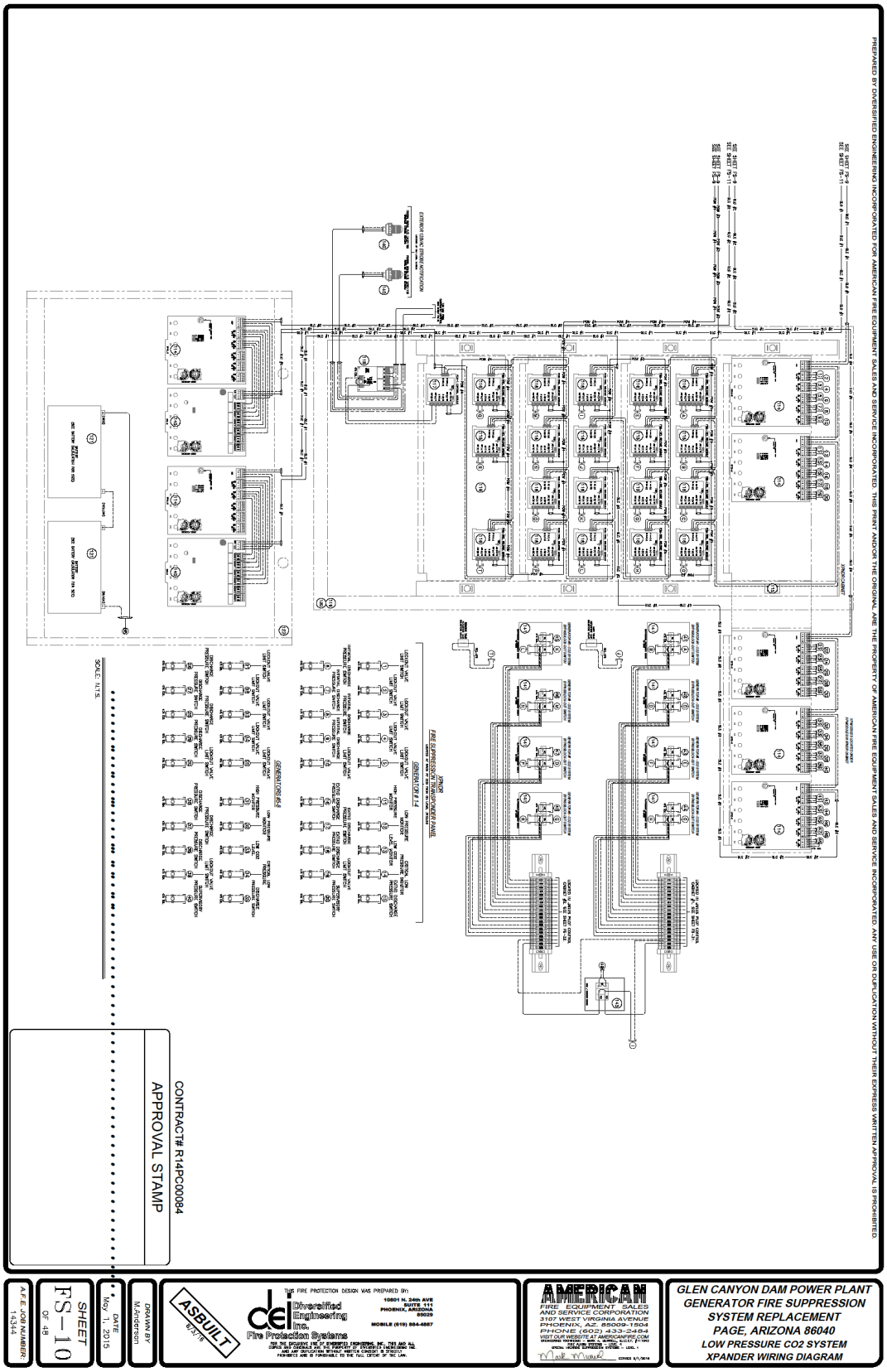
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 594-4687
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
VISIT OUR WEBSITE AT AMERICANFIRE.COM
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
FSCP WIRING DIAGRAM
DRAWN BY
M.Andersen
DATE
May 1, 2015
SHEET
FS – 9
OF 48
A.F.E. JOB NUMBER:
14344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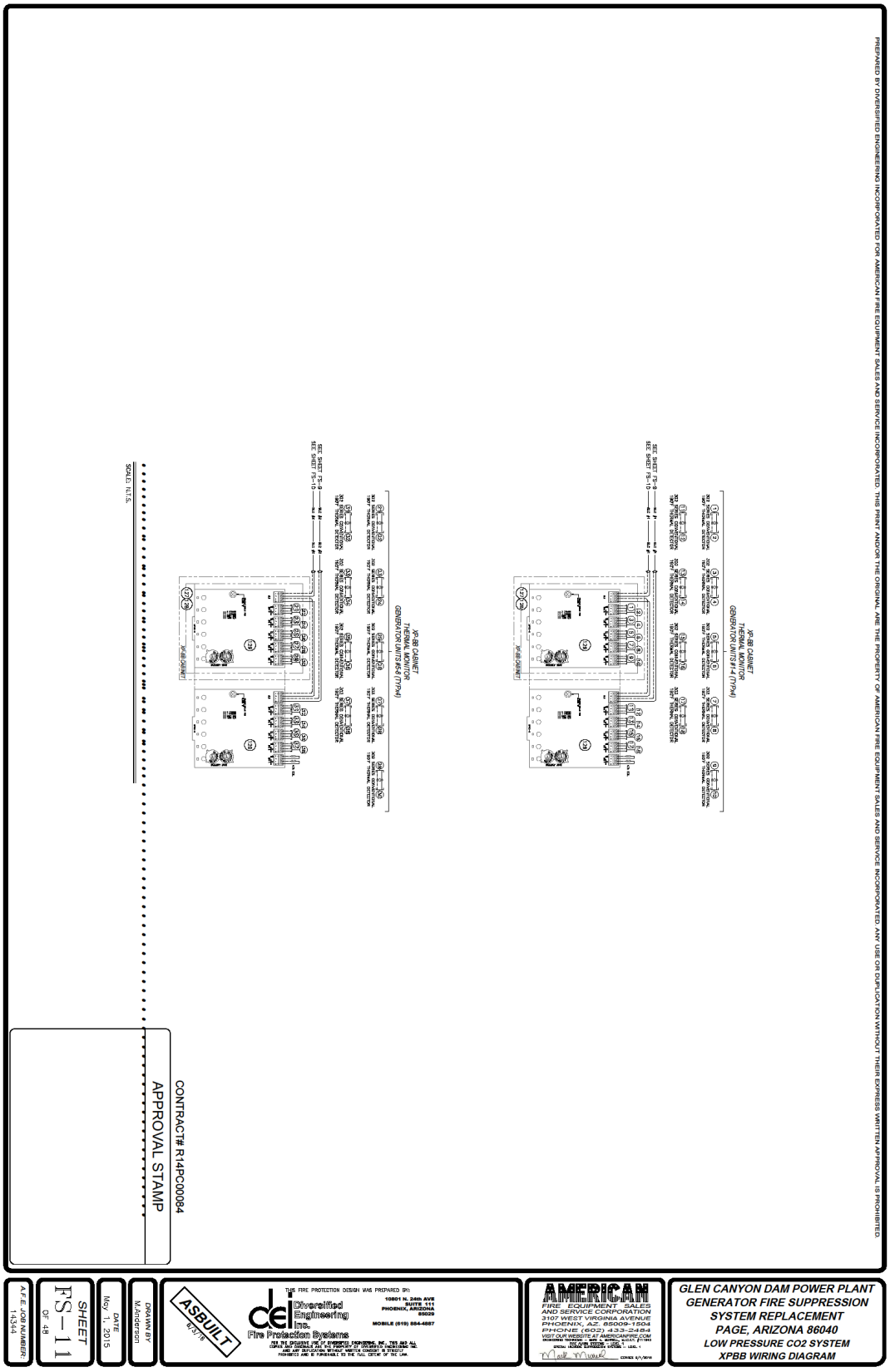
SEE SHEET FS-1000
SCALE: N.T.S.
CONTRACT# R14PC00084
APPROVAL STAMP
DATE
May. 1, 2015
DRAWN BY:
M.Anderson
ASBUILT
THE FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 884-4887
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
VISIT OUR WEBSITE AT AMERICANFIRE.COM
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
XPANDER WIRING DIAGRAM
SHEET
FS-10
OF 48
A.F.E. JOB NUMBER:
14344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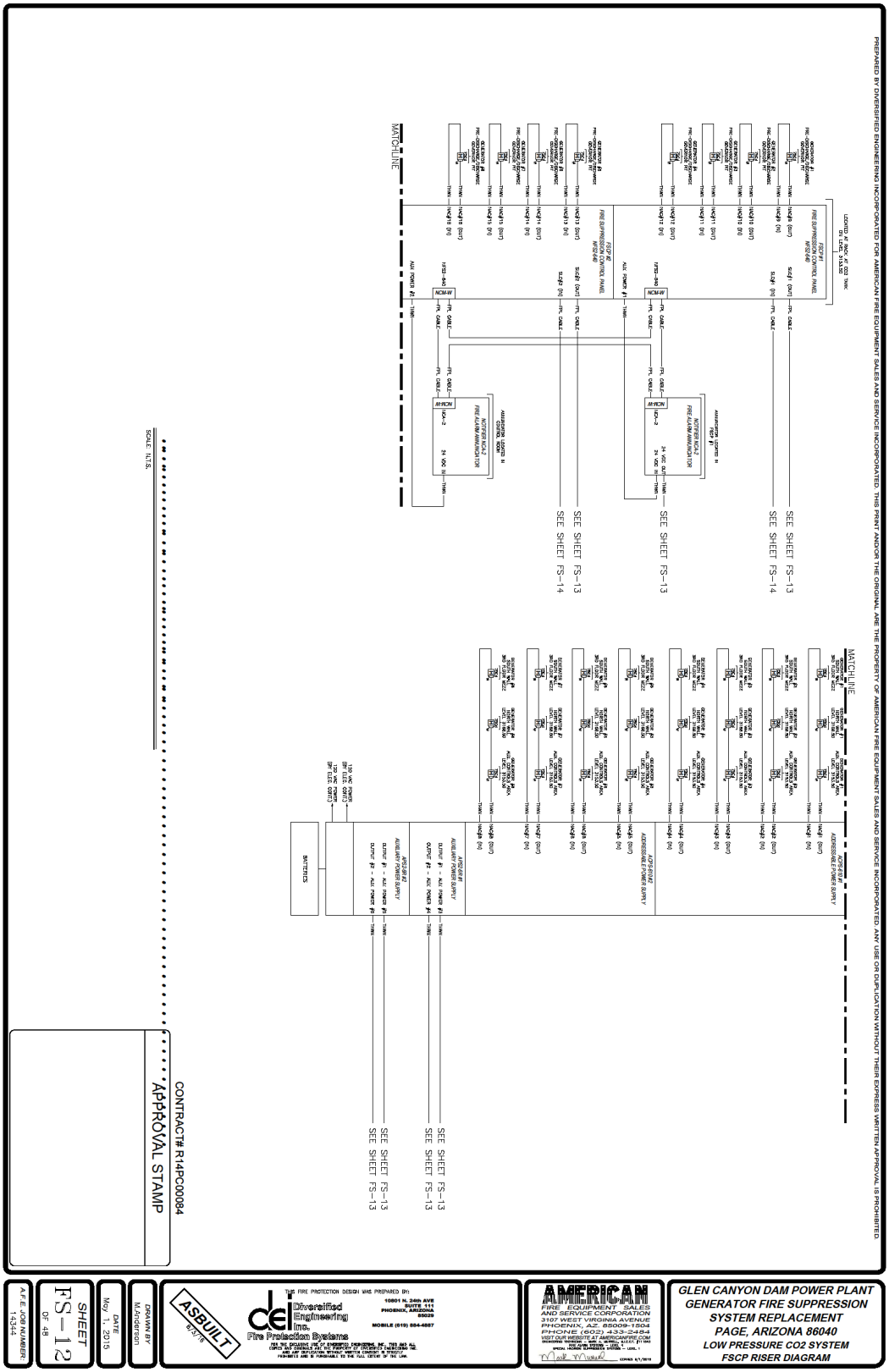
XP-BB CABINET
THERMAL MONITOR
GENERATOR UNITS #1-4 (TYP-4)
SEE SHEET FS-9
SEE SHEET FS-10
XP-BB CABINET
THERMAL MONITOR
GENERATOR UNITS #5-8 (TYP-4)
SEE SHEET FS-9
SEE SHEET FS-10
SCALE: N.T.S.
CONTRACT# R14PC00084
APPROVAL STAMP
ASBUILT
THIS FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 114
PHOENIX, ARIZONA
85029
MOBILE (619) 554-4857
AMERICAN
FIRE EQUIPMENT SALES
AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
VISIT OUR WEBSITE AT AMERICANFES.COM
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
XPBB WIRING DIAGRAM
DRAWN BY
M.Anderson
DATE
May 1, 2015
SHEET
FS-11
OF 48
A.F.E. JOB NUMBER:
14344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MATCHLINE
SEE SHEET FS-13
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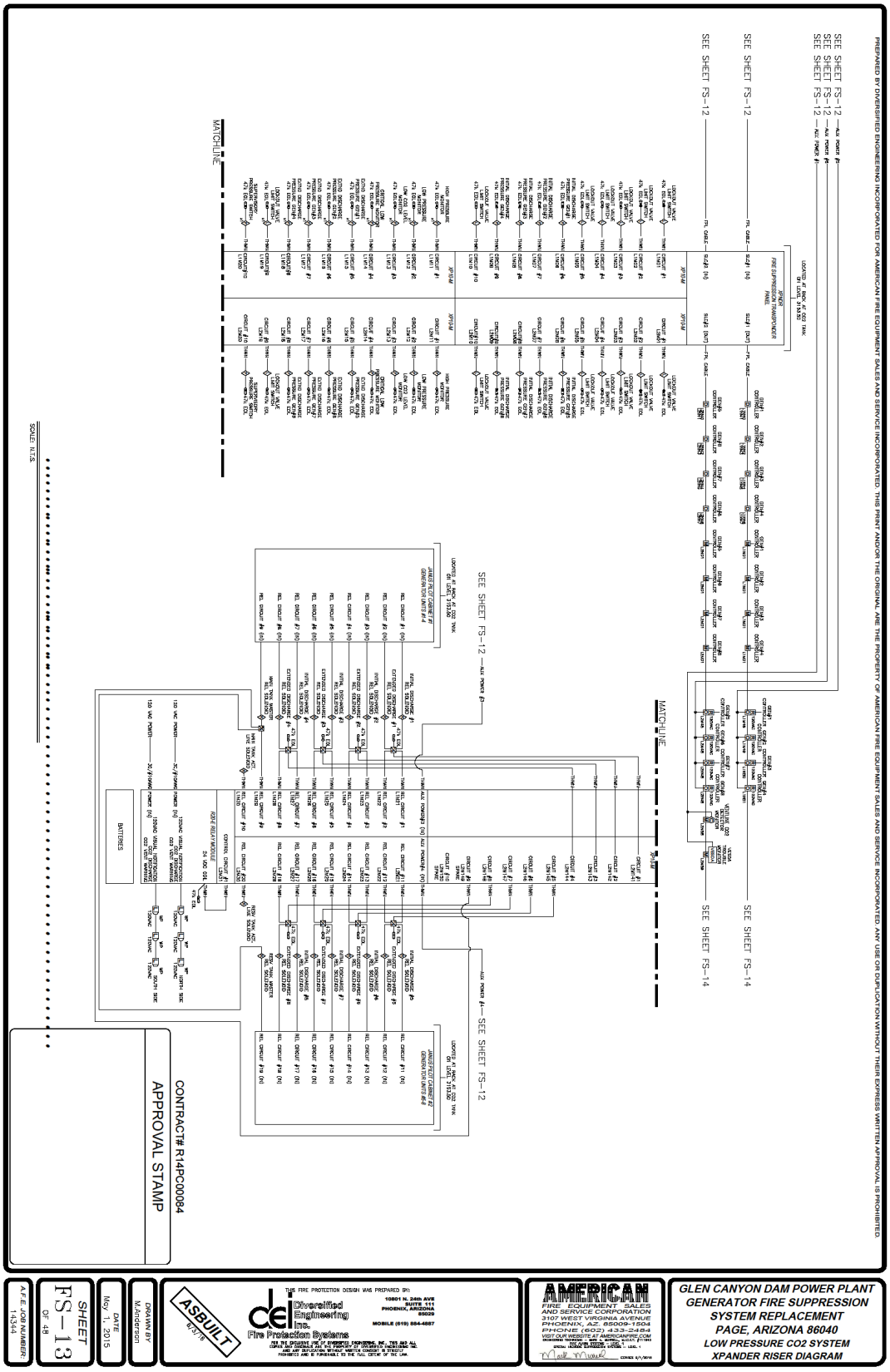
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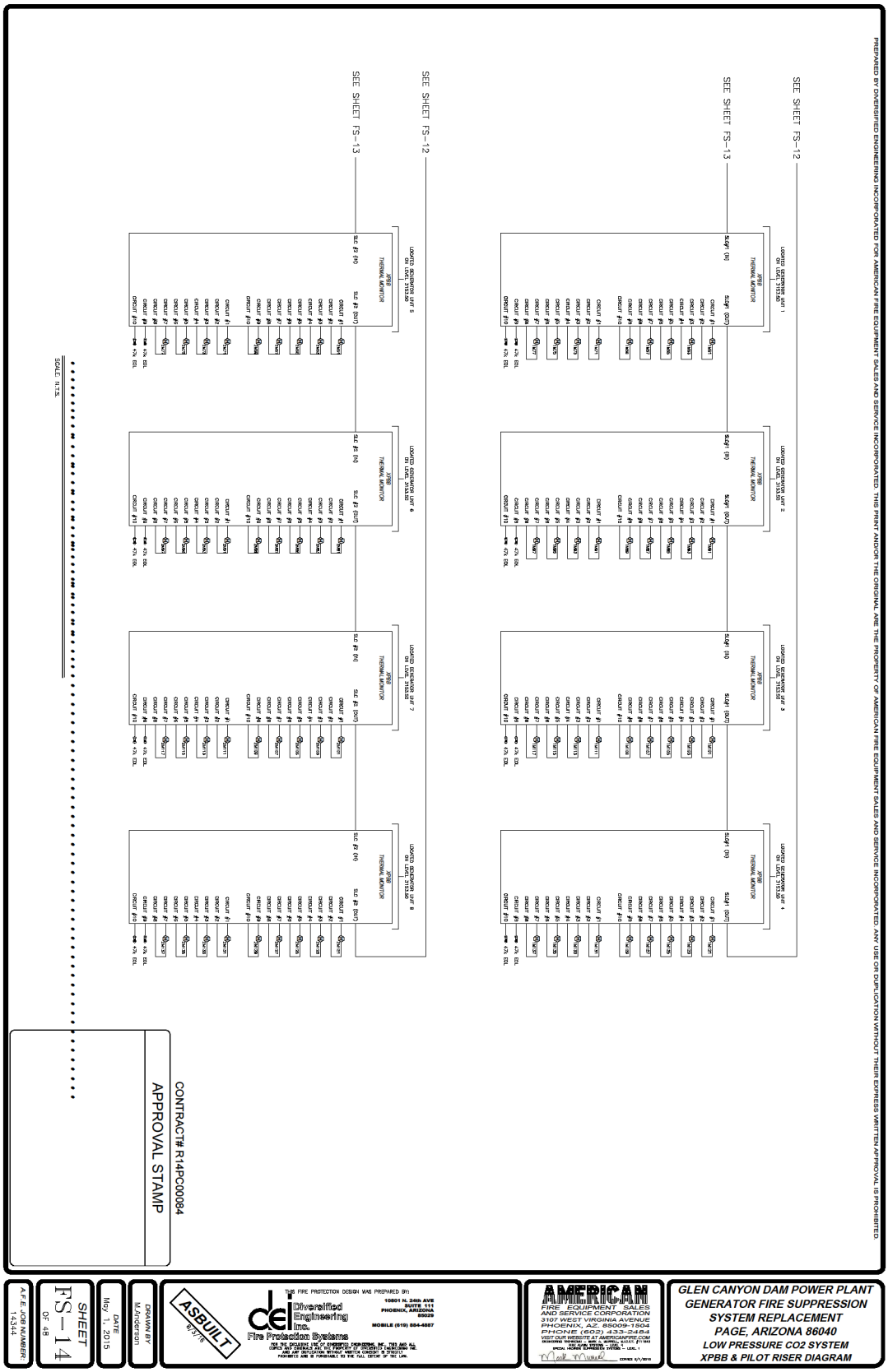
SEE SHEET FS-12
SEE SHEET FS-14
MATCHLINE
SCALE: N.T.S.
CONTRACT# R14PC00084
APPROVAL STAMP
BATTERIES
THIS FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 114
PHOENIX, ARIZONA
85029
MOBILE (619) 554-4867
ASBUILT
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ 85009-1504
PHONE (602) 433-2484
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
XPANDER RISER DIAGRAM
DATE
May 1, 2015
DRAWN BY
M.Anderson
SHEET
FS-13
OF 48
A.F.E. JOB NUMBER:
14344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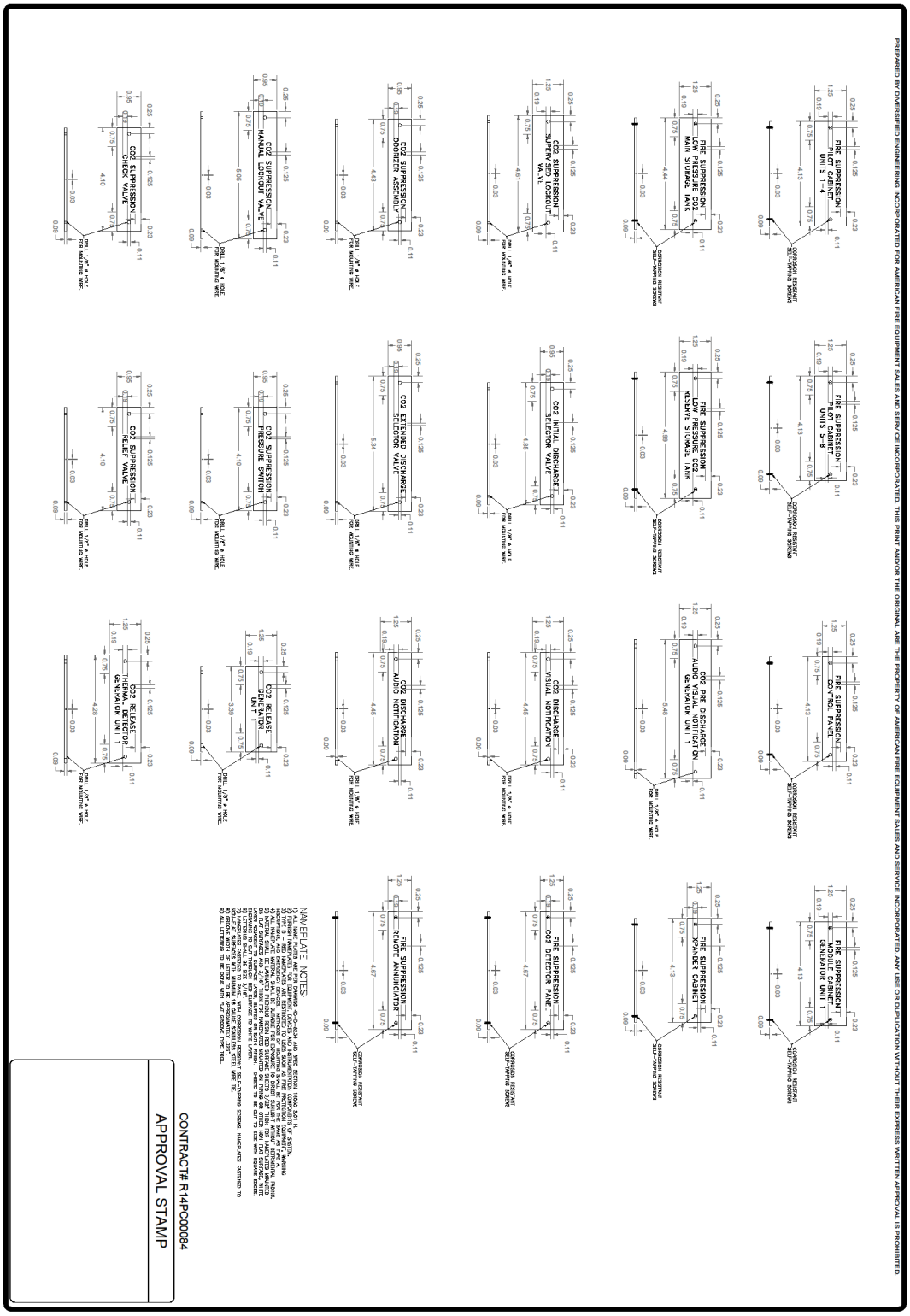
SEE SHEET FS-12
SEE SHEET FS-13
SEE SHEET FS-12
SEE SHEET FS-13
LOCATED GENERATOR UNIT 1 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 2 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 3 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 4 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 5 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 6 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 7 ON LEVEL 3153.00
LOCATED GENERATOR UNIT 8 ON LEVEL 3153.00
XPBB THERMAL MONITOR
SLOT #1 (00)
SLOT #1 (007)
CIRCUIT #1
CIRCUIT #2
CIRCUIT #3
CIRCUIT #4
CIRCUIT #5
CIRCUIT #6
CIRCUIT #7
CIRCUIT #8
CIRCUIT #9
CIRCUIT #10
SLOT #2 (00)
SLOT #2 (007)
SCALE: N.T.S.
CONTRACT# R14PC00084
APPROVAL STAMP
ASBUILT
THIS FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 884-4887
AMERICAN
FIRE EQUIPMENT SALES
AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
XPBB & PILOT RISER DIAGRAM
DRAWN BY
M.Anderson
DATE
May 1, 2015
SHEET
FS-14
OF 48
A.F.E. JOB NUMBER:
14344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FIRE SUPPRESSION T
PILOT CABINET UNITS 1 - 4
CORROSION RESISTANT SELF-HARVING SIGNAGE
FIRE SUPPRESSION T
PILOT CABINET UNITS 5 - 8
FIRE SUPPRESSION T
LOW PRESSURE CO2 MAIN STORAGE TANK
FIRE SUPPRESSION T
LOW PRESSURE CO2 RESERVE STORAGE TANK
FIRE SUPPRESSION T
CONTROL PANEL
CO2 PRE DISCHARGE T
AUDIO VISUAL NOTIFICATION GENERATOR UNIT 1
FIRE SUPPRESSION T
XPANDER CABINET
FIRE SUPPRESSION T
GENERATOR UNIT 1
CO2 SUPPRESSION T
SUPERVISED LOCKOUT VALVE
CO2 SUPPRESSION T
DROSSMETER ASSEMBLY
CO2 SUPPRESSION T
MANUAL LOCKOUT VALVE
CO2 SUPPRESSION T
CHECK VALVE
CO2 SUPPRESSION T
RELIEF VALVE
CO2 SUPPRESSION T
PRESSURE SWITCH
CO2 EXTENDED DISCHARGE T
SELECTOR VALVE
CO2 INITIAL DISCHARGE T
SELECTOR VALVE
CO2 DISCHARGE T
VISUAL NOTIFICATION
CO2 DISCHARGE T
AUDIO NOTIFICATION
CO2 RELEASE T
GENERATOR UNIT 1
CO2 RELEASE T
TIME DELAY GENERATOR UNIT 1
FIRE SUPPRESSION T
CO2 DETECTOR TANK
FIRE SUPPRESSION T
REMOTE ANNUNCIATOR
DRILL 1/8" ø HOLE FOR MOUNTING WIRE.
NAMEPLATE NOTES
1) SIZE PLATE TO FIT FRAME 40-0-40M AND PER SECTION 10000.5.01.H.
2) LETTERS MUST BE CLEAR RESISTANT, HIGH SUNLIGHT AND PRE INSPECTION FOR ABSENCE OF ANY WARPING
3) LETTERS MUST BE CLEAR RESISTANT, HIGH SUNLIGHT AND PRE INSPECTION FOR ABSENCE OF ANY WARPING
4) PLATE MUST BE MADE OF ALUMINUM, PLASTIC, OR STAINLESS STEEL. PLATE MUST BE ALUMINUM, PLASTIC, OR STAINLESS STEEL. PLATE MUST BE ALUMINUM, PLASTIC, OR STAINLESS STEEL. PLATE MUST BE ALUMINUM, PLASTIC, OR STAINLESS STEEL.
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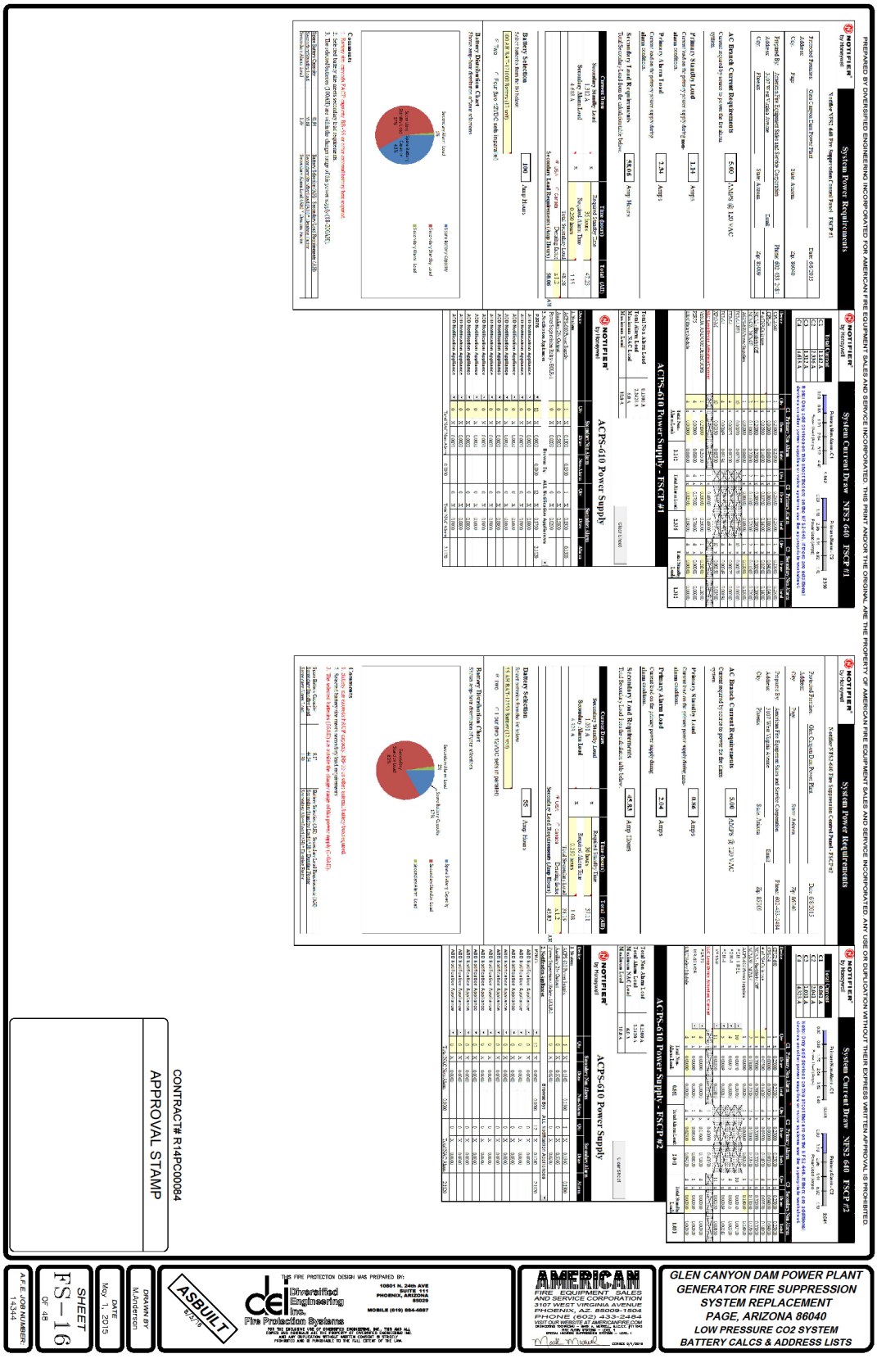
6) PLATE MUST BE MADE OF ALUMINUM, PLASTIC, OR STAINLESS STEEL. PLATE MUST BE ALUMINUM, PLASTIC, OR STAINLESS STEEL. PLATE MUST BE ALUMINUM, PLASTIC, OR STAINLESS STEEL. PLATE MUST BE ALUMINUM, PLASTIC, OR STAINLESS STEEL.
7) NAMEPLATE FASTENED TO PANEL WITH CORROSION RESISTANT SELF-TAPPING SCREWS. NAMEPLATE FASTENED TO PANEL WITH CORROSION RESISTANT SELF-TAPPING SCREWS. NAMEPLATE FASTENED TO PANEL WITH CORROSION RESISTANT SELF-TAPPING SCREWS. NAMEPLATE FASTENED TO PANEL WITH CORROSION RESISTANT SELF-TAPPING SCREWS.
8) ALL LETTERS TO BE CLEAR WITH FLAT BORDER. (TYPE TWO).
CONTRACT# R14PC00084
APPROVAL STAMP
ASBUILT
THIS FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 664-4887
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
NAMEPLATE DETAILS
DRAWN BY
M.Anderson
DATE
May 1, 2015
SHEET
FS-15
OF 48
A.F.E. JOB NUMBER
14344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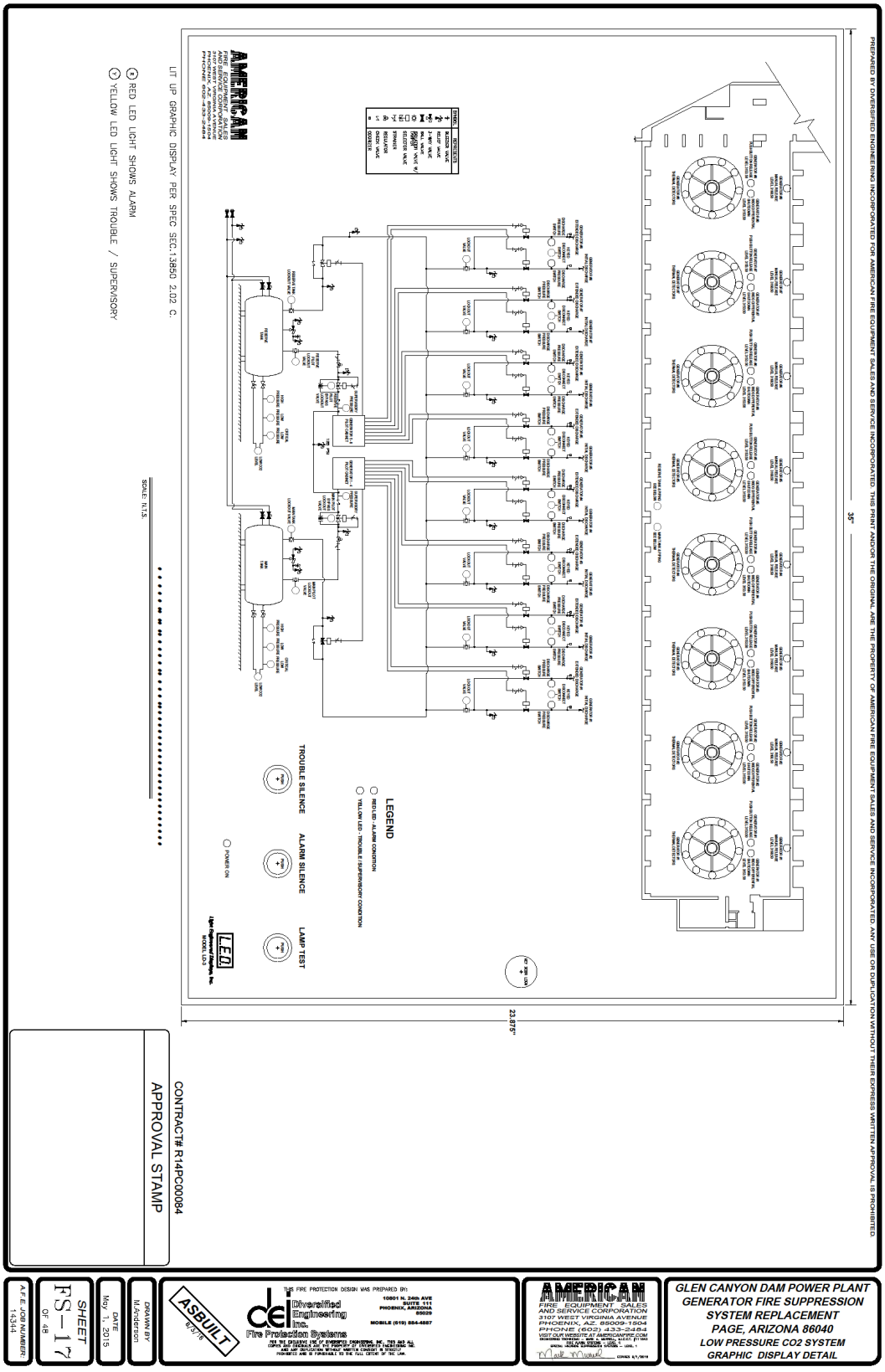
System Power Requirements
System Current Draw NFS2 640 FSCP #1
System Current Draw NFS2 640 FSCP #2
ACPS-610 Power Supply - FSCP #1
ACPS-610 Power Supply - FSCP #2
ACPS-610 Power Supply
AMERICAN FIRE EQUIPMENT SALES AND SERVICE CORPORATION
2107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2464
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
BATTERY CALCS & ADDRESS LISTS
THE FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10001 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 884-4887
ASBUILT
CONTRACT# R14PC00084
APPROVAL STAMP
DRAWN BY
M.Anderson
DATE
May 11, 2015
SHEET
FS-16
OF 48
A.F.E. JOB NUMBER:
14344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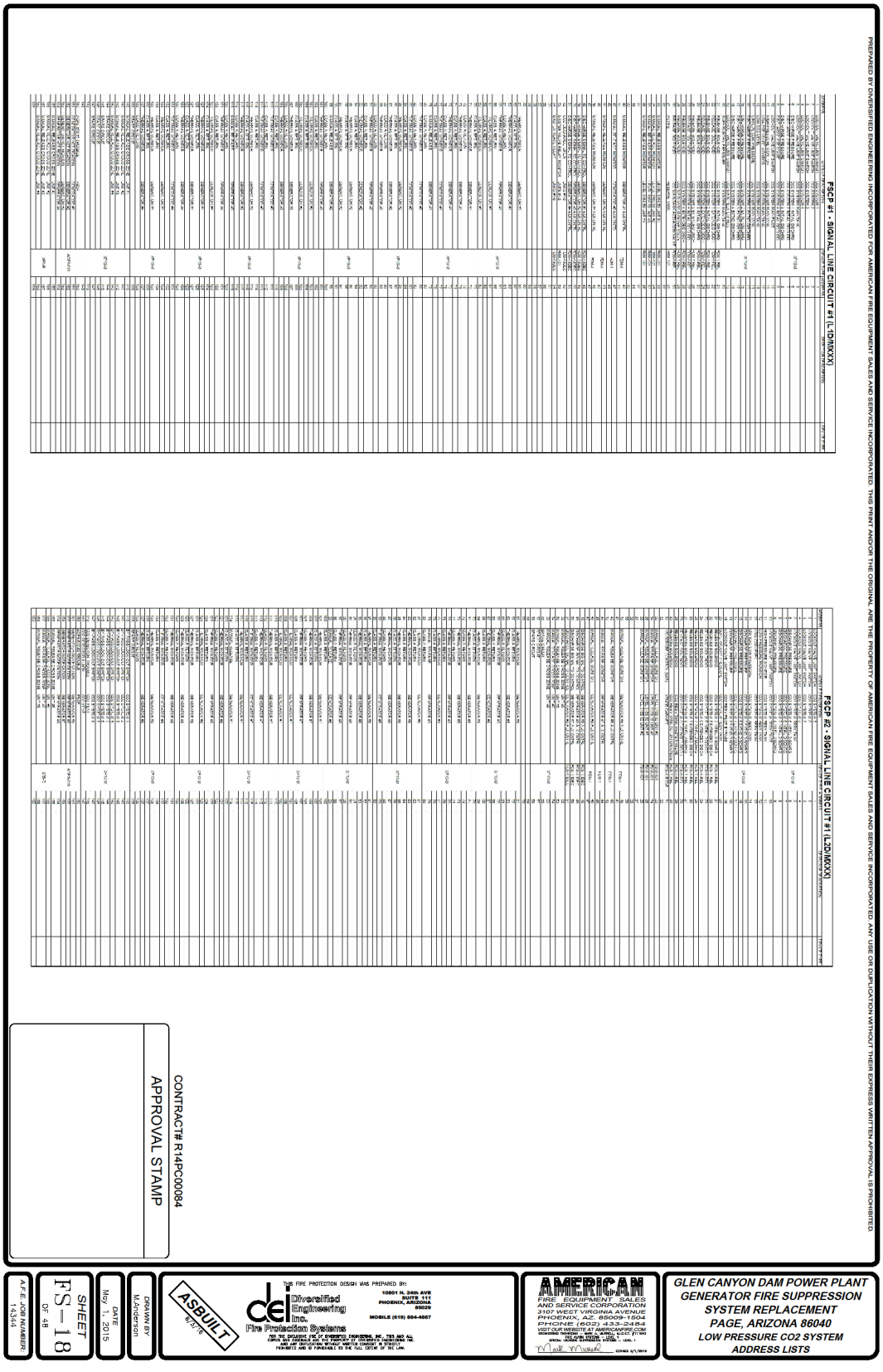
35"
23.375"
LIT UP GRAPHIC DISPLAY PER SPEC SEC.13850 2.02 C.
RED LED LIGHT SHOWS ALARM
YELLOW LED LIGHT SHOWS TROUBLE / SUPERVISORY
SCALE: N.T.S.
LEGEND
RED LED - ALARM CONDITION
YELLOW LED - TROUBLE / SUPERVISORY CONDITION
TROUBLE SILENCE
ALARM SILENCE
LAMP TEST
POWER ON
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE: (602) 433-2484
CONTRACT#: R14PC00084
APPROVAL STAMP
ASBUILT
THIS FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering Inc.
Fire Protection Systems
10861 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 884-4687
DRAWN BY
M.Anderson
DATE
May 1, 2015
SHEET
FS-17
OF 48
A.F.E. JOB NUMBER:
14344
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
GRAPHIC DISPLAY DETAIL


FSCP #1 - SIGNAL LINE CIRCUIT #1 (L1D/MXXX)
FSCP #2 - SIGNAL LINE CIRCUIT #1 (L2D/MXXX)
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CONTRACT# R14PC00084
APPROVAL STAMP
ASBUILT
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Diversified Engineering Inc.
Fire Protection Systems
10801 N. 24th AVE
SUITE 111
PHOENIX, ARIZONA
85029
MOBILE (619) 594-4687
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
3107 WEST VIRGINIA AVENUE
PHOENIX, AZ. 85009-1504
PHONE (602) 433-2484
GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
ADDRESS LISTS
A.F.E. JOB NUMBER: 14344
SHEET FS-18 OF 48
DATE May 1, 2015
DRAWN BY M.Anderson

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PROJECT INFORMATION

JOB NUMBER	3685
CUSTOMER	AMERICAN FIRE
LOCATION OF FACILITY	GLEN CANYON POWER PLANT
AUTH. HAVING JURISD.	
DESIGNED PER	PER NFPA 12

DRAWING INDEX

DRAWING NUMBER	SHEET NO.	PRODUCT LINE	SHEET DESCRIPTION
3685-GA1	FS-15	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 SYSTEM GENERAL NOTES, BOM, DRAWING INDEX
3685-GA1	FS-16	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 SYSTEM PIPING & INSTRUMENTATION DIAGRAM
3685-N01	FS-17	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION PLAN VIEW DRAWINGS
3685-N01	FS-18	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION PLAN VIEW DRAWINGS
3685-N01	FS-19	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION PLAN VIEW DRAWINGS
3685-N01	FS-20	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION PLAN VIEW DRAWINGS
3685-N01	FS-21	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION SECTION VIEW DRAWINGS
3685-N01	FS-22	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION SECTION VIEW DRAWINGS
3685-N02	FS-23	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION ISOMETRIC
3685-N02	FS-24	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 PIPING INSTALLATION ISOMETRIC
3685-N03	FS-25	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION SYSTEM 4 TON LPCO2 TANK DETAILS
3685-N03	FS-26	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION SYSTEM 4 TON LPCO2 TANK WIRING DIAGRAM
3685-N03	FS-27	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION SYSTEM UNIT BAYS 1 – 4 PILOT CABINET
3685-N03	FS-28	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION SYSTEM UNIT BAYS 5 – 8 PILOT CABINET
3685-N04	FS-29	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 1 INITIAL DISCHARGE
3685-N04	FS-30	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 1 EXTENDED DISCHARGE
3685-N04	FS-31	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 2 INITIAL DISCHARGE
3685-N04	FS-32	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 2 EXTENDED DISCHARGE
3685-N04	FS-33	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 3 INITIAL DISCHARGE
3685-N04	FS-34	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 3 EXTENDED DISCHARGE
3685-N04	FS-35	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 4 INITIAL DISCHARGE
3685-N04	FS-36	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 4 EXTENDED DISCHARGE
3685-N04	FS-37	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 5 INITIAL DISCHARGE
3685-N04	FS-38	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 5 EXTENDED DISCHARGE
3685-N04	FS-39	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 6 INITIAL DISCHARGE
3685-N04	FS-40	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 6 EXTENDED DISCHARGE
3685-N04	FS-41	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 7 INITIAL DISCHARGE
3685-N04	FS-42	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 7 EXTENDED DISCHARGE
3685-N04	FS-43	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 8 INITIAL DISCHARGE
3685-N04	FS-44	LOW PRESSURE CO2 FIRE SUPPRESSION	CO2 FIRE PROTECTION UNIT BAY 8 EXTENDED DISCHARGE

NOTES:
1. JANUS FIRE SYSTEMS DESIGN PROVIDES CALCULATIONS, PIPE DIAMETERS, GENERAL ROUTING, EQUIPMENT TYPE AND SIZES NECESSARY FOR AN ADEQUATE FIRE EXTINGUISHING SYSTEM PER NFPA AND JFS STANDARDS.
2. REFER TO THE SYSTEM DISTRIBUTION NOTES ACCOMPANIED WITH THIS PROJECT DRAWING SET FOR ADDITIONAL INFORMATION.
3. EQUIPMENT AND DEVICES, EXCLUDING PIPING MATERIALS AND HANGERS, ARE SUPPLIED BY JANUS FIRE SYSTEMS (UNLESS NOTED OTHERWISE ON THE SYSTEM DRAWINGS).
4. THE INSTALLING CONTRACTOR IS RESPONSIBLE FOR PROVIDING EQUIPMENT AND MATERIAL REQUIRED PER THE DESIGN DRAWINGS, THAT IS NOT SUPPLIED BY JANUS FIRE SYSTEMS.
5. PIPE ROUTING, LENGTHS, ELEVATIONS AND DIMENSIONS ARE ESTIMATED VALUES, ONLY.
6. CONSTRUCTION COORDINATION WITH THE OWNER/SITE IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR.
7. THE INSTALLING CONTRACTOR IS RESPONSIBLE FOR PROVIDING ON SITE FABRICATION FOR PIPING AND HANGERS AS NECESSARY PER CODE AND GOOD INDUSTRY PRACTICES.
8. MAJOR FIELD CHANGES THAT DIFFER FROM THE JANUS FIRE SYSTEMS PROJECT DRAWINGS SHALL BE RED-LINED BY THE INSTALLING CONTRACTOR. BASED ON RED-LINE INFORMATION JANUS FIRE SYSTEMS SHALL DETERMINE WHETHER THE SYSTEM STILL MEETS NFPA REQUIREMENTS.

LP CO2 SYSTEM DISTRIBUTION NOTES

PIPE:
1. BLACK OR GALVANIZED STEEL PIPE SHALL BE EITHER ASTM A-53 SEAMLESS OR ELECTRIC WELDED, GRADE A OR B; OR ASTM A-106, GRADE A, B OR C.
2. ASTM A-120 AND ORDINARY CAST-IRON PIPE SHALL NOT BE USED.
3. STAINLESS STEEL PIPING SHALL BE TP304 OR TP316 FOR THREADED CONNECTIONS OR TP304, TP316, TP304L OR TP316L FOR WELDED CONNECTIONS.
4. DISCHARGE PIPE DOWNSTREAM OF THE MASTER OR MASTER / SELECTOR VALVE PIPE SHALL BE A MINIMUM OF SCHEDULE 40.
5. FURNACE BUTT-WELD ASTM A-53 PIPE SHALL BE PERMITTED TO BE USED.
6. THE STORAGE UNIT HEADER (VALVE MANIFOLD) IS UNDER CONTINUOUS CO2 PRESSURE (NOMINALLY 300 PSIG [20.68 BAR]) AND SHALL BE FABRICATED OF SCHEDULE 80 BUTT WELDED OR SEAMLESS BLACK STEEL PIPE. FITTINGS SHALL BE EXTRA STRONG BUTT WELDING. (NO CHILL RINGS PERMITTED).
7. COMPANION FLANGES FOR VALVES, ETC. SHALL BE CLASS 300 FORGED STEEL.
8. A DIRT TRAP CONSISTING OF A TEE WITH A CAPPED NIPPLE, AT LEAST 2" (51 mm) LONG, SHALL BE INSTALLED AT THE END OF EACH PIPE RUN.
9. PIPING SECTIONS NOT NORMALLY OPENED TO ATMOSPHERE SHALL NOT BE REQUIRED TO HAVE CORROSION-RESISTANT FINISH ON THE INSIDE.
10. FLEXIBLE PIPING SYSTEM COMPONENTS SHALL HAVE A MINIMUM BURST PRESSURE 1800 psi (12,411 kPa).
11. REFER TO THE LATEST EDITION OF FSSA PIPE DESIGN HANDBOOK FOR TUBING SPECIFICATIONS.

FITTINGS:
1. CLASS 150 AND CAST-IRON FITTINGS SHALL NOT BE USED.
2. CLASS 300 MALLEABLE OR DUCTILE IRON FITTINGS SHALL BE USED THROUGH 3" (80 mm) INTERNAL PIPE DIAMETER (IPS) AND 1000 lb DUCTILE IRON OR FORGED STEEL FITTINGS IN ALL LARGER SIZES.
3. FLANGED JOINTS SHALL BE CLASS 300.
4. STAINLESS STEEL FITTINGS SHALL BE TYPE 304 OR 316 FOR THREADED CONNECTIONS OR TYPE 304, 316, 304L OR 316L FOR WELDED CONNECTIONS, WROUGHT OR FORGED IN ACCORDANCE WITH ASTM A 182, CLASS 2000, THREADED OR SOCKET WELD, FOR ALL SIZES, 1/8" (3 mm) THROUGH 4" (100 mm).
5. WELDED JOINTS AND SCREWED OR FLANGED FITTINGS (MALLEABLE IRON OR DUCTILE IRON) SHALL BE PERMITTED TO BE USED.
6. MECHANICAL GROOVED COUPLINGS AND FITTINGS SHALL BE PERMITTED TO BE USED IF THEY ARE SPECIFICALLY LISTED FOR CARBON DIOXIDE SERVICE
7. FLUSH BUSHINGS SHALL NOT BE USED.
8. WHERE HEX BUSHINGS ARE USED FOR ONE PIPE SIZE REDUCTION, A 3000 lb (207 bar) STEEL BUSHING SHALL BE PROVIDED TO MAINTAIN ADEQUATE STRENGTH.
9. WHERE HEX BUSHINGS ARE USED FOR MORE THAN ONE PIPE SIZE REDUCTION, NOTES 2, 3 & 4 SHALL BE FOLLOWED.
10. FLARED, COMPRESSION-TYPE OR BRAZED FITTINGS SHALL BE USED WITH COMPATIBLE TUBING.
11. WHERE BRAZED JOINTS ARE USED, THE BRAZING ALLOY SHALL HAVE A MELTING POINT OF 1000°F (385°C) OR HIGHER.

PIPE SUPPORTS:
1. THE PIPING SYSTEM SHALL BE SECURELY SUPPORTED WITH DUE ALLOWANCE FOR AGENT THRUST FORCES AND THERMAL EXPANSION AND CONTRACTION AND SHALL NOT BE SUBJECT TO MECHANICAL, CHEMICAL OR OTHER DAMAGE.
   1.1. ASME B31.1 SHOULD BE CONSULTED FOR GUIDANCE ON THIS MATTER.
2. REFERENCE THE LATEST EDITION OF THE FSSA PIPE DESIGN HANDBOOK, SECTION 6.0 PIPE SUPPORTS AND HANGERS, FOR DETAILS AND REQUIREMENTS.
3. WHERE EXPLOSIONS ARE POSSIBLE, THE PIPING SYSTEM SHALL BE HUNG FROM SUPPORTS THAT ARE LEAST LIKELY TO BE DISPLACED.

PRESSURE RELIEF:
1. IN SYSTEMS WHERE VALVE ARRANGEMENT INTRODUCES SECTIONS OF CLOSED PIPING, SUCH SECTION SHALL BE EQUIPPED WITH PRESSURE RELIEF DEVICES, OR THE VALVES SHALL BE DESIGNED TO PREVENT THE ENTRAPMENT OF LIQUID CARBON DIOXIDE.
2. THE PRESSURE RELIEF DEVICES SHALL OPERATE AT 450 psi (3103 kPa).
3. WHERE PRESSURE-OPERATED CYLINDER VALVES ARE USED, A MEANS SHALL BE PROVIDED TO VENT ANY CYLINDERS GAS LEAKAGE FROM THE MANIFOLD, BUT THE MEANS SHALL ALSO PREVENT LOSS OF GAS WHEN THE SYSTEM OPERATES.
4. ALL PRESSURE RELIEF DEVICES SHALL BE OF SUCH DESIGN AND SO LOCATED THAT THE DISCHARGE OF CARBON DIOXIDE THEREFROM WILL NOT INJURE PERSONNEL.

GENERAL:
1. PIPE SHALL BE REAMED AND CLEANED BEFORE ASSEMBLY, AND AFTER ASSEMBLY THE ENTIRE PIPING SYSTEM SHALL BE BLOWN OUT BEFORE NOZZLES OR DISCHARGE DEVICES ARE INSTALLED.
2. WHERE PIPING IS INSTALLED IN SEVERELY CORROSIVE ATMOSPHERE, SPECIAL CORROSION-RESISTANT MATERIALS OR COATINGS SHALL BE USED. REFER TO MANUFACTURE RECOMMENDATIONS REGARDING THESE MATERIALS OR COATINGS.

REFERENCES:
1. LATEST EDITION OF NFPA 12, STANDARD ON CARBON DIOXIDE EXTINGUISHING SYSTEMS.
2. LATEST EDITION OF ASME B31.1 POWER PIPING CODE.
3. LATEST EDITION OF FSSA PIPE DESIGN HANDBOOK.

LPCO2 BILL OF MATERIALS

TTL QTY	ITEM	DESCRIPTION	STOCK NUMBER
2	1	REGULATOR, 1/2 INCH FNPT, CV= 1.0, INLET=3000PSI, OUTLET 0-200PSI, SST, LPCO2	99772
2	2	GAUGE, PRESSURE, 1/4 INCH (8 MM) MNPT, 0-160 PSIG, 2-1/2 INCH DIAL	19771
3	3	VALVE, RELIEF, 1/2 INCH (15 MM) MNPT, 125 PSI	19316
2	4	VALVE, CHECK, 1/2 INCH (15 MM), BRASS, U3, FNPT	19501
13	5	VALVE, RELIEF, 1/2 INCH (15 MM) MNPT, 450 PSI	19317
16	6	ADAPTER, PIPE-AWAY, 1/2 INCH (15MM) FNPT, RELIEF VALVE, BRASS	16318
1	7	SWITCH, PRESSURE, SUPERVISORY, 1/4 INCH (8 MM) MNPT, 55 PSIG FALL, SPDT, WP	19307
2	8	VALVE, CHECK, 3/4 INCH (20 MM), BRASS, U3	19507
16	9	MANIFOLD ASSEMBLY	99703
16	10	SWITCH, DISCHARGE PRESSURE	19773
2	11	VALVE, BALL, PNEUMATIC, 1/2 INCH (15MM), W/SOLENOID, CARBON STEEL W/EPOXY COATING, 4000 SERIES	19485-C50
8	12	VALVE, BALL, PNEUMATIC, 3/4 INCH (20MM), CARBON STEEL W/EPOXY COATING, 4000 SERIES	19484-C00
10	13	VALVE, BALL, PNEUMATIC, 2 INCH (50MM), CARBON STEEL W/EPOXY COATING, 4000 SERIES	19487-C00
10	14	VALVE, BALL, 2 INCH (50MM), MANUAL, W/LIMIT SWITCH, CARBON STEEL W/EPOXY COATING, 4000 SERIES	19469-CL0
1	15	VALVE, BALL, 1 INCH (25MM), MANUAL, STAINLESS STEEL, 4000 SERIES	19467-S00
1	16	VALVE, BALL, 1-1/2 INCH (40MM), MANUAL, STAINLESS STEEL, 4000 SERIES	19468-S00
23	17	STRAINER, 1/2 INCH (15 MM) FNPT, Y, 40 MESH, SST	16370
2	18	SIGN, WARNING, CO2, STORAGE	99932
8	19	SIGN, WARNING, CO2, MANUAL ACTUATION	99934
16	20	SIGN, WARNING, CO2, WINTERGREEN	99935
16	21	SIGN, WARNING, CO2, ENTRANCE	99936
16	22	SIGN, WARNING, CO2, EXIT	99937
1	23	STATION, KEYED LOCK-OUT, WEATHERPROOF/EXPLOSION-PROOF, 24VDC, BLACK, 1.05-2 (1L)	99742
2	24	STORAGE UNIT, LPCO2, HORIZONTAL, 4 TON, RED, SHP-380/480V-3PH	19356-GA
2	25	CABINET, PILOT, 4-ZONE INITIAL/EXTENDED W/ MASTER CABINET, W/O SIREN	99098
2	26	VALVE, BALL, 1/2 INCH (15MM), MANUAL, W/LIMIT SWITCH, CARBON STEEL W/EPOXY COATING, 4000 SERIES	19465-CL0
64	27	NOZZLE, ORIFICE, 1/2 INCH, SST, 0.2816, CODE 7.0	19372-077
64	28	NOZZLE, ORIFICE, 1/2 INCH, SST, 0.0785, CODE 3.00	19372-008

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
Tim E. Pope
T-3788-A, A-3788-W, T-3788-W
AUTOMATIC SPRINKLER SYSTEMS LAYOUT/DESIGN
SPECIAL HAZARDS SYSTEMS LAYOUT/DESIGN
EXPIRES: 10/31/2015
CERTIFICATE NUMBER: T-3788-A-3788-W-100107

DRAWING NUMBER: 3685-GA1	DRAWN BY: J GASPAR	DESIGNER: T POPE
JOB NUMBER: 3685	APPD: TIM POPE	REVISION: A
DATE CREATED: 10/29/14	SHEET NUMBER: 1 OF 2	

THIS DRAWING IN DESIGN AND DETAIL IS JANUS PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH JANUS WORK. ALL RIGHTS OF DESIGN OR INVENTION ARE RESERVED.

JANUS FIRE SYSTEMS™
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Your Gateway to New Kind of Service

CONTRACT# R14PC00084
RSN#13965-2
RSN#13850-2

APPROVAL STAMP

GLEN CANYON DAM POWER PLANT
GENERATOR FIRE SUPPRESSION
SYSTEM REPLACEMENT
PAGE, ARIZONA 86040
LOW PRESSURE CO2 SYSTEM
CO2 DRAWING INDEX

INSTALL CERTIFY
AMERICAN
FIRE EQUIPMENT SALES AND SERVICE CORPORATION
2120 W. CAMELBACK RD. #114, PHOENIX, ARIZONA 85015-1905
PHONE (602) 433-2464
WWW.AMERICANFIREEQUIPMENT.COM

ASBUILT
8/3/16

THE FIRE PROTECTION DESIGN WAS PREPARED BY:
Diversified Engineering
Fire Protection Systems
PROFESSIONAL ENGINEERS
2120 W. CAMELBACK AVE
SUITE 114
PHOENIX, AZ 85015
MOBILE (870) 584-0007

DRAWN BY
JMG

DATE
November 24, 2014

SHEET
FS-19
OF 48

A.F.E. JOB NUMBER:
14344

1.05 PAGES FROM AIR CHILLER FREON DETECTION PANEL PRODUCT MANUAL

A. Drawings provided for information only.

Installation
Operation
Maintenance

Trane TruSense™ SD Refrigerant Monitor - Sensor Module

Models: RMWG (Shown above with optional alarm beacon)

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RMWG-SVX01C-EN

Electrical Connections

Wiring Connections

See Appendix A, "Installation Outline Drawings" for wire entry hole locations. All wiring to the TruSense™ SD Refrigerant Diffusion style Monitor is made via the access ports on the bottom of the unit.

CAUTION
Component Damage!

Monitor components must be protected from splashing, spraying, or dripping water. Failure to do so may cause damage to internal components.

Wiring

The RMWG Refrigerant Monitor is factory wired with either a universal power supply for 110/220 Vac operation or no power supply for 24 Vac/dc operation.

The following steps outline the procedure for connecting the wiring

1. Determine the power supply for your RMWG Refrigerant Monitor (From the nameplate model number as shown in Figure 1).

   All wiring is done via the access ports (openings) in the bottom of the enclosure. Do not drill new holes through the enclosure - serious damage to the instrument could result.

CAUTION
Instrument Damage!

Correct power voltage must be connected to the instrument. Failure to use correct voltage may result in instrument damage.

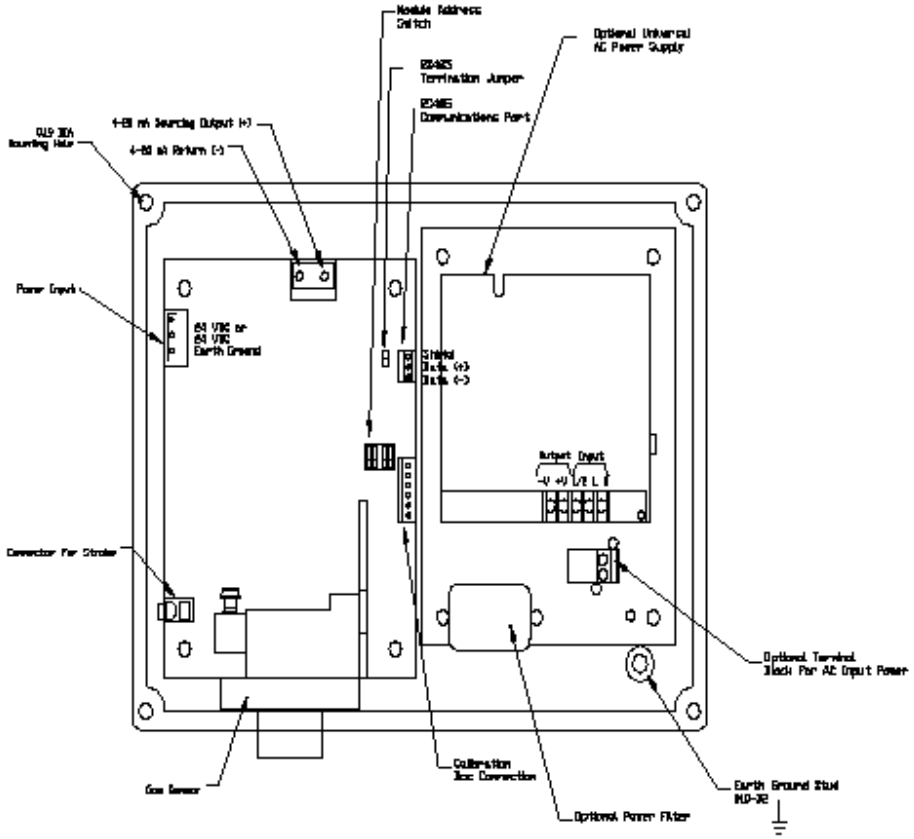
Note: External overcurrent shall be included in the building installation, shall be in close proximity to the equipment, within easy reach of the operator, and shall be marked as the disconnecting device for the equipment.

All power wiring is connected to the terminal block, see Figure 4.

TRANE

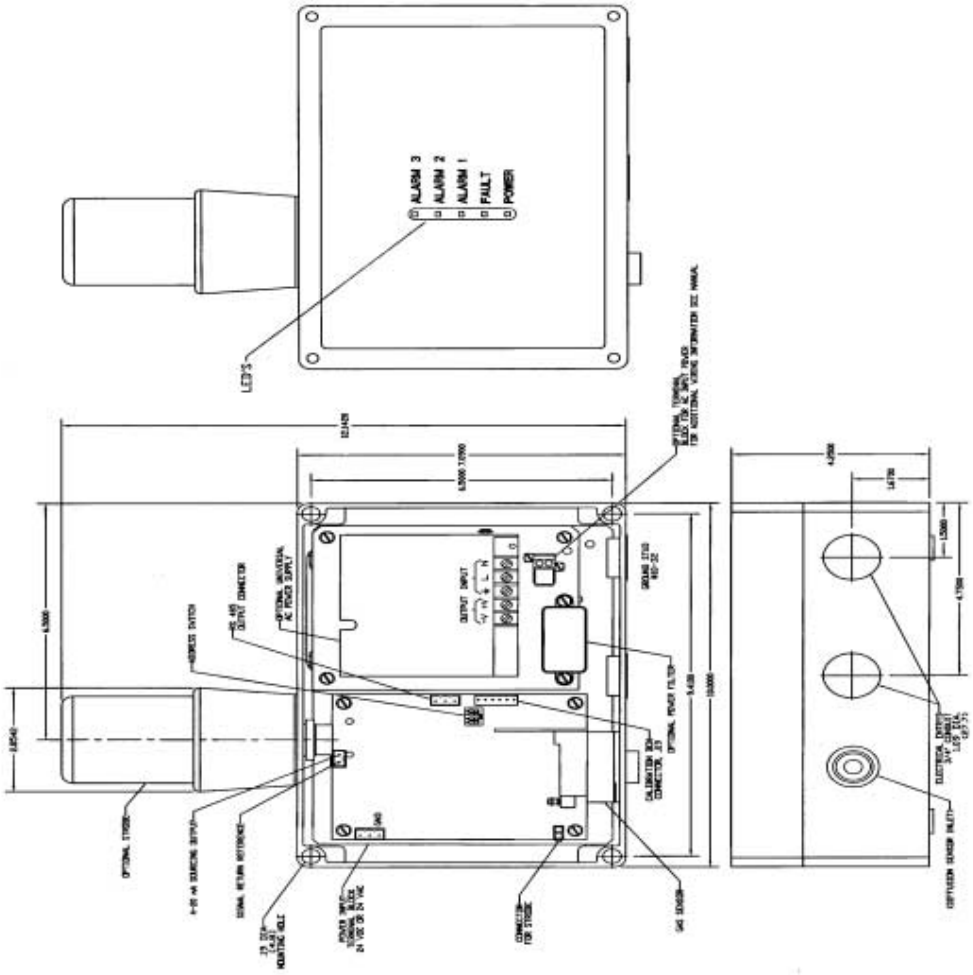
Electrical Connections

Figure 4. Terminal diagram



Appendix A

Figure A-1. Installation outline drawing



PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 51 00 50

ELECTRONIC MEDIA RELEASE

U.S. Bureau of Reclamation
Electronic Media Release

U.S. Bureau of Reclamation, Contract Number/Solicitation Number: _____

This release for electronic media is dated the ___ day of _____ (month), ____ (year), between _____ (RECIPIENT) and U.S. 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 U.S. Bureau of Reclamation and may not be copied or distributed to any other party without the written permission of U.S. Bureau of Reclamation.
2. The electronic files provided to RECIPIENT by U.S. 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 U.S. Bureau of Reclamation.
3. Because information and data provided electronically may be altered, whether inadvertently or otherwise, U.S. 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 U.S. Bureau of Reclamation, in their preparation.
4. The electronic files are provided solely as a convenience to RECIPIENT by U.S. 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 U.S. 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 U.S. Bureau of Reclamation, should data erosion, erasure, and/or alteration of these electronic files occur.

7. RECIPIENT agrees to defend, indemnify, and hold U.S. 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 U.S. BUREAU OF RECLAMATION:
By: _____	_____
Title: _____	_____
Date: _____	_____

END OF SECTION

SECTION 52 00 00
DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Inform the CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction.

B. In accordance with clause at FAR 52.236-21, Specifications and Drawings for Construction, in case of discrepancies, written specifications take precedence over drawings unless otherwise specified.

1.02 PROJECT CONDITIONS

A. Where there are differences as determined by the CO between details and dimensions shown on drawings and details and dimensions of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.03 INFORMATION DRAWINGS

A. Drawings marked "For Information Only" in the drawing list are included to show existing 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 STANDARD DRAWINGS

A. Standard drawings may show details which are not a part of work under this contract. Disregard details shown on these drawings which are not applicable to work under this contract.

1.05 COPIES OF DRAWINGS

A. One set of full-size (22 inches by 34 inches) drawings, except standard drawings, will be furnished to the Contractor.

B. Upon request, additional half-size (11 inches by 17 inches) copies of standard drawings will be furnished to the Contractor.

1.06 LIST OF DRAWINGS

A. Drawings listed in Table 52 00 00A - List of Drawings are made a part of Section C - Description/Specifications.

1.07 DRAWING NUMBERS IN NUMERICAL ORDER

A. Specification drawings are listed in numerical order in Table 52 00 00B - Drawings in Numerical Order.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
General:		
1	557-D-60169	General – Location Map
2	557-D-60170	Communication System – Network Diagram
Manufacturer's Information Drawings (Facility Building):		
3	557-420-2668/M2668	60' Wide x 100' Long – 18'-3"/18'-0" EAVE HT
4	557-420-2669/M2669	Anchor Bolt Layout – Sheet 1
5	557-420-2670/M2670	Frame Cross Section – Sheet 2
6	557-420-2671/M2671	Frame Cross Section – Sheet 3
7	557-420-2672/M2672	Frame Cross Section – Sheet 4
8	557-420-2673/M2673	Roof Plan – Sheet 5
9	557-420-2674/M2674	Sidewall Elevation – Sheet 6
10	557-420-2675/M2675	Sidewall Elevation – Sheet 7
11	557-420-2676/M2676	Sidewall Elevation – Sheet 8
12	557-420-2677/M2677	Sidewall Elevation – Sheet 9

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
13	557-420-2877-2	MF Sidewall Elevation
14	557-420-2679/M2679	MF Facility Building – Endwall Elevation – Sheet 11
15	557-420-2680/M2680	MF Facility Building – Endwall Elevation – Sheet 12
Information Drawings:		
16	557-D-29	Glen Canyon Dam – Location Map
17	557-D-119	Glen Canyon Power Plant – General Arrangement – Transverse Section Thru Generating Units 3 Thru 8
18	557-D-180	Glen Canyon Dam – Power Plant Service Road – Alinement, Profile and Tunnel Sections
19	557-D-1095	Glen Canyon Power Plant – Electrical Installation – Cable Trays Layout – Plan – El. 3153.50 – Bays 1, 2, 3, and 4
20	557-420-11096	Glen Canyon Power Plant – Electrical Installation – Cable Trays Layout – Plan – El. 3153.50 – Bays 5, 6, 7, 8, S and M
21	557-420-1711	Glen Canyon Power Plant – Electrical Installation – Halon Fire Protection System and Water Detection System Layout
22	557-420-1797	Glen Canyon Power Plant – Electrical Installation – Elevator Fire System - Schematic
23	557-420-14066	Glen Canyon Power Plant – Mechanical Planning Drawing – Single-Line Fire Water Main Drawing – Fire Protection Systems
24	557-420-14104	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – 480V Smoke Exhaust Distribtuion Board MME – Single-Line and Board Schedule
25	Cover Page	Advanced Fire Protection System – Siemens MXL Series – Fire Alarm – Glen Canyon Dam – Contract No. 04CC408055 – Page, Arizona – As-Builts - Hiller Systems Inc.
26	M2724	Gen & Install Notes Hiller Systems PP Fire Protecton-Model - 1 of 31

Table 52 00 00A - List of Drawings

Sheet No.	Drawing No.	Title
27	M2725	Tables Hiller Systems PP Fire Protecton – 2 of 31
28	M2726	SEQ-Chart Hiller Systems PP Fire Protecton – 3 of 31
29	M2727	RISER Hiller Systems PP Fire Protecton – 4 of 31
30	M2728	EL3124.75-1 Hiller Systems PP Fire Protecton – 5 of 31
31	M2729	EL3138.50-2 Hiller Systems PP Fire Protecton – 6 of 31
32	M2730	EL3153.50-3 Hiller Systems PP Fire Protecton – 7 of 31
33	M2731	EL3168.50-4 Hiller Systems PP Fire Protecton – 8 of 31
34	M2732	EL3188.50-5 Hiller Systems PP Fire Protecton – 9 of 31
35	M2733	EL3199.79-6 Hiller Systems PP Fire Protecton – 10 of 31
36	M2734	EL3244.24-7 Hiller Systems PP Fire Protecton – 11 of 31
37	M2735	EL3257.25-8 Hiller Systems PP Fire Protecton – 1 2 of 31
38	M2736	EL3262.87-9 Hiller Systems PP Fire Protecton – 13 of 31
39	M2737	FACP Hiller Systems PP Fire Protecton – 14 of 31
40	M2738	FTJB1 Hiller Systems PP Fire Protecton – 15 of 31
41	M2739	FTJB2 Hiller Systems PP Fire Protecton – 16 of 31
42	M2740	FTJB3 Hiller Systems PP Fire Protecton – 17 of 31
43	M2741	FTJB4 Hiller Systems PP Fire Protecton – 18 of 31
44	M2742	FTJB5 Hiller Systems PP Fire Protecton – 19 of 31
45	M2743	FTJB6 Hiller Systems PP Fire Protecton – 20 of 31
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47	M2745	FTJB8 Hiller Systems PP Fire Protecton – 22 of 31
48	M2746	FCCP-PNL Hiller Systems PP Fire Protecton – 23 of 31
49	M2747	FCCP-WIRE1 Hiller Systems PP Fire Protecton – 24 of 31
50	M2748	FCCP-WIRE2 Hiller Systems PP Fire Protecton – 25 of 31
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53	M2751	TW01 Hiller Systems PP Fire Protecton – 28 of 31
54	M2752	TWO1 - MTG Hiller Systems PP Fire Protecton – 29 of 31
55	M2753	TW02 Hiller Systems PP Fire Protecton – 30 of 31
56	M2754	TW03 Hiller Systems PP Fire Protecton - 31 of 31
57		480 VAC Smoke Exhaust Distribution Board Layout – 1 of 2
58		480 VAC Smoke Exhaust Distribution Board Layout – 2 of 2
59	VM4070-01	HVAC As-Builts HVAC Sheet 1 Hiller Systems PP Fire Protecton-Model – Sheet 1 of 4
60	VM4070-02	HVAC As-Builts HVAC Sheet 2 Hiller Systems PP Fire Protecton-HVAC – Sheet 2 of 4
61	VM4070-03	HVAC As-Builts HVAC Sheet 3 Hiller Systems PP Fire Protecton-HVAC – Sheet 3 of 4
62	VM4070-04	HVAC As-Builts HVAC Sheet 4 Hiller Systems PP Fire Protecton-HVAC – Sheet 4 of 4
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63	557-D-3971	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3124.75 Location Plan
64	557-D-3972	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3153.5 Location Plan
65	557-D-3973	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3168.50 Location Map
66	557-D-3974	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3188.50 Location Plan

Table 52 00 00A - List of Drawings

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67	557-D-3975	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3244.24 Location Plan
68	557-D-3976	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3257.25, 3267.87, and 3279.12 Location Plan
69	557-D-4067	Glen Canyon Power Plant – Electrical Installation – Fire Detection and Alarm Systems – Notification and Fire Safety Control Devices – El. 3124.75 Location Plan
Standard Drawings:		
70	40-D-6234	Standard Nameplates
71	40-D-7094	Electrical Installation – Conduit Clamp and Conduit Supports – Typlical Details
72	40-D-7102	Standard and Typical Designs – Government Drawing Format – Drawing Border, Sample Title Block, and Signature Lines
73	104-D-1150	Major Power/Pumping Plants – Electrical Installation – Device Designations and Symbols to be Used on Single-Line and Schematic Diagrams
74	104-D-1165	Design Data Typical – Powerplant_Pumping Plant – Electrical Installation – Main Control Board CSA – Panel 7R – Wiring Diagram

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557-420-1711	20
557-420-1797	21
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